

EFFECT PROJECT

Creating effects through communication
and engagement in Future and Emerging
Technologies

Deliverable 2.1: EFFECT projects' database

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Technical references

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PU = Public

PP = Restricted to other programme participants (including the Commission Services)

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Executive Summary

EFFECT project is H2020 funded projects aiming to enhance visibility and impact of FET research in a wide diversity of actors (researchers, industry, policy makers, civil society organisations, citizens etc.) and to stimulate debate and collaboration among multiple stakeholders through dedicated community building and public engagement activities.

This deliverable, called “EFFECT project’s database”, contains a database gathering all the factual information and contacts for the FP7 and H2020 FET projects that the EFFECT consortium will identify as relevant for communication.

The starting point of this database is a pre-selection of **170 FET projects** (130 of FP7 and 40 of H2020), which have been chosen for this screening, based on the following criteria: projects started between 2012 and 2014 and that finished or will finish between 2015 and 2018. This ensures that the contacted projects already have result to be communicated, but they are still a breakthrough.

The methodology followed in the elaboration of the database included in this deliverable, is based on a desk research: the collection and processing of data available in the official websites of the projects and other public sources, such as European Commission’s [CORDIS](#) repository of projects.

The main output of this activity is a database with information to contact the coordinators or participants of the FET projects that have been pre-selected, in order to identify results or outcomes that will be communicated, by different tools, to targeted stakeholders and the wide audience.

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1 Objectives

The final objective of this deliverable, elaborated as result of task 2.1, is the creation of a database containing basic information of FET projects approved both in FP7 and H2020. In the next stage, EFFECT team will contact these projects' coordinators and/or key partners in order to gather direct and detailed information and select communicable results.

This document is one of the deliverables of the Work Package 2 “**Content provision**”, which aims to define the editorial management strategy of FET projects' contents, in order to unleash their communication and impact potential, stimulate debates and engagement and support the translation of the FET visionary thinking into concrete and more understandable scenarios. The main output of this Work Package is the selection of 30 results or stories that will be communicated to both a broader audience and targeted stakeholders.

As part of the task 2.1, the EFFECT consortium has retrieved, analysed and elaborate facts, data, tools, information and highlights of FP7 and H2020 FET projects, to identify the FET key results having best potential attractiveness for communication to the media and key target groups approached by the project. The output of this task is a **database containing all the factual information and contacts for the FP7 and H2020 FET projects** that the consortium will identify as relevant for communication. This database will be continuously updated and broadened along the entire project lifetime.

2 Database

2.1 The screening and selection process

EFFECT has screened FP7 and H2020 FET themes: **170 projects out of a total of 252 funded FP7 projects and 117 H2020 projects**. Some selection criteria have been applied in order to focus on achievements and impacts in different communication formats. A first selection criterion has been applied by excluding CSA projects. A second criterion includes the timing of execution of the projects, i.e. including FP7 projects that started between 2012 and 2014 and that finished or will finish between 2015 and 2018 and H2020 RIA projects that started in 2015 and that will finish between 2016 and 2018, for a total number of 170 projects to be screened.

Projects	Total funded	Types of projects	Selection Criteria projects	Total to be screened
FP7 projects	252 projects	47 CSA 202 collaborative projects 2 small or medium-scale focus research projects	CSA excluded FP7 projects started between 2012 - 2014 FP7 projects that finished or will finish between 2015 and 2018	130 R&I projects
H2020 projects	117 projects	16 CSA 2 FPA 98 RIA 1 SGA-RIA	CSA excluded RIA projects that started in 2015 and that will finish between 2016 and 2018	40 RIA projects
Total	369 projects			170 projects

Table 1: approved FET projects and first selection criteria

During the screening process, EFFECT team has collected the information considered as useful by conducting a **desk research**: extracting information from both [CORDIS](#) and projects' own websites. Based on this database, project coordinators or partners will be contacted in order to identify outputs and/or stories of these projects to be later communicated through a mix of communication formats and distribution channels.

- Project

2.2 Database

The following database contains factual information and contacts for the FP7 and H2020 FET projects: **130 of FP7 and 40 of H2020**. Out of the 130 projects selected in FP7, 79 have already finished and 51 are expected to finish between May 2016 and the end of 2018. All the 40 projects selected in H2020 will finish in 2018.

These data has been used to produce a **contact database**, which will remain as an **internal tool**. This database includes the following data:

- **Project**
 - Acronym
 - Title
 - Programme
 - Start date
 - End date
 - Budget
 - EC contribution
 - Contract (RIA/Collaborative project)
 - Topic
 - Website
 - Summary
- **Organization**
 - Name
 - Country
 - City
 - Coordinator (Yes/no)
 - Contact person
- **Contact person (1)**
 - Title
 - First name
 - Last name
 - Email
 - Phone 1
 - Phone 2
 - Area
- **Contact person (2)**
 - Title
 - First name
 - Last name
 - Email
 - Phone 1
 - Phone 2
 - Area
 -

PROJECT											
Acronym	Title	Programme	Start date	End date	Budget	EC contributi	Contract	Topic	Website	CORDIS	Summary
3X3D IMAGI	Fast two-ph	FP7-ICT	01/06/2013	31/05/2016	2.305.232 €	1.690.999 €	Collaborati	ICT-2013.9.2	http://3x3d	http://cordis	We propos
ABACUS	Parallel cor	FP7-ICT	01/01/2014	31/12/2016	2.699.590 €	1.725.271 €	Collaborati	ICT-2013.9.5	http://abacus	http://cordis	Many techn
ABIOMATER	Magnetical	H2020 - FET	01/11/2015	01/11/2018	2.978.882 €	2.978.882 €	RIA	FETOPEN-RI	http://blog	http://cordis	This project
ACMOL	Electrical s	FP7-ICT	01/01/2014	31/12/2016	1.548.866 €	1.187.431 €	Collaborati	ICT-2011.9.3	http://www	http://cordis	The project
ADVENT	Architecture	FP7-ICT	01/04/2013	31/03/2016	1.366.371 €	1.075.824 €	Collaborati	ICT-2011.9.3	http://www	http://cordis	Systems sc
ALLOW ENSI	ALLOW Ens	FP7-ICT	01/02/2013	31/01/2016	3.893.424 €	2.959.000 €	Collaborati	ICT-2011.9.1	http://www	http://cordis	The recent

Figure 1: EFFECT projects' database - Project information

ORGANISATION						
Partner	City	Country	Coordinator	Contrib. End	EU contrib.	Contact
FEMTONICS	1094 BUDAPEST	Hungary	Yes	Yes		*****
LUNDS UNIVERSITY	LUND	Sweden	Yes	Yes		*****
THE UNIVERSITY OF EXETER	EXETER	United Kingdom	Yes	No	688.878 €	*****
AGENCIA ESPAÑOLA DE INVESTIGACIONES CIENTÍFICAS	MADRID	Spain	Yes	Yes		*****
FUNDACION CIENCIA Y DEPORTE	MADRID	Spain	Yes	Yes		*****
UNIVERSITÄT STUTTGART	STUTTGART	Germany	Yes	Yes		*****

Figure 2: EFFECT projects' database - organisation

CONTACT PERSON DETAILS						
Title (Prof./Dr./Ms./Mr.)	First name	Last name	E-mail	Phone	Phone 2	area
(Dr)	*****	*****	*****	*****	*****	Private for-profit
(Professor)	*****	*****	*****	*****	*****	Higher or Secondary
Dr	*****	*****	*****	*****	*****	coordinator
(Ms.)	*****	*****	*****	*****	*****	Projectos Europe
(Ms.)	*****	*****	*****	*****	*****	Research Or
(Mr)	*****	*****	*****	*****	*****	Higher or Se

Figure 3: EFFECT projects' database - Contact person

Due to confidentiality reasons, non personal data are included in the public version of the data based attached in this deliverable. The personal data will be used only internally.

The public database includes the following data:

- **Project**
 - Acronym
 - Title
 - Programme
 - Start date
 - End date
 - Budget
 - EC contribution
 - Topic
 - Website
 - Summary
 - Coordinator
 - Country

The internal tool includes FET projects coordinators and key partners personal data (as shown in figure 3), and they are going to be used only to contact them, as the objective of the collection of the personal data is to get to contact these people to select the stories.

Acronym	Title	Programme	Start date	End date	Budget	EC contribution	Contract	Topic	Website	Summary	Coordinator	Country
3X3D IMAGING	Fast two-photon in vivo imaging and stimulation with simultaneous three-dimensional random-access scanning in multiple brain regions	FP7-ICT	01/06/2013	31/05/2016	2.305.232 €	1.690.999 €	Collaborative project (generic)	ICT-2013.9.2 High-Tech Research Intensive SMEs in FET research	http://3x3dimging.eu/	We propose to engineer and validate a novel random access three-dimensional two-photon (2P) laser scanning microscope which can simultaneously image three different brain regions in the three spatial dimensions (3x3D system), where each scanned volume can exceed cubic millimeters. Our 3x3D system, which allows the simultaneous recording of neuronal activity in multiple, functionally connected distant brain volumes, is essential for understanding distributed brain computations. As each site can be scanned with sub-millisecond temporal resolution in several hundred user defined locations, the activity of single neurons in neuronal microcircuits or even neuronal compartments such as dendrites or axons will be followed. Furthermore, by combining imaging with powerful genetic methods and 3D photo-activation, we will not only record from identified circuits but also map connectivity between regions. We will validate the capability of our 3x3D system by simultaneously performing retinal, lateral geniculate nucleus, and cortical 3D imaging and photo stimulation. No currently available technology is able to achieve such multi-region 3D recordings of neuronal activity, considering not only products on the market but scientific publications as well. In the long term, the project leader SME will release a high-value added product family to the world market based on the methods and results that are realized and validated during this project. Despite steep competition from overseas laboratories, the first single region 3D 2P brain imaging was invented in Europe. Now, having similarly heavy competition this project attempts to realize the first multi-region 3D 2P brain imaging microscope.	FEMTONICS KUTATO ES FEJLESZTO KORLATOLT FELELOSSEGU TARSASAG	Hungary
ABACUS	Parallel computing based on designed networks explored by self-propelled, biological agents	FP7-ICT	01/01/2014	31/12/2016	2.699.590 €	1.725.271 €	Collaborative project (generic)	ICT-2013.9.5 FET-Open Xtrack	http://abacus4eu.com/	Many technologically and societally important mathematical problems are essentially intractable for traditional, serial computers. Therefore, a significant need exists for parallel computing approaches that would be able to solve such problems faster than current serial computers. This project will develop and benchmark a novel paradigm for future parallel computing approaches, based on biological entities. Specifically, we will encode mathematical problems into networks consisting of nano- or micro-sized channels and nodes, and will use self-propelled biological agents to explore these networks and find the solution to the encoded mathematical problems. Due to the very large number of agents, the problem is solved in a highly parallel manner. A number of different types of micro- and nanoscale biological agents will be used, including innate objects (protein filaments propelled by molecular motors) and living systems (bacteria and fungi). The novelty of this approach lies in the use of self-propelled agents (avoiding scalability issues associated with the use of external driving forces), as well as in the combination of human intelligence (in the target-oriented design of networks) with the parallelism enabled by large numbers of biological agents. Key aims of the project will be the benchmarking against existing computational approaches, and the identification of application areas where this novel paradigm may lead to transformative applications. Benefits to society will include the ability to solve hitherto intractable problems, and the development of a sustainable and energy-efficient computing approach that is radically different from current ICT technology.	LUNDS UNIVERSITET	Sweden
ABIOMATER	Magnetically actuated bio-inspired metamaterials	H2020 - FET	01/11/2015	01/11/2018	2.978.882 €	2.978.882 €	RIA	FETOPEN-RIA-2014-2015	http://blogs.oxeter.ac.uk/abiomater/	This project will deliver a new class of metamaterials whose functionality can be controlled by external magnetic fields. The materials consist of micromotors, comprising an anisotropically "hard" and "soft" ferromagnetic particle pair embedded in a polymer matrix, and promise wide-ranging technological applications. The project, involves 5 partners with expertise in experimental and theoretical physics, biological science and technology. Building upon a detailed analysis of the physical properties of the individual motors, and their dependency on their magnetic and material properties, the team will develop methods for incorporating the motors into elastic membranes (MEMs). We shall analyse the mechanical and optical properties of these constructs and the ways in which they can be modulated by the external magnetic fields. These novel properties will then be used to produce prototype devices: <ul style="list-style-type: none"> • Pumps for fluids and tuneable filters for dissolved solutes, operating down to microscopic length scales and based on magnetically driven membrane deformation and changes in internal pore structure. • Tuneable optical devices such as lenses and filters based on magnetic strain-induced changes in the optical and photonic properties of the constructs. • Substrates for biotechnology, tissue engineering and regenerative medicine. These devices will be based on our ability to apply to cells in culture the patterns of temporally and spatially varying strain fields to which they are exposed in vivo and which maintain their phenotype and metabolic activity. The prototypes will find immediate applications in expanding areas of technology ranging from lab-on-a-chip systems to biomedical implants. They will also help the team to develop a thorough understanding of the novel emergent properties of the MEMs leading, in turn to many other applications.	THE UNIVERSITY OF EXETER	United Kingdom

ACMOL	Electrical spin manipulation in electroActive MOLEcules	FP7-ICT	01/01/2014	31/12/2016	1.548.866 €	1.187.431 €	Collaborative project (generic)	ICT-2011.9.3 FET Young Explorers	http://www.acmolproject.eu/1-eng-home.html	The project "Electrical spin manipulation in electroActive MOLEcules" (ACMOL) has the ambitious goal of fabricating a switchable, room-temperature spin-polarizer employing electro-active and magnetic molecules, which are integrated into graphene-type electrodes modified with ferromagnetic materials. The combination of these molecules with ferromagnetic electrodes is a new route in spintronics. Exploiting the high stability of graphene, we aim to demonstrate for the first time good performance of the device at room temperature. The outstanding devices can be applied to a broad number of different technological and societal fields, such as high-density data storage, microelectronics, (bio)sensors, quantum computing and medical technologies. An external electric field will be applied to read and manipulate the state of the device, as well as its charge transport properties. The characterization of the electrical response will be carried out in a 3-terminal configuration composed of source, drain and gate. The charge transport properties of the molecular junctions will be investigated in a solid-state back-gate configuration, as well as in solution, employing an "electrolyte gate". In this way, the devices will operate as switches that can be exploited to read and write information, which is stored in the oxidation and magnetic state of each molecule. The project involves the synthesis of the functional moieties, the device fabrication and characterization, as well as DFT modelling, which will be based on a fully quantitative description of the electronic structure at non-equilibrium. To accomplish the objectives of the project, we have chosen an interdisciplinary approach with four young research teams representing expertise in synthetic chemistry, molecular self-assembly, molecular-scale surface electrochemistry, device engineering, and DFT-based mesoscopic spin-transport calculations.	AGENCIA ESTATAL CONSEJO SUPERIOR DE INVESTIGACIONES CIENTIFICAS	Spain
ADVENT	Architecture-driven verification of systems software	FP7-ICT	01/04/2013	31/03/2016	1.366.371 €	1.075.824 €	Collaborative project (generic)	ICT-2011.9.3 FET Young Explorers	http://www.advent-project.eu/	Systems software such as operating system kernels, hypervisors, database engines, web servers and language run-times forms the foundation of any modern computer system. It is extremely complex and hard to get right, with bugs making whole services unavailable or opening the doors of seemingly secure systems to viruses and criminals. Ensuring its reliability is thus imperative for building future trustworthy ICT infrastructures. The advent project will develop innovative methods and tools for cost-effective verification of real-world systems software, making it possible to guarantee an unprecedented level of reliability. We will achieve this by exploiting a trend among programmers to use informally described patterns, idioms, abstractions and other forms of structure contained in their software, which are together called its architecture. Building on the emerging technology of separation logic, we will formalise such software engineering concepts used by systems programmers to reason about their software informally, and will use the results to drive the design of verification techniques. This is a radically novel approach to the problem of verifying complex software: it departs from the common practice of building generic verification tools that, not being able to take advantage of programmers' knowledge and intuition, do not scale to big and complicated systems. The architecture-driven verification techniques resulting from the project have the potential to yield a dramatic leap in the cost-benefit ratio of the verification technology. This will allow verification to scale to systems of real-world size and complexity that so far have been beyond the reach of quality assurance methods guaranteeing correctness.	FUNDACION IMDEA SOFTWARE	Spain
ALLOW ENSEMBLES	ALLOW Ensembles	FP7-ICT	01/02/2013	31/01/2016	3.893.424 €	2.959.000 €	Collaborative project (generic)	ICT-2011.9.10 FET Proactive: Fundamental s of Collective Adaptive Systems (FOCAS)	http://www.allow-ensembles.eu/	The recent advances in pervasive technologies enable construction of large-scale socio-technical systems which tightly interweave humans and their social structures with the technology. These systems are realized as a collective of diverse heterogeneous actors situated both in the physical world such as people, objects etc., and in the backend computer systems such as control processes. The objective of ALLOW Ensemble is to develop a new design principle for large-scale collective systems (CAS) based on the concepts of cells and ensembles. Cells are basic building blocks representing the different components of the system and ensembles are collections of cells collaborating together to accomplish certain goal in a given context. We use Adaptive Pervasive Flows - a programming paradigm based on workflow technology for pervasive systems - to model the behaviour of cells as a set of interrelated tasks. This enables the salient principle of cell specialization. It allows for changing the behaviour of the individual cell (tasks and order of execution) to fit into an ensemble and to achieve a given goal with high utility in collaboration with other cells of the ensemble. Following the principle of cell specialization, we develop methodologies for the evolution of cells and ensembles to meet arbitrary system goals, autonomously improving the utility of the system under changing contexts. Another major goal of the project is to develop models, theories and algorithm to ensure robustness and security so that ensembles can survive wide range of hardware/software failures and can protect sensitive data. Furthermore, we do novel research on the controllability of emergent properties of complex ensemble systems. The ensemble concept challenges current thinking as it represents a new type of systems that evolve over multiple generations to adapt to contextual changes and constantly improve utility. Evolutionary data is collected and analysed to learn from the characteristics of past ensembles executions. This knowledge forms the foundation of evolution, leading to robust and high utility systems. The resulting fundamental concepts will be tested based on visionary application scenarios such as integrated urban transport and smart production chains, to evaluate their applicability.	UNIVERSITAET STUTTGART	Germany

ALLOXIDEPV	Novel Composite Oxides by Combinatorial Material Synthesis for Next Generation All-Oxide-Photovoltaics	FP7-ENERGY	01/11/2012	31/10/2015	3.904.760 €	2.999.674 €	Collaborative project (generic)	ENERGY.201 2.10.2.1 Future Emerging Technologies	NOT AVAILABLE	The global market for photovoltaic (PV) cells that are converting sunlight into electricity almost doubled in 2010 to reach a massive 18.2 GW, nearly three times size of the market back in 2008. Crystalline silicon is the most common PV material today with a market share of more than 80%. New developments such as electrolyte based dye-sensitized solar cells as well as organic polymer cells have experienced remarkable progress in the laboratory but penetration into the market is still far away due to stability and sealing problems. Thus, this project will develop all-oxide photovoltaic cells based on nano-composite materials using combinatorial synthesis methods in conjunction with large throughput characterization and computational data analysis. Oxides are chemically stable, many of them are not hazardous, abundant and can furthermore be produced by low-cost methods. To challenge the inherent limitations of pure oxide semiconductors novel composite materials consisting of two or more pure metal oxides using various mixing ratios will be developed. Moreover, new fabrication techniques, powerful characterization tools and computational analysis methods will be employed that have not been available yet for material science. Combinatorial synthesis methods used in biology, chemistry and pharmaceutical research will be adopted to screen efficiently through a large amount of oxide compositions.	BAR ILAN UNIVERSITY	Israel
ALLScale	An Exascale Programming, Multi-objective Optimisation and Resilience Management Environment Based on Nested Recursive Parallelism	H2020 - FET	01/10/2015	01/10/2018	3.366.196 €	3.366.196 €	RIA	FETHPC-1-2014	http://www.allscale.eu/custom4	Extreme scale HPC systems impose significant challenges for developers aiming at obtaining applications efficiently utilising all available resources. In particular, the development of such applications is accompanied by the complex and labour-intensive task of managing parallel control flows, data dependencies and underlying hardware resources – each of these obligations constituting challenging problems on its own. The ALLScale environment, the focus of this project, will provide a novel, sophisticated approach enabling the decoupling of the specification of parallelism from the associated management activities during program execution. Its foundation is a parallel programming model based on nested recursive parallelism, opening up the potential for a variety of compiler and runtime system based techniques adding to the capabilities of resulting applications. These include the (i) automated porting of application from small- to extreme scale architectures, (ii) the flexible tuning of the program execution to satisfy trade-offs among multiple objectives including execution time, energy and resource usage, (iii) the management of hardware resources and associated parameters (e.g. clock speed), (iv) the integration of resilience management measures to compensate for isolated hardware failures and (v) the possibility of online performance monitoring and analysis. All these services will be provided in an application independent, reusable fashion by a combination of sophisticated, modular, and customizable compiler and runtime system based solutions. ALLScale will boost the development productivity, portability, and runtime, energy, and resource efficiency of parallel applications targeting small to extreme scale parallel systems by leveraging the inherent advantages of nested recursive parallelism, and will be validated with applications from fluid dynamics, environmental hazard and space weather simulations provided by SME, industry and scientific partners.	UNIVERSITAET INNSBRUCK	Austria
ANTAREX	AutoTuning and Adaptivity appRoach for Energy efficient eXascale HPC systems	H2020 - FET	01/09/2015	01/09/2018	3.115.251 €	3.115.251 €	RIA	FETHPC-1-2014	http://antarex-project.eu/	Energy-efficient heterogeneous supercomputing architectures need to be coupled with a radically new software stack capable of exploiting the benefits offered by the heterogeneity at all the different levels (supercomputer, job, node) to meet the scalability and energy efficiency required by Exascale supercomputers. ANTAREX will solve these challenging problems by proposing a disruptive holistic approach spanning all the decision layers composing the supercomputer software stack and exploiting effectively the full system capabilities (including heterogeneity and energy management). The main goal of the ANTAREX project is to provide a breakthrough approach to express application self-adaptivity at design-time and to runtime manage and autotune applications for green and heterogenous High Performance Computing (HPC) systems up to the Exascale level.	POLITECNICO DI MILANO	Italy
AQuS	Analog quantum simulators for many-body dynamics	H2020 - FET	01/01/2015	01/01/2018	2.000.500 €	2.000.500 €	RIA	FETPROACT-3-2014	https://www.kip.uni-heidelberg.de/aqus/	Quantum simulators promise to provide unprecedented insights into physical phenomena not accessible with classical computers and have the potential to enable radically new technologies. In this proposal, we argue that analog dynamical quantum simulators are currently realisable and constitute a most promising class of architectures to fulfil the ultimate promise to devise quantum machines outperforming classical computers. The approach taken is two-pronged: On the one hand, we devise versatile and practical platforms for dynamical simulators – making use of systems of ultra-cold atoms in optical lattices and the continuum, as well as cavity polaritons. We suggest a concerted and interdisciplinary research programme of certifying quantum devices and assess them in their computational capabilities, addressing largely unexplored key questions on the power of quantum simulators. On the other, we make use of those devices to probe important questions in fundamental and applied physics, ranging from technology-relevant problems, concerning transport processes or glassy dynamics, via long-standing challenges in the physics of non-equilibrium and thermalisation phenomena, through puzzles in notions of quantum turbulence, to questions in the study of quantum gravity.	RUPRECHT-KARLS-UNIVERSITAET HEIDELBERG	Germany

ASSISI_BF	Animal and robot Societies Self-organise and Integrate by Social Interaction	FP7-ICT	01/02/2013	31/01/2018	7.649.939 €	6.007.664 €	Collaborative project (generic)	ICT-2011.9.10 FET Proactive: Fundamental s of Collective Adaptive Systems (FOCAS)	http://assisi-project.eu/	The aim of ASSISI_bf is to develop (1) a fundamental new class of distributed ICT systems, which are bio-hybrid collective adaptive systems (CASs) that consist of two sub-systems: One is a self-organising society of animals; the other one is a society of technical devices. These CASs will solve problems by distributed spatial computation; this heterogeneous system (animals, robots, nodes) will perform collective decision-making and maintain internal homeostasis. (2) We plan to develop a fundamental new method to design CASs by exploiting evolutionary computation on mathematical models that are used to drive the engineered part of the CAS. This way the collective of animals and robots will adapt to environmental changes and will maximize its efficiency and stability. (3) We will develop several novel benchmarks, using the level of acceptance of robots by the animal society as a hard-to-reach criterion. (4) Finally, we will derive a general model for heterogeneous CASs, which will be used to develop new algorithms for other heterogeneous robotic CASs. We address all 3 principles that should be researched for CASs, which are: design, operation and evolution. The project tackles several severe engineering challenges. It has a high potential of impact and foundational character on several communities. On the one hand it has the potential to establish a new field of science, which focuses on self-adapting engineered systems able to integrate themselves into an existing natural society. On the other hand, the proposed long-term impact reaches from establishing important new methods in agriculture, environmental sustainability policies, live stock management, environmental monitoring, bio-hybrid engineering and pharmaceutical industry, as our proposed technology allows fully automated (but non-invasive, non-harmful) experimentation with social animals. By deducting models and algorithms our project can also influence and promote general research of distributed ICT systems.	TECHNISCHE UNIVERSITAET GRAZ	Austria
BAMBI	Bottom-up Approaches to Machines dedicated to Bayesian Inference	FP7-ICT	01/01/2014	31/12/2016	3.334.510 €	2.520.176 €	Collaborative project (generic)	ICT-2011.9.1 Challenging current Thinking	https://www.bambi-fet.eu/	We propose a theory and a hardware implementation of probabilistic computation inspired by biochemical cell signalling. We will study probabilistic computation following three axes: algebra, biology, and hardware. In each case, we will develop a bottom-up hierarchical approach starting from the elementary components, and study how to combine them to build more complex systems. We propose Bayesian gates operating on probability distributions on binary variables as the building blocks of our probabilistic algebra. These Bayesian gates can be seen as a generalization of logical operators in Boolean algebra. We propose to interpret elementary cell signalling pathways as biological implementation of these probabilistic gates. In turn, the key features of biochemical processes give new insights for innovative probabilistic hardware implementation. We propose to associate conventional electronics and novel stochastic nano-devices to build the required hardware elements. Combining them will lead to new artificial information processing systems, which could, in the future, outperform classical computers in tasks involving a direct interaction with the physical world. For these purposes, the BAMBI project associates research in Bayesian probability theory, molecular biology, nanophysics, computer science and electronics.	CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE	France
BBOI	Breaking the Barrier on Optical Integration	FP7-ICT	01/09/2013	31/08/2016	2.232.896 €	1.699.922 €	Collaborative project (generic)	ICT-2013.9.1 Challenging current Thinking	http://www.bboi.eu/	Photonic technologies enable today to generate, manipulate and detect photons by means of miniaturized devices integrated onto the same optical chip. However, compared to electronics, photonics still lacks essential tools enabling the aggregation of hundreds of functionalities into large scale circuits, this hindering its full exploitation in many applicative domains. The BBOI project aims to break this limitation, boosting the complexity of photonic architectures well beyond the state of the art, but without increasing power consumption in proportion. A full-optioned multifunctional silicon photonic platform will be developed integrating on board novel sensor and actuator technologies for a reliable real-time monitoring, tuning and reconfiguration of the circuit behaviour. Lightpaths will be inspected in strategic points of the circuit through novel non-perturbative probes capable to sense the light inside optical waveguides without wasting any single photon. Photon routing will be achieved by using power-saving actuators exploiting resistive switching materials used in electronic non-volatile memories, but never explored in the optical domain. The vast technology equipment of the BBOI platform will be harnessed and controlled by a never conceptualized algorithmic intelligence, enabling a multitude of devices to be concurrently steered to the desired working point. BBOI success will make photonics to penetrate deeply in various ICT areas where conventional technologies are approaching their performance limits. For instance, the huge scaling of information transmitted and routed through data centres and super computing architectures is pushing multi-core electronic parallelization to collide against unsustainable power consumption. Large scale photonic circuits will also enable demonstrations of quantum processors, solving an important class of problems that are more efficiently solved using quantum processors than even the fastest class of modern supercomputer.	POLITECNICO DI MILANO	Italy

BIOMICS	Biological and Mathematical Basis of Interaction Computing	FP7-ICT	01/10/2012	30/09/2015	2.334.234 €	1.829.998 €	Collaborative project (generic)	ICT-2011.9.6 Unconventional Computation (UCOMP)	http://www.biomicsproject.eu/	Interaction Computing (IC) takes inspiration from cellular processes rather than from evolution. BIOMICS aims to leverage existing cell metabolic and regulatory mechanisms as the ontogenetic basis of a model for IC. However, because the knowledge to properly mimic, exploit and adapt these systems to computer science is lacking, BIOMICS will also advance the state of the art in the mathematics of biocomputing. The mathematical structure thus uncovered feeds into two different and complementary directions. On the one hand, it will inform the automata theory formalisms for IC; on the other hand, it will be mapped through category theory to the logic foundations of the BIOMICS specification language. Whereas the automata theory research will focus on the structural properties of self-organising systems, the BIOMICS specification language will instead focus on the specification of self-organising behaviour. By end of Year 2 we will have developed the formal tools and frameworks from both points of view of the behaviour-realisation dichotomy to be able to effect their synthesis in the form of an environment which, through interactions, is capable of generating useful software systems that match the biological structure template – and are therefore themselves based on interactions. This foundational mathematical work of BIOMICS will be applicable to software systems of a radically new kind and to systems biology, creating a unified mathematical framework for understanding, predicting, manipulating, and dynamically synthesising algorithmic activity-in-context based on interactions (i.e. interaction computation) in both realms. This will be demonstrated not only by the application of the framework to the analysis of complex-adaptive biological systems beyond those studied in the course of its development, but also by proof-of-concept implementations of software systems (for example demonstrating security properties) as a potential new paradigm for unconventional computing.	THE UNIVERSITY OF HERTFORDSHIRE HIGHER EDUCATION CORPORATION	United Kingdom
BOC	The Body-on-a-Chip (BoC)	FP7-ICT	01/06/2012	31/05/2015	1.919.000 €	1.395.000 €	Collaborative project (generic)	ICT-2011.9.2 High-Tech Research Intensive SMEs in FET research	https://www.insphero.com/company/index.php?option=com_content&view=article&id=840	High attrition and failures rates in pharmaceutical and biotechnological drug development require a paradigm change towards more physiological human cell-based assays at an early time point in the process. The central idea of this proposal is to develop a versatile and reconfigurable pharmaceutical screening technology platform that relies on organotypic three-dimensional spherical micro-tissues. This platform will accommodate different types of human micro-tissues (tumour, brain, liver, heart etc.) and feature microfluidic interconnection between these tissues, thus mimicking the physiological context and conditions in a human body. Dosage of components or candidate drugs to, e.g., liver tissue will lead to the generation of metabolic products in the respective tissue compartment. These products then can be routed via the microfluidics to, e.g., connective tissue to assess the efficacy of the candidate drug and related adverse toxicological effects on the target tissue and functionally related tissues. This way, functional connectivity in a real body can be mimicked at the desired level of complexity, and the effects of drugs can be comprehensively assessed.	INSPHERO AG	Switzerland
BRAINBOW	Linking biological and artificial neuronal assemblies to restore lost brain functions: towards the design of innovative bi-directional neuroprostheses	FP7-ICT	01/02/2012	31/01/2015	1.304.278 €	997.107 €	Collaborative project (generic)	ICT-2011.9.3 FET Young Explorers	http://www.brainbowproject.eu/	The possibility to control actions from thoughts is becoming reality thanks to Brain Machine Interfaces (BMIs). However modern BMIs are mostly unidirectional and aimed at restoring lost motor functions. In a wider perspective, neural interfaces must be bi-directional devices that substitute motor, sensory or cognitive circuits within the brain, that might have been damaged as a result of an injury or a disease. The project goes towards this direction: it will provide the knowledge to realize a new class of neuroprostheses aimed at treating those diseases where a portion of brain tissue is damaged (e.g. lesion). The ultimate goal of the project is to connect in vitro neuronal assemblies to an artificial system (a neuromorphic chip) which aims at restoring the lost neuronal functionality, with the long-term perspective to be implanted in humans affected by invalidating brain diseases. This will allow us to reach three main scientific objectives: (i-DECODING) improve the performance of BMIs by investigating optimal decoding schemes to extract useful information by multisite acquisitions from neuronal assemblies; (ii-PROCESSING) provide an artificial link between two previously connected assemblies by designing computational models (sw and hw) which mimic the behaviour of the injured part of the network; (iii-CODING) design new strategies by developing stimulation protocols aimed at effectively sending appropriate information to cell assemblies. These goals will be reached by using an engineering approach to neuroscience: a fully controlled and measurable experimental system where the biological neural element will be investigated at different levels of anatomical complexity: from random, unstructured circuits up to the intact brain. Thanks to this approach we will be able to exploit the peculiarity of each biological model to study different coding/decoding schemes in order to optimize the performance of advanced neuroprostheses.	FONDAZIONE ISTITUTO ITALIANO DI TECNOLOGIA	Italy

BRAINLEAP	A quantum leap: from a spike-centered brain universe to its underlying synaptic landscape	FP7-ICT	01/02/2013	31/01/2016	3.291.799 €	2.478.350 €	Collaborative project (generic)	ICT-2011.9.1 Challenging current Thinking http://www.brainleap.eu/home	The richness of high-level cognitive and adaptive properties of the brain is reflected in the complexity of its anatomy and (electro)physiology. At the cellular level, evolution privileged for the central nervous system an analog distributed information storage and encoding, by plastic (graded) synapses and by their continuous temporal and spatial integration into firing rates. Beyond all-or-none action potentials, subthreshold synaptic and membrane electric activity in neurons disclose the details of single-neuron computations, neuronal identity and role, information processing and synaptic readout, as well as history-dependent dynamics of excitability and synaptic efficacy. The long-term experimental access to subthreshold activity of many neurons simultaneously, during behaviour and cognition, is then a requirement for the ultimate understanding of brain functions, its reverse engineering, as well as an unexplored alternative for neuroprosthetics. Project BRAINLEAP develops a breakthrough, revolutionary technological approach to explore cognition and plasticity in cortical neuronal networks, and preliminary applies it in vitro and in awake behaving rodents and primates. BRAINLEAP will enable simultaneous, long-term, and independent recording and stimulation of the electrical activity from hundreds of individual mammalian neurons, with a quality that in practice matches the intracellular configuration. By allowing one to record (and stimulate) for very long times, synaptic- and action-potentials from individual neurons, in the context of specific sensorimotor integration tasks, the leap we propose might ultimately shift current paradigms and theories, from spike-centred computation to its underlying subthreshold synaptic potentials computation.	UNIVERSITEIT ANTWERPEN	Belgium
BRISQ2	Bright Squeezed Vacuum and its Applications	FP7-ICT	01/12/2012	30/11/2015	2.387.060 €	1.849.760 €	Collaborative project (generic)	ICT-2011.9.1 Challenging current Thinking http://www.brisq2.eu	Quantum information technology (QIT) offers faster processing and more secure transfer of information based on the laws of quantum mechanics. It is a vital technology of the future as conventional methods reach their limits. Current QIT operates with microscopic objects: single atoms, ions, molecules, and especially photons. Few-photon states of light are used in commercial quantum key distribution (QKD) systems. However, as single photons do not have efficient non-destructive interactions with each other or with material objects, their usefulness is limited. It is tempting to extend QIT protocols to macroscopic states of light, enabling more efficient interactions, but it is widely believed that going to macroscopic scale degrades quantum features. In particular, squeezed coherent states of light contain classical excitation as their largest part and are therefore inapplicable in most QIT protocols. We challenge the accepted viewpoint that only few-photon states provide the optimal features required in QIT. Unlike squeezed coherent states, bright squeezed vacuum (BSV) has perfect photon-number correlations. It thus resembles two-photon entangled states but has macroscopic photon numbers. The complementary teams of our consortium plan to perform proof-of-principle experiments and calculations showing that BSV can (1) manifest experimentally accessible non-separability; (2) violate Bell inequalities, including new ones, specific for such states, and thus manifest new non-classical correlations; (3) be prepared in a single Schmidt mode; (4) be used in QKD and (5) have new applications in quantum imaging. Achieving these results will foster QIT development in a new direction. Since BSV is macroscopic, it can be controlled by tapping a small portion and using almost non-invasive feedforward techniques. In QKD protocols based on entanglement this could result in practical device-independent schemes, as the macroscopic nature would remove the detection loophole problem.	MAX PLANCK GESELLSCHAFT ZUR FÖRDERUNG DER WISSENSCHAFTEN E.V.	Germany
CARTOON	CARbon nanoTube phOTonic devices on silicon	FP7-ICT	01/11/2013	31/10/2016	1.855.052 €	1.438.037 €	Collaborative project (generic)	ICT-2013.9.1 Challenging current Thinking http://cartoon.ef.u-psud.fr/CARTOON/Welcome.html	Primary goal of the proposed research action is the development of a novel strategy for hybridizing silicon based photonic devices, exploiting semiconducting carbon nanotubes (CNT) as integrated light source, modulator and detector. Photonics in Information and Communication Technologies is more and more investigated for a broad application domain. These applications require efficient optoelectronic devices to emit, modulate and detect light. To facilitate photonic and electronic convergence, the envisioned approach is based on the silicon platform. However, the definition of optoelectronic devices requires several kinds of materials (Si, Ge and III-V) as silicon is an indirect-gap material with poor electro-optic properties. This project aims at investigating a new and innovative field through the use of CNT in the near infrared wavelength range. The main breakthrough will come from the development of CNT-based optoelectronic components directly co-integrated within a silicon platform to address the major challenges of photonics. Such integration has never been investigated so far and thanks to a joint experimental and theoretical investigation our major goal is to establish the potential of CNT technology for nanophotonics applications. The project reposes on three major cornerstones: (i) A waveguide detector in the 1.3-1.6 μm wavelength range, (ii) integrated optical modulators using Kerr (electro-refraction) and Stark (electro-absorption) effects and (iii) An integrated electrically pumped optical nanosource. Each of these cornerstones will be a world's premiere and will constitute a breakthrough. Inherently, this makes it a high risk/high gain yet achievable proposal with a foundational impact both in knowledge and technology for nanophotonics. In a long term vision the establishment of new state of the art and advanced know-how on optoelectronic devices based on CNT will allow developing and addressing a broad range of applications in information technologies.	UNIVERSITE PARIS-SUD	France

CASSTING	Collective Adaptive System Synthesis with Non-zero-sum Games	FP7-ICT	01/04/2013	31/03/2016	2.737.964 €	2.007.358 €	Collaborative project (generic)	ICT-2011.9.10 FET Proactive: Fundamental s of Collective Adaptive Systems (FOCAS)	http://www.cassting-project.eu/contract/	CASSTING will develop a novel approach for analysing and designing collective adaptive systems in their totality, by setting up a game theoretic framework. Here components are viewed as players, their behaviour is captured by strategies, system runs are plays, and specifications are winning conditions. The design of collective adaptive systems, as they occur, for example, in home automation, health care, and many scenarios of mobile communication, raises fundamental challenges: These systems are distributed, with heterogeneous components interacting continuously among each other and with their environments, components may work collaboratively or as adversaries, they have to adapt over time, they are dynamic in the sense that components can come into existence or vanish, and their specification usually involves multi-dimensional quantitative objectives. Available methods (such as model-based verification and quantitative model-checking) only address selected aspects of collective adaptive systems. The game theoretic approach of CASSTING is comprehensive and has already proved very successful in simpler scenarios such as automatic controller synthesis. The CASSTING research will lift this method to the level of collective adaptive systems and provide efficient algorithmic analysis methods as well as tools for the automatic synthesis. In particular, the simple scenario of zero-sum games is extended to cover a large variety of non-zero-sum games, and concepts of algorithmic game theory are generalised to infinite-duration games. The CASSTING teams have made essential contributions in the area and are thus uniquely qualified for this project. The CASSTING research will strengthen the leading role that Europe already has in this field. The proof of concept will focus on the paradigmatic application areas of home automation and smart houses, based on case studies provided by the two internationally recognised industrial partners of the consortium.	CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE	France
CIMPLEX	Bringing Citizens, Models and Data together in Participatory, Interactive Social EXploratories	H2020 - FET	01/01/2015	01/01/2018	4.206.875 €	3.450.625 €	RIA	FETPROACT-1-2014	https://www.cimplex-project.eu/	We propose visionary research to develop modeling, computational, and ICT tools needed to predict and influence disease spread and other contagion phenomena in complex social systems. To achieve non-incremental advances we will combine large scale, realistic, data-driven models with participatory data-collection and advanced methods for Big Data analysis. In particular we will go beyond the one-dimensional focus of current approaches tackling one aspect of the problem at a time. We will interconnect contagion progression (e.g. epidemics) with social adaptation, the economic impact and other systemic aspects that will finally allow a complete analysis of the inherent systemic risk. We will develop models dealing with multiple time and length scales simultaneously, leading to the definition of new, layered computational approaches. Towards policy impact and social response we will work to close the loop between models, data, behavior and perception and develop new concepts for the explanation, visualization and interaction with data and models both on individual and on collective level. We will cast the fundamental advances into an integrated system building on widely accepted open ICT technologies that will be used and useful beyond the project. As a tangible ICT outcome directed at facilitating the uptake and impact of the project, we will implement "Interactive Social Exploratories" defined as interactive environments which act as a front-end to a set of parameterizable and adjustable models, data analysis techniques, visualization methods and data collection frameworks. In summary, we aim to (1) produce fundamental theoretical, methodological and technological advances (2) mold them into a broadly usable ICT platform that will be a catalyst for producing, delivering, and embedding scientific evidence into the policy and societal processes and (3) evaluate the system empirically with policy makers and citizens focusing on the concrete problem of epidemic spreading.	DEUTSCHES FORSCHUNGSZENTRUM FUER KUNSTLICHE INTELLIGENZ GMBH	Germany
CNTQC	Curved nanomembranes for Topological Quantum Computation	FP7-ICT	01/06/2014	31/05/2017	2.048.828 €	1.582.081 €	Collaborative project (generic)	ICT-2013.9.3 FET Young Explorers	http://www.nano2qc.eu/	Topological quantum computation, based on the encoding of quantum information in non-local degrees of freedom, provides a promising route for a working quantum computer not affected by quantum decoherence. A possible way of realizing this non-locality is to encode qubits into so-called Majorana fermions - quantum particles that are their own antiparticles. As an elementary particle, Majorana fermion is a hypothetical object. However in condensed matter it can be built out of what nature offers us: electron and hole excitations. Recently a number of experimental setups have been proposed to support Majorana zero modes, among which are planar superconductor-semiconductor heterostructures and superconductor-topological insulator hybrids. Despite the fact that such solid-state-devices consist of rather "conventional" building blocks, the actual experimental observation of Majorana fermions is still the biggest challenge in the field. The experimental difficulty stems from a required, very delicate fine-tuning of intrinsic materials parameters, e.g. strength of the Rashba spin-orbit coupling, and external physical quantities, e.g. strength of externally applied magnetic fields. The aim of CNTQC is to overcome these hurdles by designing, fabricating and testing novel platforms where strong curvature-induced quantum effects can generate the requirements of the Majorana fermion's cocktail in a controlled manner. The pursued approach will exploit modern nanostructuring technology to transform very thin nanomembranes into three-dimensional nanoarchitectures with a strongly curved geometry. The combined experimental and theoretical understanding of the geometrically-induced topological superconducting state aims to pave the way towards a direct demonstration of the existence of Majorana fermions in these curved solid-state devices. This concept sets a stage for the generation of versatile platforms for topological quantum computation.	LEIBNIZ-INSTITUT FUER FESTKORPER-UND WERKSTOFFFORSCHUNG DRESDEN E.V.	Germany

ComPat	Computing Patterns for High Performance Multiscale Computing	H2020 - FET	01/10/2015	01/10/2018	4.037.885 €	3.942.885 €	RIA	FETHPC-1-2014	http://www.compat-project.eu	Multiscale phenomena are ubiquitous and they are the key to understanding the complexity of our world. Despite the significant progress achieved through computer simulations over the last decades, we are still limited in our capability to accurately and reliably simulate hierarchies of interacting multiscale physical processes that span a wide range of time and length scales, thus quickly reaching the limits of contemporary high performance computing at the tera- and petascale. Exascale supercomputers promise to lift this limitation, and in this project we will develop multiscale computing algorithms capable of producing high-fidelity scientific results and scalable to exascale computing systems. Our main objective is to develop generic and reusable High Performance Multiscale Computing algorithms that will address the exascale challenges posed by heterogeneous architectures and will enable us to run multiscale applications with extreme data requirements while achieving scalability, robustness, resiliency, and energy efficiency. Our approach is based on generic multiscale computing patterns that allow us to implement customized algorithms to optimise load balancing, data handling, fault tolerance and energy consumption under generic exascale application scenarios. We will realise an experimental execution environment on our pan-European facility, which will be used to measure performance characteristics and develop models that can provide reliable performance predictions for emerging and future exascale architectures. The viability of our approach will be demonstrated by implementing nine grand challenge applications which are exascale-ready and pave the road to unprecedented scientific discoveries. Our ambition is to establish new standards for multiscale computing at exascale, and provision a robust and reliable software technology stack that empowers multiscale modellers to transform computer simulations into predictive science.	UNIVERSITEIT VAN AMSTERDAM	Netherlands
CONQUER	Contrast by Quadrupole Enhanced Relaxation	H2020 - FET	01/09/2015	01/09/2018	2.463.975 €	2.463.975 €	RIA	FETOPEN-RIA-2014-2015	http://www.conquer.at	The ageing society and demographic change is one of the major challenges which Europe is facing now, and even more so in the future. Mastering this challenge requires radically new diagnostic and therapeutic treatments as key factors in achieving the healthy well-being of European citizens. Molecular imaging (MI) plays a pivotal role in diagnosis, understanding of disease and in the development of effective treatments. CONQUER will explore a fundamentally new contrast mechanism with the potential to push magnetic resonance imaging (MRI) far beyond its limits towards a powerful MI modality. This will be achieved by exploiting the cross relaxation between 1H and large quadrupolar nuclei (QN) for contrast agent (CA) design. The main objective is to synthesize bio-compatible QN compounds and nano-particles (NPs), high efficiency and manifold degrees of freedom in the design of smart properties, such as the ability to switch the contrast on and off by changing the magnetic field or chemical binding (e.g. targeting). The NPs will be tailored based on quantum-mechanical simulations. Sensitivity and contrast switching will be demonstrated with MRI in cell cultures. This highly interdisciplinary project combines expertise in quantum physics, chemical and biomedical engineering, material characterisation as well as nanotoxicology. Today, European scientists and companies are already leading global players in CA development. CONQUER will significantly fertilise this field and lay the scientific foundations for a new technology by providing theoretical groundwork, synthesis guidelines, imaging instrumentation and toxicological references. These results will be actively transferred to academia and industry as well in order to strengthen European competitiveness. The combination of a so far unexploited quantum-mechanical phenomenon and cutting-edge imaging technologies has the potential to create MI solutions with significant impact.	TECHNISCHE UNIVERSITAET GRAZ	Austria
CORTICONIC	Computations and Organization of Retes Through the Interaction of Computational, Optical and Neurophysiological Investigations of the Cerebral cortex	FP7-ICT	01/01/2013	31/12/2015	3.085.165 €	2.399.000 €	Collaborative project (generic)	ICT-2011.9.11 FET Proactive: Neuro-Bio-Inspired Systems (NBIS)	http://corticonic.org	Corticonics, echoing electronics, consists of abstracting salient features of cortical organization for use in the simulation of the cortex executing higher level brain functions. Our final objective is to identify computational principles of the cerebral cortex underlying network dynamic patterns. In our long term vision, interfacing with the brain will take place: i) Towards the brain, delivering stimuli onto the nervous tissue to induce recovery, correct imbalances or to augment function and cognition, and ii) From the brain: to be able to operate machines by thinking. Both interfaces require a detailed understanding of brain function. Our project has a multilevel experimental approach, covering scales from the micro to the macro, combined with a theoretical/computational approach. We take slow oscillations observed during sleep or anaesthesia as a basic dynamic pattern constrained by features of the excitability distribution in the neural tissue. We aim to identify these features by analysing the generation and propagation of activity and its susceptibility to interference. Progressively we will wake up the cortex in order to identify the features that are critical in adding computational complexity to the system. To achieve this we start by developing novel recording tools to obtain detailed subcellular and large cortical area recordings while we will further develop electrical and targeted optogenetic stimulation for the spatiotemporal control of activity. Based on this mesoscopic and modular approach we will provide a computational equivalent of the properties of a macroscopic region of neural tissue described as an excitable medium, and carry out large scale simulations made possible by a cutting-edge distributed computing facility. The approach and technologies developed here will have long term implications for areas including brain-computer interfaces, brain repair, brain modelling and massive scale computing.	CONSORCIO INSTITUT D'INVESTIGACIONS BIOMEDIQUES AUGUST PI I SUNYER	Spain

CYANOFACTORY	Design, construction and demonstration of solar biofuel production using novel (photo)synthetic cell factories	FP7-ENERGY	01/12/2012	30/11/2015	3.914.852 €	2.997.464 €	Collaborative project (generic)	ENERGY.2012.10.2.1 Future Emerging Technologies	NOT AVAILABLE	CyanoFactory brings together ten selected leading, highly complementary European partners with the aim to carry out integrated, fundamental research aiming at applying synthetic biology principles towards a cell factory notion in microbial biotechnology. The vision is to build on recent progress in synthetic biology and develop novel photosynthetic cyanobacteria as chassis to be used as self-sustained cell factories in generating a solar fuel. This will include the development of a toolbox with orthogonal parts and devices for cyanobacterial synthetic biology, improvement of the chassis enabling enhanced growth and robustness in challenging environmental conditions, establishment of a data warehouse facilitating the modelling and optimization of cyanobacterial metabolic pathways, and strong and novel bioinformatics for effective data mining. To reach the goal, a combination of basic and applied R&D is needed; basic research to design and construct the cyanobacterial cells efficiently evolving H2 from the endless resources solar energy and water, and applied research to design and construct the advanced photobioreactors that efficiently produce H2. Biosafety is of highest concern and dedicated efforts will be made to address and control cell survival and death. The aim, to develop a (photo)synthetic cell factory, will have an enormous impact on the future options and possibilities for renewable solar fuel production. The consortium includes academic, research institute and industry participants with the direct involvement of two SMEs in the advanced photobioreactor design, construction and use. Purpose-designed, specifically engineered self-sustained cells utilising solar energy and CO2 from the air, may be the mechanisms and processes by which we generate large scale renewable energy carriers in our future societies. CyanoFactory offers Europe the possibility to take a lead, and not only follow, in these very important future and emerging technologies!	UPPSALA UNIVERSITET	Sweden
DEDALE	Data Learning on Manifolds and Future Challenges	H2020 - FET	01/10/2015	01/10/2018	2.702.397 €	2.702.397 €	RIA	FETOPEN-RIA-2014-2015	http://dedale.cosmostat.org/cea/	Future data processing challenges in science will enter the 'Big Data' era, involving massive, as well as complex and heterogeneous data. Extracting, with high precision, every bit of information from scientific data requires overcoming fundamental statistical challenges, which mandate the design of dedicated methods that must be both effective enough to capture the intricacy of real-world datasets and robust to the high complexity of instrumental measurements. Moreover, future datasets, such as those provided by the space mission Euclid, will involve at least gigascale data, which will make mandatory the development of new, physically relevant, data models and the implementation of effective and computationally efficient processing tools. The recent emergence of novel data analysis methods in machine learning should foster a new modeling framework, allowing for a better preservation of the intrinsic physical properties of real data that generally live on intricate spaces, such as signal manifolds. Furthermore, advances in operations research and optimization theory pave the way for effective solutions to overcome the large-scale data processing bottlenecks. In this context, the objective of the DEDALE project is threefold: i) introduce new models and methods to analyze and restore complex, multivariate, manifold-based signals; ii) exploit the current knowledge in optimization and operations research to build efficient numerical data processing algorithms in the large-scale settings; and iii) show the reliability of the proposed data modeling and analysis technologies to tackle Scientific Big Data challenges in two different applications: one in cosmology, to map the dark matter mass map of the universe, and one in remote sensing to increase the capabilities of automatic airborne imaging analysis systems.'	COMMISSARIAT A L'ENERGIE ATOMIQUE ET AUX ENERGIES ALTERNATIVES	France
DIADEMS	DIAmond Devices Enabled Metrology and Sensing	FP7-ICT	01/09/2013	31/08/2017	8.265.991 €	5.867.000 €	Collaborative project (generic)	ICT-2013.9.7 FET Proactive: Atomic and Molecular Scale Devices and Systems	http://www.dia-dems.eu/page/en/home.php	The DIADEMS project aims at exploiting the unique physical properties of NV color centres in ultrapure single-crystal CVD-grown diamond to develop innovative devices with unprecedented performances for ICT applications. By exploiting the atom-like structure of the NV that exhibits spin dependent optical transitions, DIADEMS will make optics-based magnetometry possible. The objectives of DIADEMS are to develop:- Wide field magnetic imagers with 1 nT sensitivities,- Scanning probe magnetometer with sensitivity 10 nT and spatial resolution 10 nm,- Sensor heads with resolution 1 pT. To reach such performances, DIADEMS will:- Use new theoretical protocols for sensing,- Develop ultrahigh purity diamond material with controlled single nitrogen implantation with a precision better than 5 nm,- Process scanning probe tips with diameter in the 20 nm range,- Transfer them to AFM cantilever, improve the emission properties of NV by coupling them with photonic cavities and photonic waveguides. DIADEMS outputs will demonstrate new ICT functionalities that will boost applications with high impact on society:- Calibration and optimization of write/read magnetic heads for future high capacity (3 Tbit per square inch) storage disk required for intense computing,- Imaging of electron-spin in graphene and carbon nanotubes for next generation of electronic components based on spintronics,- Non-invasive investigation of living neuronal networks to understand brain function,- Demonstration of magnetic resonance imaging of single spins allowing single protein imaging for medical research. DIADEMS aims at integrating the efforts of the European Community on NV centres to push further the limits of this promising technology and to keep Europe's prominent position.	THALES SA	France

DIVERSIFY	DIVERSIFY : Ecology-inspired software diversity for distributed adaptation in CAS	FP7-ICT	01/02/2013	31/01/2016	2.447.830 €	1.864.000 €	Collaborative project (generic)	ICT-2011.9.10 FET Proactive: Fundamental s of Collective Adaptive Systems (FOCAS)	http://diversify-project.eu/	Biodiversity is essential for the robustness and adaptability of ecological systems. Similarly, multiple theoretical and experimental scientific results emphasize the need for high levels of diversity for the wealth of other forms of complex systems (e.g., economy or social communities). In the face of these numerous scientific evidences, the limited amount of diversity in software that constitutes collaborative adaptive systems (CAS) is a major concern. This is particularly critical since CASs are complex systems that integrate multiple concerns, interact with the physical world and need to adapt to unforeseen evolutions and perturbations.DIVERSIFY explores diversity as the foundation for a holistic software design principle and increased adaptive capacities in CASs. Higher levels of diversity in the system provide a pool of software solutions that can eventually be used to adapt in front of a situation unforeseen at design time. The scientific development of DIVERSIFY lays in a strong analogy with ecological systems, biodiversity, and evolutionary ecology. DIVERSIFY gathers researchers from the software-intensive, distributed systems and the ecology areas in order to transfer ecological concepts and processes as software design principles.DIVERSIFY's aims at establishing novel principles and techniques to increase software diversity levels in CASs and to leverage this diversity for distributed adaptation. The consortium's ecology group will drive the transfer of ecological processes in software. Software diversity synthesis and adaptation will leverage model-driven approaches to deal with the heterogeneity of entities in CASs. The project will develop a CAS simulator in the domain of smart cities to reveal the role of software diversity in CASs and to establish empirical knowledge about ecology-inspired software engineering.DIVERSIFY will run for 36 months with a requested funding of 1.86M for a total budget of 2,44M.	INSTITUT NATIONAL DE RECHERCHE EN INFORMATIQUE ET EN AUTOMATIQUE	France
DOLFINS	Distributed Global Financial Systems for Society	H2020 - FET	01/03/2015	01/03/2018	4.250.000 €	3.650.000 €	RIA	FETPROACT-1-2014	http://www.dolfinsproject.eu/	The DOLFINS project addresses the global challenge of making the financial system better serve society by placing scientific evidence and citizens participation at the centre of the policy process in finance. The project strives to give scientific evidence and citizens participation central roles in the policy process concerning finance. DOLFINS will focus on two crucial and interconnected policy areas that will shape the public debate in the coming 5 years: How to achieve financial stability and how to facilitate the long-term investments required by the transition to a more sustainable, more innovative, less unequal and greener EU economy. The expected impact is to achieve crucial advances in reshaping the policy process to overcome the financial and political crisis faced by the EU. We will deliver quantitative tools to evaluate policies aiming to tame systemic risk and to foster sustainable investing. The tools will be based on fundamental research combining network models and algorithmic game theory with broader economic insights. This approach can provide a more satisfactory understanding of credit, risk and sustainable investments in an interconnected world. We will investigate how to engage citizens in the early stage of the policy making process and will develop evidence-based narratives in order to better shape policies in the public interest. To this end, our project will take advantage of semantic web technologies, big data and ICT in general. Given the highly technical nature of key issues in finance, we will explore how ICT and art can facilitate citizens' engagement through innovative narratives, leading to better coordinated actions of stakeholders.	UNIVERSITAET ZUERICH	Switzerland
ECOSCALE	Energy-efficient Heterogeneous Computing at exaSCALE	H2020 - FET	01/10/2015	01/10/2018	4.237.397 €	4.237.397 €	RIA	FETHPC-1-2014	http://www.ecoscale.eu/	In order to reach exascale performance current HPC servers need to be improved. Simple scaling is not a feasible solution due to the increasing utility costs and power consumption limitations. Apart from improvements in implementation technology, what is needed is to refine the HPC application development as well as the architecture of the future HPC systems. ECOSCALE tackles this challenge by proposing a scalable programming environment and hardware architecture tailored to the characteristics and trends of current and future HPC applications, reducing significantly the data traffic as well as the energy consumption and delays. We first propose a novel heterogeneous energy-efficient hierarchical architecture and a hybrid MPI/OpenCL programming environment and runtime system. The proposed architecture, programming model and runtime system follows a hierarchical approach where the system is partitioned into multiple autonomous Workers (i.e. compute nodes). Workers are interconnected in a tree-like structure in order to form larger Partitioned Global Address Space (PGAS) partitions, which are further hierarchically interconnected via an MPI protocol. Secondly, to further increase the energy efficiency of the system as well as its resilience, the Workers will employ reconfigurable accelerators that can perform coherent memory accesses in the virtual address space utilizing an IOMMU. The ECOSCALE architecture will support shared partitioned reconfigurable resources accessed by any Worker in a PGAS partition, and, more importantly, automated hardware synthesis of these resources from an OpenCL-based programming model. We follow a co-design approach that spans a scalable HPC hardware platform, a middleware layer, a programming and a runtime environment as well as a high-level design environment for mapping applications onto the system. A proof of concept prototype and a simulator will be built in order to run two real-world HPC applications and several benchmarks.	TELECOMMUNICATION SYSTEMS INSTITUTE	Greece

ENLIGHTENMENT	Exploring the neural coding in behaving animals by novel optogenetic, high-density microrecordings and computational approaches: Towards cognitive Brain-Computer Interfaces	FP7-ICT	01/03/2012	28/02/2015	3.231.760 €	2.235.100 €	Collaborative project (generic)	ICT-2011.9.1 Challenging current Thinking	http://enlightenment-fp7.eu/	In this project we aim to investigate the mechanisms involved in memory storage in the brain by a combination of advanced multisite, single unit neural activity monitoring, closed-loop patterned and cell specific activations, and computational techniques, that would allow developing ways to stimulate brain networks in an activity-driven fashion. Combining neuroscience, neuro-engineering and computational methods, we intend to create a technological platform for directly interacting with cell assemblies in a two-way dialogue. Using this, we will investigate whether manipulations of cell assembly activities can actually delete or create memories in behavioural experiments. In particular we will concentrate on the hippocampal/cortical interactions in a memory consolidation context as well as on the interactions between two cortical areas, the prefrontal and perirhinal cortex that form a hierarchical representation of memories. The results will provide solid evidence for the role of assemblies in memory processes, and the proof of concept of how these could be manipulated. Eventually these findings should enable radically new research directions for neuro-inspired technologies such as neuro-morphic design and cognitive brain-computer interfaces (BCIs) with consequences that we can only begin to imagine.	KATHOLIEKE UNIVERSITEIT LEUVEN	Belgium
ENTRA	Whole-Systems Energy Transparency	FP7-ICT	01/10/2012	30/09/2015	2.715.456 €	2.100.000 €	Collaborative project (generic)	ICT-2011.9.8 FET Proactive: Minimising Energy Consumption of Computing to the Limit (MINECC)	http://entraproject.eu/	This project proposes an energy-aware system development approach covering hardware, software and the run-time environment. The central goal is to make energy usage transparent through the system layers, thus enabling optimizations both during code development and at run-time. The project work packages will develop novel program analysis and energy modelling techniques. Tools incorporating these techniques will enable energy optimizations both during code development and at run-time, helping to promote energy efficiency to a first-class software design objective. The project will also develop a concept of optimality and a set of benchmarks allowing measurement of energy efficiency with respect to the minimal energy achievable by optimal utilization of existing hardware. Lack of energy transparency in today's system development tools means that much of the potential energy saving available from power-efficient hardware is wasted. The project departs from the approach of today's systems and development tools because energy transparency is at odds with a basic principle in modern software engineering - the desire to abstract away machine-level details in high-level code in the interests of portability, understandability and software reuse. By contrast, energy transparency requires making visible the effects of energy-saving features of modern processors. The project targets outcome (c) of Objective ICT-2011.9.8, namely to address software models and programming methodologies supporting the strive for the energetic limit (e.g. energy cost awareness or exploiting the trade-off between energy and performance/precision).	ROSkilde UNIVERSITETSCENTER	Denmark
EQUAM	Emulators of Quantum Frustrated Magnetism	FP7-ICT	01/10/2013	30/09/2016	2.621.829 €	1.945.900 €	Collaborative project (generic)	ICT-2013.9.1 Challenging current Thinking	http://www.project-equam.eu/	Among complex systems with emergent behaviours, frustrated quantum magnets are predicted to exhibit novel, highly nontrivial phases of matter that may play a major role in future and emerging quantum technologies such as the synthesis of innovative materials for energy harnessing and storage, entanglement-enhanced metrology, and topological quantum computing. Unfortunately, due to the intrinsic levels of noise in "natural" compounds, the controlled realization, characterization, and manipulation of frustrated quantum magnets appear exceedingly demanding. On the other hand, we are now entering an advanced stage of development of quantum emulators, engineered quantum systems that realize model Hamiltonians of increasing complexity in a controlled fashion. Cutting-edge technologies for quantum emulation science include cold atoms in optical lattices, trapped ultracold ions (Coulomb crystals), NV centres in diamond, and photonic circuits. By developing, comparing, and integrating these four different atom-optical platforms, project EQUAM's breakthrough is the controlled experimental emulation of fundamental model Hamiltonians for frustrated quantum magnetism, both in nontrivial lattice geometries and for competing long-range interactions, and the characterization of their phase diagrams, targeting fundamental features such as spin liquid phases, global topological order, and fractional excitations. By achieving this objective, EQUAM's groundbreaking contribution to the long-term vision in Information and Communication Technologies (ICT) is the efficient quantum emulation, not admitting efficient classical computational counterparts, of many-body quantum systems with essential elements of complexity. Besides providing crucial insights in the physics of complex many-body systems, it will be a foundational step in the realization of large-scale architectures for topologically protected quantum computation and information.	UNIVERSITA DEGLI STUDI DI SALERNO	Italy

ESCAPE	Energy-efficient SCalable Algorithms for weather Prediction at Exascale	H2020 - FET	01/10/2015	01/10/2018	3.977.952 €	3.977.952 €	RIA	FETHPC-1- 2014	http://www.hp-c-escape.eu	<p>ESCAPE will develop world-class, extreme-scale computing capabilities for European operational numerical weather prediction (NWP) and future climate models. The biggest challenge for state-of-the-art NWP arises from the need to simulate complex physical phenomena within tight production schedules. Existing extreme-scale application software of weather and climate services is ill-equipped to adapt to the rapidly evolving hardware. This is exacerbated by other drivers for hardware development, with processor arrangements not necessarily optimal for weather and climate simulations. ESCAPE will redress this imbalance through innovation actions that fundamentally reform Earth-system modelling. ESCAPE addresses the ETP4HPC SRA 'Energy and resiliency' priority topic, developing a holistic understanding of energy-efficiency for extreme-scale applications using heterogeneous architectures, accelerators and special compute units. The three key reasons why this proposal will provide the necessary means to take a huge step forward in weather and climate modelling as well as interdisciplinary research on energy-efficient high-performance computing are:</p> <p>1) Defining and encapsulating the fundamental algorithmic building blocks ('Weather & Climate Dwarfs') underlying weather and climate services. This is the pre-requisite for any subsequent co-design, optimization, and adaptation efforts.</p> <p>2) Combining ground-breaking frontier research on algorithm development for use in extreme-scale, high-performance computing applications, minimizing time- and cost-to-solution.</p> <p>3) Synthesizing the complementary skills of all project partners. This includes ECMWF, the world leader in global NWP together with leading European regional forecasting consortia, teaming up with excellent university research and experienced high-performance computing centres, two world-leading hardware companies, and one European start-up SME, providing entirely new knowledge and technology to the field.</p>	EUROPEAN CENTRE FOR MEDIUM-RANGE WEATHER FORECASTS	United Kingdom
EUNISON	Extensive UNIFIED- domain Simulation of the human voice	FP7-ICT	01/03/2013	29/02/2016	3.933.641 €	2.960.000 €	Collaborative project (generic)	ICT-2011.9.1 Challenging current Thinking	http://eunison.eu/	<p>Everyone needs their voice, and speech has a pivotal function in modern society. A detailed, working model of the voice would contribute to the human atlas and would find profound applications in fields such as speech technology, medical research, pedagogy, linguistics and the arts. But the physics are very intricate: we make the sounds of speech, song and emotions using multiple mechanisms; and these are under exquisite control, through muscle activation patterns acquired from years of training. Physically, voice involves complex interactions between laminar and turbulent airflow; vibrating, deforming, colliding elastic solids; and sound waves resonating in a contorting duct. So far, these mechanisms have had to be studied one at a time, using disparate tools and often gross approximations, for each of the subproblems. Now, advances in computing techniques suggest the possibility of simulating the entire voice organ, including its biomechanics and aeroacoustics, in a unified numerical domain. This major computational challenge would bring research and education much closer to reality. In the EUNISON project, we seek to build a new voice simulator that is based on physical first principles to an unprecedented degree. From given inputs, representing topology or muscle activations or phonemes, it will render the 3-D physics of the voice, including of course its acoustic output. This will give important insights into how the voice works, and how it fails. The goal is not a speech synthesis system, but rather a voice simulation engine, with many applications; given the right controls and enough computer time, it could be made to speak in any language, or sing in any style. The model will be operable on-line, as a reference and a platform for others to exploit in further studies. The long-term prospects include more natural speech synthesis, improved clinical procedures, greater public awareness of voice, better voice pedagogy and new forms of cultural expression.</p>	KUNGLIGA TEKNISKA HOEGSKOLAN	Sweden
EOBLISS	Technological Evolution of Synergy Between Physicochemical and Living Systems	FP7-ICT	01/02/2014	31/01/2018	3.342.623 €	2.555.978 €	Collaborative project (generic)	ICT-2013.9.6 FET Proactive: Evolving Living Technologies (EVLIT)	https://blogit.it.u.dk/evoblissproject/	<p>We will develop artificial, technological evolution and use it to design functional ecosystems consisting of up to three forms of living technology, namely, artificial chemical life, living microorganisms, and complex chemical reaction networks for the purpose of improved treatment and cleanup of wastewater for energy generation. The goals of this project are i) develop a general, robotic platform, which by using artificial evolution can optimize the performance of a physicochemical or microbial system and its environment and ii) use the robotic platform to evolve improved microbial fuel cells in terms of robustness, longevity, or adaptability. The robot evolutionary platform will take the form of an open-source 3D printer extended with functionality for handling liquids and reaction vessels, and for obtaining feedback from the reaction vessels either using computer vision or task-specific sensors in real-time. The robot platform will optimize parameters such as the environment, hydraulics or real-time interaction with experiments (for instance, timing of injection of nutrients, removal of metabolic products, stirring, etc.) to maximize a desired functionality. Initially, we investigate processes such as fluid-structure-interaction driving bio-aggregate structure and in turn metabolic activity as well as the interaction of nanoparticles and bacterial cells by analysing the outcome of the evolutionary process using state-of-the-art imaging techniques. We then seek to exploit synergies between these technologies to significantly improve the ability of the living technology, in the form of optimized microbial fuel cells, to clean-up wastewater. Overall, this is a cross-disciplinary project involving state-of-the-art chemistry, imaging, robotics, artificial life, microbiology and bio-energy harvesting for the purpose of enhancing our understanding of living technologies and how to best design and exploit ground-breaking bio-hybrid systems.</p>	IT UNIVERSITY OF COPENHAGEN	Denmark

EVOEVO	Evolution of Evolution	FP7-ICT	01/11/2013	31/10/2016	3.432.929 €	2.629.000 €	Collaborative project (generic)	ICT-2013.9.6 FET Proactive: Evolving Living Technologies (EVLIT) http://www.evoevo.eu/	Evolution is the major source of complexity on Earth, at the origin of all the species we can observe, interact with or breed. On a smaller scale, evolution is at the heart of the adaptation process for many species, in particular micro-organisms (e.g. bacteria, viruses...). Microbial evolution results in the emergence of the species itself, and it also contributes to the organisms' adaptation to perturbations or environmental changes. These organisms are not only organised by evolution, they are also organised to evolve. The EvoEvo project will develop new evolutionary approaches in information science and will produce algorithms based on the latest understanding of molecular and evolutionary biology. Our ultimate goal is to address open-ended problems, where the specifications are either unknown or too complicated to express, and to produce software able to operate in unpredictable, varying conditions. We will start from experimental observations of micro-organism evolution, and abstract this to reproduce EvoEvo, in biological models, in computational models, and in application software. Our aim is to observe EvoEvo in action, to model EvoEvo, to understand EvoEvo and, ultimately, to implement and exploit EvoEvo in software and computational systems. The EvoEvo project will have impact in ICT, through the development of new technologies. It will also have impact in biology and public health, by providing a better understanding of micro-organism adaptation (such as the emergence of new pathogens or the development of antibiotic resistances).	INSTITUT NATIONAL DE RECHERCHE EN INFORMATIQUE ET EN AUTOMATIQUE	France
EVOPROG	General-Purpose Programmable Evolution Machine on a Chip	FP7-ICT	01/10/2013	30/09/2016	3.848.117 €	2.939.996 €	Collaborative project (generic)	ICT-2013.9.6 FET Proactive: Evolving Living Technologies (EVLIT) http://www.evoevo.eu/	Despite recent advances in in vivo directed evolution techniques and the interest they have attracted so far, their impact in applied biotechnology is limited because of their limitations in programmability, selective drivers, cost and scalability. Here, we propose to construct a general-purpose programmable evolution machine able to quickly evolve new biomolecules or phenotypes in bacterial cells. The proposed device will use existing phage technology and synthetic regulation to engineer a programmable directed evolution machine able to produce biomolecules or biocomputational functionality two orders of magnitude faster than conventional techniques, while consuming fewer consumables. In its core, living matter will be subject to combinatorial search algorithms that will exploit large numbers of small, separate, bacterial populations. Each one will contain phage that evolve under different custom fitness selections. The different phage will then be recombined according to combinatorial optimization strategies. The software and hardware design of our device is inspired by microprocessor manufacturing practice. Hence, in addition to the genetic devices for phage engineering, mutation, recombination and selection, we will develop: i) fluidic modules for cell and phage growth, ii) their hardware primitives, iii) a custom instruction set architecture, and iv) a high-level language with its compiler. We will demonstrate the operation of our device by engineering site-specific ribonucleases and nucleases with real-world applications, such as anti-HIV activity. We will also develop applications for new type of distributed bacterial computing using phage communication. We will thus put in place the foundations and approaches for this radical living technology that will impact ICT as well as many areas beyond, such as biology, chemistry and manufacturing.	UNIVERSITE D'EVRY-VAL D'ESSONNE	France
EXA2GREEN	Energy-Aware Sustainable Computing on Future Technology – Paving the Road to Exascale Computing	FP7-ICT	01/11/2012	31/10/2015	2.958.898 €	2.100.000 €	Collaborative project (generic)	ICT-2011.9.8 FET Proactive: Minimising Energy Consumption of Computing to the Limit (MINECC) http://exa2green-project.eu/	The EXA2GREEN project aims at developing a radically new energy aware computing paradigm and programming methodology for exascale computing. The key aspect of the proposed approach is that the issue of energy sumption and the resulting trade-off with the performance and the accuracy of the overall simulation process will be taken into account in all simulation levels: from the kernel, numerical/combinatorial building blocks to the application level by means of the sidered mathematical models. The proposed approach of Energy-Aware Numerics goes beyond the standard hardware level or operating software stack usually sidered for energy issues and puts the application in the centre of the scene for all aspects related to energy efficiency. The EXA2GREEN project takes up this multidisciplinary challenge by bringing together HPC experts, computer scientists, mathematicians, physicists and engineers. The project team is part of an emerging, multidisciplinary European research community and covers all essential fields of expertise, which allow opening absolutely new perspectives in the area of energy-aware numerics in the exascale era. The overall goal of this project is to develop unventional ideas in order to cope with the issue of power sumption. Reducing the power requirement by a factor of at least 100 is the challenge which needs to be addressed in order to be able to use this technology in a meaningful way. This is one of the reason why making the transition to exascale computing requests radical transformation in the current perception of numerical simulation in high performance computing. The viability of the proposed approach will be investigated sidering a proof of cept where the energy footprint of a large and operational meteorological model for atmospheric and aerosol simulation (COSMO-ART) will be analysed.	KARLSRUHER INSTITUT FUER TECHNOLOGIE	Germany

ExaFLOW	Enabling Exascale Fluid Dynamics Simulations	H2020 - FET	01/10/2015	01/10/2018	3.312.235 €	3.312.235 €	RIA	FETHPC-1-2014	http://exaflow-project.eu	<p>We are surrounded by moving fluids (gases and liquids), be it during breathing or the blood flowing in arteries; the flow around cars, ships, and airplanes; the changes in cloud formations or the plankton transport in oceans; even the formation of stars and galaxies are closely modeled as phenomena in fluid dynamics. Fluid Dynamics (FD) simulations provide a powerful tool for the analysis of such fluid flows and are an essential element of many industrial and academic problems.</p> <p>The complexities and nature of fluid flows, often combined with problems set in open domains, implies that the resources needed to computationally model problems of industrial and academic relevance is virtually unbounded. FD simulations therefore are a natural driver for exascale computing and have the potential for substantial societal impact, like reduced energy consumption, alternative sources of energy, improved health care, and improved climate models.</p> <p>The main goal of this project is to address algorithmic challenges to enable the use of accurate simulation models in exascale environments. Driven by problems of practical engineering interest we focus on important simulation aspects including:</p> <ul style="list-style-type: none"> • error control and adaptive mesh refinement in complex computational domains, • resilience and fault tolerance in complex simulations • heterogeneous modeling • evaluation of energy efficiency in solver design • parallel input/output and in-situ compression for extreme data. <p>The algorithms developed by the project will be prototyped in major open-source simulation packages in a co-design fashion, exploiting software engineering techniques for exascale. We are building directly on the results of previous exascale projects (CRESTA, EPIGRAM, etc.) and will exploit advanced and novel parallelism features required for emerging exascale architectures. The results will be validated in a number of pilot applications of concrete practical importance in close collaboration with industrial partners.</p>	KUNGLIGA TEKNISKA HOGSKOLAN	Sweden
ExaNeSt	European Exascale System Interconnect and Storage	H2020 - FET	01/12/2015	01/12/2018	8.442.547 €	8.442.547 €	RIA	FETHPC-1-2014	http://www.exanest.eu	<p>ExaNeSt will develop, evaluate, and prototype the physical platform and architectural solution for a unified Communication and Storage Interconnect and the physical rack and environmental structures required to deliver European Exascale Systems. The consortium brings technology, skills, and knowledge across the entire value chain from computing IP to packaging and system deployment; and from operating systems, storage, and communication to HPC with big data management, algorithms, applications, and frameworks. Building on a decade of advanced R&D, ExaNeSt will deliver the solution that can support exascale deployment in the follow-up industrial commercialization phases. Using direction from the ET4HPC roadmap and soon-available high density and efficiency compute, we will model, simulate, and validate through prototype, a system with:</p> <ol style="list-style-type: none"> 1. High throughput, low latency connectivity, suitable for exascale-level compute, their storage, and I/O, with congestion mitigation, QoS guarantees, and resilience. 2. Support for distributed storage located with the compute elements providing low latency that non-volatile memories require, while reducing energy, complexity, and costs. 3. Support for task-to-data sw locality models to ensure minimum data communication energy overheads and property maintenance in databases. 4. Hyper-density system integration scheme that will develop a modular, commercial, European-sourced advanced cooling system for exascale in ~200 racks while maintaining reliability and cost of ownership. 5. The platform management scheme for big-data I/O to this resilient, unified distributed storage compute architecture. 6. Demonstrate the applicability of the platform for the complete spectrum of Big Data applications, e.g. from HPC simulations to Business Intelligence support. <p>All aspects will be steered and validated with the first-hand experience of HPC applications and experts, through kernel turning and subsequent data management and application analysis.</p>	FOUNDATION FOR RESEARCH AND TECHNOLOGY HELLAS	Greece

ExaNoDe	European Exascale Processor Memory Node Design	H2020 - FET	01/10/2015	01/10/2018	8.629.873 €	8.629.247 €	RIA	FETHPC-1-2014	http://exanode.eu/	<p>ExaNoDe will investigate, develop and pilot (technology readiness level 7) a highly efficient, highly integrated, multi-way, high-performance, heterogeneous compute element aimed towards exascale computing and demonstrated using hardware-emulated interconnect. It will build on multiple European initiatives for scalable computing, utilizing low-power processors and advanced nanotechnologies. ExaNoDe will draw heavily on the Unimem memory and system design paradigm defined within the EUROSERFER FP7 project, providing low-latency, high-bandwidth and resilient memory access, scalable to Exabyte levels.</p> <p>The ExaNoDe compute element aims towards exascale compute goals through:</p> <ul style="list-style-type: none"> •Integration of the most advanced low-power processors and accelerators across scalar, SIMD, GPGPU and FPGA processing elements supported by research and innovation in the deployment of associated nanotechnologies and in the mechanical requirements to enable the development of a high-density, high-performance integrated compute element with advanced thermal characteristics and connectivity to the next generation of system interconnect and storage; •Undertaking essential research to ensure the ExaNoDe compute element provides necessary support of HPC applications including I/O and storage virtualization techniques, operating system and semantically aware runtime capabilities and PGAS, OpenMP and MPI paradigms; •The development of an instantiation of a hardware emulation of interconnect to enable the evaluation of Unimem for the deployment of multiple compute elements and the evaluation, tuning and analysis of HPC mini-apps. <p>Each aspect of ExaNoDe is aligned with the goals of the ETP4HPC. The work will be steered by first-hand experience and analysis of high-performance applications, their requirements and the tuning of their kernels.</p>	COMMISSARIAT A L ENERGIE ATOMIQUE ET AUX ENERGIES ALTERNATIVES	France
ExCAPE	Exascale Compound Activity Prediction Engine	H2020 - FET	01/09/2015	01/09/2018	3.910.140 €	3.910.140 €	RIA	FETHPC-1-2014	http://excape-h2020.eu/index.php/	<p>Scalable machine learning of complex models on extreme data will be an important industrial application of exascale computers. In this project, we take the example of predicting compound bioactivity for the pharmaceutical industry, an important sector for Europe for employment, income, and solving the problems of an ageing society. Small scale approaches to machine learning have already been trialed and show great promise to reduce empirical testing costs by acting as a virtual screen to filter out tests unlikely to work. However, it is not yet possible to use all available data to make the best possible models, as algorithms (and their implementations) capable of learning the best models do not scale to such sizes and heterogeneity of input data. There are also further challenges including imbalanced data, confidence estimation, data standards model quality and feature diversity.</p> <p>The ExCAPE project aims to solve these problems by producing state of the art scalable algorithms and implementations thereof suitable for running on future Exascale machines. These approaches will scale programs for complex pharmaceutical workloads to input data sets at industry scale. The programs will be targeted at exascale platforms by using a mix of HPC programming techniques, advanced platform simulation for tuning and and suitable accelerators.</p>	INTERUNIVERSITAIR MICRO-ELECTRONICACESTRUM IMECVZW	Belgium
GAS	Dynamics and COevolution in Multi-Level Strategic Interaction GAmes	FP7-ICT	01/10/2012	30/09/2015	3.420.704 €	2.600.000 €	Collaborative project (generic)	ICT-2011.9.7 FET Proactive: Dynamics of Multi-Level Complex Systems (DyM-CS)	http://www.cogas-project.eu/	<p>Many real world systems possess a rich multi-level structure and exhibit complex dynamics that are the result of a web of interwoven interactions among elements with autonomous decision-making capabilities. GAS will develop new mathematical models and tools, rooted in game theory, for the analysis, prediction and control of dynamical processes in such complex systems.</p> <p>GAS will provide a coherent theoretical framework for understanding the emergence of structure and patterns in complex systems, accounting for interactions spanning various scales in time and space, and acting at different structural and aggregation levels. This framework will be built around game theoretical concepts, in particular evolutionary and multi-resolution games, and will include also techniques drawn from graph theory, statistical mechanics, control and optimization theory. Specific attention will be devoted to systems that are prone to intermittency and catastrophic events due to the effect of collective dynamics.</p> <p>The theory developed in the project will be validated by considering three use cases, one on the growth of the Internet, one on business ecosystems and one on viral marketing dynamics in Internet marketplaces.</p> <p>The GAS consortium comprises seven universities and research institution and includes leading scientists in game theory, evolutionary games, complex systems science, network science and data-driven analysis of socio-technical systems.</p>	CREATE-NET (CENTER FOR RESEARCH AND TELECOMMUNICATION EXPERIMENTATION FOR NETWORKED COMMUNITIES)	Italy

GEMINI	Germanium Mid-infrared plasmonics for sensing	FP7-ICT	01/02/2014	31/01/2017	2.267.220 €	1.737.205 €	Collaborative project (generic)	ICT-2013.9.5 FET-Open Xtrack	http://www.gemini-fp7.eu/	We aim at laying the foundations of a novel paradigm in optical sensing by introducing molecule-specific strong light-matter interaction at mid-infrared wavelengths through the engineering of plasmonic effects in group-IV semiconductors. The key enabling technology is the novel germanium-on-silicon material platform: heavily-doped Ge films display plasma frequencies in the mid-infrared range. This allows for the complete substitution of metals with CMOS-compatible semiconductors in plasmonic infrared sensors, with enormous advantages in terms of fabrication quality and costs. Moreover, the mid-infrared range offers the unique opportunity of molecule specificity to target gases in the atmosphere, analytes in a solution or biomolecules in a diagnostic assay. We will develop sensing substrates containing infrared antennas and waveguides with antenna-enhanced detectors. Antennas and waveguides will be made of heavily-doped Ge to fully exploit plasmonic effects: high field concentration to increase sensitivity, resonant coupling to vibrational lines for chemical specificity, deeper integration to decrease costs. To achieve our goals we will rely on semiconductor growth by chemical vapour deposition, electromagnetic simulations, micro/nanofabrication of devices and advanced infrared spectroscopy. We aim at studying the fundamental properties of new materials and devices in order to assess their potential for sensing. Impacts of the proposed research go far beyond transforming optical sensing technology. Lab-on-chip disposable biosensors with integrated readout for medical diagnostics would radically cut healthcare costs. The possibility of actively tuning electromagnetic signals by electrical and/or optical control of the plasma frequency in semiconductors holds promises for dramatic opto-electronic integration. Finally, plasmonic semiconductor antennas will impact on photovoltaics, light harvesting and thermal imaging.	POLITECNICO DI MILANO	Italy
GHOST	Generic and Highly Organic, Shape-changing Interfaces	FP7-ICT	01/01/2013	31/12/2015	2.474.819 €	1.931.185 €	Collaborative project (generic)	ICT-2011.9.1 Challenging current Thinking	http://www.ghost-fet.com/	Current user interfaces for computers and mobile devices often separate input and output, are typically static in their physical appearance, and rarely tap humans' ability to reason about and manipulate physical objects. We propose a new paradigm of interfaces that address these limitations. The paradigm is called Generic and Highly Organic, Shape-changing Interfaces (GHOSTs). GHOSTs are display surfaces made of malleable materials that can change into and retain arbitrary shapes so as to display output from the system or afford new actions. At the same time, GHOSTs allow users to deform, touch, or otherwise manipulate the shape of their display surface to provide input to the system. We argue that such interfaces provide many benefits over current user interfaces by leveraging humans' ability to perceive, express, and communicate through touch and manipulation of physical objects. The present project will design, develop, and evaluate GHOST prototypes. We combine disciplines focusing on (a) the hardware and software for shape change, using combinations of shape actuators and smart materials; (b) the industrial and interaction design for such interfaces, in particular how to make them physically appealing, useful, and usable; and (c) the user experience of interacting with GHOSTs, quantifying and modelling users' performance with and affect towards the interface. These disciplines are brought together in four iterations of prototypes, continuously testing and refining the prototypes' resolution, the shape-change response, users' performance, and the experience of interaction. In addition to the proof-of-concept prototypes, we establish the technical and scientific basis for useful and usable shape-changing interfaces.	KØBENHAVNS UNIVERSITET	Denmark
GLOBASOL	Global solar spectrum harvesting through highly efficient photovoltaic and thermoelectric integrated cells	FP7-ENERGY	01/03/2013	29/02/2016	3.972.560 €	2.995.040 €	Collaborative project (generic)	ENERGY.201 2.10.2.1 Future Emerging Technologies	http://www.globasol.eu/	GLOBASOL will develop new concepts, materials and devices for advanced light harvesting and light management for a panchromatic collection of the solar energy and an unprecedented power conversion efficiency. This will be accomplished by integrating in a single device three light-to-electricity converters, exploiting different regions of the solar spectrum based on sensitized mesoscopic solar cells (SMSC), photonic crystals, thermoelectric (TE) cells. The key elements of the project are: 1) new absorbers for SMSC, with a very high conversion efficiency in the UV-vis region; 2) novel photonic materials for the collection/split of the IR spectrum; 3) advanced nanostructured materials for TE conversion of the IR part of the spectrum; 4) radically new architectures for the integrated devices, to increase the total efficiency. The innovative materials will include organometallics, organic dyes and quantum dots as sensitizers, quasi-solid electrolytes, nanostructures and nanowires alloys as well as quantum dots for TE. The devices will be engineered either in tandem arrangements or with optical splitting of the incident radiation, and concentration of the IR fraction to the TE. The targeted power conversion efficiencies are above 15% and 10% for SMSC in high and medium energy spectral regions, respectively, and 6% for TE, to reach a global efficiency above 30%, well beyond the present limits, along with cost-effectiveness and environmental safety. Five Universities and one Research Institution guarantee a scientific and technological multidisciplinary research, based on top level theoretical and experimental approaches. The high degree of knowledge in solid-state physics and chemistry, nanoscience and nanotechnology and engineering of the researchers assures that the new concepts and the objectives proposed will be successfully developed/pursued. A high-tech SME will provide proof-of-concept prototypes to validate the innovative GLOBASOL devices.	UNIVERSITA DEGLI STUDI DEL PIEMONTE ORIENTALE AMEDEO AVOGADRO	Italy

GLODERS	The Global Dynamics of Extortion Racket Systems	FP7-ICT	01/10/2012	30/09/2015	2.183.977 €	1.671.000 €	Collaborative project (generic)	ICT-2011.9.14 Joint Call ICT-SSH on 'Science of Global Systems'	http://www.gloders.eu/	The GLODERS research project is directed towards development of an ICT model for understanding a specific aspect of the dynamics of the global financial system: Extortion Racket Systems (ERSs). ERSs, of which the Mafia is but one example, are spreading globally from a small number of seed locations, causing massive disruption to economies. Yet there is no good understanding of their dynamics and thus how they may be countered. ERSs are not only powerful criminal organizations, operating at several hierarchical levels, but also prosperous economic enterprises and highly dynamic systems, likely to reinvest in new markets. If stakeholders - legislators and law enforcers - are to be successful in attacking ERSs, they need the much better understanding of the evolution of ERSs that computational models and ICT tools can give them. GLODERS will provide a theory-driven set of computational tools, developed through a process of participatory modelling with stakeholders, to study, monitor, and possibly predict the dynamics of ERSs, as they spread from local through regional into global influence. The research will draw on expertise already developed in the small, but highly experienced multidisciplinary consortium to use:- computer-assisted qualitative text mining of documentary evidence;- guided semi-automatic semantic analysis of stakeholder narratives and other textual data; and- multi-level, stakeholder-centred agent-based modelling of the distributed negotiations between normative agents. These methods will advance the state of the art for using data to inform policy decisions. Throughout, the project will interact with a large, international group of stakeholder representatives from EU Ministries of Justice and police forces. The output will provide a set of ICT tools to facilitate strategic policies that could prevent the further penetration and extension of the global menace posed by ERSs.	UNIVERSITY OF SURREY	United Kingdom
GO-NEXTS	Graphene doping and texturing in efficient electrodes for organic solar cells	FP7-ENERGY	01/11/2012	31/10/2015	2.689.525 €	2.087.998 €	Collaborative project (generic)	ENERGY.201 2.10.2.1 Future Emerging Technologies	http://www.go-nexts.eu	Organic semiconductor solar cells are a promising route to scalable, economically viable, energy conversion technologies due to the potential for development of low-cost, flexible, large-area cells and modules. In order to achieve the goal of obtaining efficient bulk heterojunction solar cells (BHJ-SCs), graphene electrodes have been recently proposed as a promising candidate. Research is however at the very beginning, so that if graphene will manage to accomplish this task still has to be proved. In particular, many questions remain open like the degree of interaction of graphene with the polymeric layer, which could degrade the outstanding graphene electron conductivity, as well as the graphene/polymer electron affinity, which plays an important role in the overall solar cell efficiency. Furthermore, up to now no analysis on light management improvements induced by structuring graphene as photonic crystal for light trapping in BHJ-SC has been reported. The GO-NEXTS project, will focus its attention on new kind of electrodes based on doped, textured (ie 3D) graphene electrodes, in order to increase the overall efficiency and performance of bulk heterojunction solar cells. To our knowledge, this represents the first proposal to enhance light trapping in a solar cell by structuring one or more graphene contact electrode(s) to act as photonic crystal(s). The project will leverage the combination of two different fabrication processes, and in particular the doping of the graphene, to obtain semi-transparent electrodes as well as the texturing of the electrodes. This approach, which has never been proposed before, represents a high-risk, high-impact approach. If successful, it should lead to improvements in solar cell efficiency by up to 14%. Furthermore, all the technologies proposed are suitable for large area realization paving the way for scalable, economic fabrication technologies on low-cost flexible substrates.	UNIVERSITA DEGLI STUDI DI ROMA TOR VERGATA	Switzerland
GOSFEL	GRAPHENE ON SILICON FREE ELECTRON LASER	FP7-ICT	01/10/2012	30/09/2015	2.295.434 €	1.739.511 €	Collaborative project (generic)	ICT-2011.9.1 Challenging current Thinking	http://www.gosfel.eu/	The aim of this project is to demonstrate an entirely new type of compact laser source by exploiting the unique properties of graphene to realise a solid-state free electron laser. Free electron lasers (FELs) represent a radical alternative to conventional lasers as they do not have the restrictions of conventional lasers on operating wavelengths, and they are potentially the most flexible, high power and efficient generators of tuneable coherent radiation from the ultra-violet to the infra-red. In a FEL radiation is emitted from an electron beam travelling in a vacuum and passing through an undulatory magnetic field, and the emission wavelength is only determined by the period of the magnetic field and electron beam energy. However, current free electron lasers are large and expensive facilities. The recent isolation of graphene, in which electrons travel ballistically and at extremely high saturation velocities, has provided an exciting potential route for creating a compact solid state free electron laser. In this project we will first develop the theory for the operation of such a device and will use this to design and fabricate devices containing a suspended graphene active region. Metallic gratings will be patterned on top of, or below, the graphene to provide the modulation needed to accelerate/decelerate the electrons, causing the emission of radiation in the 0.2 to 10 THz range. We will then integrate an electromagnetic feedback cavity to enhance stimulated emission and to produce coherent radiation. The demonstration of such a room temperature source would challenge established notions of laser operation and would be a significant technological development.	THE UNIVERSITY OF EXETER	United Kingdom

GRACeFUL	Global systems Rapid Assessment tools through Constraint FUnctional Languages	H2020 - FET	01/02/2015	01/02/2018	2.404.943 €	2.404.943 €	RIA	FETPROACT- 1-2014	https://www.graceful-project.eu/	<p>The making of policies coping with Global Systems is a process that necessarily involves stakeholders from diverse disciplines, each with their own interests, constraints and objectives. People play a central role in such collective decision making and the quest for solutions to a problem generally intertwines its very specification. Simulators can assist in this process provided they employ adequate high-level modelling to separate the political question from the underlying scientific details. Domain-specific Languages (DSL) embedded in Functional Programming (FP) languages offer a promising way to implement scalable and verifiable simulators. But the use of simulators is essentially a trial-and-error process too tedious for execution in a group session. A paradigm shift is needed towards active problem solving where stakeholders' objectives can be taken along from the very beginning. Constraint Programming (CP) has demonstrated to enable such a shift for e.g. managed physical systems like water and power networks.</p> <p>This project lays the base for a DSL aimed at building scalable Rapid Assessment Tools for collective policy making in global systems. This can be achieved through foundational scientific work at different levels: from the high-level, political modelling, adapting the social discipline of Group Model Building (as used in business organizations), through visual forms of CP as well as gamification aspects, down to the needs for a host language, combining CP and FP. Special emphasis is put on domain-specific constraints, constraint composition, and composable solvers and heuristics.</p> <p>Results are applied and validated for the problem case of Climate-Resilient Urban Design, but the ambition is a general framework applicable to many other systems. The case study is assessed by an external multi-disciplinary Advisory Board of Stakeholders that guides the specification process and evaluates needs and usability of the tools.</p>	UNIVERSITAT POLITECNICA DE CATALUNYA	Spain
GRAPHENICS	Graphene-enabled on-chip supercontinuum light sources	FP7-ICT	01/12/2013	30/11/2016	1.184.805 €	923.409 €	Collaborative project (generic)	ICT-2013.9.3 FET Young Explorers	https://sites.google.com/site/graphenicseu/	<p>To pave the way towards the widespread application of on-chip mid-infrared(MIR)-pumped nonlinear supercontinuum light sources, we want to introduce a paradigm shift in integrated nonlinear optics. Rather than relying on non-standard waveguide designs, large waveguide footprints, bulky MIR pump lasers and/or limited spectral coverage in strategies that could never comply with the requirements for widespread deployment, we target a major advance based on novel material physics and device design, eliminating these issues. Our goal is to develop a near-infrared(NIR)- and MIR-emitting, ultra-compact on-chip supercontinuum light source by exploiting practically unexplored optical nonlinearities of standard silicon waveguides covered with graphene.</p> <p>This groundbreaking dual-band source will be realized by cascading two devices which are based on graphene-covered standard silicon waveguides, and which enable for the first time broadband self-phase modulation in the MIR and power-efficient second harmonic generation in the NIR within an ultra-compact chip footprint. To ensure that the entire supercontinuum device including the pump laser is compact, we will in addition develop a novel, small-sized, and practical modelocked MIR Tm-Ho fibre laser to pump the supercontinuum generation. These breakthroughs carry a highly novel and foundational character, and fit very well within the framework of the FET Open FP7-ICT-2013-C call. Since the partners involved in this project have both the knowledge and the equipment to model, design, fabricate and pump graphene-based nonlinear optical devices, our consortium holds all necessary skills required to successfully carry out this "high-gain/high-risk" project. In doing so, we will lay the foundations for graphene-on-silicon-based nonlinear photonic integrated circuits, and at the same time pave the way to the extensive use of on-chip supercontinuum light sources in real-life applications.</p>	VRIJE UNIVERSITEIT BRUSSEL	Belgium
GRASP	GRAPHENE-BASED SINGLE-PHOTON NONLINEAR OPTICAL DEVICES	FP7-ICT	01/01/2014	31/12/2016	2.680.715 €	2.003.851 €	Collaborative project (generic)	ICT-2013.9.5 FET-Open Xtrack	http://www.grasp-fet.eu/	<p>Finding an approach to actuate nonlinear optical effects at ultra-low powers and on chip-scale devices is one of the outstanding challenges in optics. The ultimate limit is the quantum regime where individual light quanta strongly interact with each other. This limit has so far been technologically impossible, but if achieved would have far-reaching consequences in information technologies. In particular, it would enable the best possible performance and wide deployment of classical nonlinear devices, and facilitate disruptive quantum information protocols that fundamentally cannot be realized on classical platforms. The primary obstacle is the weak nonlinear response of available optical materials, which necessitates high intensities and long interaction times to induce nonlinear effects. In this proposal, we will theoretically and experimentally pursue a fundamentally new paradigm – graphene-based single-photon nonlinear optics – that eliminates all of the current barriers. Our approach builds upon remarkable properties of graphene, which cause surface plasmons to be confined to scales millions of times smaller than the diffraction limit, and also induce exceptional nonlinear interaction strengths. We will show that in this unconventional nonlinear medium, even single quanta attain the requisite intensities to actuate nonlinear processes. Significantly, we aim for the first demonstration of the deterministic generation of non-classical light, which is based on "bulk" nonlinear materials rather than individual quantum emitters. The partners of GRASP are internationally recognized in the fields of graphene, nano-photonics, quantum optics, and quantum information science, and have a strong history of launching innovative multi-disciplinary research directions. This team is uniquely suited to establish graphene as the first viable route to widely deployable, chip-scale classical and quantum nonlinear optical technologies.</p>	FUNDACIO INSTITUT DE CIENCIES FOTONIQUES	Spain

GREENEYES	Networked energy-aware visual analysis	FP7-ICT	01/10/2012	30/09/2015	1.334.031 €	993.770 €	Collaborative project (generic)	ICT-2011.9.3 FET Young Explorers	NOT AVAILABLE	<p>The potential of the Internet of Things is leading to a paradigm shift with an ambitious long-term vision, in which battery-operated sensing nodes are empowered with sight and are capable of complex visual analysis tasks. Unfortunately, this is out of reach with the current technology. GreenEyes will develop a comprehensive set of new methodologies, algorithms and protocols, to empower wireless sensor networks with vision capabilities comparable to those achievable by power-eager smart camera systems. The key tenet is that most visual analysis tasks can be carried out based on a succinct representation of the image, which entails both global and local features, while it disregards the underlying pixel-level representation. Still, under severe energy constraints it is imperative to optimize the computation, the coding and the transmission of the features. On the computation and coding side, GreenEyes will tackle the problem by reversing the conventional compress-then-analyze paradigm. That is, image features are collected by sensing nodes, processed, and delivered to final destination(s) in order to enable higher level visual analysis tasks by means of either centralized or distributed detectors and classifiers, somewhat mimicking the processing of visual stimuli in the early visual system. The transmission of visual features is subject to tight application-dependent requirements (bandwidth/delay guarantees), and may be affected by network conditions. Therefore, on the communication side, GreenEyes will pursue the design of networking tools for wireless multimedia sensor networks for energy efficient distributed control, information delivery and in-network processing optimized for the visual analysis task.</p>	POLITECNICO DI MILANO	Italy
greenFLASH	Green Flash, energy efficient high performance computing for real-time science	H2020 - FET	01/10/2015	01/10/2018	3.760.793 €	3.760.793 €	RIA	FETHPC-1-2014	http://green-flash.lesia.obspm.fr/	<p>The main goal of Green Flash is to design and build a prototype for a Real-Time Controller (RTC) targeting the European Extremely Large Telescope (E-ELT) Adaptive Optics (AO) instrumentation. The E-ELT is a 39m diameter telescope to see first light in the early 2020s. To build this critical component of the telescope operations, the astronomical community is facing technical challenges, emerging from the combination of high data transfer bandwidth, low latency and high throughput requirements, similar to the identified critical barriers on the road to Exascale. With Green Flash, we will propose technical solutions, assess these enabling technologies through prototyping and assemble a full scale demonstrator to be validated with a simulator and tested on sky. With this R&D program we aim at feeding the E-ELT AO systems preliminary design studies, led by the selected first-light instruments consortia, with technological validations supporting the designs of their RTC modules. Our strategy is based on a strong interaction between academic and industrial partners. Components specifications and system requirements are derived from the AO application. Industrial partners lead the development of enabling technologies aiming at innovative tailored solutions with potential wide application range. The academic partners provide the missing links in the ecosystem, targeting their application with mainstream solutions. This increases both the value and market opportunities of the developed products. A prototype harboring all the features is used to assess the performance. It also provides the proof of concept for a resilient modular solution to equip a large scale European scientific facility, while containing the development cost by providing opportunities for return on investment.</p>	OBSERVATOIRE DE PARIS	France
GRIDMAP	Grid cells: From brains to technical implementation	FP7-ICT	01/03/2013	29/02/2016	4.346.717 €	2.917.961 €	Collaborative project (generic)	ICT-2011.9.11 FET Proactive: Neuro-Bio-Inspired Systems (NBIS)	http://www.ntnu.no/kavli/research/gridmap	<p>Since the invention of the first computers, their speed and computing power have grown exponentially but their fundamental operating principles remain essentially unchanged. Computers are still operating on one or a few central processing units, each with limited interconnectivity. Such processors, coupled with fast access to memory, are good for performing precisely instructed operations on large quantities of data very rapidly, but less effective in enabling the near instantaneous processing of the rapidly changing and ambiguous information that living interactive organisms are apparently so good at dealing with. With this in mind, it has been argued that computer technology would benefit from looking at how parallel computation is handled by the brain, nature's most advanced computer. Our recent discovery of a key mechanism for the neural mapping of space, using the metric encoded by 'grid cells', provides us with unprecedented direct-access to some of the fundamental operating principles of cortical circuits - principles to which engineers need access for developing brain-inspired computing technologies. We shall use grid cells as an access ramp to understanding massively parallel-distributed spatial computations in sufficient detail to implement these basic working principles in computational architecture. Building on our recent breakthrough discovery, and guided by new brain experiments, computationally tractable algorithms will be tested in artificial navigating agents (robots), with the overall aim of identifying cardinal elements of future emerging technologies in the domain of spatial navigation and, more generally, in the development of massively parallel multi-core interactive computers. Because the expected long-term impacts are substantial, the project group will interact regularly with advisory panels on both IPR and machine ethics.</p>	NORGES TEKNISKE HOGSKOLEN NTNU	Norway

GUARDIAN ANGELS	Guardian Angels for a Smarter Life	FP7-ICT	01/02/2013	31/01/2016	1.656.719 €	1.333.279 €	Collaborative project (generic)	ICT-2011.9.5 FET Flagship Initiative Preparatory Actions http://www.ga-project.eu/	Guardian Angels (GA) are future zero-power, intelligent, autonomous systems-of-systems featuring sensing, computation, and communication beyond human aptitudes. GA will assist humans from their infancy to old age in complex life situations and environments. Zero-power reflects system-of-systems ability to scavenge energy in dynamic environments by disruptive harvesting techniques. The project prepares zero-power technologies based on future energy-efficient technologies, heterogeneous design, and disruptive energy scavengers. Three zero-power generations of GAs are foreseen:- Physical Guardian Angels are zero-power, on-body networks or implantable devices that monitor vital health signals and take appropriate actions to preserve human health.- Environmental Guardian Angels extend monitoring to dynamic environments, using disruptive scavengers, personalized data communication, and first "thinking" algorithms. They are personal assistants that protect their wearers from environment dangers.- Emotional Guardian Angels are intelligent personal companions with disruptive zero-power, man-machine interfaces deployed at large scale. They sense and communicate using non-verbal languages playing an important role in health, education, and security worldwide. This project addresses the following scientific challenges for energy-efficient visionary Guardian Angel autonomous systems: (i) energy-efficient computing (down to E=10-100kT), (ii) and communication (approaching the limit of 1pJ/bit), (iii) low-power sensing, (iv) disruptive scavenging (bio-inspired, thermoelectric, etc, targeting energy densities of tens of mW/cm ²), and (v) zero-power man-machine interfaces. A selection of emerging technologies based on energy efficiency is proposed. We will also develop design tools that integrate electrical, mechanical, optical, thermal, and chemical simulation tools over length and time scales currently not achievable.	SAGIVTECH LTD	Israel
H2ESOT	Waste Heat to Electrical Energy via Sustainable Organic Thermoelectric Devices	FP7-ENERGY	01/01/2013	31/12/2015	1.674.053 €	1.265.842 €	Collaborative project (generic)	ENERGY.201 2.10.2.1 Future Emerging Technologies http://www.h2esot.com/	It is estimated that mankind wastes ~20% of the 15 terawatts required annually for global power consumption as low level heat (THE UNIVERSITY OF NOTTINGHAM	United Kingdom
HAIRS	Hybrid Architecture for quantum Information using Rydberg ensembles and Superconductors	FP7-ICT	01/02/2014	31/01/2017	2.073.878 €	1.590.344 €	Collaborative project (generic)	ICT-2013.9.5 FET-Open Xtrack NOT AVAILABLE	We propose to solve the long-standing problem of coupling quantum states in atoms to solid-state quantum devices. The realization of such a quantum interface represents a major breakthrough for information science, as it enables the development of a powerful hybrid architecture, where long-lived states of atoms store quantum information that can be processed rapidly using superconducting quantum circuits. Within such a hybrid approach, the problem of scalability, fast information processing and long-time storage of quantum information can all be solved on a single integrated platform. The major obstacle, thus far, has been to find a suitable quantum interface between atoms (memory) and the surface of the solid-state device (processor), hampered by too low coupling strengths and/or too fast information loss due to fluctuating atom surface interactions. In this project, we propose to develop and implement a novel approach that solves both of these problems simultaneously. On the one hand, we will make use of the strong microwave transition between highly-excited, atomic Rydberg states to achieve strong coupling to a superconducting stripline cavity. On the other hand, the key point of this proposal is the use of the enormous interactions between Rydberg atoms for collective encoding of quantum information in large ensembles that will be immunised against parasitic field fluctuations by the strong interactions. We will tackle this ambitious goal within a consortium that combines strong experimental and theoretical expertise in all the necessary areas and contributes complementary setups for state-of-the-art experiments on cold Rydberg atoms superconducting quantum circuits.	CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE	France
HANAS	Hybrid Artificial and Natural Atomic Systems	FP7-ICT	01/02/2013	31/01/2016	3.244.910 €	2.500.000 €	Collaborative project (generic)	ICT-2011.9.9 FET Proactive: Quantum ICT (QICT) including ERA-NET-Plus NOT AVAILABLE	This project will establish a groundbreaking research program in hybrid quantum systems combining solid state and atomic components. The key elements in this project are devices based on single quantum dots and novel photon storage schemes in atomic systems. Quantum dots, also known as artificial atoms, enable photon generation in the solid state with functionalities such as tunability, high collection efficiency, radiative lifetime engineering and scalability. Atomic systems are well controlled, exhibit long coherence times and enable the implementation of robust schemes for photon storage. HANAS will demonstrate that a powerful synergy can emerge from hybrid quantum systems where the advantageous functionalities of solid state and atomic systems are combined. We will develop a new type of solid state quantum emitters optimized for coupling to atomic transitions, based on quantum dots in complex nanostructures. New schemes to efficiently couple the emission from single quantum dots with atomic transitions will also be developed and implemented. A range of new hybrid experiments will be carried out that will result in the demonstration of hybrid quantum interconnects where photons generated in a quantum dot will be stored in a rubidium vapour. Additionally, frequency locking techniques borrowed from the atomic community will be implemented in the solid state to counteract spectral diffusion of single quantum dots. To reach our ambitious goals, we bring together European leaders in atomic optics, quantum dot optics, quantum dot growth and nanoprocessing. These achievements will play crucial roles in the development of complex quantum networks.	TECHNISCHE UNIVERSITEIT DELFT	Netherlands

HANDICAMS	Heterogeneous Ad-hoc Networks for Distributed, Cooperative, and Adaptive Multimedia Signal Processing	FP7-ICT	01/10/2013	30/09/2016	1.999.111 €	1.572.969 €	Collaborative project (generic)	ICT-2013.9.1 Challenging current Thinking	http://www.handicams-fet.eu/	The project is aimed at developing a new ICT paradigm, which considers multiple heterogeneous devices that cooperate in multiple signal processing tasks. This is radically different from current ICT paradigms, in which stand-alone devices merely focus on individual tasks or multiple devices perform one joint task, e.g., in a wireless sensor network (WSN). Examples of the heterogeneous devices considered are tablets, smartphones, handheld cameras, active headsets and hearing aids. Each device is equipped with one or several sensors, e.g., microphones and cameras, as well as with computing and wireless communication facilities, and has its own signal processing task, e.g., a local signal enhancement task. The aim is to achieve superior performance in these tasks through cooperation amongst the devices, which then effectively act as nodes in a WSN type set-up, where each node contributes to the other nodes' tasks. The main objective is to develop distributed, cooperative and adaptive signal processing algorithms for the acquisition, coding, processing, and in-network fusion of multimedia signals, in particular for the enhancement of audio and video signals. The algorithms are operated in a heterogeneous, ad-hoc and dynamic network, where each node has its own signal processing task as well as its own specific mode of operation. Furthermore, the algorithms should be scalable and require minimal communication bandwidth and power. As the network nodes may be selfish or opportunistic, general operating principles will be designed that provide incentives for cooperation. A general bottom-up design strategy will be adopted, rather than the usual top-down approach used in WSNs. The project will yield new theoretical frameworks for distributed detection, classification, estimation, coding, topology inference and cooperation strategies. In addition, two use cases are proposed in the context of audio and video enhancement, which will eventually serve as a proof of concept.	KATHOLIEKE UNIVERSITEIT LEUVEN	Belgium
HARVEST4D	Harvesting Dynamic 3D Worlds from Commodity Sensor Clouds	FP7-ICT	01/06/2013	31/05/2016	3.483.770 €	2.730.670 €	Collaborative project (generic)	ICT-2013.9.1 Challenging current Thinking	https://harvest4d.org/	The current acquisition pipeline for visual models of 3D worlds is based on a paradigm of planning a goal-oriented acquisition - sampling on site - processing. The digital model of an artifact (an object, a building, up to an entire city) is produced by planning a specific scanning campaign, carefully selecting the (often costly) acquisition devices, performing the on-site acquisition at the required resolution and then post-processing the acquired data to produce a beautified triangulated and textured model. However, in the future we will be faced with the ubiquitous availability of sensing devices that deliver different data streams that need to be processed and displayed in a new way, for example smartphones, commodity stereo cameras, cheap aerial data acquisition devices, etc. We therefore propose a radical paradigm change in acquisition and processing technology: instead of a goal-driven acquisition that determines the devices and sensors, we let the sensors and resulting available data determine the acquisition process. Data acquisition might become incidental to other tasks that devices/people to which sensors are attached carry out. A variety of challenging problems need to be solved to exploit this huge amount of data, including: dealing with continuous streams of time-dependent data, finding means of integrating data from different sensors and modalities, detecting changes in data sets to create 4D models, harvesting data to go beyond simple 3D geometry, and researching new paradigms for interactive inspection capabilities with 4D data sets. In this project, we envision solutions to these challenges, paving the way for affordable and innovative uses of information technology in an evolving world sampled by ubiquitous visual sensors. Our approach is high-risk and an enabling factor for future visual applications. The focus is clearly on basic research questions to lay the foundation for the new paradigm of incidental 4D data capture.	TECHNISCHE UNIVERSITAET WIEN	Austria
HELENIC-REF	Hybrid Electric Energy Integrated Cluster concerning Renewable Fuels	H2020 - FET	01/06/2015	01/06/2018	2.578.386 €	2.578.386 €	RIA	FETOPEN-RIA-2014-2015	http://www.helenic-ref.eu/	The targeted breakthrough of the HELENIC-REF project refers to the establishment of a new sustainable methodology for the water thermolysis at temperatures below 300oC and the immediate corresponding production of energy or fuels. The method is based on our preliminary experimental evidence of water thermolysis at 286oC in the presence of Fe3O4 nanoporous catalytic thick films, with the sustainable maintenance of the catalyst due to a new reduction method based on Lorentz force electrons generated by a magnetic field in the vicinity of the electric current heating the semiconducting catalyst. The method is used for the production of hydrogen and oxygen, as well as of fuels in the presence of CO2 in order to reduce CO2 to CO or even to hydrocarbons, (like Synthetic Natural Gas – SNG) via methanation.	NATIONAL TECHNICAL UNIVERSITY OF ATHENS - NTUA	Greece
HELICOID	HypErspectral Imaging Cancer Detection	FP7-ICT	01/01/2014	31/12/2016	1.375.838 €	992.758 €	Collaborative project (generic)	ICT-2011.9.2 High-Tech Research Intensive SMEs in FET research	http://www.helicoid.eu/	Starting with some specific types of cancers, this project will try to generalize the methodology to discriminate between healthy and malignant tissues in real-time during surgical procedures. Using the hyperspectral signatures of the healthy tissues and the same tissues affected by cancer, a mathematical model of how cancer affects to the hyperspectral signature will be derived. The research will start with the challenging task of brain cancer detection. A precise resection of the gliomas will minimize the negative effect of removing brain cells while assuring an effective tumour resection. The second type of tumours to be analysed will be the lung and breast cancers as they represent the two most common cancers in the world. Based on the experience gained during the evolution of the project and guided by the oncologist expertise, many other types of cancer out from the more than 200 that affect human beings will be studied. As cancer supposes a change in the cellular physiology, it should be detected as a change in the hyper-spectral signature. This project will try to determine if there is a certain pattern that could be identified as a cancer hyperspectral signature. Although previous works demonstrates that hyperspectral imaging can be used for certain cancer detection in animals, no application to human beings in real-time surgery has been found. This project will develop an experimental intraoperative setup based on non-invasive hyperspectral cameras connected to a platform running a set of algorithms capable of discriminate between healthy or pathological tissues. This information will be provided, through different display devices to the surgeon, overlapping normal viewing images with simulated colours that will indicate the cancer probability of the tissue presently exposed during every instant of the surgical procedure. A high-efficiency hardware/software prototype will be developed with the aim of recognising cancer tissues on real time.	UNIVERSIDAD DE LAS PALMAS DE GRAN CANARIA	Spain

HIDO	Holographic Integrated Display and Optics	FP7-ICT	01/11/2013	31/12/2015	1.647.687 €	1.263.243 €	Collaborative project (generic)	ICT-2013.9.2 High-Tech Research Intensive SMEs in FET research	NOT AVAILABLE	The possibility to create an augmented reality vision has been investigated since the 60's. Most augmented reality systems require the use of a Head Mount Display (HMD) to project a virtual image in the user's eyes. To date, no HMD featuring good field of view, good resolution and small dimensions has been developed. This has been one of the major bottlenecks to create an augmented reality market. Although, several interesting concepts emerged during the last years (Google Glass project is a recent example), all of those rely on a display decoupled from the optical system. This creates constraints on the mechanical configuration of the eyewear which increases volume and mass. Moreover, those systems have difficulties to cope with corrective vision requirements of a significant part of the users. The proposed project brings forth a completely disruptive solution using an innovative optical design where the display and the optical system are merged together in a single lens. This opens a new paradigm in the design of a HMD. First: it decreases the mass and the volume of the system. Second: it allows very large field of view. Third: it makes possible fashion and variable designs without any severe geometrical constraint. Fourth: it allows integrating correction optics inside the HMD lens. Fifth: it creates the possibility to use the traditional eyewear market to leverage the augmented reality market (similar design, similar distribution configuration, similar customization). The proposed design uses the most advanced technologies in optics, holography and OLED displays and integrates them in a single piece. This Lensplay (lens and display in one single physical element) will open up complete new ways for humans to interact with information computers. It will be a breakthrough that will ultimately change the world sees itself.	LUSOSPACE - PROJECTOS ENGENHERIA LDA	Portugal
HIERATIC	Hierarchical Analysis of Complex Dynamical Systems	FP7-ICT	01/10/2012	30/09/2015	2.429.435 €	1.899.967 €	Collaborative project (generic)	ICT-2011.9.7 FET Proactive: Dynamics of Multi-Level Complex Systems (DyM-CS)	NOT AVAILABLE	The central aim of HIERATIC is to develop a new framework for understanding complex systems as a multi-level hierarchy of sub-systems using non-linear decompositions. To achieve this goal, HIERATIC is structured in three interlinked sets of activities: theoretical work, deriving the novel mathematics required to identify suitable non-linear state space reductions of complex systems; software development of efficient multi-scale simulation and prediction libraries; demonstrators, illustrating the power of our results - network dynamics, cell cycle simulations, social interactions in animals. The theoretical work will use unconventional approaches from topology and dynamical systems theory to derive an algorithmic approach to identifying "coarse-grainings" of large complex systems. These algorithms will be used to develop highly efficient simulation and prediction tools, integrated with the world-leading software libraries MASON and PRISM. The demonstrators will show the potential application of these techniques, in a range of applications, including validation on large empirical data sets. The project brings together leading researchers in complex systems theory, biosystems, multi-agent simulation, and experimental ecology, from around the EU and USA.	THE UNIVERSITY OF BIRMINGHAM	United Kingdom
HRC POWER	Hybrid Renewable Energy Converter for continuous and flexible power production	FP7-ENERGY	01/11/2012	30/04/2016	3.101.969 €	2.383.041 €	Collaborative project (generic)	ENERGY.201 2.10.2.1 Future Emerging Technologies	NOT AVAILABLE	The HRC POWER project proposes a radically new approach combining novel advanced materials and an innovative hybridization technology to make breakthroughs at materials and concept levels: very high temperature operation up to 1300°C with high Carnot efficiency, round-the-clock operation for 95% ACF, high flexibility / dispatchability, low water consumption. Novel materials will consist of advanced absorber metamaterials based on self-organized structure and advanced infrared selective emitter refractory crystals. Novel technology / concept will consist of specific micro-combustor operating at very high temperature. This concept is a radically new path for renewable energy hybridization in a solid state device able to provide high quality thermal energy from solar and H2 or Biogas sources to thermal / electrical solid state converters. The main objectives of the HRC POWER project are to develop novel functional materials for advanced building blocks (solar, combustion and hybrid modes), novel high temperature joining technologies (integration of the building blocks) and to realize the proof of concept of this fully new technology, going from the architecture design to the performance assessment.	COMMISSARIAT A L ENERGIE ATOMIQUE ET AUX ENERGIES ALTERNATIVES	France
HRC POWER	Hybrid Renewable Energy Converter for continuous and flexible power production	FP7-ENERGY	01/11/2012	30/04/2016	3.101.969 €	2.383.041 €	Collaborative project (generic)	ENERGY.201 2.10.2.1 Future Emerging Technologies	NOT AVAILABLE	The HRC POWER project proposes a radically new approach combining novel advanced materials and an innovative hybridization technology to make breakthroughs at materials and concept levels: very high temperature operation up to 1300°C with high Carnot efficiency, round-the-clock operation for 95% ACF, high flexibility / dispatchability, low water consumption. Novel materials will consist of advanced absorber metamaterials based on self-organized structure and advanced infrared selective emitter refractory crystals. Novel technology / concept will consist of specific micro-combustor operating at very high temperature. This concept is a radically new path for renewable energy hybridization in a solid state device able to provide high quality thermal energy from solar and H2 or Biogas sources to thermal / electrical solid state converters. The main objectives of the HRC POWER project are to develop novel functional materials for advanced building blocks (solar, combustion and hybrid modes), novel high temperature joining technologies (integration of the building blocks) and to realize the proof of concept of this fully new technology, going from the architecture design to the performance assessment.	COMMISSARIAT A L ENERGIE ATOMIQUE ET AUX ENERGIES ALTERNATIVES	France

IBSEN	Bridging the gap: from Individual Behaviour to the Socio-technical MaN	H2020 - FET	01/09/2015	01/09/2018	2.663.237 €	2.663.237 €	RIA	FETOPEN-RIA-2014-2015	https://ibsen-2020.eu/	Developing models of real-world societal scenarios and systems is a key topic in the research agenda of social sciences, but is hindered by the lack of controlled experimentation with large groups of people. IBSEN will provide a breakthrough by building a repertoire of human behaviour in large (1000\ persons) structured groups using controlled experiments. To that end, we will develop a novel setup for large groups of people that will provide an experimental protocol, the necessary software and analytical tools to allow us to deal with thousands of people at the same time. We will apply our setup to specific research questions, focusing on novel phenomenology that may arise in large systems as compared to typical smaller ones, to find the rules that govern human behaviour in those cases, including the influence of social context and individual identity on them. We will assess our approach by building a model of human interaction in groups based on the behavioural rules we have found. The project requires a high-degree of interdisciplinarity; accordingly, the team consists of physicists, economists, social psychologists, and computer scientists. On the other hand, this is a high-risk project, as the experimental design may prove unfeasible for really large systems and extracting meaningful data from the participants' actions may not be possible. Notwithstanding, encouraging results in some pilot studies run by partners underpin the scientific feasibility of the concept and approach. If successful, researchers will be able to build on our findings to develop a human behaviour simulator, a technology providing a basis for socio-economic simulations that would radically change many fields, from robotics to economics, with technological and societal impacts, including policy-making in socially pressing issues. We will thus lay the foundations to kick start a new way of doing social science for the problems arising in a technologically highly connected society.	UNIVERSIDAD CARLOS III DE MADRID	Spain
INFERNOS	Information, Fluctuations, and Energy Control in Small Systems	FP7-ICT	01/01/2013	31/12/2015	3.001.209 €	2.294.426 €	Collaborative project (generic)	ICT-2011.9.1 Challenging current Thinking	http://www.infernos.eu/	Strong statistical fluctuations in meso- and nano-scale structures make their thermodynamic properties extremely dependent on the information available about them. The most basic process illustrating the importance of information to statistical systems is the information-to-energy conversion in the famous Maxwell's Demon (MD). Our primary goal is to study both experimentally and theoretically the statistics of fluctuations and the role of information in thermodynamics of the nano-scale systems. The first milestone will be the experimental realization of the nanoscale MD. We will create an experimental set-up and develop the corresponding theory of the monitored statistical evolution with feedback that optimizes the information-to-energy conversion. Our vision is to develop the nanoelectronic and bio-molecular devices that will allow us to systematically explore the limits of information-powered systems, in particular to test the Szilard's limit relating one bit of information to extracted energy. We will also study statistics of energy fluctuations as revealed via equilibrium and non-equilibrium fluctuations of temperature. Part of these fluctuations has a quantum mechanical origin, but identification of this contribution in practice poses a challenging problem. Another novel extension of the MD work will be the study of thermodynamic constraints on quantum detectors. The principal novelty of our project is that it brings a rigorous experimental component to the field presently dominated by theory. Though the concept of a MD is tremendously important for development of modern statistical mechanics, MD-type experiments are still at their infancy. Our experimental study of MD will naturally lead to further progress in the relevant theoretical concepts.	AALTO-KORKEAKOULUS AATIO	Finland
InnoSMART	An Innovative Method for Improving the Structural Integrity using SMA Revolutionary Technology	H2020 - FET	01/07/2015	01/07/2018	1.995.113 €	1.995.113 €	RIA	FETOPEN-RIA-2014-2015	http://inno-smart.eu/	The project proposes to develop a revolutionary coating that will be able to alter and control the mechanical properties of materials by external stimuli. This novel coating will be able to contribute to the stiffness and rigidity of an elastic metallic structure, to withstand the expected loading conditions safely, to enhance the integrity of a damaged structure and at the same time to protect it from corrosion. Such coating can bring multiple breakthroughs from the design level to the maintenance and repair level of the structure. The innovative compounds of the proposed coating are elements of smart materials - Shape Memory Alloys (SMAs). SMA elements are designed materials that have one or more properties that can be significantly changed in a controlled fashion by external stimuli. They can sense temperatures or stress as a function of change in damping, stiffness, electrical resistivity and deflection. It is specifically the latter aspect, which makes SMAs highly interesting for the particular application, since it is the actuation function built into the material. The innovative concept of the coating is described briefly as follows: upon mechanical loading the structure and hence the coating are deformed together as a system. However, by heating the coating, the SMA elements tend to recover their experienced deformations and return to their original shape. At this point, shear forces will be developed to the interface between coating and structure. The developed shear forces are expected to mitigate the deformation of the structure and reduce the level of the stress field. The latter is a great benefit for the regions, where cracks exist, since the local reduction of the stress field will delay the crack propagation and hence the structural failure. Finally, the coating will be also followed by a system that will ensure a satisfactory cover of the metallic surface, as well as a module for assessing the effect of any structural defects that may exist.	CRANFIELD UNIVERSITY	United Kingdom

INSIGHT	INSIGHT - DARWINIAN NEURODYNAMICS	FP7-ICT	01/03/2013	29/02/2016	2.876.708 €	2.219.079 €	Collaborative project (generic)	ICT-2011.9.1 Challenging current Thinking	http://www.insight-project.eu/	Despite eminent and numerous attempts to understand complex thinking, insight problem solving and language acquisition, one is left with the feeling that an essential component of these processes is being overlooked. This project offers and elaborates the Neural Replicator Hypothesis (NRH) stating that this missing ingredient is true Darwinian neurodynamics of replicators within the brain itself. Previous related approaches have been either sketchy, metaphorical, merely philosophical, or have used selection but not replication. INSIGHT-II is based on, and will refine, plausible neurobiological foundations of neuronal replicators despite the fact that neurons do not reproduce. It will show that Darwinian neurodynamics offers a credible and efficient algorithm for approximate Bayesian inference in the brain. The project will investigate the NRH in three ways: (1) The hypothesis will be worked out rigorously using formal models and computer simulations, (2) Its empirical relevance will be tested both from the viewpoint of neurophysiology using cell cultures, and from the viewpoint of human psychology using psychological experiments and neuroimaging. (3) Its ICT application potential is tested for two critical domains: robotics and language communication. Robotics work will test whether Darwinian neurodynamic controllers can be constructed that allow robots to engage in open-ended creative autonomous exploration. Language processing research will test whether detailed models of language learning that are based on a replicator dynamics of grammatical constructions is effective for explaining and synthesizing creative linguistic performance.	PARMENIDES STIFTUNG	Germany
INSPIN	Insulator Spintronics	FP7-ICT	01/03/2014	28/02/2017	2.699.728 €	2.009.301 €	Collaborative project (generic)	ICT-2013.9.5 FET-Open Xtrack	NOT AVAILABLE	InSpin will develop revolutionary nano-scale insulator spintronics that can replace or be integrated with conventional electronics and function at ambient temperatures. The innovation lies in the use of spin currents that in magnetic insulators are decoupled from charge currents and propagate with extremely low power dissipation. InSpin's objectives are to provide a disruptive technology that is spin-based, low-power and ultra-low-noise, leading to superior oscillators, logics, and random access memory compared to those based on charge-based electronics. Ultimately, electrical current-driven magnon Bose-Einstein condensation and the associated super spin-currents enable dissipationless spintronics at room temperature. The strong reduction or even the complete absence of power dissipation in (super) insulator spintronics implies loss-less transfer of spin signals that circumvents the energy dissipation problem, which threatens to end Moore's Law in information and communication technology. InSpin's final deliverable is to fabricate the first functional spin wave bus with signal input and detection and to use this bus to realize a logic majority gate as the key component for future insulator spintronics.	NORGES TEKNISKE UNIVERSITET NTNU	Norway
INTERTWINE	Programming Model INTERoperability ToWards Exascale (INTERTWinE)	H2020 - FET	01/10/2015	01/10/2018	3.861.400 €	3.861.400 €	RIA	FETHPC-1-2014	http://www.intertwine-project.eu/	This project addresses the problem of programming model design and implementation for the Exascale. The first Exascale computers will be very highly parallel systems, consisting of a hierarchy of architectural levels. To program such systems effectively and portably, programming APIs with efficient and robust implementations must be ready in the appropriate timescale. A single, "silver bullet" API which addresses all the architectural levels does not exist and seems very unlikely to emerge soon enough. We must therefore expect that using combinations of different APIs at different system levels will be the only practical solution in the short to medium term. Although there remains room for improvement in individual programming models and their implementations, the main challenges lie in interoperability between APIs. It is this interoperability, both at the specification level and at the implementation level, which this project seeks to address and to further the state of the art. INTERTWinE brings together the principal European organisations driving the evolution of programming models and their implementations. The project will focus on seven key programming APIs: MPI, GASPI, OpenMP, OpenSs, StarPU, QUARK and PaRSEC, each of which has a project partner with extensive experience in API design and implementation. Interoperability requirements, and evaluation of implementations will be driven by a set of kernels and applications, each of which has a project partner with a major role in their development. The project will implement a co-design cycle, by feeding back advances in API design and implementation into the applications and kernels, thereby driving new requirements and hence further advances.	THE UNIVERSITY OF EDINBURGH	United Kingdom
IQUOEMS	Interfacing Quantum Optical, Electrical, and Mechanical Systems	FP7-ICT	01/10/2013	30/09/2016	2.986.692 €	2.269.320 €	Collaborative project (generic)	ICT-2013.9.1 Challenging current Thinking	http://d7.unica.it/iquoems/contacts	This project aims at the efficient realization of quantum interfaces for high-fidelity conversion and coherent manipulation of quantum states of phonons and of photons at vastly distinct wavelengths. We will consider different experimental platforms, e.g. photonic crystal cavities, nonlinear crystalline resonators, graphene-based nanoelectromechanical systems, and nanomembranes, with the aim of implementing interfaces that are able to interact simultaneously in a tuneable way with optical and microwave fields. State transfer and controlled dynamics between radiation modes at completely different frequencies and between photons and phonons will be accomplished using diverse strategies, e.g. by tailoring the coupling of the interface with the fields, by exploiting electromagnetically-induced transparency, or the nonlinearities achievable in the strong coupling regime. The project results will enable new regimes for radio- and microwave electro-magnetic field detection, allowing quantum-limited amplification and readout of microwave and radio-frequency radiation. At the same time solid-state quantum devices which are now mainly manipulated by radiofrequencies and/or microwaves will become efficiently coupled to and controlled by optical fields.	UNIVERSITA DEGLI STUDI DI CAMERINO	Italy

I-RISC	Innovative Reliable Chip Designs from Low-Powered Unreliable Components	FP7-ICT	01/02/2013	31/01/2016	2.161.095 €	1.613.284 €	Collaborative project (generic)	ICT-2011.9.1 Challenging current Thinking http://www.i-risc.eu/scripts/home/publigen/content/templates/show.asp?L=EN&P=55&ITEMID=2	The ongoing miniaturization of data processing and storage devices and the imperative of low-energy consumption can only be sustained through low-powered components. Lower supply voltages and variations in technological process of emerging nanoelectronic devices make them inherently unreliable. As a consequence, the nanoscale integration of chips built out of unreliable components has emerged as one of the most critical challenges for the next-generation electronic circuit design. To make such nanoscale integration economically viable, new solutions for efficient and fault-tolerant data processing and storage must now be invented. The i-RISC project aims at achieving these goals, by providing innovative fault-tolerant solutions at both device- and system-level that are fundamentally rooted in mathematical models, algorithms, and techniques of information theory. Proposed solutions will build on error correcting codes and encoder/decoder architectures able to provide reliable error protection even if they themselves operate on unreliable hardware. The project will develop the scientific foundation and provide a first proof-of-concept by validating the proposed solutions on accurate error models and energy measurement tools developed within the project. In the forthcoming challenge of nanoscale technologies, the i-RISC project is an essential prerequisite for preparing the European industry for this paradigm shift.	COMMISSARIAT A L'ENERGIE ATOMIQUE ET AUX ENERGIES ALTERNATIVES	France
LANDAUER	Operating ICT basic switches below the Landauer limit	FP7-ICT	01/09/2012	31/08/2015	3.192.904 €	2.400.000 €	Collaborative project (generic)	ICT-2011.9.8 FET Proactive: Minimising Energy Consumption of Computing to the Limit (MINECC) http://www.lan-dauer-project.eu/	The scientific objective of this project is to test the fundamental limits in energy dissipation during the operation of physical switches representing the basic elements of logic gates. We address the physical limits arising from a generic switch mechanism that is common to any digital device, with specific reference to the fundamental limit arising from the decrease of information in the computation procedure, also known as Landauer limit. The technological objective of this project is to introduce new conceptual devices that, through novel computing paradigms with radically improved efficiency, are capable of trading the minimum amount of energy dissipated with the computational precision. In order to reach such objectives in a joint effort, the LANDAUER consortium composed by world leading experts in nanoscale energy management will fabricate, test and evaluate three classes of new conceptual devices: "magnetic switching nanoparticles", "nanomechanical switches" and "nanoelectronic stochastic logic gates" addressing applied prototypes for computing tasks in the presence of noisy operating conditions.	UNIVERSITÀ DEGLI STUDI DI PERUGIA - CENTRO INTERUNIVERSITARIO DI RICERCA SULL'INQUINAMENTO DA AGENTI FISICI	Italy
LASAGNE	multi-Layer Spatiotemporal Generalized Networks	FP7-ICT	01/11/2012	31/10/2015	2.733.858 €	2.075.000 €	Collaborative project (generic)	ICT-2011.9.7 FET Proactive: Dynamics of Multi-Level Complex Systems (DyM-CS) http://complex.ffn.ub.es/~lasagne/	Thanks to modern ICT, a new generation of large data sets of social, biological, and man-made systems are now available. Many more will be produced at an ever-increasing rate in the near future. Such data contain high precision and integrated information on the nature and the evolution -in space and time- of the state of each single component, together with information on different types of interactions between them. Unfortunately, it is extremely difficult to extract meaningful information from this new generation of high-integrated data, since current network theory provides not much more than a static description of single, independent networks. The aim of this project is to provide a novel and coherent theoretical framework for analysing and modelling these dynamic and multi-layer networks in terms of multi-graphs embedded in space and time. To do this, we will treat time, space and the nature of interactions not as additional dimensions of the problem, but as natural, inherent components of the very same generalized network (GNE) description. The first goal of the project is to devise novel metrics and models, able to capture the interactions between different layers and across different spatio-temporal scales. The second goal is to understand the combined role of spatial distance, time and inter-layer interactions on the dynamics of processes running on GNEs, and on the emergence of collective behaviours, such as synchronization. The third goal is to investigate cases where GNEs are co-evolving with the processes they facilitate. The theory will be validated on real-world applications involving large and heterogeneous data sets of brain networks, on- and off-line social systems, healthcare systems, and transportation flows in cities. Our project will provide new quantitative opportunities in different fields, ranging from the prediction of pathologies to the diffusion of ideas and trends in societies, and for the management of socio-technological systems.	MEDIZINISCHE UNIVERSITÄT WIEN	Austria
LiNaBioFluid	Laser-induced Nanostructures as Biomimetic Model of Fluid Transport in the Integument of Animals	H2020 - FET	01/07/2015	01/07/2018	3.024.827 €	3.024.827 €	RIA	FETOPEN-RIA-2014-2015 http://www.las-erbiofluid.eu/	The integument of an animal body has various functions, which are often achieved by specific micro- and/or nano hierarchical structures. Examples are the very low water friction and air retention of water spiders or the swim fern of salvinia and the outstanding adhesion properties of geckos. In this project, we will employ advanced laser-processing strategies based on self-organization, to mimic the specific topography and the excellent wetting properties of the integument of bark bugs and moisture harvesting lizards resulting from adaptations to their environment. Flat bark bugs darken during rain fall due to a super-wettable body surface with capillaries out of which water spreads onto plain areas of the bug. For moisture harvesting in lizards wettability takes place in opposed direction, i.e. from plain areas into a capillary network on the skin. A fast and directional transport results from a special geometry of capillaries. Thus as general objective we want to test whether both effects, i.e. fast capillary transport (lizard) and liquid spreading onto plain areas (bark bugs), can be combined by optimized structures with hierarchical geometry. The outcome of this innovative biomimetic exploitation of wetting effects is expected to lead to a radically new technological approach of laser-generated surface textures on micro- and nanometer scale. Especially for control of friction and wear in liquids, leveraging new results can be expected, e.g. for developing slide bearings. The extension of surface structures over large areas is feasible. Thus, laser-fabrication of biomimetic surfaces with extreme wetting properties can be also anticipated in further applications, e.g. lubrication, water and oil separation, reduced drag in underwater applications, high power device cooling. All related to an innovative and sustainable reduction of CO2 emission.	FOUNDATION FOR RESEARCH AND TECHNOLOGY HELLAS	Greece

MAESTRA	Learning from Massive, Incompletely annotated, and Structured Data	FP7-ICT	01/02/2014	31/01/2017	2.293.310 €	1.748.295 €	Collaborative project (generic)	ICT-2013.9.5 FET-Open Xtrack	http://maestra-project.eu/	INSTITUT JOZEF STEFAN	Slovenia
MAGicSky	Magnetic Skyrmions for Future Nanospintronic Devices	H2020 - FET	01/09/2015	01/09/2018	3.396.439 €	3.396.439 €	RIA	FETOPEN-RIA-2014-2015	http://magicsky-fet.eu/	CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE	France
MAGNETRODES	Electromagnetic detection of neural activity at cellular resolution	FP7-ICT	01/01/2013	31/12/2015	2.222.049 €	1.700.000 €	Collaborative project (generic)	ICT-2011.9.11 FET Proactive: Neuro-Bio-Inspired Systems (NBIS)	http://www.magnetodes.eu/	COMMISSARIAT A L ENERGIE ATOMIQUE ET AUX ENERGIES ALTERNATIVES	France

The need for machine learning (ML) and data mining (DM) is ever growing due to the increased pervasiveness of data analysis tasks in almost every area of life, including business, science and technology. Not only is the pervasiveness of data analysis tasks increasing, but so is their complexity. We are increasingly often facing predictive modelling tasks involving one or several of the following complexity aspects: (a)structured data as input or output of the prediction process, (b)very large/massive datasets, with many examples and/or many input/output dimensions, where data may be streaming at high rates, (c)incompletely/partially labelled data, and (d)data placed in a spatio-temporal or network context. Each of these is a major challenge to current ML/DM approaches and is the central topic of active research in areas such as structured-output prediction, mining data streams, semi-supervised learning, and mining network data. The simultaneous presence of several of them is a much harder, currently insurmountable, challenge and severely limits the applicability of ML/DM approaches. The proposed project will develop predictive modelling methods capable of simultaneously addressing several (ultimately all) of the above complexity aspects. In the most complex case, the methods would be able to address massive sets of network data incompletely labelled with structured outputs. We will develop the foundations (basic concepts and notions) for and the methodology (design and implementation of algorithms) of such approaches. We will demonstrate the potential and utility of the methods on showcase problems from a diverse set of application areas (molecular biology, sensor networks, multimedia, and social networks). Some of these applications, such as relating the composition of microbiota to human health and the design of social media aggregators, have the potential of transformational impact on important aspects of society, such as personalized medicine and social media.

Challenges facing technology for power efficient, high density, high speed information processing and storage are well recognised, and strategies for meeting them in the short term define the shape of industry roadmaps. As a consequence, in the next ten years, radically new approaches will be implemented and will transform how data is stored and manipulated. Skyrmion-based devices are newcomers to this global race for the next generations of information technology. Skyrmions were discovered in magnetic crystals only a few years ago, but we already have within reach a possibility to create them in nanoscale devices that can be made compatible with conventional integrated circuit technology. Our work in MAGicSky will substantiate this possibility. The potential benefits are enormous. Skyrmions are magnetic solitons that carry information, and are remarkably robust against defects that can trap or destroy them due to the topology of their magnetic texture. Topology also appears to further underlie other of their technologically important features: mobility with small continuous currents and singular dynamics under radio-frequency. MAGicSky will engage some of the most advanced materials fabrication, characterisation and microscopic imaging facilities in Europe together with leading theoretical and computational modelling capabilities, to create the first proof-of-concept room temperature spintronic devices based on magnetic skyrmions.

The main goal of the project is to develop a new generation of neuroscience tools for electromagnetic measurement and spectroscopy at the neuron level. Spin electronics offers nowadays the possibility to create very sensitive, micrometer-scale magnetic field detectors. Here, we propose to exploit this technological advance to create novel tools for probing neuronal magnetic fields at the cellular level. The first goal of the project will be to develop the magnetic equivalent of an electrode, a 'magnetrotrode', sensitive enough to detect the very small magnetic fields induced by the ionic currents flowing within electrically active neurons, and small enough to probe a limited number of cells. We will adapt magnetrotrodes also for local nuclear magnetic resonance spectroscopy (MRS); thus, they could record both electromagnetic and chemical activity of neurons. In addition, means for local electric or magnetic stimulation could be integrated in to a magnetrotrode. We will test magnetrotrodes in vitro and in vivo at various spatial scales, from brain areas down to single neurons. In parallel, based on the measurements with magnetrotrodes, we will augment existing computational models and develop new ones to characterize the electromagnetic fields emitted by neurons and neuron assemblies. We will use these models to bridge from the activity of single neurons to macroscopic non-invasive measurements such as electroencephalography (EEG) and magnetoencephalography (MEG). This project shall pave the way towards "magnetophysiology", which enables investigating electric activity of neurons without disturbing the ionic flow and without physical contact to the cell. We will create new experimental and modelling tools for magnetic measurements and stimulation at neuron scale. The resulting techniques will be applicable in neurosciences, brain-computer interfacing and possibly in the treatment of certain brain diseases. The consortium is composed of 5 teams from 4 EU countries.

MANAQA	Magnetic Nano Actuators for Quantitative Analysis	FP7-ICT	01/08/2012	31/07/2015	3.628.758 €	2.775.302 €	Collaborative project (generic)	ICT-2011.9.1 Challenging current Thinking	http://www.managa.eu/MANAQA	The MANAQA project is a multidisciplinary approach that combines innovative technologies emerging from different fields including nanotechnology, biochemistry, and nanorobotics. The strategy that will be exploited is based on a recently developed 5-DOF magnetic manipulation system combined with an atomic force microscope (AFM) system and functionalized magnetic nanowires. The fusion of these technologies has the potential to revolutionize many aspects of single-molecule manipulation and measurement. Information related to the structure and physical properties of macromolecules (i.e., proteins, polynucleotides) will be obtained. In a typical experiment, a molecule will be regiospecifically attached between a magnetic nanowire and the tip of an AFM cantilever. The extremely small footprint of the magnetic nanowire and the accuracy of a five degree-of-freedom magnetic manipulation system will allow high-resolution and stable force control on the molecule. The mechanical response of the molecule will be monitored using the AFM cantilever. Moreover, the system will be capable of measuring the electrical parameters of the nanowire-molecule hybrid. The success of this proposal will lead to long time-scale, low drift experiments that will provide invaluable insights on mechanisms governing conformational changes in single macromolecules by elucidating protein folding/unfolding/refolding trajectories at a low-force regime. This will contribute to the long-term vision of MANAQA of establishing a biomolecular measurement platform with extended capabilities. MANAQA opens new avenues in disciplines such as biochemistry, pharmacy, and biomedicine. The development of new miniaturized electronic devices within the scope of MANAQA project with single chemical entities integrated as their components will revolutionize the field of Information and Communication Technologies (ICT).	EIDGENÖSSISCHE TECHNISCHE HOCHSCHULE ZÜRICH	Switzerland
MANGO	MANGO: exploring Manycore Architectures for Next-GeneratiOn HPC systems	H2020 - FET	01/10/2015	01/10/2018	5.801.820 €	5.801.820 €	RIA	FETHPC-1-2014	http://www.mango-project.eu/administrativedata	MANGO targets to achieve extreme resource efficiency in future QoS-sensitive HPC through ambitious cross-boundary architecture exploration for performance/power/predictability (PPP) based on the definition of new-generation high-performance, power-efficient, heterogeneous architectures with native mechanisms for isolation and quality-of-service, and an innovative two-phase passive cooling system. Its disruptive approach will involve many interrelated mechanisms at various architectural levels, including heterogeneous computing cores, memory architectures, interconnects, run-time resource management, power monitoring and cooling, to the programming models. The system architecture will be inherently heterogeneous as an enabler for efficiency and application-based customization, where general-purpose compute nodes (GN) are intertwined with heterogeneous acceleration nodes (HN), linked by an across-boundary homogeneous interconnect. It will provide guarantees for predictability, bandwidth and latency for the whole HN node infrastructure, allowing dynamic adaptation to applications. MANGO will develop a toolset for PPP and explore holistic pro-active thermal and power management for energy optimization including chip, board and rack cooling levels, creating a hitherto inexistent link between HW and SW effects at all layers. Project will build an effective large-scale emulation platform. The architecture will be validated through noticeable examples of application with QoS and high-performance requirements. Ultimately, the combined interplay of the multi-level innovative solutions brought by MANGO will result in a new positioning in the PPP space, ensuring sustainable performance as high as 100 PFLOPS for the realistic levels of power consumption (<15MWatt) delivered to QoS-sensitive applications in large-scale capacity computing scenarios providing essential building blocks at the architectural level enabling the full realization of the ETP4HPC strategic research agenda	UNIVERSITAT POLITÈCNICA DE VALENCIA	Spain
MATHEMACS	MATHEmatics of Multi-level Anticipatory Complex Systems	FP7-ICT	01/10/2012	30/09/2015	3.335.758 €	2.552.916 €	Collaborative project (generic)	ICT-2011.9.7 FET Proactive: Dynamics of Multi-Level Complex Systems (DyM-CS)	https://www.mathemacsen.eu/index/	The MATHEMACS project aims to develop a mathematical theory of complex multi-level systems and their dynamics. In addition to considering systems with respect to a given level structure, as is natural in certain applications or dictated by available data, the project has the unique goal of identifying additional meaningful levels for understanding multi-level systems. This is done through a general formulation based on the mathematical tools of information and dynamical systems theories. To ensure that the theoretical framework is at the same time practically applicable, three key application areas are represented within the project, namely neurobiology, human communication, and economics. These areas not only provide us with some of the best-known epitomes of complex multi-level systems, but also constitute a challenging test bed for validating the generality of the theory since they span a vast range of spatial and temporal scales. Furthermore, they have an important common aspect; namely, their complexity and self-organizational character is partly due to the anticipatory and predictive actions of their constituent units. The MATHEMACS project contends that the concepts of anticipation and prediction are particularly relevant for multi-level systems since they often involve different levels. Thus, as a further unique feature, the project includes the mathematical representation and modelling of anticipation in its agenda for understanding complex multi-level systems. For validating the theory on large heterogeneous data sets, the project has a specific component with exclusive access to a wide range of data from human movement patterns to complex urban environments. In this way, MATHEMACS provides a complete and well-rounded approach to lay the foundations of a mathematical theory of the dynamics of complex multi-level systems.	MAX PLANCK GESELLSCHAFT ZUR FÖRDERUNG DER WISSENSCHAFTEN E.V.	Germany

MATTERWAVE	A Guided Matter-Wave Interferometer on a Atom-Chip	FP7-ICT	01/02/2013	31/01/2017	3.435.493 €	2.600.000 €	Collaborative project (generic)	ICT-2011.9.9 FET Proactive: Quantum ICT (QICT) including ERA-NET-Plus	http://matterwave.eu/	The ultimate aim of the proposed research is to make ultra-sensitive matter-interferometry available in a compact and eventually portable device. Specifically, we seek to test the ideas in a guided matter-wave interferometer based on ultracold bosonic atoms. We will explore matter-wave interferometry in macroscopic traps as well as on atom-chips. Such device has the potential to induce a step change in the sensitivity with which acceleration and rotation can be measured. The expected impact extends well beyond fundamental research, for example to geoscience and navigation. En route to the ultimate goal of a portable matter-wave interferometer, we hope to break new ground in the understanding of important aspects of matter-wave interferometry with interacting atomic gases. We will strive to master the coherence preserving manipulation of matter-waves in wave-guides and the miniaturisation eventually down to the size of a microchip. In addition, we will address the challenge of combining all these ingredients in a mobile device.	FOUNDATION FOR RESEARCH AND TECHNOLOGY HELLAS	Greece
MERGING	Membrane-based phononic engineering for energy harvesting	FP7-ENERGY	01/01/2013	31/12/2015	3.698.667 €	2.849.654 €	Collaborative project (generic)	ENERGY.201 2.10.2.1 Future Emerging Technologies	NOT AVAILABLE	The aim of this proposal is to realise a compact thermoelectric module to harvest the energy of devices to be used in applications requiring heterogeneous integration packaging techniques leading to small size, integrability and high thermoelectric efficiency. Our concept, which goes up to a test device, is based on deep understanding of the behaviour of phonons, their control leading to the control of thermal transport. It is based on minimizing the thermal conductance and/or thermal conductivity by phonon engineering. A ZT=2.5 is targeted together with module compactness and integration potential. The module will be based on technologies combining Si microelectronics, thin film thermoelectric material and novel concepts to understand heat transport in 2-dimensional (2D) nanostructured materials such as Si-based ultrathin membranes, GeMn and strontium titanate. The device will carry enough current but insignificant or little heat. Theoretical and experimental investigations of heat transport will be carried out. The methods and technologies developed will enable nm-scale control of energy generation and heat flow. This will impact on on-chip and in-package energy management that is of crucial importance for future technologies. Especially, our targets contribute to (a) on-chip harvesting of thermoelectricity and (b) management of heat flow in the applications of heterogeneous integration and nanoelectronics.	FUNDACIO PRIVADA INSTITUT CATALA DE NANOTECNOLOGIA	Spain
MICREAGENTS	Microscale Chemically Reactive Electronic Agents	FP7-ICT	01/09/2012	31/08/2015	4.461.304 €	3.400.000 €	Collaborative project (generic)	ICT-2011.9.6 Unconventional Computation (UCOMP)	http://www.micreagents.eu/index.html	The goal of the project is to give electronics and chemistry an equal autonomous say in programming complex chemical constructions, processes and analyses at the nano and microscale: the same scale where information processing in living systems occurs – where "to construct is to compute". To do this MICREAgents (Microscopic Chemically Reactive Electronic Agents) will develop novel electronically active microreactor components, called lablets, that self-assemble at a scale less than 100 µm, approaching that of living cells. The project will integrate the necessary components to ensure autonomous action of millions of these "very smart chemicals", including electronic logic, supercapacitors for power, pairwise coupling for communication, programmable chemical sensors and electronic actuation of chemical processing. Key examples of MICREAgent actuation are to reversibly switch their association, load or dose chemicals, modify surfaces, initiate reactions and control locomotion in complex chemical environments. MICREAgents lablets can join forces to communicate both chemicals and electronic information in order to solve complex tasks, acting as smart collective agents of chemical change. Like cells, they will be essentially genetically encoded, but with chemical and electronic memories, translating electronic signals into constructive chemical processing and recording the results of this processing. They will also reversibly employ DNA molecules as chemical information, for example to control surface-surface binding of lablets, or to program chemical sensors, not to synthesize proteins as in cells. The project builds on pioneering FET-funded work towards electronic chemical cells, taking a giant stride to cell-like microscopic autonomous chemical electronics with self-assembling electronic membranes controlling the entry and exit of chemicals. These autonomous mobile smart reactors will provide a novel form of computation that microscopically links reaction processing and chemical construction with computation, providing a radical integration of autonomous chemical experimentation. The self-assembling smart micro reactors can be programmed for molecular amplification and other chemical processing pathways, that start from complex mixtures, concentrate and purify chemicals, perform reactions in programmed cascades, sense completion, and transport and release products to defined locations. The project defines a continuous achievable path towards this ambitious goal, making use of a novel pairwise local communication strategy to overcome the limitations of current smart dust and autonomous sensor network communication. It will provide a technical platform spawning research in new computing paradigms that integrate multilevel construction with electronic ICT. The 10 groups, from 8 countries including Israel and New Zealand, are all pioneers in the multidisciplinary areas required to achieve the project goals, with a common grounding in IT.	RUHR-UNIVERSITAET BOCHUM	Germany
MINIMAL	Miniature Insect Model for Active Learning	FP7-ICT	01/01/2014	31/12/2016	3.019.057 €	2.297.522 €	Collaborative project (generic)	ICT-2011.9.1 Challenging current Thinking	http://blog.inf.ed.ac.uk/minimal/	Biology provides the inspiration for a vision of small low-power devices that are able to learn rapidly and autonomously about environmental contingencies, enabling prediction and adaptive anticipatory action. Larval Drosophila have fewer than 10,000 neurons, yet express a variety of complex orientation and learning behaviours, including non-trivial anticipatory actions requiring context-dependent evaluation of the value of learned cues. Current computational learning theory cannot fully account for or replicate these capacities. We aim to develop a new foundation for understanding natural learning by developing a complete multilevel model of learning in larvae. Our aims are: (1) to analyse at a fine scale how larval olfactory behaviour is controlled and altered by associative conditioning, linked to agent-based models that ground learning capabilities in ongoing sensorimotor control; (2) to build one-to-one computational neural models that can be validated by exploiting the recent expansion of the Drosophila neurogenetic toolkit to gain unprecedented ability to characterise and manipulate neural circuits during unconstrained behaviour; (3) To derive from these models novel, generalisable algorithms and circuit architectures that can be used to enhance the learning and anticipatory capabilities of machines.	THE UNIVERSITY OF EDINBURGH	United Kingdom

MOLARNET	Molecular Architectures for QCA-inspired Boolean Networks	FP7-ICT	01/10/2012	30/09/2016	3.876.607 €	2.759.000 €	Collaborative project (generic)	ICT-2011.9.6 Unconventional Computation (UCOMP)	NOT AVAILABLE	Achievement of ever higher levels of integration in microelectronics will eventually require a radical shift from the field-effect transistor (FET) based paradigm to a revolutionary approach to computing. Quantum-dot Cellular Automata (QCA) is an alternative vision to binary computing since no current flow is required to encode binary information, and has been considered one of the most promising post-Moore alternatives. Implementation and miniaturization of QCA at the molecular level offer important advantages, including the perspective of room temperature operation, an essential step for industrial exploitation. However, the small sizes of the building blocks lead also to severe challenges when addressing the single elementary units. The present proposal specifically addresses the basic requirements to implement molecular QCA-inspired Networks, namely the measurement of the electrostatic interaction between a forced molecule (input) and its neighbour; the investigation of the propagation of a signal in a longer row of molecule (binary line); the implementation and testing of a majority gate. In particular we will address the following topics:-Pattern the molecules in controlled positions.-Contact the single molecules to force the state (inputs) and apply the clock (outputs)-Set up of a sensitive read-out system to discriminate among the two logic states of the molecule.-Understand the precise conformation and positioning of the molecules in the built system.-Evaluate the impact of non-idealities with respect to classical QCA on computation.State of the art research and development of activities in the field of molecular scale architectures for unconventional computation will be undertaken during the research programme, to reach the envisioned project's objectives and to develop a technology for the development of QCA computing in Europe. We expect our results to build a solid starting point for the development of a novel unconventional computational paradigm.	CONSIGLIO NAZIONALE DELLE RICERCHE	Italy
Mont-Blanc 3	Mont-Blanc 3, European scalable and power efficient HPC platform based on low-power embedded technology	H2020 - FET	01/10/2015	01/10/2018	7.968.375 €	7.968.375 €	RIA	FETHPC-1-2014	http://www.montblanc-project.eu/	The main target of the Mont-Blanc 3 project 'European Scalable and power efficient HPC platform based on low-power embedded technology' is the creation of a new high-end HPC platform (SoC and node) that is able to deliver a new level of performance / energy ratio whilst executing real applications. The technical objectives are: 1. To design a well-balanced architecture and to deliver the design for an ARM based SoC or SoP (System on Package) capable of providing pre-exascale performance when implemented in the time frame of 2019-2020. The predicted performance target must be measured using real HPC applications. 2. To maximise the benefit for HPC applications with new high-performance ARM processors and throughput-oriented compute accelerators designed to work together within the well-balanced architecture . 3. To develop the necessary software ecosystem for the future SoC. This additional objective is important to maximize the impact of the project and make sure that this ARM architecture path will be successful in the market. The project shall build upon the previous Mont-Blanc & Mont-Blanc 2 FP7 projects, with ARM, BSC & Bull being involved in Mont-Blanc 1, 2 and 3 projects. It will adopt a co-design approach to make sure that the hardware and system innovations are readily translated into benefits for HPC applications. This approach shall integrate architecture work (WP3 & 4 - on balanced architecture and computing efficiency) together with a simulation work (to feed and validate the architecture studies) and work on the needed software ecosystem.	BULL SAS	France
MOQUAS	Molecular Quantum Spintronics	FP7-ICT	01/10/2013	30/09/2016	2.692.964 €	2.006.000 €	Collaborative project (generic)	ICT-2013.9.7 FET Proactive: Atomic and Molecular Scale Devices and Systems	http://www.moquas.eu/	MoQuaS aims at developing devices and protocols to read out and process quantum information using individual molecular spins embedded in electronic circuits. To this end, prototypical hybrid nano-devices addressing single molecular spins will be designed and reliable methods for their realization will be developed. Core of such nano-architectures are magnetic molecules, specifically functionalized to graft electrodes, and exploited as spin (qu)bits. MoQuaS will design and realize the necessary platform for the read out and the manipulation of the electron and nuclear states of single molecules. Besides electromigrated junctions, contact electrodes based on carbon allotropes, including carbon nanotubes and graphene nano-ribbons will be developed. These will allow for interfacing the specially designed magnetic molecule to the outside world with an unprecedented flexibility, beyond what is possible with metallic electrodes.The resulting hybrid device will function either as molecular spin transistors (three terminal device) or as molecular spin valves by combining carbon based channels with molecular spin filters. The ultimate ambitious goal of MoQuaS is the implementation of quantum gates that will be achieved by using additional strip lines close to our hybrid nano-devices to carry out the spin manipulation. On the way to achieving this goal, a range of challenges will be met by implementing experiments and theoretical descriptions that will ascertain the fundamental mechanisms underlying the functioning of quantum molecular devices. In particular, the key processes of the electron and nuclear spin state preparation, manipulation and read out, spin injection and relaxation will be individually investigated in order to understand the basic mechanisms and then combine the knowledge into prototypes that will set references for a new era in Spintronics in which Quantum information is encoded by Molecular processors.	CONSIGLIO NAZIONALE DELLE RICERCHE	Italy

MRG-Grammar	Massive Reverse Genomics to Decipher Gene Regulatory Grammar	H2020 - FET	01/08/2015	01/08/2018	3.999.661 €	3.999.661 €	RIA	FETOPEN-RIA-2014-2015	https://www.mrg-grammar.eu/#/	<p>MRG-Grammar aims to devise an entirely new strategy for deciphering the regulatory rules of gene regulation. We will leverage Synthetic Biology with cutting-edge DNA synthesis technologies and high-throughput analysis to generate new types of biological datasets that systematically explore all possible regulatory landscapes rather than just the naturally occurring regulatory sequences.</p> <p>The extensive and unbiased nature of these unique datasets will allow us to build new models explaining different aspects of regulatory activity, which will be tested in second-generation libraries, designed based on model predictions. Consequently, through such an iterative process, we expect to make a significant breakthrough in deciphering, and evolving, the regulatory code. Our strategy synergizes four orthogonal objectives that will form a new knowledge base from which the regulatory algorithm can be derived. We will employ our strategy on diverse model organisms from the tree of life, from single cell to whole organism: bacteria, yeast, mouse ex-vivo cells, human cell-lines and finally, whole D. melanogaster and mouse embryos. We expect this multidisciplinary synthetic biology approach to generate a major technological advance, which will provide the community with algorithms that will not only decipher extant natural regulatory code, but also interpret variations leading to a profoundly deeper understanding of the origins of many diseases. We expect our models to also serve as a reference in designing and implementing accurate and more controllable synthetic biology devices, with applications in fuel production, healthcare and other industrial fields. Thus, our ultimate goal is to substantially accelerate the advance of technologies and knowledge related to generating systematic and personal therapeutic solutions based on the analysis of each individual's natural genomic variations.</p>	TECHNION - ISRAEL INSTITUTE OF TECHNOLOGY	Israel
MULTI	MULTI-valued and parallel molecular logic	FP7-ICT	01/09/2012	31/08/2015	2.487.237 €	1.900.000 €	Collaborative project (generic)	ICT-2011.9.6 Unconventional Computation (UCOMP)	http://www.multiplexproject.eu/	<p>MULTI replaces the familiar sequential model of computation that uses Boolean variables and combinational gates by logic operations that are executed in parallel on devices that have a built-in many state memory and whose inputs and outputs are multivalued. MULTI seeks to design, simulate and experimentally implement proof of principle devices on the atomic and molecular scale. MULTI refers to the unique novel characteristics of the proposed schemes. We use MULTI-level logic variables as opposed to two valued Boolean variables. We use MULTI-variate circuits that act in parallel so that more than one logic function is evaluated at every stage of the computation thereby aiming for parallel circuits. We use MULTI-state inbuilt memories. New functionalities and ground-breaking characteristics of information processing are provided by the radically post-Boolean MULTI approach. As a final thrust, MULTI will explore a post-Turing model of computation by using continuous variables. In MULTI a single atom, molecule or a supra(bio)molecular assembly acts as a logic element. We aim for new foundational principles and for proof of concept of computing in hardware at the level of laboratory experiments. MULTI plans to take advantage of internal degrees of freedom of atoms or molecules to implement logic operations by electrical addressing in the solid state and/or by optical addressing in solution. The dynamics offers time-resolved response and thereby enables parallelism that can be massive because of the many resolvable states. Internal states of different molecules can be made to communicate thereby providing for concatenation. The other route of MULTI is (bio)chemical recognition that offers exquisite control for implementing many state, optically readable finite state machines. Benefits of MULTI approach are higher information rates for inputs and outputs, enhanced rates of processing due to parallelism and computing in memory and exploration of continuous logic.</p>	UNIVERSITE DE LIEGE	Belgium
MULTIPLEX	Foundational Research on MULTILEvel comPLEX networks and systems	FP7-ICT	01/11/2012	31/10/2016	6.698.834 €	5.100.000 €	Collaborative project (generic)	ICT-2011.9.7 FET Proactive: Dynamics of Multi-Level Complex Systems (DyM-CS)	http://www.multiplexproject.eu/	<p>Future advancements in ICT domain are closely linked to the understanding about how multi-level complex systems function. Indeed, multi-level dependencies may amplify cascade failures or make more sudden the collapse of the entire system. Recent large-scale blackouts resulting from cascades in the power-grid coupled to the control communication system witness this point very clearly. A better understanding of multi-level systems is essential for future ICT's and for improving life quality and security in an increasingly interconnected and interdependent world. In this respect, complex networks science is particularly suitable for the many challenges that we face today, from critical infrastructures and communication systems, to techno-social and socio-economic networks. MULTIPLEX proposes a substantial paradigm shift for the development of a mathematical, computational and algorithmic framework for multi-level complex networks. Firstly, this will lead to a significant progress in the understanding and the prediction of complex multi-level systems. Secondly, it will enable a better control, and optimization of their dynamics. By combining mathematical analyses, modelling approaches and the use of massive heterogeneous data sets, we shall address several prominent aspects of multi-level complex networks, i.e. their topology, dynamical organization and evolution.</p>	Institute of Complex Systems	Italy

MUSE	Machine Understanding for interactive Storytelling	FP7-ICT	01/09/2012	31/08/2015	2.543.279 €	1.993.326 €	Collaborative project (generic)	ICT-2011.9.1 Challenging current Thinking	http://www.mu-se-project.eu/	The MUSE project will introduce a new way of exploring and understanding information by "bringing text to life" through 3D interactive storytelling. Taking as input natural language text like children's stories or medical patient education materials, MUSE will process the natural language, translate it into formal knowledge that represents the actions, actors, plots and surrounding world, and then render these as virtual 3D worlds in which the user can explore the text through interaction, re-enactment and guided game play. To enable such a system, MUSE will make targeted advances in natural language processing that enable the translation of natural language text to the necessary knowledge representations, as well as targeted advances in the action representation and story planning necessary for interactive storytelling. In natural language processing, MUSE will develop new techniques for finding explicit action structures in text and combining them with implicit action structures inferred from the context based on probabilistic models of translation and automatic methods for acquiring world knowledge from large corpora. In interactive storytelling, MUSE will develop action and object representations that bridge the gap between natural language and virtual worlds, and will create advanced techniques for planning virtual world stories given inconsistent and incomplete information. The proposed methodology will be evaluated and showcased on two scenarios: one for creating immersive children's stories from text and one for allowing medical patients to interact with patient education materials. Comparable to the invention of symbolic writing systems several millennia ago, MUSE contribute to a novel symbolic system communicating natural language utterances.	KATHOLIEKE UNIVERSITEIT LEUVEN	Belgium
NADINE	New tools and Algorithms for Directed Network Analysis	FP7-ICT	01/05/2012	30/04/2015	1.630.612 €	1.222.958 €	Collaborative project (generic)	ICT-2011.9.1 Challenging current Thinking	http://www.quantware.ups-tlse.fr/FETNAD/NE/	On the scale of the past ten years, modern societies have developed enormous communication and social networks. Their classification and information retrieval becomes a formidable task for the society. Various search engines have been developed by private companies which are actively used by Internet users. Due to the recent enormous development of World Wide Web and communication networks, new tools and algorithms should be invented to characterize the properties of these networks on a more detailed and precise level. It is also highly important to have new tools to classify and rank enormous amount of network information in a way adapted to internal network structures and characteristics. The project will develop new algorithms to facilitate classification and information retrieval from large directed networks, including PageRank and CheiRank with two-dimensional ranking proposed by partners, using newly developed Monte Carlo methods. The Google matrix formed by the links of the network will be analyzed by analytical tools of Stochastic Processes, Random Matrix Theory and quantum chaos and by efficient numerical methods for large matrix diagonalization including the Arnoldi method. New tools and algorithms produced by the project will create fundamental basis for development of new types of search engines which will put Europe on leading positions in this important area dominated at present by other countries. These tools and engines will be actively used for modern networks, including mobile communication networks which will play more and more important role in future. New characterization of complex networks will allow to manage in an efficient and rapid way information extraction for social networks, communication and other networks. The project will create efficient voting systems in social networks that will pave the way for new types of democracy solutions in societies at a high communication level.	CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE	France
NANOMATCELL	NOVEL ENVIRONMENTALLY FRIENDLY SOLUTION PROCESSED NANOMATERIALS FOR PANCHROMATIC SOLAR CELLS	FP7-ENERGY	01/01/2013	31/12/2015	3.545.958 €	2.722.101 €	Collaborative project (generic)	ENERGY.201 2.10.2.1 Future Emerging Technologies	NOT AVAILABLE	Dye-sensitized solar cell (DSSC) is the leading technology of third-generation solution-processed solar cells with reported efficiencies in excess of 10%. However despite the huge efforts in the last two decades saturation effects are observed in their performance. Efforts so far have been concentrated towards engineering and fine-tuning of the dyes, the electrolytes and the interface of the dye to the electron acceptor, employing titania as the electron acceptor. DSSCs rely, then, on dyes for efficient light harvesting which in turn entails high fabrication costs associated to the Ru-based dyes as well as the use of 10 um thick devices. In addition, optimized titania requires high-temperature processing raising concerns for its potential for low-cost, flexible-platform fabrication. In this project we propose a disruptive approach; to replace titania with a novel electron accepting nanoporous semiconductor with a bandgap suitable for optimized solar harnessing and a very high absorption coefficient to allow total light absorption within 2 um across its absorption spectrum. In addition the deposition of the nanostructured platform will employ processing below 200oC, compatible with plastic, flexible substrates and cost-effective roll-to-roll manufacturing. We will focus on non-toxic high-abundance nanomaterials in order to enable successful deployment of DSSCs with targeted efficiencies in excess of 15% and 10% for SS-DSSCs, thanks to efficient solar harnessing offered by the novel nanocrystal electron acceptor. To tackle this multidisciplinary challenge we have assembled a group of experts in the respective fields: development of nanocrystal solar cells, DSSC technology and physics, atomic layer and surface characterisation and a technology leader (industrial partner) in the manufacturing and development of third generation, thin film, photovoltaic cells and modules (DSSCs).	FUNDACIO INSTITUT DE CIENCIES FOTONIQUES	Spain

NANOQUESTFIT	Nanoparticles in Quantum Experiments: Exploring the scientific basis of future innovative quantum technologies	FP7-ICT	01/01/2013	31/12/2015	2.629.612 €	1.994.883 €	Collaborative project (generic)	ICT-2011.9.1 Challenging current Thinking http://www.nanoquestfit.eu	Quantum phenomena are an important basis for future information processing and information acquisition technologies. They will become particularly relevant for quantum-enhanced metrology and advanced sensors, which exploit the quantum superposition principle at a mesoscopic scale. NANOQUESTFIT will prepare nanoparticles in highly non-classical quantum states and utilize them to test the linearity of quantum physics over mesoscopic distances and time scales in a mass range that has remained hitherto unexplored. This goal will be realized in an interdisciplinary effort of European experts in quantum optics, nanotechnology, chemistry, and cluster physics. NANOQUESTFIT will realize novel quantum optical elements, such as optical depletion and phase gratings, atomically thin transmission gratings, as well as doped substrates in ultra-flat silicon. This will enable quantum coherence and interference studies with objects up to and beyond 10^5 atomic mass units for the first time. For that purpose new beam methods will be explored for tailor-made nanoparticles between 10^4 and 10^7 atomic mass units. This includes the efficient volatilization and detection of chemically functionalized nanoparticles, of pure and doped nanodroplets, as well as of cold slow cluster ions. Decoherence is the enemy of all future quantum-based technologies. The consortium will therefore investigate environmental decoherence with objects in a complexity class that is expected to become relevant in future quantum devices. Advanced experiments in NANOQUESTFIT will allow defining new constraints on unconventional extensions of quantum theory, which will be explored and elaborated on with regard to their conceptual consistency. Since the linearity of the Schrödinger equation is the very basis for the majority of current quantum information concepts this has direct implications for QIPC. NANOQUESTFIT works at the cutting edge of modern science to lay the scientific ground for a better understanding of practical and fundamental limits of future quantum technologies. It will also generate spin-offs for new quantum-enhanced sensing devices: in particular the beam splitter technologies developed in NANOQUESTFIT will be applicable to a wide range of matter waves composed of atoms, molecules and genuine nanoparticles.	TECHNISCHE UNIVERSITÄT WIEN	Austria
NASCENCE	NAnoScale Engineering for Novel Computation using Evolution (NASCENCE)	FP7-ICT	01/11/2012	31/10/2015	3.690.146 €	2.900.000 €	Collaborative project (generic)	ICT-2011.9.6 Unconventional Computation (UCOMP) http://nascence.no/	The aim of this project is to model, understand and exploit the behaviour of evolving nanosystems (e.g. networks of nanoparticles, carbon nanotubes or films of graphene) with the long term goal to build information processing devices exploiting these architectures without reproducing individual components. With an interface to a conventional digital computer we will use computer controlled manipulation of physical systems to evolve them towards doing useful computation. During the project our target is to lay the technological and theoretical foundations for this new kind of information processing technology, inspired by the success of natural evolution and the advancement of nanotechnology, and the expectation that we soon reach the limits of miniaturisation in digital circuitry (Moore's Law). The mathematical modelling of the configuration of networks of nanoscale particles combined with the embodied realisation of such systems through computer controlled stochastic search can strengthen the theoretical foundations of the field while keeping a strong focus on their potential application in future devices. Members of the consortium have already demonstrated proof of principle by the evolution of liquid crystal computational processors for simple tasks, but these earlier studies have only scraped the surface of what such systems may be capable of achieving. With this project we want to develop alternative approaches for situations or problems that are challenging or impossible to solve with conventional methods and models of computation. Achieving our objectives fully would provide not only a major disruptive technology for the electronics industry but probably the foundations of the next industrial revolution. Overall, we consider that this is to be a highly adventurous, high risk project with an enormous potential impact on society and the quality of life in general, including medicine, everyday household items, energy-saving policies, security, and communication.	UNIVERSITEIT TWENTE	Netherlands
NEBIAS	NEurocontrolled BIdirectional Artificial upper limb and hand prosthesis	FP7-ICT	01/11/2013	31/10/2017	4.545.859 €	3.464.600 €	Collaborative project (generic)	ICT-2013.9.6 FET Proactive: Evolving Living Technologies (EVLIT) http://www.nebias-project.eu/	The NEBIAS ("NEurocontrolled BIdirectional Artificial upper limb and hand prosthesis") proposal aims at developing and clinically evaluating (in selected amputees) a neuro-controlled upper limb prosthesis intuitively controlled and felt by the amputee as the natural one. This will be possible by means of a novel neural interface able to provide a stable and very selective connection with the nervous system. This goal will be achieved by combining microtechnology and material science and will allow, on one side, recording of the motor-related signals governing the actions of the amputated hand/arm for the motion control of a mechanical prosthesis, and on the other providing sensory feedback from tactile and kinesthetic sensors through neuromorphic stimulation of the adequate afferent pathway within the residual limb. The NEBIAS proposal is also aimed at finding out the 'language' intrinsically linking central nervous system with peripheral nerve signals in order to govern simple and complex hand/fingers movements. To reach this goal, a variety of techniques exploring brain and nerve functions will be assembled and integrated; this includes the analysis of electromagnetic brain and nerve signals, as well as of movement-related changes in brain's blood flow/metabolism.	SCUOLA SUPERIORE DI STUDI UNIVERSITARI E DI PERFEZIONAMENTO SANT'ANNA	Italy

NEMF21	Noisy Electromagnetic Fields - A Technological Platform for Chip-to-Chip Communication in the 21st Century	H2020 - FET	01/10/2015	01/10/2018	3.419.637 €	3.419.637 €	RIA	FETOPEN-RIA-2014-2015	http://www.nemf21.org/	Wireless Chip-to-Chip (C2C) communication and wireless links between printed circuit boards operating as Multiple Input Multiple Output devices need to become dominant features of future generations of integrated circuits and chip architectures. They will be able to overcome the information bottleneck due to wired connections and will lead the semiconductor industry into a new More-Than-Moore era. Designing the architecture of these wireless C2C networks is, however, impossible today based on standard engineering design tools. Efficient modelling strategies for describing noisy electromagnetic fields in complex environments are necessary for developing these new chip architectures and wireless interconnectors. Device modelling and chip optimization procedures need to be based on the underlying physics for determining the electromagnetic fields, the noise models and complex interference pattern. In addition, they need to take into account input signals of modern communication systems being modulated, coded, noisy and eventually disturbed by other signals and thus extremely complex. Recent advances both in electrical engineering and mathematical physics make it possible to deliver the breakthroughs necessary to enable this future emerging wireless C2C technology by creating a revolutionary electromagnetic field simulation toolbox. Increasingly sophisticated physical models of wireless interconnects and associated signal processing strategies and new insight into wave modelling in complex environments based on dynamical systems theory and random matrix theory make it possible to envisage wireless communication on a chip level. This opens up completely new pathways for chip design, for carrier frequency ranges as well as for energy efficiency and miniaturisation, which will shape the electronic consumer market in the 21st century.	THE UNIVERSITY OF NOTTINGHAM	United Kingdom
NEST	Nanowires for Energy Storage	FP7-ENERGY	01/11/2012	31/10/2015	3.320.520 €	2.356.536 €	Collaborative project (generic)	ENERGY.2012.10.2.1	Future Emerging Technologies	Among today challenges that of energy needs is one of the most important. An obvious question is its production but the need of energy storage systems is almost as large. Renewable energies will not have an impact unless we find an efficient way to store the electricity that they produce. Energy should be available everywhere and at any time, this translates in a strong need for energy containers in the form of electrochemical storage. In this context, the NEST project aims to demonstrate and develop a new kind of integrated supercapacitors, electrochemical capacitors (ECs), as well as novel pseudocapacitors devices able to drastically enhance the energy storage capacity. The primary target of the project is to produce a micro-supercapacitor with integrated electrodes compatible with microelectronics process that can withstand solder reflow (280°C for few minutes). We will associate the high surface area of a new kind of silicon nanostructures, to the high thermal stability of ionic liquids used as the electrolyte. We propose to integrate Si nanowires with sub-nanostructures such as silicon branches and nano-diamond coatings. Diamond coating will bring the additional advantage to allow using protonic electrolyte while keeping a wide 2-3 V electrochemical window. In addition to the giant surface area provided by the nanotree design, even higher capacitance will be achieved by using redox-active coating such as metal oxides and electro-conducting polymers (ECPs). As a result, this combination will lead to highly reversible surface redox reaction with electrochemical double layer capacitance. These new devices well adapted to peak power demand and storage while improving energy capacity will enhance the energy efficiency and consequently will increase the competitiveness of Europe's industries.	COMMISSARIAT A L ENERGIE ATOMIQUE ET AUX ENERGIES ALTERNATIVES	France
NEUROSEEKER	Investigation of local and global cortical circuits with advanced neural probes for high-resolution electrophysiological monitoring and optogenetic stimulation	FP7-ICT	01/01/2013	31/12/2016	9.196.808 €	6.180.000 €	Collaborative project (generic)	ICT-2011.9.11 FET Proactive: Neuro-Bio-Inspired Systems (NBIS)	NOT AVAILABLE	Most cognitive functions are based on computations that take place in the cerebral cortex, composed of a larger number of areas, each with a complex anatomical structure, with neurons of different types and in different layers interacting according to a precise scheme. The anatomical organization of cortical areas is similar, with some modulation according to its sensory, motor or associative function. Several areas have a columnar organization, but in all areas a similar vertical organization of cortical modules is repeated, suggesting that the same fundamental computation scheme is carried out. Despite the large amount of available data, this processing capability of the cortical module is still poorly understood. Two key technological advances to explore cortical computation have been ensemble electrophysiology, the use of multiple electrodes to record groups of neurons, and optogenetics. However, the optogenetic tools are still critically lacking in layer and cell-type specificity, and the recording techniques still do not attain the yields necessary to properly characterize the cortical microcircuit. To overcome these limitations, we propose a new probe that dramatically increases the density of electrodes providing an unprecedented view of currents in the extracellular medium. This will be complemented with an optical stimulator, capable of activating excitatory and inhibitory channelrhodopsins with a 100 µm resolution. We will take full advantage of the rich data that can be obtained with these new devices by producing new strategies for signal classification, to locate cells in cortical layers and assign them to a cell type based on the spatiotemporal fingerprint generated at each action potential. We will analyze cortical function at multiple scales in a number of contexts, from memory formation, to ongoing processing during decision making, and to sensorimotor integration for actions, advancing our understanding of cortical representations.	ALBERT-LUDWIGS-UNIVERSITÄT FREIBURG	Germany

NEXTGenIO	Next Generation I/O for Exascale	H2020 - FET	01/10/2015	01/10/2018	8.114.504 €	8.114.504 €	RIA	FETHPC-1-2014	www.nextgenio.eu	<p>The overall objective of the Next Generation I/O Project (NEXTGenIO) is to design and prototype a new, scalable, high-performance, energy efficient computing platform designed to address the challenge of delivering scalable I/O performance to applications at the Exascale. It will achieve this using highly innovative, non-volatile, dual in-line memory modules (NV-DIMMs). These hardware and systemware developments will be coupled to a co-design approach driven by the needs of some of today's most demanding HPC applications. By meeting this overall objective, NEXTGenIO will solve a key part of the Exascale challenge and enable HPC and Big Data applications to overcome the limitations of today's HPC I/O subsystems.</p> <p>Today most high-end HPC systems employ data storage separate from the main system and the I/O subsystem often struggles to deal with the degree of parallelism present. As we move into the domain of extreme parallelism at the Exascale we need to address I/O if such systems are to deliver appropriate performance and efficiency for their application user communities.</p> <p>The NEXTGenIO project will explore the use of NV-DIMMs and associated systemware developments through a co-design process with three 'end-user' partners: a high-end academic HPC service provider, a numerical weather forecasting service provider and a commercial on-demand HPC service provider. These partners will develop a set of I/O workload simulators to allow quantitative improvements in I/O performance to be directly measured on the new system in a variety of research configurations. Systemware software developed in the project will include performance analysis tools, improved job schedulers that take into account data locality and energy efficiency, optimised programming models, and APIs and drivers for optimal use of the new I/O hierarchy.</p> <p>The project will deliver immediately exploitable hardware and software results and show how to deliver high performance I/O at the Exascale.</p>	THE UNIVERSITY OF EDINBURGH	United Kingdom
NLAFET	Parallel Numerical Linear Algebra for Future Extreme-Scale Systems	H2020 - FET	01/11/2015	01/11/2018	3.907.375 €	3.907.375 €	RIA	FETHPC-1-2014	http://www.nla-fet.eu/	<p>The NLAFET proposal is a direct response to the demands for new mathematical and algorithmic approaches for applications on extreme scale systems, as identified in the FETHPC work programme and call. This project will enable a radical improvement in the performance and scalability of a wide range of real-world applications relying on linear algebra software, by developing novel architecture-aware algorithms and software libraries, and the supporting runtime capabilities to achieve scalable performance and resilience on heterogeneous architectures. The focus is on a critical set of fundamental linear algebra operations including direct and iterative solvers for dense and sparse linear systems of equations and eigenvalue problems. Achieving this requires a co-design effort due to the characteristics and overwhelming complexity and immense scale of such systems. Recognized experts in algorithm design and theory, parallelism, and auto-tuning will work together to explore and negotiate the necessary tradeoffs.</p> <p>The main research objectives are:</p> <ul style="list-style-type: none"> (i) development of novel algorithms that expose as much parallelism as possible, exploit heterogeneity, avoid communication bottlenecks, respond to escalating fault rates, and help meet emerging power constraints; (ii) exploration of advanced scheduling strategies and runtime systems focusing on the extreme scale and strong scalability in multi/many-core and hybrid environments; (iii) design and evaluation of novel strategies and software support for both offline and online auto-tuning. <p>The validation and dissemination of results will be done by integrating new software solutions into challenging scientific applications in materials science, power systems, study of energy solutions, and data analysis in astrophysics. The deliverables also include a sustainable set of methods and tools for cross-cutting issues such as scheduling, auto-tuning, and algorithm-based fault tolerance packaged into open-source library modules.</p>	UMEA UNIVERSITET	Sweden
PAMS	Planar Atomic and Molecular Scale devices	FP7-ICT	01/10/2013	30/09/2017	9.188.726 €	6.683.998 €	Collaborative project (generic)	ICT-2013.9.7 FET Proactive: Atomic and Molecular Scale Devices and Systems	http://pams.pro.d.jamp.cnrs.fr/	<p>The PAMS project will explore all scientific and technological aspects of the fabrication of planar atomic and sub-molecular scale electronic devices on surfaces of Si:H, Ge:H, AlN, CaCO₃ (calcite) and CaF₂ with atomic scale precision and reproducibility. The sub-nanoscale devices will be made by combining ultra-precise Scanning Tunnelling Microscopy (STM) and non-contact-Atomic Force Microscopy (NC-AFM) atomic and molecular manipulation, including hydrogen extraction from passivated surfaces, controlled local doping and on-surface chemical synthesis of molecular devices and wires by coupling of precursors. PAMS will develop new solutions to reliably address sub-nanometer scale devices from the human scale by developing a new generation of low-temperature interconnection and manipulation machines comprising four STM/NC-AFM heads with sub-Å? precision, allowing for contacting nanopads connected to dangling bond nanowires, doped silicon nanowires or molecular nanowires. Understanding and optimization of the electronic structures of these nanowires and of the contacts between the various components of the planar device will be one of the central objectives. The atomic and molecular devices will include dangling bond circuitries, functionalized by coupling with organic molecules, and controlled by remote alteration of molecular states by local band bending; alternatively multi-branch polyaromatic logical gates will be synthesized and addressed by up to four nanowires. PAMS will address the novel theoretical challenges posed by these planar devices. Accordingly, new methodological tools will be developed, allowing for a multiscale description (using from first-principles to empirical force-fields) of the structural, electronic and transport properties of such atomic and molecular devices, as well as their fabrication and characterization. These new theoretical tools will ultimately permit us to optimize the design and synthesis of atomic and molecular gates.</p>	CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE	France

PAPETS	Phonon-Assisted Processes for Energy Transfer and Sensing	FP7-ICT	01/09/2013	31/08/2016	2.503.347 €	1.834.424 €	Collaborative project (generic)	ICT-2013.9.1 Challenging current Thinking http://www.papets.eu/	There is mounting experimental and theoretical evidence that suggests that coherent electronic and vibrational dynamics are essential to understand physiological processes. This project addresses this newly emerging frontier between biology and quantum physics by aiming to determine the role of coherent vibrational dynamics in the efficiency of energy storage in natural and artificial light harvesting systems, as well as in odour recognition. Although these are at first sight two very different biological processes, in both cases their effectiveness is now believed to rely on phonon-assisted mechanisms. In fact, more generally, it is becoming increasingly clear that vibrational dynamics plays a key role in establishing the fundamental connection between structure and function of protein complexes. In this project we not only plan to experimentally demonstrate the crucial role of the phonon-assisted dynamics in facilitating efficient energy transfer in chromophoric complexes and odour recognition, but also to develop a general theoretical framework to describe and understand the role coherent vibrations play in the dynamics of biomolecular systems, as well as to develop methods to identify the presence and properties of such vibrations. Furthermore, we aim at controlling the vibrational dynamics for the development of efficient artificial light harvesting systems. To attain these goals we develop a truly multidisciplinary and original approach. The project will be developed in close collaboration between theorists and experimentalists, and is expected to yield an understanding of photosynthesis and olfaction at the most fundamental level, thus contributing in a unique way to such important challenges as the development of more efficient light harvesting technologies or artificial odour sensors. Furthermore, the understanding and control of environment-assisted coherent dynamics could potentially lead to new forms of robust quantum information processing in the future...	INSTITUTO DE TELECOMUNICAC OES Portugal
PARADIME	Parallel Distributed Infrastructure for Minimization of Energy	FP7-ICT	01/10/2012	30/09/2015	3.235.707 €	2.499.998 €	Collaborative project (generic)	ICT-2011.9.8 FET Proactive: Minimising Energy Consumption of Computing to the Limit (MINECC) http://www.paradime-project.eu/	The increasing power and energy consumption of modern computing devices is perhaps the largest threat to technology minimization and associated gains in performance and productivity. On the one hand, we expect technology scaling to face the problem of "dark silicon" (only segments of a chip can function concurrently due to power restrictions) in the near future and lead us to use devices with completely new characteristics. On the other hand, as core counts increase, the shared memory model based on cache coherence will severely limit scalability and increase energy consumption. Therefore, to overcome these problems, we need new computing paradigms that are radically more energy efficient. The objective of ParaDIME is to attack the power-wall problem by radical software-hardware techniques that are driven by future circuit and device characteristics on one side, and by a programming model based on message passing on the other side. In particular ParaDIME will utilize: circuit and architecture operation below safe voltage limits for drastic energy savings, the use of specialized energy-aware computing accelerators, energy-aware runtime, approximate computing and power-aware message passing. The outcome of the project will be a processor architecture for a heterogeneous distributed system that utilizes future device characteristics for dramatic energy savings. Wherever possible, ParaDIME will adopt multidisciplinary techniques, such as hardware support for message passing, runtime energy optimization utilizing new hardware energy performance counters, use of accelerators for error recovery from sub-safe voltage operation, and approximate computing through annotated code. Furthermore, we will establish and investigate the theoretical limits of energy savings at the device, circuit, architecture, runtime, and programming model levels of the computing stack, as well as quantify the actual energy savings achieved by the ParaDIME approach for the complete computing stack.	BARCELONA SUPERCOMPUTING CENTER - NACIONAL DE SUPERCOMPUTACION Spain
PHIDIAS	Ultra-Low-Power Holistic Design for Smart Biosignals Computing Platforms	FP7-ICT	01/10/2012	30/09/2015	2.426.987 €	1.799.958 €	Collaborative project (generic)	ICT-2011.9.8 FET Proactive: Minimising Energy Consumption of Computing to the Limit (MINECC) http://www.phidiasproject.eu/	Emerging and future HealthCare policies are fuelling up an application driven shift toward long term monitoring of biosignals by means of embedded ultra low power Wireless Body Sensor Networks (WBSNs). In order to break out, these applications need the emergence of new technologies to allow the development of extremely power-efficient bio sensing nodes. This project aims at unlocking the development of ultra-low power bio-sensing WBSNs by tackling the following key technological breakthroughs:- The development of new signal processing models and methods based on the new Compressive Sampling paradigm and optimized for low power computational architectures that will generate the necessary front-end but will necessitate to depart from the traditional Shannon sampling methodologies,- The efficient hardware implementation of components, both analog and digital, building upon the new ultra-low-power signal processing front-end,- The joint architecture optimization and integration of those components using novel ultra-compact heterogeneous 3D architectures,- The evaluation of the global power reduction using a system wide integration of hardware and software components focused on compressed sensing based biosignals analysis. Based on these breakthroughs, PHIDIAS aims at developing and evaluating a proof-of-concept system that will allow disrupting the design of WBSNs for biosensing applications as well as shifting the expectations of health monitoring applications. PHIDIAS will tackle these challenges by bringing together a mixed consortium of academic and industrial research partners representing pan-European excellence in those technologies. Moreover, PHIDIAS will pioneer a unique holistic approach, ensuring that key breakthroughs work out in a cooperative way toward the global objective of the project.	ECOLE POLYTECHNIQUE FEDERALE DE LAUSANNE Switzerland

PHOCS	Photogenerated Hydrogen by Organic Catalytic Systems	FP7-ENERGY	01/12/2012	30/11/2015	3.835.342 €	2.849.000 €	Collaborative project (generic)	ENERGY.201 2.10.2.1 Future Emerging Technologies	http://www.phocs.eu/	Aim of the project Photogenerated Hydrogen by Organic Catalytic Systems (PHOCS) is the realization of a new-concept, photoelectrochemical system for hydrogen production, based on the hybrid organic/inorganic and organic/liquid interfaces. PHOCS takes the move from the recent demonstration of reduction/oxidation reactions taking place, under visible light and at zero bias, at the interface of an organic semiconductor and an aqueous electrolyte, obtained by the coordinators group. PHOCS intends to combine the visible-light absorption properties of organics, together with the enhanced charge transport capabilities of inorganic semiconductors, in order to build a hybrid photoelectrode for hydrogen generation. New organic donor and acceptor materials (conjugated polymers and fullerenes derivatives) will be synthesized, properly tuning HOMO-LUMO levels position and energy gap extent for semi-water splitting purposes. In order to build properly-working photo-electrochemical cells, issues such as stability, wettability, catalytic functionality, electron transfer processes at the polymer/electrolyte interface will also be faced during the synthesis step. Multifunctional, high surface area, inorganic electrodes will be moreover developed, in order to increase surface area, provide ohmic contact to the organic active layer, 3D control of the donor-acceptor junction and advanced light management. Spectro-electrochemical characterization of organic/inorganic and organic/electrolytic solution interfaces will be continuously performed, in order to deep characterize charge transfer phenomena and improve the device performances. Final aim of PHOCS project is the realization of a scaled-up, 10x10 cm ² , 1% solar-to-hydrogen energy conversion efficient device, as a tangible first step towards the new organic water splitting technology.	FONDAZIONE ISTITUTO ITALIANO DI TECNOLOGIA	Italy
PHOTONVOLTAICS	Nanophotonics for ultra-thin crystalline silicon photovoltaics	FP7-ENERGY	01/11/2012	31/10/2015	3.994.164 €	2.894.454 €	Collaborative project (generic)	ENERGY.201 2.10.2.1 Future Emerging Technologies	http://www.photonvoltaics.org	The ambition of PhotoNvoltaics is to enable the development of a new and disruptive solar cell generation resulting from the marriage of crystalline-silicon photovoltaics (PV) with advanced light-trapping schemes from the field of nanophotonics. These two technologies will be allied through a third one, nanoimprint, an emerging lithography technique from the field of microelectronics. The outcome of this alliance will be a nano-textured thin-film crystalline silicon (c-Si) cell featuring a drastic reduction in silicon consumption and a greater cell and module process simplicity. It will thus ally the sustainability and efficiency of crystalline silicon PV with the simplicity and low cost of the current thin-film solar cells. The challenge behind PhotoNvoltaics lies behind the successful identification and integration of these nano-textures into thin c-Si-based cells, which aim is a record boost of the light-collection efficiency of these cells, without harming their charge-collection efficiency. The goals of this project are scientific and technological. The scientific goal is two-fold: (1) to demonstrate that the so-called Yablonovitch limit of light trapping can be overcome, with specific nanoscale surface structures, periodic, random or pseudo-periodic, and (2) to answer the old question whether random or periodic patterns are best. The technological goal is also two-fold: (1) to fabricate thin c-Si solar cells with the highest current enhancement ever reached and (2) to demonstrate the up-scalability of this concept by fabricating patterns over industrially relevant areas. To reach these goals, PhotoNvoltaics will gather seven partners, expert in all the required fields to model and identify the optimal structures, fabricate them with a large span of techniques, integrate them into solar cells and, finally, assess the conditions of transferability of these novel concepts, that bring nanophotonics into PV, further towards industry.	INTERUNIVERSITAIR MICRO-ELECTRONICA CENTRUM VZW	Belgium
PHYCHIP	Physarum Chip: Growing Computers from Slime Mould	FP7-ICT	01/03/2013	29/02/2016	2.716.324 €	2.099.984 €	Collaborative project (generic)	ICT-2011.9.6 Unconventional Computation (UCOMP)	http://www.phychip.eu/	We will design and fabricate a distributed biomorphic computing device built and operated by slime mould Physarum polycephalum. A Physarum chip is a network of processing elements made of the slime mould's protoplasmic tubes coated with conductive substances; the network is populated by living slime mould. A living network of protoplasmic tubes acts as an active non-linear transducer of information, while templates of tubes coated with conductor act as fast information channels. The Physarum chip will have parallel inputs (optical, chemo- and electro-based) and outputs (electrical and optical). The Physarum chip will solve a wide range of computation tasks, including optimisation on graphs, computational geometry, robot control, logic and arithmetical computing. The slime mould-based implementation is a bio-physical model of future nano-chips based on biomorphic mineralisation. We envisage that research and development centred on novel computing substrates, as self-assembled and fault-tolerant fungal networks will lead to a revolution in the bio-electronics and computer industry. Combined with conventional electronic components in a hybrid chip, Physarum networks will radically improve the performance of digital and analog circuits. Taking into account the enormous and growing interest of research centres and commercial laboratories in the recent experimental implementations of chemical, molecular and biological computers, we can predict that in the next 20-30 years, networks of slime mould mineralised and/or coated with compound substances will become a widespread commodity and a very promising component of novel information processing circuits.	UNIVERSITY OF THE WEST OF ENGLAND, BRISTOL	United Kingdom

PLANTOID	Innovative Robotic Artefacts Inspired by Plant Roots for Soil Monitoring	FP7-ICT	01/05/2012	30/04/2015	2.091.887 €	1.619.924 €	Collaborative project (generic)	ICT-2011.9.1 Challenging current Thinking	http://www.plantoidproject.eu/	We aim at designing, prototyping, and validating a new generation of ICT hardware and software technologies inspired from plant roots, called PLANTOIDS, endowed with distributed sensing, actuation, and intelligence for tasks of environmental exploration and monitoring. PLANTOIDS take inspiration from, and aim at reproducing, the amazing penetration, exploration, and adaptation capabilities of plant roots. Plants have evolved very robust growth behaviours to respond to changes in their environment and a network of highly sensorized branching roots to efficiently explore the soil volume, mining minerals and up-taking water. PLANTOID has two major goals:1) To abstract and synthesize with robotic artefacts the principles that enable plant roots to effectively and efficiently explore and adapt to underground environments;2) To formulate scientifically testable hypotheses and models of some unknown aspects of plant roots, such as the role of local communication among root apices during adaptive growth and the combination of rich sensory information to produce collective decisions.The PLANTOID artefact will be composed of a network of sensorized and actuated roots, displaying rich sensing and coordination capabilities as well as energy-efficient actuation and high sustainability, typical of the Plant Kingdom. Each PLANTOID root will consist of an apex that comprises sensors, actuators, control units, and by an elongation zone that mechanically connects the apex and the trunk of the robot. The new technologies expected to result from PLANTOID concern energy-efficient actuation systems, chemical and physical micro-sensors, sensor fusion techniques, kinematics models, and distributed, adaptive control in networked structures with local information and communication capabilities. The foundational research program of PLANTOID will be carried out by a consortium of engineers, plant biologists, and computer scientists with demonstrated experience in interdisciplinary work.	FONDAZIONE ISTITUTO ITALIANO DI TECNOLOGIA	Italy
PLASWIRES	Engineering multicellular biocircuits: programming cell-cell communication using plasmids as wires	FP7-ICT	01/10/2013	30/09/2016	2.617.039 €	2.014.998 €	Collaborative project (generic)	ICT-2013.9.6 FET Proactive: Evolving Living Technologies (EVLIT)	http://www.plaswires.eu/	Conjugation is a natural communication mechanism used by plasmids (autonomous self- replicating DNA molecules) to travel from bacteria to bacteria as a survival strategy. The genes and proteins that control conjugation are well known by biologists. This conjugation hardware is highly specific and robust and has been refined over millions of years of natural selection. It allows the independent transmission of different conjugative plasmids without interference even when the plasmids share the same sender or receiver bacteria.We will harness this sophisticated and exquisite biological hardware to engineer a new multicellular communication technology where plasmids will be used as intercellular wires. Among others, during PLASWIRES project we will engineer large multicellular circuits such as a multi-layered AND gate circuit with 5 inputs, or an AND-OR and OR-AND Boolean logic circuit with up to 6 inputs.To simplify the design and implementation of conjugation based circuits we will engineer a multicellular programmable logic array (PLA). To show the power of this cell-cell communication technology, we will solve an NP-complete problem in-vivo: the SAT problem. To solve this problem is interesting not only theoretically, but also in practice: our plasmids solving SAT can potentially be used as programmable antibiotics or sentinel plasmids able to detect danger sets of plasmids in virulent bacteria. PLASWIRES will also develop software (CellModeller and BactoSIM will be the simulators used) to help biologists in the design of all these multicellular circuits.PLASWIRES' ultimate goal is to establish conjugation as a new tool in synthetic biology, which has not previously been exploited, to engineer multicellular circuits with potential applications in biomedicine and biotechnology. From a computational standpoint, PLASWIRES aims to demonstrate that conjugative plasmids are programmable wires enabling distributed bacterial computations. In other words: PLASWIRES' main goal is to show how to program a parallel distributed living computer using conjugative plasmids as wires between cellular processors.	UNIVERSIDAD POLITECNICA DE MADRID	Spain
PLEASED	PLants Employed As SEnsor Devices	FP7-ICT	01/05/2012	30/04/2015	1.454.700 €	1.076.025 €	Collaborative project (generic)	ICT-2011.9.2 High-Tech Research Intensive SMEs in FET research	http://pleased-fp7.eu/	Plants have amazing and significant sensing capabilities. For instance, each single root apex can simultaneously and continuously monitor many chemical and physical parameters. Natural organisms, including human beings, have often inspired works of science and science fiction on how to augment their abilities or interface them with machines. As a remarkable example, electroencephalography (EEG) enables the transduction of electrical activity in the brain into machine understandable signals of non-verbalised patterns.In this project, we plan to extend this approach to the realm of plants, shifting focus from interfacing a single entity (e.g. a human brain that controls a prosthetic device) to a network of entities (a community of plants) that renders an orchestrated response to the environment in which it lives. While artificial sensing devices exist that can monitor environmental parameters of interest, such as temperature or humidity, the focus of our research will be on the use of plants themselves as sensing and decision-making devices.The holistic approach we propose is novel: while plants as bio-sensors have been the object of previous studies, prior work has focused on the study of the sensing capabilities of individual plants in a controlled laboratory environment. In contrast, we plan to consider real field scenarios (e.g. a forest or a meadow) in which plants often receive uncontrollable and unpredictable stimuli. We will consider the case of multiple points of observations, in which readings from several plants are collected over a wireless network and integrated in a suitable way to obtain a consistent and global view of an environment of interest. Eco-compatible, self-sustainable and cost effective plant-based solutions will be studied to tackle two relevant problems of the modern society: air pollution and the use of chemicals in organic agriculture.We are used to thinking of plants as inanimate objects. A nice aphorism well describes our vision: \"One day you will step into the garden to look at the flowers - and the flowers will look back at you!\". Even more interestingly, we also claim that plants will gossip about you!	WLAB SRL	Italy

PLEXMATH	Mathematical framework for multiplex networks	FP7-ICT	01/11/2012	31/10/2015	1.975.673 €	1.515.000 €	Collaborative project (generic)	ICT-2011.9.7 FET Proactive: Dynamics of Multi-Level Complex Systems (DyM-CS)	http://www.plexmath.eu/	The aim of PLEXMATH is that of formulating a brand new mathematical framework for the analysis of multi-level time-dependent complex networks in terms of tensor-like structures, in particular rank-four objects that represent with four indices the most general structure of possible connections. Generally speaking, our goal is similar to that of Maxwell equations when representing the foundation of classical electromagnetism, i.e. to provide a closed representation of the theory (of complex networks in our case) unifying notation and dynamical equations. We therefore will accommodate current and future theoretical and algorithmic needs by adopting a radically new point of view. Capitalizing on 4th-rank order algebra we will reformulate all network descriptors and will propose dynamical equations to represent diffusive processes on multiplex networks. In doing this, we will generate new mathematical models that will be validated on unparalleled amounts of ICT data that describe relevant socioeconomic and techno- social systems, like the structure and dynamics of social networks and transportation systems that operate at different levels. PLEXMATH constitutes a vital step towards a more general formalism for real-world networks, as the generated knowledge will substantially improve our understanding of complex systems, and will directly impact the way we deal with structural and dynamical patterns in many systems, including ICT.	UNIVERSITAT ROVIRA I VIRGILI	Spain
POLYWEC	New mechanisms and concepts for exploiting electroactive Polymers for Wave Energy Conversion.	FP7-ENERGY	01/11/2012	31/10/2016	2.561.976 €	2.059.156 €	Collaborative project (generic)	ENERGY.201 2.10.2.1 Future Emerging Technologies	NOT AVAILABLE	Wave energy has a great potential as renewable source of electricity. Studies have demonstrated that significant percentage of world electricity could be produced by Wave Energy Converters (WECs). However electricity generation from waves still lacks of spreading because the combination of harsh environment and form of energy makes the technical development of cost effective WECs particularly difficult. This Project introduces a new class of Polymeric WECs (PolyWECs), characterized by the employment of Electroactive Elastomer (EE) transducers. The goal is to introduce a radical change in the traditional architecture of WECs that usually includes three basic components: mechanical wave absorbers, a mechanical transmission and a power take-off system. Due to their nature, PolyWECs can be conceived in a way that such three components are integrated into a single deformable lightweight and low-cost polymeric element. EEs have been largely investigated in the form of actuators for robotics and ICT applications. Preliminary studies on energy generation through EEs demonstrated their great potential in terms of cost effectiveness, efficiency and reduced complexity. Due to their intrinsic low mass, flexibility and resilience, as well as their capacitive nature and high voltage operation, EE technology perfectly matches the requirements of WECs. The Project investigates on new concepts and mechanisms for wave energy harvesting that are based on EEs through a multidisciplinary approach that includes competencies on WEC design/tests, fluid dynamics simulation/test, control/mechatronics and material science. The aim of the Project is to develop new knowledge and new technologies aiming at: (1) optimizing EE materials for WEC applications, (2) conceiving new electro-mechanical configurations for PolyWECs, (3) studying the fluid-EE interaction through numerical simulations, (4) performing wave-tank tests of small scale prototypes, (5) providing economic and environmental assessment.	SCUOLA SUPERIORE DI STUDI UNIVERSITARI DI PERFEZIONAMENTO TO SANT'ANNA	Italy
POLYWEC	New mechanisms and concepts for exploiting electroactive Polymers for Wave Energy Conversion.	FP7-ENERGY	01/11/2012	31/10/2016	2.561.976 €	2.059.156 €	Collaborative project (generic)	ENERGY.201 2.10.2.1 Future Emerging Technologies	NOT AVAILABLE	Wave energy has a great potential as renewable source of electricity. Studies have demonstrated that significant percentage of world electricity could be produced by Wave Energy Converters (WECs). However electricity generation from waves still lacks of spreading because the combination of harsh environment and form of energy makes the technical development of cost effective WECs particularly difficult. This Project introduces a new class of Polymeric WECs (PolyWECs), characterized by the employment of Electroactive Elastomer (EE) transducers. The goal is to introduce a radical change in the traditional architecture of WECs that usually includes three basic components: mechanical wave absorbers, a mechanical transmission and a power take-off system. Due to their nature, PolyWECs can be conceived in a way that such three components are integrated into a single deformable lightweight and low-cost polymeric element. EEs have been largely investigated in the form of actuators for robotics and ICT applications. Preliminary studies on energy generation through EEs demonstrated their great potential in terms of cost effectiveness, efficiency and reduced complexity. Due to their intrinsic low mass, flexibility and resilience, as well as their capacitive nature and high voltage operation, EE technology perfectly matches the requirements of WECs. The Project investigates on new concepts and mechanisms for wave energy harvesting that are based on EEs through a multidisciplinary approach that includes competencies on WEC design/tests, fluid dynamics simulation/test, control/mechatronics and material science. The aim of the Project is to develop new knowledge and new technologies aiming at: (1) optimizing EE materials for WEC applications, (2) conceiving new electro-mechanical configurations for PolyWECs, (3) studying the fluid-EE interaction through numerical simulations, (4) performing wave-tank tests of small scale prototypes, (5) providing economic and environmental assessment.	SCUOLA SUPERIORE DI STUDI UNIVERSITARI DI PERFEZIONAMENTO TO SANT'ANNA	Italy

PROME3THE2US2	Production Method Of Electrical Energy by Enhanced Thermal Electron Emission by the Use of Superior Semiconductors	FP7-ENERGY	01/05/2013	30/04/2016	4.210.827 €	2.995.259 €	Collaborative project (generic)	ENERGY.201.2.10.2.1 Future Emerging Technologies	NOT AVAILABLE	The project aims to develop, validate and implement a novel solid-state conversion mechanism able to transform concentrated solar radiation into electric energy, at very high efficiency, with a direct conversion obtained by an enhanced electron emission from advanced semiconductor structures. Its application is in high-flux concentrating solar systems, characterized by presently mature optical technology, reduced request for active components, high cost-effectiveness. The energy conversion exploits the high radiation flux, provided by solar concentrators, by combining an efficient thermionic emission to an enhanced photo-electron emission from a cathode structure, obtained by tailoring the physical properties of advanced semiconductors able to work at temperatures as high as 1000 °C. The high operating temperatures are also connected to the possibility to exploit the residual thermal energy into electric energy by thermo-mechanical conversion. ProME3The2US2 will develop a proof-of-concept converter working under vacuum conditions, composed of an absorber able to employ the solar infrared (IR) radiation to provide a temperature increase, a semiconductor cathode properly deposited on it, and a work-function-matched anode, separated from the cathode by an inter-electrode spacing. The concept novelty bases on: (1) Use of both bandgap and over-bandgap energy to generate electrical current; (2) Additional use of sub-bandgap IR radiation, with a spectral energy not able to excite photo-emitters, for augmenting the thermionic emission from cathode; (3) Engineered semiconductors, able to emit electrons at lower temperatures than standard refractory metals; (4) Experimentation of a hetero-structured cathode for emission enhancement by an internal field; (5) Recovery of exhaust heat from the anode by thermo-mechanical conversion. It is estimated that the proposed technology could achieve a conversion efficiency of 45% if used under high-flux irradiation conditions (~1000 suns).	CONSIGLIO NAZIONALE DELLE RICERCHE	Italy
PROMISCE	Quantum Propagating Microwaves in Strongly Coupled Environments	FP7-ICT	01/04/2012	31/03/2015	2.869.083 €	2.168.921 €	Collaborative project (generic)	ICT-2011.9.1 Challenging current Thinking	NOT AVAILABLE	The aim of PROMISCE is to provide the foundations for a novel research field: propagating quantum microwave technologies in strongly and ultra-strongly coupled environments. In particular, its potential for scalable quantum information and communication technology (Q-ICT) applications will be demonstrated. PROMISCE is born from a challenging and controversial idea, which is that microwave photons can interact strongly among each other and with their environment even in the absence of confining cavities. PROMISCE combines two major innovative and interdisciplinary components. The first one, propagating quantum microwave photonics, focuses on the generation, control, and detection of quantum microwave beams and photons using superconducting quantum circuits. The second component aims at exploring propagating quantum microwave interactions. Novel paths in engineering strong and ultra-strong controlled interactions between propagating microwave photons and their environment, and among photons themselves, will be pursued. To this end, we will employ superconducting quantum circuits and develop sophisticated quantum meta-materials. We note that both components are intimately connected: technological and conceptual achievements in one component will immediately trigger progress in the other one. Together they will provide, integrated on a chip, the equivalent of optical Q-ICT experiments in the microwave regime. PROMISCE represents a complete paradigm shift beyond the common interest in superconducting qubits for Q-ICT to the concept of encoding quantum information in propagating microwave photons and using an (ultra-)strongly coupled environment as the basic tool for their manipulation. In this context, PROMISCE also introduces a new understanding of the term environment. Instead of being seen as a source of decoherence or noise, it is converted into a powerful tool for control, communication and information processing.	AGENCIA ESTATAL CONSEJO SUPERIOR DE INVESTIGACIONES CIENTIFICAS	Spain
PUFFIN	Physically unclonable functions found in standard PC components	FP7-ICT	01/02/2012	31/01/2015	1.319.480 €	1.004.517 €	Collaborative project (generic)	ICT-2011.9.2 High-Tech Research Intensive SMEs in FET research	http://puffin.eu.org/	Physically Unclonable Functions (PUFs) are used to uniquely identify electronic components and to protect valuable objects against counterfeiting. They allow creating a root of trust in a hardware system through generating device-unique "fingerprints" and deriving secret keys from the underlying physical properties of the silicon. Today they are typically found in specially designed hardware components and result from the silicon properties of individual transistors. They exist in many forms, among which are the so-called SRAM PUFs. This project intends to study and show the existence of SRAM PUFs and other types of PUFs in standard PCs, laptops, mobile phones and consumer electronics. This has not been attempted so far. The mere existence of physical properties that depend on a component and are reproducible is only the first step to guarantee appropriate robustness, reliability and randomness properties for use as secret keys or trust anchors in mass-market applications. By uncovering the security properties of PUFs in standard components such as graphical processing units, central processing units and PCI connectors, this project will provide the first intrinsic and long-wanted basis for security in everyone's most common computing platforms: standard PCs and similar hardware. This new root of trust in turn adds security for mass-market applications, replacing or complementing the role of a trusted platform module and enabling security for applications such as broadcast applications, content protection for the gaming industry and secure day-to-day transactions for everyone. The results of the project will allow for the first time an a priori open platform, the most difficult element to secure in an information-technology system today, to inherit security properties from its own identity and its intrinsic physical properties.	TECHNISCHE UNIVERSITEIT EINDHOVEN	Netherlands

QALGO	Quantum Algorithmics	FP7-ICT	01/05/2013	30/04/2016	2.569.465 €	1.949.998 €	Collaborative project (generic)	ICT-2011.9.9 FET Proactive: Quantum ICT (QICT) including ERA-NET-Plus	<p>We will study the algorithmic aspects of quantum information. Our goal is to find new algorithms for quantum computers and new quantum communication protocols that are more efficient than the classical protocols. We will pursue this goal in a number of different ways. Firstly, we will study concrete problems that may have fast quantum algorithms and develop methods for constructing quantum algorithms. We will investigate the use of quantum walks (quantum counterparts of random walks) and learning graphs (a very new method which appeared less than a year ago) to construct quantum algorithms. We will also study two promising application areas for new quantum algorithms: hidden shift problems and property testing. Secondly, we will investigate general properties of quantum algorithms, such as the role of various resources (e.g., quantum entanglement or quantum discord) in quantum algorithms. We will study restricted forms of quantum computation, to find the minimum conditions under which universal quantum computation is possible. We will investigate the role of structure in input data in quantum speedups, by studying the maximum quantum speedups achievable in various settings. Thirdly, we will study the counterparts of those questions in the communication setting. We will work on designing quantum protocols that solve communication tasks more efficiently than any classical protocol and investigate quantum communication in a game-theoretic setting where parties act to maximize their self-interest. Lastly, we will investigate applications of quantum information concepts in other areas, namely to solve classical problems in computer science and to understand the computational complexity of problems in quantum physics. One of the major applications of a future quantum computer is to simulate quantum physical systems. Our goal is to understand this area in terms of complexity and possible quantum algorithms and to compare these with classical computational techniques.</p>	LATVIJAS UNIVERSITATE	Latvia
QCUMBER	Quantum Controlled Ultrafast Multimode Entanglement and Measurement	H2020 - FET	01/09/2015	01/09/2018	3.219.721 €	3.219.721 €	RIA	FETOPEN-RIA-2014-2015 http://www.qcumber.eu/	<p>Ultrafast light pulses offer the fascinating opportunity to study system dynamics at ultrashort time scales. Trains of ultrafast light pulses also feature a broad frequency comb structure that has been exploited e.g. in high precision metrology. These characteristics have made ultrafast optics with coherent control techniques a flourishing field in recent years. A rich toolbox has been developed to generate shorter pulses with engineered temporal and spectral properties.</p> <p>Likewise, exploiting quantum features of light has enabled remarkable progress for the experimental exploration of fundamental physics and has been central to establishing the fields of quantum communication and quantum metrology. This proposal aims to bring together these two vibrant fields with the goal of exploring new capabilities that arise from the interplay of the quantum properties of light at extreme timescales and over extremely broad spectra. Ultrafast quantum pulses feature an inherent non-classical pulse-mode or supermode structure, which is imprinted onto the states in the generation process and is closely related to the entanglement properties between different frequency constituents of the quantum pulses. Harnessing this structure will dramatically enhance quantum channel capacities per signal state, enable precision time-frequency measurements beyond classical boundaries and open new avenues to scalable quantum information processing. Each partner brings unique expertise from the areas of quantum information, ultrafast and quantum optics, which expands the combined knowledge of the consortium. The partners' research profiles cover engineered integrated optics with pulsed light, quantum communication systems, coherent control of light-matter interaction and continuous variable quantum states. Experience in classical ultrafast pulse-shaping as well as advanced theoretical analysis tools addressing high-dimensional entanglement and multimode photon statistics round out the consortium.</p>	THE CHANCELLOR, MASTERS AND SCHOLARS OF THE UNIVERSITY OF OXFORD	United Kingdom
QUANTICOL	A Quantitative Approach to Management and Design of Collective and Adaptive Behaviours	FP7-ICT	01/04/2013	31/03/2017	3.375.162 €	2.605.000 €	Collaborative project (generic)	ICT-2011.9.10 FET Proactive: Fundamentals of Collective Adaptive Systems (FOCAS) http://blog.inf.ed.ac.uk/quanticol/	<p>The problem: The design of collective adaptive systems (CAS) must be supported by a powerful well-founded framework for modelling and analysis. CAS consist of a large number of heterogeneous entities with decentralised control and varying degrees of complex autonomous behaviour. These entities may be competing for shared resources even when collaborating to reach common goals. The pervasive but transparent nature of CAS, together with the importance of the societal goals they address, mean that it is imperative that thorough a priori analysis and verification of their design is carried out to investigate all aspects of their behaviour before they are put into operation. Solution and target outcome: Our main objective is the development of an innovative formal design framework that provides a specification language for CAS and a large variety of tool-supported, scalable analysis and verification techniques. These techniques will be based on the original combination of recent breakthroughs in the field of Formal Methods, in particular stochastic process algebras and associated verification techniques, and Applied Mathematics, in particular mean field/continuous approximation and control theory. Such a design framework will provide scalable extensive support for the verification of developed models, and also enable and facilitate experimentation and discovery of new design patterns for emergent behaviour and control over spatially distributed CAS. Case studies: ICT-based CAS are at the core of the envisioned smart cities of the future. The development of our methodology will focus on the provisioning challenges of smart urban transport and smart grid. Such systems of heterogeneous components with competing goals must also manage resources in a fair and efficient way. This is particularly challenging when designing for behaviour that is emergent and spatially inhomogeneous but must nevertheless be guaranteed to satisfy operational requirements.</p>	THE UNIVERSITY OF EDINBURGH	United Kingdom

QUCHIP	Quantum Simulation on a Photonic Chip	H2020 - FET	01/03/2015	01/03/2018	2.681.713 €	2.681.713 €	RIA	FETPROACT-3-2014	http://www.quchip.eu/	Simulation is a fundamental computational tool for modern science with applications ranging from drug design to materials science. Quantum simulators have the potential to revolutionize the way simulations are performed by accessing system sizes that are untractable in classical machines. As a result, they will become a suite of powerful and precise instruments enabling the investigation of relevant phenomena in the dynamics of complex quantum systems, such as quantum transport and energy transfer, as well as implementing quantum improved computation - tasks hard to simulate classically. QUCHIP aims at implementing quantum simulation on integrated photonic processors. Photons present unique advantages deriving from their mobility and the immunity to decoherence: these two features make them substantially different from any other quantum system. Moreover integrated quantum photonics capitalizes on the multi-billion dollar investment already placed into photonics development and commercialization. QUCHIP will exploit these advantages to implement quantum walk experiments in which several photons propagate over complex circuit architectures "jumping" between different waveguides. This platform represents the most resource-efficient quantum computation scheme to date: Boson Sampling. Recent computational theory findings have shown exceptional potential for this scheme to achieve the quantum supremacy regime in which quantum systems surpass classical ones. QUCHIP will develop new photonic technologies, ranging from on-chip sources of single photons to complex waveguide architectures and on-chip detectors. We will explore the dynamics of noisy quantum networks and develop practical schemes to demonstrate key structural and functional elements of the network dynamics. The benefits range from insights into the dynamics of complex systems to a dramatic push forward for the realization of an experimental device whose output cannot be formally calculated by classical means.	UNIVERSITA DEGLI STUDI DI ROMA LA SAPIENZA	Italy
QUILMI	Quantum Integrated Light Matter Interface	FP7-ICT	01/10/2012	31/03/2016	1.619.838 €	1.228.876 €	Collaborative project (generic)	ICT-2011.9.3 FET Young Explorers	NOT AVAILABLE	This project brings together an interdisciplinary team of young, ambitious and internationally recognized researchers. The aim of the proposed research is to create a highly integrated device, which permits to manipulate, store and control light on a single-photon level using tailored quantum matter. Specifically, we will implement a three-dimensional optical lattice on an atom chip together with sophisticated waveguides for single-photon manipulation and detection, all integrated on the very same chip. Our vision is that this device becomes the centrepiece of novel hybrid light-matter networks, with which quantum information processing can be approached from a highly modularized standpoint. Our objective is to develop a far-reaching theoretical framework for light-matter interaction on an atom chip and to conduct experiments that, for the first time, demonstrate both coherent light-matter coupling and single-photon detection in an integrated device. This proof-of-principle demonstration will push quantum technology and methods beyond the current state-of-the-art. To achieve this ambitious goal we will exploit the combined expertise of our team in theoretical and experimental quantum optics, atomic physics and many-body physics. The proposed project promises high benefit for the European Research Area, as its prospective achievements will advance applications in quantum technology, and strongly enhance the competitive edge of European Research. The envisioned program will promote young researchers from different European countries and will allow them to forge a new international research alliance. This contributes to the exploitation of synergies in the European science scene, thereby building and securing leadership of Europe in ICT research.	THE UNIVERSITY OF NOTTINGHAM	United Kingdom
QuProCS	Quantum Probes for Complex Systems	H2020 - FET	01/04/2015	01/04/2018	2.268.746 €	2.268.746 €	RIA	FETPROACT-3-2014	http://www.quprocs.eu/	We are on the verge of a new scientific and technological era as the first quantum simulators able to investigate physical systems that cannot be studied classically are about to be built in the laboratories. Controlling and probing complex quantum systems is of paramount importance for the implementation of these devices. Quantum simulators are controllable complex quantum systems that emulate the behaviour of other quantum systems whose properties cannot be easily tested. While several models of quantum simulators are currently under construction, the development of effective probing techniques is still lagging behind, despite their crucial role. In most of the quantum simulator experiments measurement techniques are invasive and destructive, destroying not only the very quantum properties from which the simulator stems, but often also the quantum system itself. QuProCS works on the development of a radically new approach to probe complex quantum systems for quantum simulations, based on the quantification and optimisation of the information that can be extracted by an immersed quantum probe as opposed to a classical one. The team will theoretically investigate and experimentally implement quantum information probes to detect and characterise quantum correlations, quantum phase transitions, transport properties, and nonequilibrium phenomena in ultracold gases. By a shift in perspective to a complementary viewpoint, we will at the same time investigate experimentally, in a quantum optical platform, how changing the properties of the environment via reservoir engineering modifies the behaviour of the quantum probe. We will develop optimal probing strategies to read out and benchmark quantum simulators, thus providing the most crucial ingredient for commercial devices.	TURUN YLIOPISTO	Finland

QWAD	Quantum Waveguides Application and Development	FP7-ICT	01/01/2013	31/12/2015	2.162.233 €	1.649.999 €	Collaborative project (generic)	ICT-2011.9.9 FET Proactive: Quantum ICT (QICT) including ERA-NET-Plus	http://www.qwad-project.eu/	Quantum technologies promise to revolutionise our digital world providing security in communications and solutions for what have been thought of as unsolvable computational problems. The project QWAD introduces the technology of laser-written integrated optics, a powerful new tool for next generation quantum communications and computing, solving critical problems in terms of scalability and reliability. This disruptive photonic technology will speed up the evolution from lab systems to real world applications. Our consortium will target three main outcomes: 1) Fabricate laser-written waveguides in highly integrated three dimensional structures to generate and to manipulate both path- and polarization entangled photonic qubits. 2) Implement large integrated circuits to perform scalable quantum logic operations and quantum simulation of many-body dynamics. 3) Design dedicated waveguide structures for fully integrated quantum key exchange and for quantum enhanced sensing in application ready prototypes. The project benefits from the outstanding expertise of consortium members who have pioneered photonic and quantum information technologies over the past decades. The development of laser-written waveguide structures will allow extraordinary progress in terms of miniaturization and scalability while maintaining incomparable stability and durability. Key advances in quantum ICT will exploit the 3D waveguide geometries and other innovations to produce tailored quantum simulators and photonic quantum computer nodes. The development of novel ready-made quantum devices within QWAD will open new doors for innovative chip based quantum key exchange components and unrivalled efficiency and sensitivity Lab-on-a-chip devices.	LUDWIG-MAXIMILIANS-UNIVERSITAET MUENCHEN	Germany
RAMP	Real neurons-nanoelectronics Architecture with Memristive Plasticity	FP7-ICT	01/11/2013	31/10/2016	2.740.750 €	2.068.000 €	Collaborative project (generic)	ICT-2013.9.6 FET Proactive: Evolving Living Technologies (EVLIT)	http://www.rampproject.eu/	Information processing in classical 'von Neumann' architectures is less efficient compared to biological counterparts when dealing with ill-posed problems and noisy data. The reason is that the biological brain is configured differently and the key is its evolving structure, where connectivity elements between individual neurons, the synapses, undergo 'birth' and 'death' as well as strengthening and weakening through a selection process, reconfiguring neuronal connectivity in a self-organizing manner and allowing the networked population of neuronal processors to adapt motor and behavioural responses to the ever changing environment. Artificial neural networks in the form of software run on conventional 'von Neumann' computers appear incomparable to the biological systems in terms of speed, energy efficiency, adaptability and robustness. The challenge is to propose a 'physical' neural network where elements overcome this deficiency by merging data storage and processing into single electronic devices and by self-organizing and reconfiguring connectivity. Along this route, we aim to create a new biohybrid architecture of natural and artificial neurons endowed with plasticity properties. Communication between artificial and natural worlds will be established through new nano- and microtransducers allowing direct electrical interfacing of a network of neurons in culture to an artificial CMOS-based counterpart. Adaptation properties of the artificial network will rely on memristive nanoelectronic devices with synaptic-like plasticity and on activity-dependent rearrangement of neuronal connectivity. As such, the biohybrid system will provide new and unique adaptive, self-organizing and evolving properties deriving from the fusion of natural and artificial neuronal elements into a new plastic entity and will represent a fundamental step towards the development of novel brain-inspired computing architectures as well as 'intelligent' autonomous systems and prostheses...	UNIVERSITA DEGLI STUDI DI PADOVA	Italy
RAQUEL	Randomness and Quantum Entanglement	FP7-ICT	01/10/2013	30/09/2016	2.656.856 €	2.023.792 €	Collaborative project (generic)	ICT-2013.9.1 Challenging current Thinking	http://raquelproject.eu/	Randomness has established itself as a vital building block of information processing and represents an integral ingredient for practically any aspect in the field of information processing and technology. The principal objective of this project will be to establish and evaluate the role played by randomness in quantum information processing. We propose to address the main difficulties that arise through the use of randomness, in particular, 1) the use of randomness as a theoretical tool to prove existence and properties of information processing applications; 2) the design of novel quantum information processing applications that exploit randomness; 3) the design and analysis of applications that work with real-world (that is, non-uniform) randomness; 4) the construction of design techniques that produce high-quality randomness, both from a computational and adversarial perspective; and, finally, 5) the use of randomness to analyse and improve the physical processes necessary for the design quantum communication and computation devices. The consortium (composed of 8 research teams) aims to unite the forces of EU expertise in computer science, physics and mathematics to undertake a comprehensive study of randomness and quantum information within their research portfolio. Many of the targeted tasks combine the knowledge of partners. Hence, strong research interactions will be necessary to successfully achieve the objectives of the project.	MASARYKOVA UNIVERZITA	Czech Republic

READEX	Runtime Exploitation of Application Dynamism for Energy-efficient eXascale computing	H2020 - FET	01/09/2015	01/09/2018	3.534.198 €	3.534.198 €	RIA	FETHPC-1- 2014	http://www.rea-dex.eu/	High Performance Computing (HPC) has become a major instrument for many scientific and industrial fields to generate new insights and product developments. There is a continuous demand for growing compute power, leading to a constant increase in system size and complexity. Efficiently utilizing the resources provided on Exascale systems will be a challenging task, potentially causing a large amount of underutilized resources and wasted energy. Parameters for adjusting the system to application requirements exist both on the hardware and on the system software level but are mostly unused today. Moreover, accelerators and co-processors offer a significant performance improvement at the cost of increased overhead, e.g., for data-transfers. While HPC applications are usually highly compute intensive, they also exhibit a large degree of dynamic behaviour, e.g., the alternation between communication phases and compute kernels. Manually detecting and leveraging this dynamism to improve energy-efficiency is a tedious task that is commonly neglected by developers. However, using an automatic optimization approach, application dynamism can be detected at design-time and used to generate optimized system configurations. A light-weight run-time system will then detect this dynamic behaviour in production and switch parameter configurations if beneficial for the performance and energy-efficiency of the application. The READEX project will develop an integrated tool-suite and the READEX Programming Paradigm to exploit application domain knowledge, together achieving an improvement in energy-efficiency of up to 22.5%. Driven by a consortium of European experts from academia, HPC resource providers, and industry, the READEX project will develop a tools-aided methodology to exploit the dynamic behaviour of applications to achieve improved energy-efficiency and performance. The developed tool-suite will be efficient and scalable to support current and future extreme scale systems.	TECHNISCHE UNIVERSITAET DRESDEN	Germany
RECALL	RECALL: Enhanced Human Memory	FP7-ICT	01/11/2013	31/10/2016	2.632.680 €	1.999.814 €	Collaborative project (generic)	ICT-2013.9.5 FET-Open Xtrack	http://recall-fet.eu/	RECALL aims to re-think and re-define the notion of memory augmentation. Recent developments in capture technology and information retrieval allow for continuous and automated recordings of many aspects of our everyday lives. RECALL will harness these trends and develop a new paradigm for memory augmentation technologies that are technically feasible, desired by users, and beneficial to society. By combining technological interventions with basic research questions in memory psychology, we plan to elevate memory augmentation technologies from a clinical niche application to a mainstream technology, initiating a major change in the way we use technology to remember and to externalize memory. RECALL will build on contemporary memory theories that highlight how technology augmented recall can be used to both re-enforce and attenuate memories. It will develop novel capture technologies and corresponding control mechanisms to automate the acquisition of personal memories, and investigate how feedback through ambient large displays and personal mobile devices can aid personal memory acquisition, retention, and attenuation. The project is highly innovative – no such memory augmentation systems exist today and their emergence would represent a radical transformation in the way we understand and manage human memory acquisition and recall. The project is high risk – numerous technical and societal challenges need to be addressed before augmented memory systems are possible; and potentially high pay-off – if successful, the project will contribute to our fundamental understanding of human memory and have a transformational impact on all spheres of life – the workplace, family life, education, and psychological well-being – by measurably improving the acquisition of new knowledge, the retention of existing knowledge, and the loss of unwanted knowledge.	LANCASTER UNIVERSITY	United Kingdom
RECORD-IT	Reservoir Computing with Real-time Data for future IT	H2020 - FET	01/09/2015	01/09/2018	4.193.147 €	4.193.147 €	RIA	FETOPEN-RIA- 2014-2015	https://www.chalmers.se/en/projects/Pages/RECORD-IT.aspx	The aim of this proposal is to develop an intelligent biocompatible sensing device which detects complex behavioural changes in ion concentrations. The sensor will use wet NOMFETs, coated Si nanowires, self-conjugated polymers, arrays of photocells, flow of lipids. The level of ions will be measured by monitoring changes in the response function of the system. The high sensitivity of the device will be achieved by ensuring a strong coupling between the environment and the device. The key research challenges will be: accessing the feasibility of the idea to use reservoir computing for sensing complex environmental changes, identifying suitable integration strategies for the components, optimizing the sets of input/output pairs (response functions) and the device components for enhanced sensitivity.	CHALMERS TEKNISKA HOEGSKOLA AB	Sweden
RENVISION	Retina-inspired ENcoding for advanced VISION tasks	FP7-ICT	01/03/2013	29/02/2016	2.907.267 €	2.213.000 €	Collaborative project (generic)	ICT- 2011.9.11 FET Proactive: Neuro-Bio- Inspired Systems (NBIS)	http://www.renvision-fp7.eu/	The retina is a sophisticated distributed processing unit of the central nervous system encoding visual stimuli in a highly parallel, adaptive and computationally efficient way. Recent studies show that rather than being a simple spatiotemporal filter that encodes visual information, the retina performs sophisticated non-linear computations extracting specific spatio-temporal stimulus features in a highly selective manner (e.g. motion selectivity). Understanding the neurobiological principles beyond retinal functionality is essential to develop successful artificial computer vision architectures. RENVISION's goal is, therefore, twofold: i) to achieve a comprehensive understanding of how the retina encodes visual information through the different cellular layers; ii) to use such insights to develop a retina-inspired computational approach to high-level computer vision tasks. To this aim, exploiting the recent advances in high-resolution light microscopy 3D imaging and high-density multielectrode array technologies, RENVISION will be in an unprecedented position to investigate pan-retinal signal processing at high spatio-temporal resolution, integrating these two technologies in a novel experimental setup. This will allow for simultaneous recording from the entire population of ganglion cells and functional imaging of inner retinal layers at near-cellular resolution, combined with 3D structural imaging of the whole inner retina. The combined analysis of these complex datasets will require the development of novel multimodal analysis methods. Resting on these neuroscientific and computational grounds, RENVISION will generate new knowledge on retinal processing. It will provide advanced pattern recognition and machine learning technologies to ICTs by shedding a new light on how the output of retinal processing (natural or modelled) allows solving complex vision tasks such as automated scene categorization and human action recognition.	FONDAZIONE ISTITUTO ITALIANO DI TECNOLOGIA	Italy

RIBONETS	Programming cellular networks and community behaviour with synthetic RNA-based devices	FP7-ICT	01/09/2013	31/08/2016	1.300.125 €	994.854 €	Collaborative project (generic)	ICT-2013.9.3 FET Young Explorers	http://www.ribbonets.eu/	RiboNets aims at programming cellular networks and community behaviour using newly engineered logical gates that transmit and process information within cells in an innovative way, namely via RNA-based devices. RiboNets wants to develop a newly designed RNA-based toolbox for cellular computing. RNA has three major advantages: (a) RNA turnover is fast thus efficient computing is possible with RNA networks, (b) RNA folding and RNA-RNA interactions can be well predicted, thus, a large number of novel devices can be build, (c) RNA production is energetically cheap, therefore the host cell is not affected by computing. The RiboNet toolbox will be created following a three-step process: (i) rational design and analysis of RNA-based devices on a computer, (ii) selecting best performers in vitro within highly parallel microfluidic reactors and, finally, (iii) integrating and testing them in living cells. The combination of all three layers of analysis, in silico, in vitro and in vivo, is a major point of this proposal. It will allow us to deal with complex regulatory networks and to examine the underlying mechanisms of information transmission and processing within cells. The toolbox developed by RiboNets will provide an outstanding prerequisite for novel designs in synthetic biology and life sciences. The usage of the RiboNet toolbox will result in the creation of RNA-based sensors and RNA-based devices with efficient regulation of engineered metabolic and signalling pathways that will have potential applications in white biotechnology and medicine. For example, RNA-based antibiotics would improve human condition in technological applications, as well as in health, in the future. With RiboNets, a new territory will be explored, shedding light on how RNA networks contribute to cell-to-cell information processing and communication.	CHARITE - UNIVERSITAETS MEDIZIN BERLIN	Germany
RYSQ	Rydberg Quantum Simulators	H2020 - FET	01/03/2015	01/03/2018	4.695.000 €	4.383.000 €	RIA	FETPROACT-3-2014	http://qurope.eu/projects/rysq/	Quantum Simulators provide new levels of understanding of equilibrium and out-of-equilibrium properties of many-body quantum systems, one of the most challenging problems in physics. The main objective of the RYSQ project is to use Rydberg atoms for quantum simulations, because their outstanding versatility will allow us to perform a great variety of useful quantum simulations, by exploiting different aspects of the same experimental and theoretical tools. By implementing not only one but a whole family of Rydberg Quantum Simulators, the project will address both the coherent and incoherent dissipative dynamics of many-body quantum systems, with potential applications in the understanding and design of artificial light harvesting systems, large quantum systems with controlled decoherence, and novel materials. This will be achieved by building upon a novel generic approach to quantum simulation, where Rydberg atoms allow both digital (gate) and analog (interaction) simulations. In addition to solving problems in fundamental and applied science, the project will build up core competences for quantum science and technologies in mainstream engineering, by using innovative methods for communication, dissemination and exploitation of results. In summary, RYSQ plans (A) to develop a collection of novel experimental and theoretical tools for Rydberg quantum simulators, and (B) to use them as a basis for implementing many important applications of quantum simulations. The project is structured in such a way to allow for efficient exchanges within the consortium, and to maximize the overall outcome of the work.	UNIVERSITAET ULM	Germany
SAGE	Speed of Adaptation in Population Genetics and Evolutionary Computation	FP7-ICT	01/01/2014	31/12/2016	2.041.400 €	1.578.080 €	Collaborative project (generic)	ICT-2013.9.3 FET Young Explorers	http://www.project-sage.eu/index.aspx	Biological evolution has produced an extraordinary diversity of organisms, even the simplest of which is highly adapted, with multiple complex structures. Evolutionary computation has found that many innovative solutions to optimisation and design problems can be achieved by artificial evolution via random variation and selection. Despite the centrality of evolution to biology and the usefulness of evolutionary algorithms in optimisation, the dynamics of evolution are not well understood. Consequently, population genetics theory can only make quantitative predictions about short-term, simple biological evolution, and the design and parameter tuning of evolutionary algorithms is mostly done ad-hoc in a laborious and cost-intensive process. Both fields have studied the speed of adaptation independently, and with orthogonal approaches. Our project brings together an interdisciplinary consortium of ambitious researchers from the theory of evolutionary computation and theoretical population genetics to synergise these complementary approaches and to create the foundation of a unified quantitative theory describing the speed of adaptation in both biological and artificial evolution. The transformative impact of this unified theory will lie in enabling long-term predictions about the efficiency of evolution in settings that are highly relevant for both fields and related sciences. Our approach will reveal how this efficiency is fundamentally determined by evolutionary and environmental parameters. Tuning these parameters will allow researchers from biology and computation to increase the efficiency of evolutionary processes, revolutionising applications ranging from evolutionary algorithms to experimental evolution and synthetic biology.	THE UNIVERSITY OF NOTTINGHAM	United Kingdom

SAGE	SAGE	H2020 - FET	01/09/2015	01/09/2018	7.882.531 €	7.882.531 €	RIA	FETHPC-1-2014	http://www.sagestorage.eu/consortium/seagate	<p>Worldwide data volumes are exploding and islands of storage remote from compute will not scale. We will demonstrate the first instance of intelligent data storage, uniting data processing and storage as two sides of the same rich computational model. This will enable sophisticated, intention-aware data processing to be integrated within a storage systems infrastructure, combined with the potential for Exabyte scale deployment in future generations of extreme scale HPC systems.</p> <p>Enabling only the salient data to flow in and out of compute nodes, from a sea of devices spanning next generation solid state to low performance disc we enable a vision of a new model of highly efficient and effective HPC and Big Data demonstrated through the SAGE project.</p> <p>Objectives</p> <ul style="list-style-type: none"> - Provide a next-generation multi-tiered object-based data storage system (hardware and enabling software) supporting future-generation multi-tier persistent storage media supporting integral computational capability, within a hierarchy. - Significantly improve overall scientific output through advancements in systemic data access performance and drastically reduced data movements. - Provides a roadmap of technologies supporting data access for both Exascale/Exabyte and High Performance Data Analytics. - Provide programming models, access methods and support tools validating their usability, including 'Big-Data' access and analysis methods - Co-Designing and validating on a smaller representative system with earth sciences, meteorology, clean energy, and physics communities - Projecting suitability for extreme scaling through simulation based on evaluation results. <p>Call Alignment: We address storage data access with optimised systems for converged Big Data and HPC use, in a co-design process with scientific partners and applications from many domains. System effectiveness and power efficiency are dramatically improved through minimized data transfer, with extreme scaling and resilience.</p>	SEAGATE SYSTEMS UK LIMITED	United Kingdom
SCALEQIT	Scalable Superconducting Processors for Entangled Quantum Information Technology	FP7-ICT	01/02/2013	31/01/2016	5.942.936 €	4.500.000 €	Collaborative project (generic)	ICT-2011.9.9 FET Proactive: Quantum ICT (QICT) including ERA-NET-Plus	http://www.chalmers.se	<p>The ScaleQIT vision is to "develop a conceptual platform for potentially disruptive technologies, advance their scope and breadth and speed up the process of bringing them from the lab to the real world." ScaleQIT will address the engineering side of quantum information processing (QIP), analyzing and implementing realistic scenarios for scaling-up superconducting hybrid systems for quantum computing and quantum simulation. The work will be based on proven, well-functioning circuits and components that show great promise for integration into useful QIP systems. ScaleQIT will develop a quantum processor based on microwave resonators and waveguides coupling a small (5-10) number of superconducting qubits of the "transmon" type. It will achieve most of the functionalities required by DiVincenzo's criteria, and will meet many of the challenges defined by the European Quantum Information and Processing Roadmap. For the development of a useful scalable platform, the ScaleQIT project will address a wide range of challenging issues, and take them far beyond the state of the art for multi-qubit platforms, addressing several central issues: feed-back and feed-forward control; error correction; quantum memory; quantum interfaces; algorithms and protocols for computing and simulation; design of scalable architectures for high performance quantum computing. ScaleQIT aims for groundbreaking applications to quantum simulation of physical systems. If successful, it may already in the short term have a disruptive effect on the development of quantum information science. In the longer term, it can be expected to have a disruptive effect on the science of computation: combining functional processor units with, say, 10 qubits, into larger distributed systems will eventually have simulation power that rivals that of powerful digital computers. By really building and testing larger quantum-engineering systems, ScaleQIT will be a path-finder on the road to developing solid-state fault-tolerant quantum architectures.</p>	CHALMERS TEKNISKA HOEGSKOLA AB	Sweden
SCENENET	Mobile Crowd Sourcing Video Scene Reconstruction	FP7-ICT	01/02/2013	31/01/2016	1.656.719 €	1.333.279 €	Collaborative project (generic)	ICT-2011.9.2 High-Tech Research Intensive SMEs in FET research	http://scenenet.uni-bremen.de/	<p>If you visited a rock concert recently, or any other event that attracts crowds, you cannot ignore the many people taking videos of the scenario in that specific event at the same time, using their mobile phone cameras. Our vision involves using the power of the crowd of multiple mobile phone users to create a higher quality and 3 dimensional video experience that can be shared by social networks interested in this event. We would like to offer a two-fold infrastructure: technological and social so that the individual documented experience from the mobile user's view point will lead into a 3D video experience that can be distributed into social networks and individual domains. Our aim is to have an aggregated 3D video feed that can be a live and interactive 3D scene application where you can travel across the 3D video, see people and stuff that is going on and manipulate the pictures according to multiple applications' purposes. Beyond the individual experience, the people that contributed in sourcing and generating this 3D scene and who are interested in it will constitute an ad hoc virtual community.</p>	SAGIVTECH LTD	Israel

SCORPIO	Significance-Based Computing for Reliability and Power Optimization	FP7-ICT	01/06/2013	31/05/2016	2.479.567 €	1.890.775 €	Collaborative project (generic)	ICT-2013.9.1 Challenging current Thinking	http://www.scorpio-project.eu/	Manufacturing process variability at low geometries and power dissipation are the most challenging problems in the design of future computing systems. Currently manufacturers go to great lengths to guarantee fault-free operation of their products by introducing redundancy in voltage margins, conservative layout rules, and extra protection circuitry. However, such design redundancy may result into energy overheads. Energy overheads cannot be alleviated by lowering supply voltage below a nominal value without hardware components experiencing faulty operation due to timing errors. On the other hand, many modern workloads, such as multimedia, machine learning, visualization, etc. are designed to tolerate a degree of imprecision in computations and data. SCORPIO seeks to exploit this observation and to relax reliability requirements for the hardware layer by allowing a controlled degree of imprecision to be introduced to computations and data. It proposes to introduce methodologies that allow the system- and application-software layers to synergistically characterize the significance of various parts of the program for the quality of the end result, and their tolerance to faults. Based on this information, extracted automatically or semi-automatically, the system software will steer computations and data to either low-power, yet unreliable or higher-power and reliable functional and storage units. In addition, the system will be able to aggressively reduce its power footprint by opportunistically powering hardware modules below nominal values. Significance-based computing lays the foundations for not only approaching the theoretical limits of energy reduction of CMOS technology, but moving beyond those limits by accepting hardware faults in a controlled manner. Significance-based computing promises to be a preferred alternative to dark silicon, which requires that large portions of a chip be powered-off in every cycle to avoid excessive power dissipation.	CENTRE FOR RESEARCH AND TECHNOLOGY HELLAS	Greece
SENSATION	Self Energy-Supporting Autonomous Computation	FP7-ICT	01/10/2012	30/09/2015	2.958.525 €	2.100.000 €	Collaborative project (generic)	ICT-2011.9.8 FET Proactive: Minimising Energy Consumption of Computing to the Limit (MINECC)	http://www.sensation-project.eu/index.html	SENSATION aims at increasing the scale of systems that are self-supporting by balancing energy harvesting and consumption up to the level of complete products. In order to build such Energy Centric Systems, embedded system designers face the quest for optimal performance within acceptable reliability and tight energy bounds. Programming systems that reconfigure themselves in view of changing tasks, resources, errors and available energy is a demanding challenge. The lack of effective design-time support for taking on this challenge obstructs the creativity and productivity of design teams. This is an impediment to European companies developing embedded components, devices, and platforms, and is a major obstacle to developing self-supporting systems. SENSATION will free the system design process by devising energy-centric modelling and optimization tools for the design of resource-optimal reliable systems. This depends on orchestrated, non-incremental progress in several research domains. The project combines Europe's leading scientists in model-based quantitative evaluation and optimization, and in low-power reconfigurable systems. SENSATION provides automated analysis and synthesis tools for energy-centric systems. For the first time, tools for optimizing performance and reliability will be integrated with energy analysis. Based on efficient model-checking algorithms and massive design space exploration, this leads to a many-fold increase in system design productivity. Three industrial partners, GomSpace, Recore Systems, and STMicroelectronics provide challenging case studies and serve as industrial testbeds. The yardstick for the impact of SENSATION is a reduction in energy consumption by 50% and a reduction in time-to-market of at least 10%. Two European institutes specializing in embedded systems, ESI and CISS, actively contribute to the development of the technology and its effective dissemination and industrial adoption.	AALBORG UNIVERSITET	Denmark
SI ELEGANS	Emulating the C. elegans nervous system: A blueprint for brain-inspired computational architectures	FP7-ICT	01/04/2013	31/03/2016	3.570.604 €	2.727.000 €	Collaborative project (generic)	ICT-2011.9.11 FET Proactive: Neuro-Bio-Inspired Systems (NBIS)	http://www.si-elegans.eu/	Biological neural systems are powerful, robust and highly adaptive computational entities that outperform conventional computers in almost all aspects of sensory-motor integration. Despite dramatic progress in information technology, there is a big performance discrepancy between artificial systems and brains in seemingly simple orientation and navigation tasks. In fact, no system exists that can faithfully reproduce the rich behavioural repertoire of the tiny worm <i>Caenorhabditis elegans</i> which features one of the simplest nervous systems in nature made of 302 neurons and about 8000 connections. Si elegans aims at providing this missing link. We propose to develop a computing framework that accurately mimics C. elegans and let complex and realistic behaviour emerge through its interaction with a rich, dynamic simulation of a natural environment. We will replicate the nervous system of C. elegans on a highly parallel, modular, arbitrarily programmable, reconfigurable and scalable hardware architecture, virtually embody it for behavioural studies in a realistic virtual environment and provide the resulting computational platform through an open-access web portal to the scientific community for its peer-validation and use. Si elegans will constitute a generalizable framework from which the universal working principles of nervous system function can be induced, and new scientific knowledge on higher brain function and behaviour can be generated. More importantly, it will lay the foundation for exploring and refining new neuromimetic computational concepts and will provide a blueprint for the design of brain-like hardware architectures that are orthogonal to current von Neumann-type machines. The 3-year project brings together a highly interdisciplinary, experienced and focused research team from leading European institutions with well-balanced complementary skills and will reach out to the world-wide scientific community in a peer-contribution and validation approach.	FONDAZIONE ISTITUTO ITALIANO DI TECNOLOGIA	Italy

SIAM	Silicon at the Atomic and Molecular scale	FP7-ICT	01/10/2013	30/09/2016	2.930.201 €	2.040.000 €	Collaborative project (generic)	ICT-2013.9.7 FET Proactive: Atomic and Molecular Scale Devices and Systems http://www.the-siam-project.eu/	COMMISSARIAT A L ENERGIE ATOMIQUE ET AUX ENERGIES ALTERNATIVES	France	
SI-CODE	Towards new Brain-Machine Interfaces: state-dependent information coding	FP7-ICT	01/03/2012	28/02/2015	3.271.041 €	2.471.230 €	Collaborative project (generic)	ICT-2011.9.1 Challenging current Thinking http://www.sic-ode.eu/	Brain Machine Interfaces (BMIs) are devices mediating communication between a brain and the external world, and hold the potential for a) restoring motor or sensory functions to people who lost them due to illness or injury, and b) understanding neural information processing through controlled interactions between neurons and external devices. However, the success of BMIs is hampered by the problem that neural responses to external correlates are highly variable because they depend on the internal state of the neural network. We propose to remove this obstacle by developing a radically new generation of bidirectional BMIs (which decode information from the recorded neural activity and provide information to the brain by stimulation) employing neural computational strategies and neuromorphic VLSI devices that:i) Understand how network states influence neural responses to stimuli;ii) Use this know-how to discount variability induced by state changes in real time and thus operate with increased bandwidth and performance.We gather a highly interdisciplinary team composed of both mathematical and experimental neuroscientists and of VLSI engineers. We will study the interplay between ongoing network states and stimulus-evoked responses in various nervous systems of different complexity.We will develop advanced algorithms and models of network dynamics to determine the network state variables best predicting and discounting neural variability, and to construct optimal state-dependent rules to decode neural activity. We will implement these algorithms in a new state-dependent bidirectional BMI prototype using low-power neuromorphic VLSI circuits that extract in real time network state information and use it to produce outputs optimally suited for both decoding of recorded signals and delivering electrical stimulation to a neural tissue in a given state. This BMI will be tested in a benchmark experiment in rats to guide an external device with closed loop control.	FONDAZIONE ISTITUTO ITALIANO DI TECNOLOGIA	Italy
SIMPLESKIN	Cheap, textile based whole body sensor sensing system for interaction, physiological monitoring and activity recognition	FP7-ICT	01/07/2013	30/06/2016	2.722.087 €	1.996.028 €	Collaborative project (generic)	ICT-2013.9.1 Challenging current Thinking http://simpleskin.org/	We propose a fundamentally new approach for creating smart textiles and functional garments. The basic idea is to separate sensing textile production, garment manufacturing, the hardware platform, and the software implementation by well-defined abstractions and interfaces. A major innovation is the development of a mass-producible generic sensing fabric, which will allow capacitive, resistive or inductive modes, to measure movement, electrical body signals, activities, and change in body capacity. The sensor density and intelligent signal processing will compensate the simplicity of single sensors. Based on these fabrics "sensing ready" garments can be produced, that are with respect to their properties, looks, production process and price virtually undistinguishable from today's standard garments. We expect that in the long term this will lead to functional clothes becoming the default, much like today smart, sensor-enabled phones have become the mainstream.The "sensor ready" garments become part of a wearable computing system, by adding hardware, that allows self-organizing, dynamic and adaptive processing of input signals converting the specific garment into a general wearable sensor with a dedicated high-level sensing interface. By these means we create an abstraction layer and platform on which application developers can create wearable sensing application, than are independent of the actual hardware they run on. For example, this will allow an application developer to create a sports monitoring application, that includes body posture, movement, and heard rate, which can be deployed to any available "sensing ready" shirt. This will empower a larger number of potential developers to contribute their creativity. The approach taken in SimpleSkin has great potential to build up the foundation for a new era in smart clothing. It aims at moving personal wearable monitoring from a niche topic into major industry with the potential of revolutionizing what we wear.	DEUTSCHES FORSCHUNGSZENTRUM FUER KUNSTLICHE INTELLIGENZ GMBH	Germany
SIQS	Simulators and Interfaces with Quantum Systems	FP7-ICT	01/05/2013	30/04/2016	11.784.632 €	8.800.000 €	Collaborative project (generic)	ICT-2011.9.9 FET Proactive: Quantum ICT (QICT) including ERA-NET-Plus http://qurope.eu/projects/siqs	The overarching goal of our project is to develop systems based on direct and deterministic interactions between individual quantum entities, which by involving large-scale entanglement can outperform classical systems in a series of relevant applications.We plan to achieve that by improving technologies from atomic, molecular and optical physics as well as from solid-state physics, and by developing new ones, including combinations across those different domains. We will explore a wide range of experimental platforms as enabling technologies: from cold collisions or Rydberg blockade in neutral atoms to electrostatic or spin interactions in charged systems like trapped ions and quantum dots; from photon-phonon interactions in nanomechanics to photon-photon interactions in cavity quantum electrodynamics and to spin-photon interactions in diamond colour centres.We will work on two deeply interconnected lines to build experimentally working implementations of quantum simulators and of quantum interfaces. This will enable us to conceive and realize applications exploiting those devices for simulating important problems in other fields of physics, as well as for carrying out protocols outperforming classical communication and measurement systems.	UNIVERSITAET ULM	Germany

SISPIN	Silicon Platform for Quantum Spintronics	FP7-ICT	01/09/2013	31/08/2016	4.253.342 €	2.980.428 €	Collaborative project (generic)	ICT-2013.9.1 Challenging current Thinking http://www.sispin.eu/	Quantum spintronics aims at utilizing the quantum nature of individual spins to bring new functionalities into logic circuits, either to make classical information processing more efficient or to implement spin-based quantum algorithms. Two critical aspects for quantum spintronics are a long spin coherence time and a strong, tunable spin-orbit interaction for fast electrical manipulation of spins. Up to now, experiments have mainly focused on III-V semiconductor nanostructures, where hyperfine coupling with nuclear spins limits electron-spin coherence. Low nuclear spin materials, and in particular group-IV semiconductors, were found to be a natural alternative. However, in most of the currently studied group-IV based systems, spin-orbit coupling is very weak, preventing fast electrical manipulation of spins. We propose to investigate a new direction based on p-type SiGe nanostructures. This system has the unique combination of low hyperfine and strong spin-orbit couplings. Aside from developing demonstrator devices such as spin-filters or single spin qubits, we aim at exploring recently proposed schemes for long range spin-spin coupling, an essential requirement for scalable qubit circuits. To investigate hole-spin dynamics and achieve quantum spintronic functionalities, novel types of concepts will be experimentally investigated (spin-polarized helical states, spin-orbit mechanisms for spin-selective tunnelling and long-range spin-spin coupling, etc.). Because of the higher complexity of hole-type systems, a dedicated theoretical framework will be developed in support to experiments. In addition to a bottom-up approach which has been successful in providing nanowire and quantum-dot heterostructures, we shall realize SiGe quantum devices by means of state-of-the-art CMOS technology. This will allow us to know how spin-based functionalities demonstrated in bottom-up nanostructures can be implemented into a truly scalable silicon platform.	COMMISSARIAT A L ENERGIE ATOMIQUE ET AUX ENERGIES ALTERNATIVES	France
SKAT-VG	Sketching Audio Technologies using Vocalizations and Gestures	FP7-ICT	01/01/2014	31/12/2016	3.168.299 €	2.435.491 €	Collaborative project (generic)	ICT-2011.9.1 Challenging current Thinking http://skatvg.iuav.it/	Sketching is at the root of any design activity. In visual design, hand and pencil are still the primary tools used to produce a large variety of initial concepts in a very short time. However, in product and media design the sonic behaviour of objects is also of primary importance, as sounds may afford seamless and aesthetically pleasing interactions. But how might one sketch the auditory aspects and sonic behaviour of objects, in the early stages of the design process? Non-verbal sounds, more than speech, are naturally and spontaneously used in everyday life to describe and imitate sonic events, often accompanied by manual expressive gestures that complement, qualify, or emphasize them. The SkAT-VG project aims at enabling designers to use their voice and hands, directly, to sketch the auditory aspects of an object, thereby making it easier to exploit the functional and aesthetic possibilities of sound. The core of this framework is a system able to interpret users' intentions through gestures and vocalizations, to select appropriate sound synthesis modules, and to enable iterative refinement and sharing, as it is commonly done with drawn sketches in the early stages of the design process. To reach its goal, the SkAT-VG project is based on an original mixture of complementary expertise: voice production, gesture analysis, cognitive psychology, machine learning, interaction design, and audio application development. The project tasks include case studies of how people naturally use vocalizations and gestures to communicate sounds, evaluation of current practices of sound designers, basic studies of sound identification through vocalizations and gestural production, gesture analysis and machine learning, and development of the sketching tools.	UNIVERSITA IUAV DI VENEZIA	Italy
SMARTSOCIETY	Hybrid and Diversity-Aware Collective Adaptive Systems: When People Meet Machines to Build a Smarter Society	FP7-ICT	01/01/2013	31/12/2016	6.829.666 €	5.313.000 €	Collaborative project (generic)	ICT-2011.9.10 FET Proactive: Fundamental s of Collective Adaptive Systems (FOCAS) http://www.smart-society-project.eu	Society is progressively moving towards a socio-technical ecosystem in which the physical and virtual dimensions of life are more and more intertwined and where people interaction often takes place with or mediated by machines. The scale at which this is happening and the differences in culture, language and interests makes the problem of establishing effective communication and coordinated action increasingly challenging. So far, the attention has been mainly devoted to systems that provide or impose some form of harmonization or lightweight coordination of meaning and actions where machines do most of the computation and humans are at the periphery and only act as consumers. Our goal is to move towards a hybrid system where people and machines tightly work together to build a smarter society. We envision a new generation of Collective Adaptive Systems centred on the two foundational notions of compositionality and diversity where humans and machines "compose" by synergically complement each other thus bridging the semantic gap between low level machine and high level human interpretation of data and where they interoperate collectively to achieve their possibly conflicting goals both at individual and societal levels. Operationally, peers in the system will implement a continuous unlimited cycle in which data is sensed, interpreted, shared, elaborated and acted upon. Actions are taken on the basis of system suggestions and the way humans react to them, while generating new data thus alimentering the cycle ad infinitum. To meet this very ambitious goal the SmartSociety project will develop foundational principles for the operations and design of hybrid and diversity-aware collective adaptive systems, paving the way to the arising of a smarter form of society.	UNIVERSITA DEGLI STUDI DI TRENTO	Italy

SOPHOCLES	Self-Organised information Processing, Criticality and Emergence in multilevel Systems	FP7-ICT	01/12/2012	30/11/2015	3.534.814 €	2.700.000 €	Collaborative project (generic)	ICT-2011.9.7 FET Proactive: Dynamics of Multi-Level Complex Systems (DyM-CS)	http://sophocles.eu/	We will contribute to a theory of dynamics of multi level complex systems by developing mathematical and computational formalisms for information processing in such multi level systems. We will develop the formalism in the context of criticality, emergence, and tipping points in multi level systems and apply it to real data. This should lead to a better understanding, but more important, to an improvement in predictive power for early warning. Can we observe tell-tales of things to happen in the (near) future? We will relate the emergence of structures and collective effects to the existence of an information-driven phase transition. Emergent structures may mean selection of preferred scales, creation of new levels or annihilation of existing levels, or occurrence of tipping points leading to extreme phenomena. We believe that these transitions are often self-organized because they appear in a spontaneous way, driven only by the dynamics of the system and the co-evolving topology of the interactions. We will create an experimental facility, a Computational Exploratory, which allows to implement our theoretical framework of information processing in multilevel complex systems, and to apply this to real life data. The theory will be validated on real world applications involving large, heterogeneous multi level datasets from the Socio-Economic domain (high frequency FX data, datasets on interest rates, and social media data) and applied to study the question of emergence of scales, and the detection and prediction of tipping points in real-life datasets. We contribute to the questions if and why Nature has preferred scales, and if so, if such emerging scales can be detected in real data sets. The impact of our theory on understanding of emergence of multilevel systems due to critical information processing is expected to be substantial. Our theory will offer new tools for critical transitions and extreme events prediction in real-life datasets.	UNIVERSITEIT VAN AMSTERDAM	Netherlands
SPACECOG	Spatial Cognition	FP7-ICT	01/03/2013	29/02/2016	1.992.776 €	1.524.000 €	Collaborative project (generic)	ICT-2011.9.11 FET Proactive: Neuro-Bio-Inspired Systems (NBIS)	http://www.spacecog.eu/Consortium/Staff.html	Humanoid robots will become important machines to support mankind if they develop similar capabilities as humans have. One of those capabilities is to orient in space and to extract the relevant information from its environment. A common approach has been to build a spatiotopic map of the external world, so called an internal world model. However, since the sensors, such as the eyes (cameras) are attached to the body an updating problem occurs: After any action the input changes and additional information about the position of the eyes or the posture or the position in the external world is required to map a new sensory input into an existing map of the world. As this position about sensors is not error free, internal world models are not always reliable. However, a large body of information suggests that humans do not maintain full maps of their external world. They are rather very sparse and evidence suggests that we extract the important information from the world just on time and only keep track of a few relevant aspects in a scene by means of attentive and memory processes. Humans rather know how to retrieve the necessary information rather than representing all information in an internal world model. Thus, we aim to explore how humans solve the necessary updating and by which mechanisms they keep track of important aspects and extract the relevant information from the environment. This will be done by a combination of experimental investigations and computational modelling and by the integration of the developed modules leading to a human-like neural model of spatial orientation and attention in the context of eye, head and body movements. The model will be demonstrated as "neuroware" for a virtual human acting in a virtual reality.	TECHNISCHE UNIVERSITÄT CHEMNITZ	Germany
SPANGL4Q	Spin-Photon Angular Momentum Transfer for Quantum-Enabled Technologies	FP7-ICT	01/03/2012	28/02/2015	2.599.534 €	1.965.153 €	Collaborative project (generic)	ICT-2011.9.1 Challenging current Thinking	http://www.spangl4q.eu/	The goal of this project is the development of a suite of nano-photonics devices that interface with spins, for application in quantum information and quantum-enabled classical communication technologies. Our technologies will be based on electron and nuclear spins in semiconductor quantum dots (QDs) embedded in nano-photonics devices. We will combine knowledge of the physics of semiconductor spins, photonics and cavity quantum electro-dynamics, with quantum information and optical communication technology. In this FET-Open project, we anticipate that a wealth of novel devices and fundamental understanding will result from the solution to one key problem. What is the best form for a hybrid spin-photon quantum memory, how does one transfer quanta of angular momentum from it to a single photon, and how will this angular momentum be encoded? This is an issue that is inadequately addressed so far, and we take highly novel approaches towards it. We address this question on several fronts. From the photonics side, polarization engineering in photonic nanostructures will be investigated, moving beyond linear polarization to exploit the full light angular momentum states. In terms of quantum memories, we will create the technology for long-lived (>1s) nuclear spin memories, long enough to achieve entanglement over large distances. These might one day be used over 1000s km and via satellites to potentially anywhere on the globe. Photonic crystal structures will be used for integrated quantum-optical circuit technology and plasmonic nano-antennas will enable a spin-dependent near-to-far field coupling, and ultra-fast control of the electron spin. One may use this spin-photon interface to entangle very large numbers of photons, with the memory allowing time for measurement operations of a quantum algorithm. The compatibility of these QD technologies means that the components may be combined, paving the way towards an entirely QD-based quantum internet.	UNIVERSITY OF BRISTOL	United Kingdom

SWARM-ORGAN	A theoretical framework for swarms of GRN-controlled agents which display adaptive tissue-like organisation	FP7-ICT	01/03/2013	31/08/2016	2.877.122 €	2.221.000 €	Collaborative project (generic)	ICT-2011.9.10 FET Proactive: Fundamental s of Collective Adaptive Systems (FOCAS)	http://www.swarm-organ.eu/	The Swarm-Organ project focuses on systems containing large numbers of autonomous but relatively simple agents, whose goal is to collectively organise themselves into complex spatial arrangements despite each agent having only local awareness. This particular question is directly relevant to both biological morphogenesis, and to new paradigms of distributed technology such as robotic swarms and amorphous computing. Two levels of adaptation are either evident or required in these systems: (1) As the whole system changes over time, individual agents find themselves in different local situations and must adapt and adjust their behaviour accordingly, for example dealing with conflict resolution and/or cooperation with neighbours. (2) The swarm must also adapt to the outside world (or the world it is embedded in) in various ways depending on its task - for example, coping with damage, maintaining functionality under changing environmental conditions, or tracking objects. A fundamental challenge in this field is how to design the local control system of each agent, and the Swarm-Organ project will extensively explore a specific approach - namely the use of GRNs (gene regulatory networks) - as a potentially powerful control method for these systems. By focusing on GRNs we will develop a theoretical framework about distributed adaptive control, which will be equally informative to both natural biological morphogenesis, as well as next generation technologies in robotics and computation.	FUNDACIO PRIVADA CENTRE DE REGULACIO GENOMICA	Spain
Symbiotic	INNOVATIVE AUTONOMOUS ELECTRICAL BIOSENSOR SYNERGISTICALLY ASSEMBLED INSIDE A PASSIVE DIRECT METHANOL FUEL CELL FOR SCREENING CANCER BIOMARKERS	H2020 - FET	01/06/2015	01/06/2018	3.346.660 €	3.346.660 €	RIA	FETOPEN-RIA-2014-2015	http://www.symbio-tic.eu/	Biosensors possess recognition elements that bind to target molecules which lead to detectable signals; they are made of two basic components: (i) a bioreceptor or biorecognition element; and (ii) a transducer element. The bioreceptor system interacts with the target analyte and this interaction is monitored by the transducer, which converts the information into a measurable effect such as an electrical, optical or mass-sensitive signal. This project proposes the development of an autonomous electrochemical biosensor that is lightweight, disposable and low cost by using an outstanding innovative approach: hosting synergistically the bioreceptor element inside a passive direct methanol fuel cell (DMFC). Such approach will provide an electrically independent, very simple, miniaturized, autonomous electrical biosensor. The electrical dependency is eliminated by coupling the biosensor to an electrochemical transducer that is capable of autonomous energy production, the fuel cell. This work proposes a merge between electrical biosensors and fuel cells, combining the advantages of both areas of research in a single synergetic device. In this envisaged innovative device, the electrical signal obtained from the DMFC is directly related to the concentration of the cancer biomarker in the sample analyzed. The proposed electrochemical biosensor will be completely autonomous operating at room temperature and using the oxygen present in the air, thereby allowing diagnosis everywhere.	KTH Royal Institute of Technology	Sweeden
SYMONE	SYnaptic MOlecular NEtworks for Bio-inspired Information Processing	FP7-ICT	01/09/2012	31/08/2015	2.810.042 €	2.120.000 €	Collaborative project (generic)	ICT-2011.9.6 Unconventional Computation (UCOMP)	http://www.chalmers.se/mc2/symone-en	The SYMONE long-term vision is to build multi-scale bio-/neuro-inspired systems interfacing/connecting molecular-scale devices to macroscopic systems for unconventional information processing with scalable neuromorphic architectures. The SYMONE computational substrate is a memristive/synaptic network controlled by a multi-terminal structure of input/output ports and internal gates embedded in a classical digital CMOS environment. The SYMONE goal is the exploration of a multiscale platform connecting molecular-scale devices into networks for the development and testing of synaptic devices and scalable neuromorphic architectures, and for investigating materials and components with new functionalities. The generic breakthrough concerns proof-of concept of unconventional information processing involving flow of information via short-range interactions through a network of non-linear elements: switches, memristors/synapses. These will require several breakthroughs concerning the functionality of reasonably complex networks of simple components, and the fabrication of networks of devices, including self-assembly and multi-scale interfacing/contacting between such networks. Memristive networks are expected to solve unconventional computational problems, e.g. solving maze problems and implementing dynamic multiplexers. The overall SYMONE objectives are to implement 2D memristive arrays and networks, establish multi-scale electrical connections, and to demonstrate bio-inspired functional behaviour in such systems. On the experimental side, SYMONE will work with lithographically defined NxN arrays of proven individual memristive elements (Nanoparticle Organic Memory FETs (NOMFETs)), as well as self-assembled nanoparticle (NP) networks (NPSAN) with functionalised NPs. The theoretical aspects involve detailed physical and compact models for the network elements and networks, and schemes for elementary information processing with such networks. SYMONE combines the advantages of a bottom-up approach based on molecular-scale objects and of a top-down approach based on functional modelling at the circuit level. The electronic properties of the nano-objects can be reproducibly modulated by the versatility of chemical synthesis. Such a solution is thus expected to provide continual scaling of device dimensions, or new architectures of electronics, or potential low-cost technologies, or all this together. SYMONE implements the vision of robust fault-tolerant information processing at molecular scale interfaced to conventional CMOS computers. The molecular-scale devices will be characterized and configured via post-fabrication learning without prior knowledge of the detailed structure of the self-assembled molecular network. This vision is also one of the very few routes for molecular scale information technology that does not suffer, from the start, from the same type of limitations as the ultimate CMOS technology with regard to ultra-dense computing applications.	CHALMERS TEKNISKA HOEGSKOLA AB	Sweden

TERACOMB	Quantum Cascade Lasers Based TERAhertz Frequency COMB	FP7-ICT	01/06/2012	31/05/2015	2.770.428 €	2.118.154 €	Collaborative project (generic)	ICT-2011.9.1 Challenging current Thinking	http://www.teracomb.eu/	Despite significant research efforts during the past 10 years, the terahertz (THz) spectral range remains vastly underexploited, owing essentially to the insufficient signal-to-noise ratio (SNR) achievable with present technology. The project's aim is to address this problem by building a new technological platform enabling the generation of high power, broad bandwidth, THz frequency combs (FCs) with a high frequency stability. The demonstration of FCs in the visible and near-IR spectral ranges has been among the main breakthroughs in the field of optics in the past decade. FCs are commonly generated by mode-locked lasers. In the frequency domain they consist of a broad spectrum of narrow lines, separated by a constant frequency interval, corresponding, in the time domain, to the repetition rate of the emitted pulse train. The time duration of the emitted pulses is roughly given by the inverse of the spectral bandwidth. Due to the lack of mode-locked lasers, FCs in the THz range are nowadays generated by inherently inefficient non-linear conversion techniques. This is the main cause for the low SNR of present THz systems. The THz FCs envisioned in this project will be based on THz quantum cascade lasers (QCLs), a novel, compact and powerful THz semiconductor laser source. THz FCs will be generated by mode-locked THz QCLs, and/or by using THz QCLs as semiconductor amplifiers. This will allow the production of FCs with average powers in excess of 10mW, with a spectral bandwidth > 1THz, and a corresponding pulse duration	TECHNISCHE UNIVERSITAET WIEN	Austria
THERMIQ	Thermodynamics of Mesoscopic Quantum Systems	FP7-ICT	01/01/2014	31/12/2016	2.778.040 €	2.110.564 €	Collaborative project (generic)	ICT-2011.9.1 Challenging current Thinking	http://www.thermiq2.eu/	A quantum technology going beyond microscopic borders will be confronted with aspects of thermodynamics that are yet to be understood. This is important, both from a fundamental perspective and with a view to development of quantum devices. Here we propose a comprehensive research programme -- which we dub TherMiQ -- aimed at developing a general framework that brings together thermodynamics and the physics of mesoscopic open quantum systems. The programme builds on an active interplay between theoretical and experimental work. Specifically, we pursue three scientific lines: 1. To provide unambiguous definitions of thermodynamical quantities that are genuinely quantum. 2. To construct mesoscopic thermal engines able of realising heat, mass and entropy transport at the quantum level. 3. To test the foundations of quantum mechanics through thermodynamical concepts. TherMiQ will provide the theoretical backbone for a new generation of experiments in mesoscopic systems. In particular, we will focus on: a) Entropic transformations and heat exchange processes in quantum-optomechanical devices and their hybridized versions comprising the interface with simple atomic systems and levitating nanoparticles; b) The construction of thermodynamical cycles and super efficient machines using ultracold atoms placed in controllable optical potentials; c) The design and implementation of schemes for thermometry of strongly correlated quantum systems through novel diagnostic tools. Our programme will build on an information-theoretical approach and aims to provide a clear route towards the development of a self-consistent, experimentally viable apparatus for exploring and eventually exploiting quantum thermodynamics.	THE QUEEN'S UNIVERSITY OF BELFAST	United Kingdom
TIMESTORM	Mind and Time: Investigation of the Temporal Traits of Human-Machine Convergence	H2020 - FET	01/01/2015	01/07/2018	2.892.500 €	2.892.500 €	RIA	FETPROACT-2-2014	http://timestorm.eu/	Contemporary research endeavours aim at equipping artificial systems with human-like cognitive skills, in an attempt to promote their intelligence beyond repetitive task accomplishment. However, despite the crucial role that the sense of time has in human cognition, both in perception and action, the capacity of artificial agents to experience the flow of time remains largely unexplored. The inability of existing systems to perceive time constrains their potential understanding of the inherent temporal characteristics of the dynamic world, which in turn acts as an obstacle to their symbiosis with humans. Time perception is without doubt, not an optional extra, but a necessity for the development of truly autonomous, cognitive machines. Timestorm aims at bridging this fundamental gap by shifting the focus of human-machine confluence to the temporal, short- and long-term aspects of symbiotic interaction. The integrative pursuit of research and technological developments in time perception will contribute significantly to ongoing efforts in deciphering the relevant brain circuitry and will also give rise to innovative implementations of artifacts with profoundly enhanced cognitive capacities. Equipping artificial agents with temporal cognition establishes a new framework for the investigation and integration of knowing, doing, and being in artificial systems. The proposed research will study the principles of time processing in the human brain and their replication in-silico, adopting a multidisciplinary research approach that involves developmental studies, brain imaging, computational modelling and embodied experiments. By investigating artificial temporal cognition, Timestorm inaugurates a novel research field in cognitive systems with the potential to contribute to the advent of next generation intelligent systems, significantly promoting the seamless integration of artificial agents in human societies.	univ-bpclermont	France

TOLOP	Towards Low Power ICT	FP7-ICT	01/09/2012	31/08/2015	3.320.415 €	1.999.311 €	Collaborative project (generic)	ICT-2011.9.8 FET Proactive: Minimising Energy Consumption of Computing to the Limit (MINECC)	http://www.tolop.eu/	TOLOP comprises investigations into three of the levels necessary for a paradigm shift in low-power electronics:1. Fabrication and measurement of devices which are inherently low-power in switching operation at room temperature.2. Theory of specific device implementations for each of those technologies to explain and validate the principles behind their low-power capabilities.3. Design of architecture to enable the circuit operation of these technologies for overall low-power circuit operation. There will be an investigation of the inherent losses at realistic switching rates, and estimations of the device-circuit-operation trade-offs for minimising energy consumption. Metrics such as the energy-delay product will be provided for each implementation and benchmarked against existing commercial and research technologies. The consortium brings together leading European institutions in this field, and allows the overall optimisation of energy consumption in realistic conditions, including device fabrication, device operation and circuit operation at several levels. Target outcomes:1. Novel single-atom, single-electron and spintronic devices will be investigated experimentally. In the first two cases, the structures are inherently CMOS-compatible whilst in the third a higher-risk approach will be taken whilst still addressing manufacturability.2. Both non-Boolean implementations such as multi-valued logic and parallel logic, and optimised Boolean logic implementations will be addressed. Non Boolean logic has the potential for exponential improvement in power needs.3. Architectures and operating protocols will be designed to optimise the total power consumption of a circuit-level implementation, taking into account measured and estimated losses at realistic operating rates and temperatures. Device-level proof of concept will be achieved experimentally, driving the design of specific implementations, with theoretical investigation of viability in a realistic circuit...	HITACHI EUROPE LIMITED	United Kingdom
TOPDRIM	Topology driven methods for complex systems	FP7-ICT	01/10/2012	30/09/2015	2.460.694 €	1.920.000 €	Collaborative project (generic)	ICT-2011.9.7 FET Proactive: Dynamics of Multi-Level Complex Systems (DyM-CS)	http://www.topdrim.eu/	Many complex systems are characterized by multi-level properties that make the study of their dynamics and of their emerging phenomena a daunting task. The huge amount of data available in modern sciences can be expected to support great progress in these studies, even though the nature of the data varies. Given that, it is crucial to extract as much as possible features from data, including qualitative (topological) ones. The goal of this project is to provide methods driven by the topology of data for describing the dynamics of multi-level complex systems. To this end the project will develop new mathematical and computational formalisms accounting for topological effects. To pursue these objectives the project brings together scientists from many diverse fields including as topology and geometry, statistical physics and information theory, computer science and biology. The proposed methods, obtained through concerted efforts, will cover different aspects of the science of complexity ranging from foundations, to simulations through modelling and analysis, and are expected to constitute the building blocks for a new generalized theory of complexity.	UNIVERSITA DEGLI STUDI DI CAMERINO	Italy
TOPOSYS	Topological Complex Systems	FP7-ICT	01/10/2012	30/09/2015	3.449.204 €	2.635.000 €	Collaborative project (generic)	ICT-2011.9.7 FET Proactive: Dynamics of Multi-Level Complex Systems (DyM-CS)	http://toposys.org/	In dynamics, local behaviour is often very unstable, while global behaviour often is immensely hard to derive from local knowledge. Traditionally, topology has been used in abstracting the local behaviour into qualitative classes of behaviour – while we cannot describe the path a particular flow will take around a strange attractor in a chaotic system, we can often say meaningful things about the trajectory as an entirety, and its abstract properties. We propose to use computational topology, which takes notions from algebraic topology and adapts and extends them into more algorithmic forms, to enrich the study of the dynamics of multi-scale complex systems. With the algorithmic approach, we are able to consider inverse problems, such as reconstructing dynamical behaviours from discrete point samples. This is the right approach to take for complex systems, where the precise behaviour is difficult if not impossible to analyse analytically. In particular we will extend the technique of persistence to include ideas from dynamical systems, as well as incorporating category theory and statistics. Persistence is inherently multi-scale, and provides a framework that will support the analysis of multi-scale systems, category theory provides a platform for a unified theory and joint abstraction layers, and statistics allows us to provide quality measures, inferences, and provide confidence intervals and variance measures for our analyses. The combination of these four areas: category theory, statistics, and dynamical systems with computational topology as the joint platform for the three other components, will allow for a mathematically rigorous description of the dynamics of a system from a local to a global scale. In this framework, multi-scale features have a natural place, and the focus on computation and algorithmics means we can easily verify and validate our theory. We propose to do this on two datasets, capturing robot configuration spaces and social media.	INSTITUT JOZEF STEFAN	Slovenia

TWO!EARS	TWO!EARS	FP7-ICT	01/12/2013	30/11/2016	4.133.871 €	2.969.131 €	Collaborative project (generic)	ICT-2013.9.1 Challenging current Thinking	http://www.twoears.eu/	TWO!EARS replaces current thinking about auditory modelling by a systemic approach in which human listeners are regarded as multi-modal agents that develop their concept of the world by exploratory interaction. The goal of the project is to develop an intelligent, active computational model of auditory perception and experience in a multi-modal context. Our novel approach is based on a structural link from binaural perception to judgment and action, realised by interleaved signal-driven (bottom-up) and hypothesis-driven (top-down) processing within an innovative expert system architecture. The system achieves object formation based on Gestalt principles, meaning assignment, knowledge acquisition and representation, learning, logic-based reasoning and reference-based judgment. More specifically, the system assigns meaning to acoustic events by combining signal- and symbol-based processing in a joint model structure, integrated with proprioceptive and visual percept's. It is therefore able to describe an acoustic scene in much the same way that a human listener can, in terms of the sensations that sounds evoke (e.g. loudness, timbre, spatial extent) and their semantics (e.g. whether the sound is unexpected or a familiar voice). Our system will be implemented on a robotic platform, which will actively parse its physical environment, orientate itself and move its sensors in a humanoid manner. The system has an open architecture, so that it can easily be modified or extended. This is crucial, since the cognitive functions to be modelled are domain and application specific. TWO!EARS will have significant impact on future development of ICT wherever knowledge and control of aural experience is relevant. It will also benefit research in related areas such as biology, medicine and sensory and cognitive psychology.	TECHNISCHE UNIVERSITÄT BERLIN	Germany
UAESMC	Usable and Efficient Secure Multiparty Computation	FP7-ICT	01/02/2012	31/01/2015	1.295.860 €	1.002.400 €	Collaborative project (generic)	ICT-2011.9.2 High-Tech Research Intensive SMEs in FET research	NOT AVAILABLE	In this project, we will bring the techniques and tools for Secure Multiparty Computation (SMC) to a level where they can be applied to decisional and computational problems of practical size in several different social and economic sectors. To achieve this, we will apply a multi-pronged research effort to build the theoretical foundations for the practical aspects of SMC application. Our project will combine the identification of a representative set of computational problems, the development of appropriate cryptographic and other tools for solving those problems in a privacy-preserving manner, the study of incentives of various parties to participate in privacy-preserving computations, and the exploration of practical limits and trade-offs in the deployment of SMC solutions. All these research areas will be explored in tight cooperation, as advances in any of them will shift priorities in all other areas. Through the integrated effort we hope to build a framework that allows us to place any multiparty computation problem in the appropriate context and to see whether and how the privacy issues in this problem can be mitigated. While cryptographic techniques for SMC have been studied before in Europe, our quest for identifying the other enablers of SMC through an integrated research effort appears to be novel. We believe that the research activities structured in this manner will in the fastest possible way bring us closer to our long-term goal of the privacy requirements of the input data of a computation not being a consideration whether to perform it.	CYBERNETICA AS	Estonia
ULTRAQCL	Ultrashort Pulse Generation from Terahertz Quantum Cascade Lasers	H2020 - FET	01/10/2015	01/10/2018	2.798.445 €	2.798.445 €	RIA	FETOPEN-RIA-2014-2015	http://www.ultraqcl.eu/?-Project-overview-4-	The generation of ultrafast and intense light pulses is an underpinning technology across the electromagnetic spectrum enabling the study of fundamental light-matter interactions, as well as industrial exploitation in a plethora of applications across the physical, chemical and biological sciences. A benchmark system for such studies is the modelocked Ti:Sapphire laser, which has grown from being a laboratory curiosity to an essential tool in a broad range of application sectors. Beyond Ti:Sapphire systems, there have been impressive developments in semiconductor based devices for pulse generation in the optical range. These benefit from low system costs and are an enabling technology in new application domains including high speed communications. However, in the terahertz (THz) frequency range, with its proven applications in imaging, metrology and non-destructive testing, a semiconductor based technology platform for intense and short pulse generation has yet to be realised. Ultrafast excitation of photoconductive switches or nonlinear crystals offer only low powers, low frequency modulation or broadband emission with little control of the spectral bandwidth. In the ULTRAQCL project we will breakthrough this technological gap, using THz quantum cascade lasers (QCLs) as a foundational semiconductor device for generating intense and short THz pulses. QCLs are the only practical semiconductor system that offer gain at THz frequencies, hence making them suitable for pulse generation, with the 'bandstructure-by-design' nature of QCLs allowing the frequency, bandwidth and pulse width to be entirely engineered. We will demonstrate: the first self-starting (passive) mode-locked THz QCL; the first hybrid modelocked THz QCL; the first gain-switched modelocked QCL; and, the first QCL-based THz ultrafast pulse amplifier. The ULTRAQCL project will implement these radical schemes for pulse generation enabling ultrafast QCLs to become a ubiquitous technology for the THz range.	CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE	France

UPGRADE	bottom-UP blueprinting GRAphene baseD Electronics	FP7-ICT	01/02/2013	31/01/2016	1.306.551 €	999.913 €	Collaborative project (generic)	ICT-2011.9.3 FET Young Explorers	http://www.upgrade-network.eu/	UPGRADE targets a fundamental breakthrough by achieving the first proof-of-concept of chemically controlled engineering of graphene nanoribbons (GNRs), through a novel and fast bottom-up patterning technique, which will enable the atomically-controlled fabrication of patterned GNRs over large areas. GNRs combine the advantages of graphene with the semiconducting properties required for the design of efficient field-effect transistors (FETs). The challenge here involves the development of an unconventional and innovative technology allowing for the fabrication of GNRs-based FET devices that feature reproducible and tailored electronic properties. In particular, the bottom-up approach is foreseen to provide graphene nanostructures with fully controlled physical, chemical and ultimately electronic properties at the atomic scale and should result in unprecedented graphene field-effect transistors characteristics. UPGRADE relies on a multidisciplinary and stepwise approach to integrate the work and expertise of young yet highly skilled researchers from complementary disciplines. The objectives will be achieved through five scientific work packages: i) Use of computation approaches including molecular mechanics/dynamics and quantum-chemical techniques to shed light on the process of self-assembly and electronic properties of the GNRs, as well as to provide theoretical support to the experimental results and design molecular architectures of interest; ii) Synthesis of functional building blocks; iii) Engineering of the graphene nanoribbons; iv) Multiscale physico-chemical quantitative studies of interfaces and hybrid nanostructures; v) Device fabrication and testing. The high risk nature of UPGRADE is offset by the potential breakthroughs that should emerge from the project in the field of ICT electronic devices and systems, thereby opening new R&D avenues for future technologies and strengthening Europe's global leadership in ICT.	UNIVERSITE DE STRASBOURG	France
UPSCALE	From Inherent Concurrency to Massive Parallelism through Type- based Optimizations	FP7-ICT	01/02/2014	31/01/2017	2.299.305 €	1.757.005 €	Collaborative project (generic)	ICT-2013.9.5 FET-Open Xtrack	https://upscale-project.cwi.nl/	In a radical paradigm shift, manufacturers are now moving from multicore chips to so-called manycore chips with up to a million independent processors on the same silicon real estate. However, software cannot benefit from the revolutionary potential power increase, unless the design and code is polluted by an unprecedented amount of low-level, fine-grained concurrency detail. Concurrency in mainstream object-oriented languages is based on multithreading. Due to the complexity of balancing work evenly across cores, the thread model is of little benefit for efficient processor use or horizontal scalability. Problems are exacerbated in languages with shared mutable state and a stable notion of identity -- the very foundations of object-orientation. The advent of manycore chips threatens to make not only the object-oriented model obsolete, but also the accumulated know-how of a generation of programmers. Our vision is to provide the means for industry to efficiently develop applications that seamlessly scale to the available parallelism of manycore chips without abandoning the object-oriented paradigm and the associated software engineering methodologies. We will realise this vision by a breakthrough in how parallelism and concurrency are integrated into programming languages, substantiated by a complete inversion of the current canonical language design: constructs facilitating concurrent computation will be default while constructs facilitating synchronised and sequential computation will be explicitly expressed. UpScale will exploit this inversion for a novel agile development methodology based on incremental type-based program annotations specifying ever-richer deployment-related information, and for innovative type-based deployment optimisations both at compile time and at runtime in the runtime system devised in UpScale for massively parallel execution. The targeted breakthrough will profoundly impact software development for the manycore chips of the future.	STICHTING CENTRUM VOOR WISKUNDE EN INFORMATICA	Netherlands
VISUALISE	VISUAL MODELLING USING GANGLION CELLS	FP7-ICT	01/04/2013	31/03/2016	2.167.148 €	1.669.000 €	Collaborative project (generic)	ICT-2011.9.11 FET Proactive: Neuro-Bio- Inspired Systems (NBIS)	http://www.visualise-project.eu/	The processing capabilities of biological visual systems are still vastly superior in terms of performance for real-time and low-power applications compared with ventional artificial vision. There is increasing evidence that biology has evolved a multitude of cell types, including at the level of the retina, to adapt to an extensive set of dynamic visual environments. Existing bio-inspired artificial vision technology has failed to sider the utility of modelling this rich diversity of cells, despite the fact that these cells are crucial to biology's ability to process the natural visual environment. To address this shortcoming, the VISUALISE project will create a refined understanding of retinal function in natural visual environments, enhanced models of biological signal processing in the retina and the next generation of bio-inspired asynchronous vision sensors. To achieve these objectives we will combine the efforts of physiologists, computational neuroscientists, neuromorphic electronic engineers, and roboticists, to build novel theoretical and hardware models of biological retinal ganglion cell types for dynamic vision applications. We will 1) record the activities of vertebrate retinal ganglion cells using multi-electrode arrays under dynamic natural stimulation, 2) analyse the functional response properties to expose new principles of spike encoding that bridge the gap between single cell and population information processing, 3) exploit these principles in multi-scale mathematical models which permit efficient digital circuit implementations for a next generation of real-time event-based vision sensors, and 4) evaluate their effectiveness in a challenging predator-prey high-speed robot scenario.	UNIVERSITY OF ULSTER	United Kingdom

WASPS	Wavelength tunable Advanced Single Photon Sources	FP7-ICT	01/11/2013	31/10/2016	2.634.128 €	1.998.535 €	Collaborative project (generic)	ICT-2013.9.1 Challenging current Thinking	<p>Quantum communication and computation are emerging fields with the potential to launch new technologies to control, propagate and process information. Amongst candidate systems for transporting quantum information, photons are the most promising as they can both maintain coherence over long distances, and interact strongly with electrons to generate nonlinear effects and allow transfer of information between subsystems. As a result, use of photons as 'qubits' has led to ground-breaking demonstrations of quantum entanglement, quantum teleportation and quantum cryptography. However in many of the devices being developed for use in quantum photonics, particularly solid-state devices such as single photon sources, decoherence suffered by the participating electrons is a key limiting factor, reducing the interaction strength and randomizing the quantum state of the photons. In order to minimise the effect of electron decoherence, such devices must generally be operated under cryogenic conditions; even then, in many cases, other noise mechanisms are revealed which limit device functionality. As a result of these practical obstacles and performance limitations, single photon sources have yet to find widespread use and photonic quantum information is largely confined to laboratory demonstrators. The WASPS project seeks to overcome these major bottlenecks in the technology by taking a revolutionary approach. Namely, we plan to exploit the potential of cavity quantum electrodynamics in the bad emitter limit where decoherence is mostly due to the artificial atom. In this limit, preliminary results show that cavity filtering properties and the Purcell effect can be used to engineer the electron-photon interaction, thereby turning electron decoherence into an advantage rather than an obstacle. We will use this strategy to develop a new generation of single photon source devices based on colour centres in diamond placed in optical microcavities. Devices targeted will be a high speed single photon source, an indistinguishable single photon source, and a spin-photon interface. Emphasis will be on practically useful devices with features such as wavelength tunability, room temperature operation, and robust, highly portable assembly. The team comprises six leading European groups in the fields of diamond photonics, solid state cavity quantum electrodynamics and quantum information processing. Within this three year research project we aim to develop and field-test the devices, to bring a valuable new capability to the growing quantum information community.</p>	THE CHANCELLOR, MASTERS AND SCHOLARS OF THE UNIVERSITY OF OXFORD	United Kingdom
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