ACTIVITY REPORT 2015

SYSTEMS ENGINEERING

AUTONOMOUS TRANSPORT

SMART TERRITORIES

INTERNET OF TRUST

Systemx
INSTITUT DE RECHERCHE TECHNOLOGIQUE

Technological Research Institute SystemX

Boosting Digital Transformation

SUMMARY

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Impression
Snel

Pascal Cléré
President,
Technological Research
Institute (IRT) SystemX

I am delighted to present the SystemX Institute of Technological Research (IRT) activity report for 2015.

Success: this is the key word for our Institute in 2015, the end of our first triennial phase. Since it was officially created on February 1, 2012, from the PIA (investments for the future) program, SystemX has been able to impose its expertise and form a critical mass of skills in digital engineering of tomorrow's systems, in the fields of transport, communications, digital security and energy.

In a mere three years' existence, SystemX has developed a unique technological base around 17 research projects that include 61 industrial partners and 14 academics. Our teams' expertise has enabled seven reference technology platforms to be created. These equipment and infrastructures have integrated capacities and technological building bricks into our research projects and now produce results that will contribute to national and international recognition of our research activities.

> *"Success: that sums up 2015 for our Institute, which has completed its first three-year phase successfully."*

The year 2015 thus marks the end of the first development phase for SystemX, the "model establishment" phase. Now that this three-year period is complete, we have a **new roadmap for the Institute up to 2020 to establish its model.**

Our first ambition for the years 2016-2020 will be to **accelerate innovation via our research and development activities**, so that we can assist industry in digitally transforming companies and products. For this purpose we have fixed three goals. First, meet the challenges manufacturers encounter in the design, modeling, simulation and testing phases of future innovations increasingly integrating digital aspects. Here, we have set up four research programs on systems engineering, autonomous transport, intelligent territories and trustworthy Internet. Our second goal is to pool and spread the knowledge we have acquired via the technological platforms built for our various R&D projects. Our final goal is to gain an international reputation for the work and excellence of SystemX, both in Europe and worldwide, so that it will become the French reference for digital systems engineering.

Like 2015, **2016 offers us new challenges and achievements**. I would like to extend my thanks to each and every member of our teams for the work already accomplished and that includes our founding members, our partners, and all the staff, the research engineers and the doctoral students. Because the future is being built as we speak, I encourage you all to continue to contribute to accelerating the digital transformation of the world every day.

This report will describe the activities of SystemX over the year 2015 and our development prospects for the years to come. Enjoy your reading!

Éric Perrin-Pelletier
Chief Executive Officer,
Technological Research
Institute (IRT) SystemX
@PerrinPelletier

The digital transition, in other words, the penetration of digital technology into economic activities, affects all industrial fields. This transition transforms diffusion formats, distribution channels and thus economic models. The changes save user time and give more flexibility, which means they are essential for competing businesses.

These challenges cannot reasonably be addressed by individual companies but demand efforts in collaboration, exchanges and knowledge transfers in many fields. Digital and industrial expertise must be combined and given impetus by means of a dedicated innovative ecosystem. More connected industrial companies, more reactive to their clients' needs and more respectful of the environment and their staff, must be created.

Our Institute, specialized in "systems" issues, is a key player in implementing an innovative ecosystem gathering industrial and academic partners.

> *"With 17 research projects, 61 industrial partners and 14 academic partners, SystemX came of age in 2015."*

With 17 research projects, 61 industrial partners and 14 academic partners, SystemX completed the first phase of its development in 2015 with:

- **Three distinct scientific research axis** centered on current industrial concerns in innovation: usage and collaboration, modeling and optimization, simulation and infrastructures.
- **Concrete reference technological platforms**. For example, the CHESS platform, dedicated to simulation and analysis for assessing the cybersecurity of systems architecture (CHESS, Cybersecurity Hardening Environment for Systems of Systems), presented to Bernard Cazeneuve, French Minister of the Interior, and Emmanuel Macron, Minister for the Economy, Industry and Digital Affairs at a meeting of the Committee for industrial security (CoFIS), on December 1, 2015.
- **Consolidation of our organization in preparation for our second phase "creating a model" for the period of 2016-2020**. We intend to become a player recognized at European and international level in digital systems engineering, spread use of the technological platforms developed by our research projects, and be an essential reference in systems skills. For these reasons, the IRT has chosen to locate in the heart of the Paris-Saclay campus and its industrial and academic ecosystem.

2016 thus opens on favorable prospects for our Institute, which will continue its day to day work with its partners in accelerating digital transformation, while remaining true to the values linked to our identity: **inter-disciplinarity, collaboration, expertise, agility and innovation**.

2015 IN BREF

JANUARY

- SAAS Academy enters its operating phase

FEBRUARY

- Launch of EIC project, Environment for Cybersecurity Interoperability and Integration
- Launch of SVA project, Simulation of Autonomous Vehicle Safety
- Creation of SystemX Scientific and Technological Board

MARCH

- Annual event: Future@SystemX
- Creation of the Association of Technological Research Institutes

APRIL

- Launch of ISC project, Collaborative Systems Engineering
- Launch of Anthropolis chair in collaboration with CentraleSupélec
- Paris-Saclay final of “My thesis in 180 seconds”: Timothée Leblond, doctoral student at SystemX, winner of public price

MAY

- Signature of convention for collaboration between IRT SystemX and ITE VEDECOM

JUNE

- Signature of convention for collaboration between IRT SystemX and ITE EFFICACITY
- Signature of convention for collaboration between IRT SystemX and IRT Saint Exupéry
- Annual meeting of SystemX Industrial partners club

JULY

- François Gonard, Doctoral student at SystemX, received an award at the ICON Challenge on algorithm

AUGUST

SEPTEMBER

- SystemX reveals its roadmap for 2016 - 2020 and sets up a new organization

OCTOBER

- SystemX hosts the AFIS EMEA 2015 workshop
- Signature of a collaboration agreement between IRT SystemX and the Circle of IHEDN partners
- IRT SystemX Participated in the 3rd edition of IRT in Grenoble (at the IRT NanoElec)

NOVEMBER

- Signature of convention for collaboration between IRT SystemX and ICT4V Uruguay’s center

DECEMBER

- SystemX reveals its CHESS platform to Bernard Cazeneuve (Minister of the Interior) and Emmanuel Macron (Minister of the Economy, Industry and Digital affairs) at the meeting of the Industrial Security

Creation

31 october 2012

Partners

61 Industry

14 Academics

Research projects

17 Research projects

European projects

3

ECHORD ++ (FP7)
In2rail (H2020)
TOICA (FP7)

Finance

Industrial financing

60 M€

Staff

82 researchers and 34 doctoral students

Valorisation

- 7 Platforms and equipment
- 22 Patents and software
- 27 Technological transfers
- 145 Publications

Research programs SystemX

INSTITUT DE RECHERCHE TECHNOLOGIQUE

SYSTEMS ENGINEERING

Developing optimally designed software methods, processes and software tools, agile simulation and collaborative engineering for complex systems using digital technology.

AUTONOMOUS TRANSPORT

Developing new secure, safe architectures for autonomous vehicles and transport systems, integrating new habits, critical onboard systems, infrastructure evolution and interactions.

SMART TERRITORIES

Developing decision support tools for optimization and operational planning of territorial evolutions, based on data compilation and analysis.

INTERNET OF TRUST

Developing algorithms, protocols and architectures on which to base digital infrastructures forming the foundation of digital transformation.

François Stephan
Development and International Director, Technological Research Institute (IRT) SystemX
@FrancoisStephan

“Our first ambition is to make SystemX the French reference for digital systems engineering worldwide.”

How do you coordinate the development of SystemX research projects?

In close collaboration with the other divisions, I manage the work to form the plans for our four research programs: Systems Engineering, Autonomous Transport, Smart Territories and Internet of Trust. Among others, I am in charge of detecting and preparing new research projects, or of increasing the scope of existing projects via the entry of new partners.
One example of this is the EIC (Environment for Cybersecurity Interoperability and Integration) project, launched in February 2015, which was the fruit of several months of preparation and definition by SystemX jointly with the Systematic competitive cluster and its ecosystem.

What is the SystemX’s partnership policy?

Since it was launched in 2012, our institute has concluded 61 industrial partnerships and 14 with academic ones, including large groups (Alstom, Renault, Airbus Group, Orange, etc.), innovative start-ups and SMEs (The CoSMo Company, Krono-Safe, Sherpa Engineering, OVH.com, OpenTrust, Trialog, etc.), and several renowned schools, universities and research centercenters (Institut Mines-Télécom, Inria, CentraleSupélec, ENSTA ParisTech, Université Pierre et Marie Curie, Université Paris-Sud, Inria, CEA List, etc.). These partners are the very essence of SystemX because of the skills synergy they make possible in terms of technological and scientific research. Entrepreneurship, innovation and education.
In the coming years, we wish to develop our partnership policy to support technological collaboration and scientific knowledge sharing in the field of complex digital systems engineering: two values that are close to the Institute’s heart. At the same time as developing our partnerships with businesses and the academic world, we will build European and international collaborations.

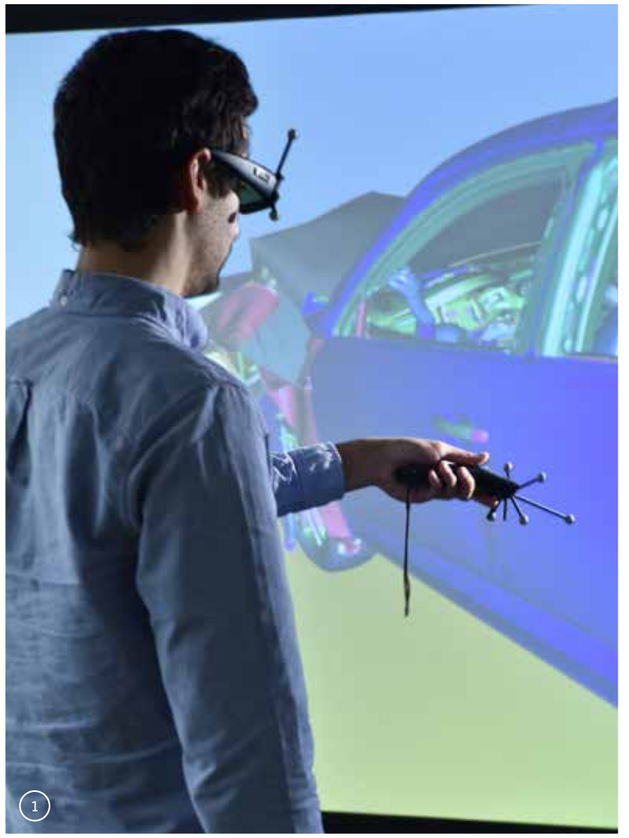
What are SystemX’s European and international ambitions?

The reputation of our IRT’s works and excellence at European and international levels forms the backbone of our development strategy that was established for our roadmap over 2016-2020. Our first ambition is to make SystemX the French reference for digital systems engineering worldwide. For this purpose, we will build partnerships with research centers and businesses on the various continents, and increase our involvement in European and international collaborative projects.
The collaboration agreement we concluded with ICT4V (Information and Communication Technologies for Verticals); the Uruguayan multidisciplinary technology center specialized in ICT shows our wish to associate with research organizations of worldwide repute.

What was the most important event in 2015 for you?

I would say that it was the start of SystemX’s participation in its first European collaborative project (H2020), as technological partner: it is the IN2RA project on intelligent management of railway infrastructure energy.

1. Visualization immersive 3D
2. Workshop AFIS EMEA 2015
3. Demonstrator of a Smart Building
4. Demonstrator of attacks simulation on an autonomous vehicle



Bruno Foyer
Platforms Director,
Technological Research
Institute (IRT) SystemX
@BrunoFoyer

"In operation and building up, our technological platforms provide specific expertise in the field of digital systems engineering."

What is the mission of the platforms management?

Running transversally through all four program divisions, the platforms management ensures that the means and assets built up around each of the seven platforms of research projects are shared. It is charged with ensuring these assets are kept and consolidated so that they can be better used and spur on the research programs. The better to meet this goal of technical collaboration and accelerated transfer towards our partners, the platforms management has channeled its activity into three sections:

- Identification, sharing and long term development of common assets (processes, methods, technological bricks, tools, algorithms etc.) developed and produced by our research work.
- Definition of the strategy for re-using these assets and use cases, and support for implementation of the services offered.
- Promotion and use of the platforms and related services, and creation of added value, transversally throughout our projects.

These activities required grouping all the technical skills into five areas under the platforms management: infrastructure, big data and HPC (High Performance Computing); software engineering; framework and algorithms; architecture, models and simulation; MMI (Man-Machine Interaction) and visualization. These skills are necessary for implementing and spreading our platforms, as well as enriching the services we offer by capitalizing on new needs and cases of usage.

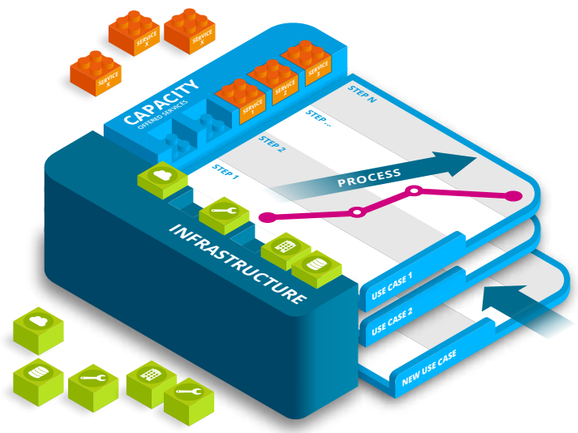
What is a platform at IRT SystemX?

A technological platform comprises all the capacities and services shared under a single research subject, implemented via a methodological process and based on shared infrastructure. Each case of usage contributes to the three components of a platform; implementation processes, capacities (value created) and all the means and tools).

Seven platforms have been created at IRT SystemX since its launch in 2012. Operational and building up, these technological platforms provide specific expertise in digital systems engineering, to consolidated and share the core competences developed in our 17 research projects.

7 technological platforms
In 2015, IRT SystemX set up its first technological platforms based on the work done on its 17 R&D projects.

What is a platform?
A technological platform is all the capacities and services shared under a single theme.



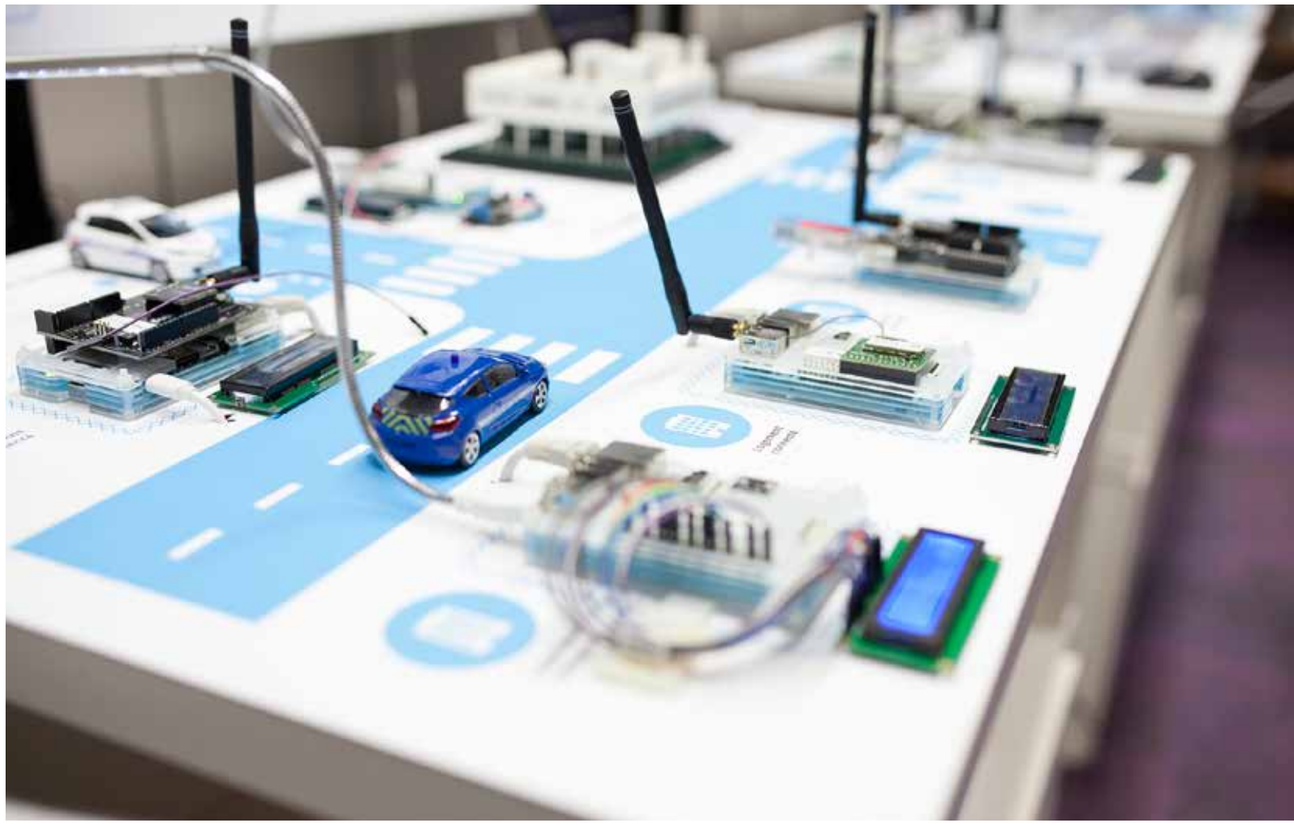
How are our platforms used?

Our technological platforms are exploited by our partners who provide their use cases. Autonomous transport, smart territories, systems engineering, Internet of trust… Each platform meets different challenges and is part of a particular context related to current issues in the field of systems digital engineering.

What technical advances have these platforms made possible?

Our seven technological platforms, true accelerators of technological transfers operated SystemX, have each contributed to establish the scientific research in our research projects.

- **CHESS** enables security solutions suppliers to assess the protection level of their innovative components, when faced with threats adapted to various user contexts, not least via modeling and simulation work. The main solutions users and integrators also rely on the platform to assess their choices of security solution architectures and identify the best alternatives.
- **FACTORY** provides various services to its users: full management over the entire lifecycle of digital project deliverables (definition, scheduling, manufacture, delivery and transfer), proposes a process environment for projects of the Platform as a Service type, trains and assists in implementation of good practice.
- **KUBIK** offers decision support for systems architects, assessment and testing of critical elements with:
  - Modeling of the collaboration scenarios for activities and exchanges.
  - Mastery of the complexity and federation of opinions: consistency and traceability of data between interested parties in a project, impact analysis on variabilities throughout the life cycle of a system (online product management, evolutions).
  - Mastery of costs and risks: reinforcing corporate strategic vision and reducing time taken to market, using a performing collaborative tool.
  - Decisional support, by comparing and evaluating critical elements.
- With **Dr SiHMI**, stakeholders in the transport sector prototype and test new IHMs (dashboard, augmented reality, sounds and light) carry out user tests for ergonomic and human factor studies, model a realistic driving scenario integrating co-simulation models.
- **MOST** enables operators and local authorities to assess and finalize modeling, simulations and optimizations in the transport sector the better to meet future needs and passenger transport modes. In the energy sector, the platform offers predictive means and optimization of consumption taking account of the new usage and generation modes (eco-responsible buildings, electrical vehicle fleets and renewable energies).
- **TREC** enables transport stakeholders to design new, reliable, safe and optimized architectures to ensure high availability in critical, real time onboard systems.
- Finally, **VITAL** serves as a support for the experiments carried out by developers of applications dedicated to analysis of multimedia and multilingual content. For technologists, the platform facilitates the integration and evaluation of new algorithms in a flexible, strong environment with the possibility of building to scale, and enables deployment and administration of processing chains based on data from the Internet and social networks. For users, it offers new methods for targeted and contextualized research that are more pertinent and efficient than traditional search engines.



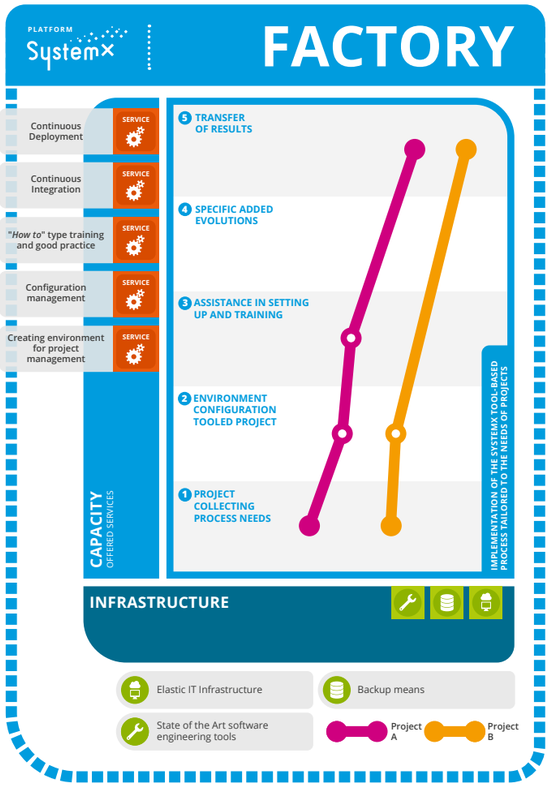
CHESS platform
Simulation and analysis platform for assessing the cybersecurity of system architecture.

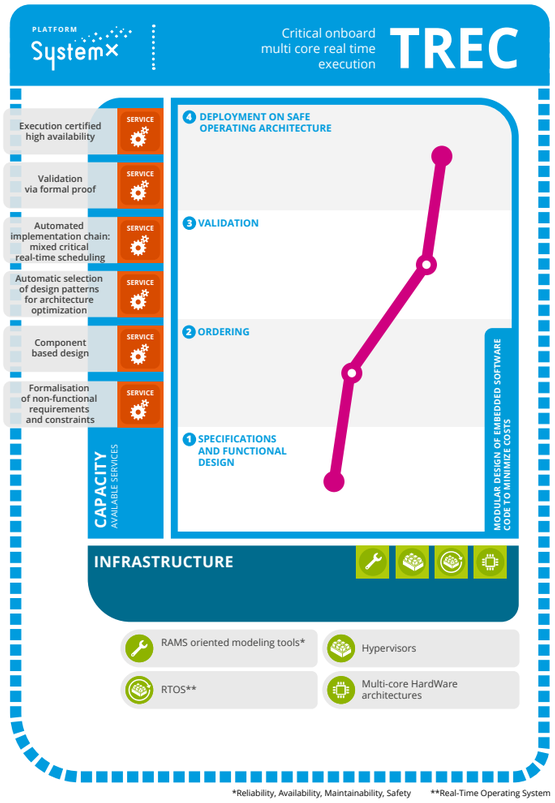
What are the platform management's development objectives?

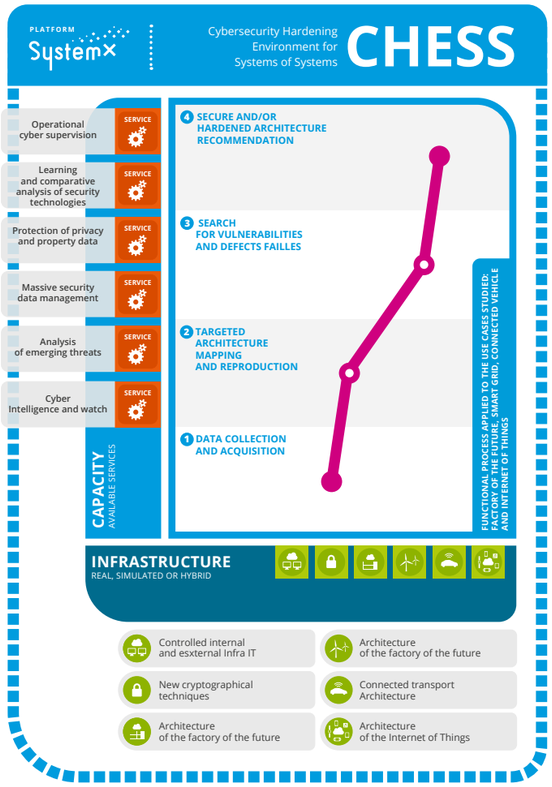
Over the 2016-2020 period, we will work towards developing our technological platforms along three lines:

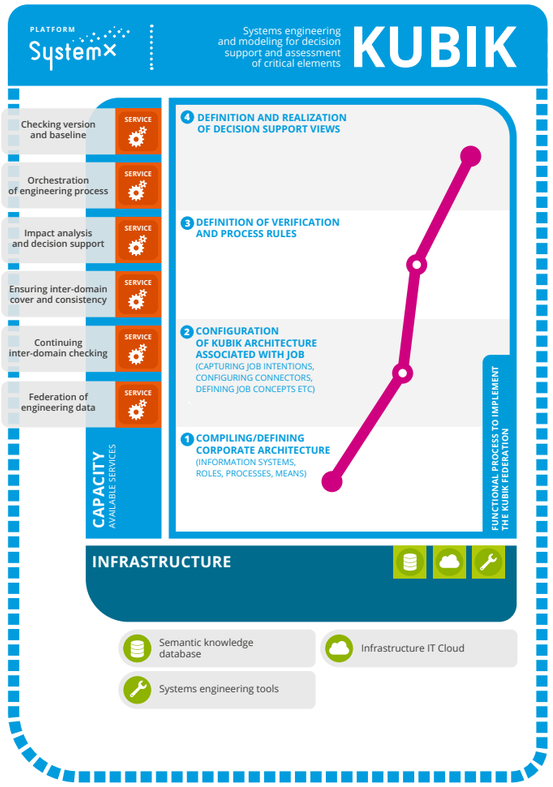
- Influence and communication around the services offered, to create new opportunities for mutualisation and usage cases.
- Developing existing platforms, not least by ongoing technological watch and creation of new platforms to meet the emerging needs and challenges in digital systems engineering.
- Developing new usage modes that will enable stakeholders outside SystemX to benefit from the technological innovations proposed by our platforms.

TECHNOLOGICAL PLATFORMS









FACTORY

A collaborative platform offering a methodological framework and infrastructure means "tailored to size" for producing, re-using and transferring digital deliverables.

TREC

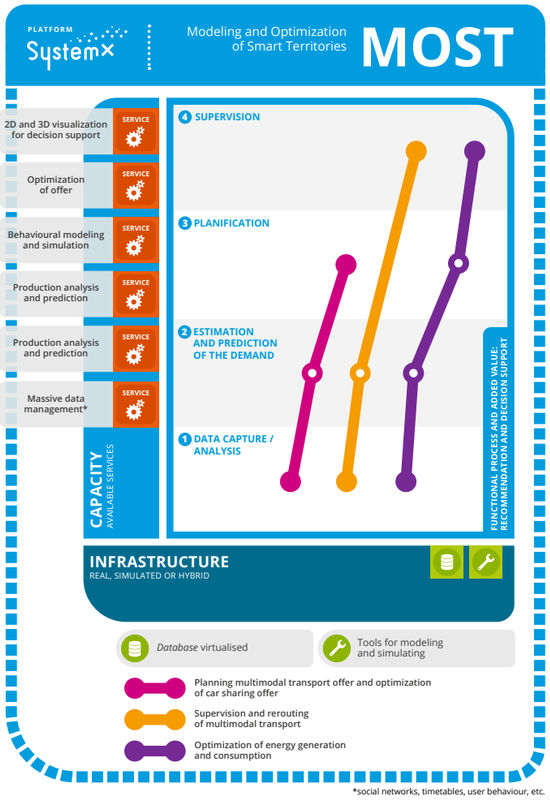
A development platform to execute critical onboard real time software on multicore architectures.

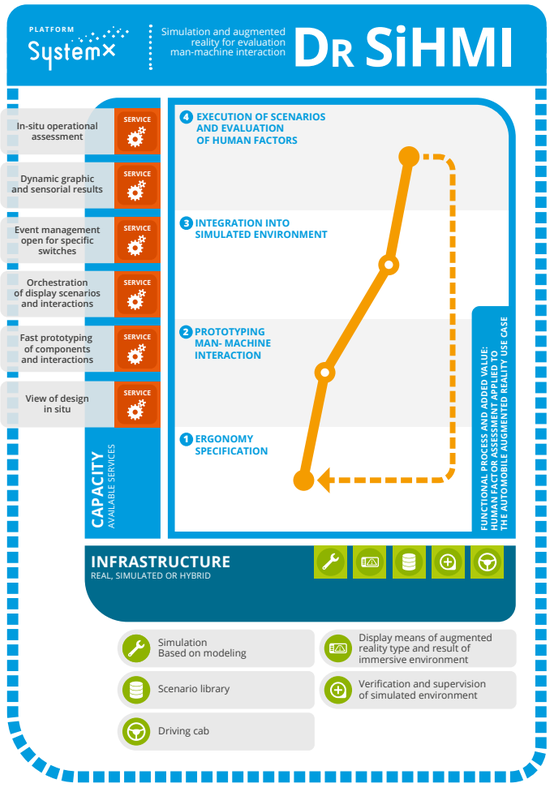
CHESS

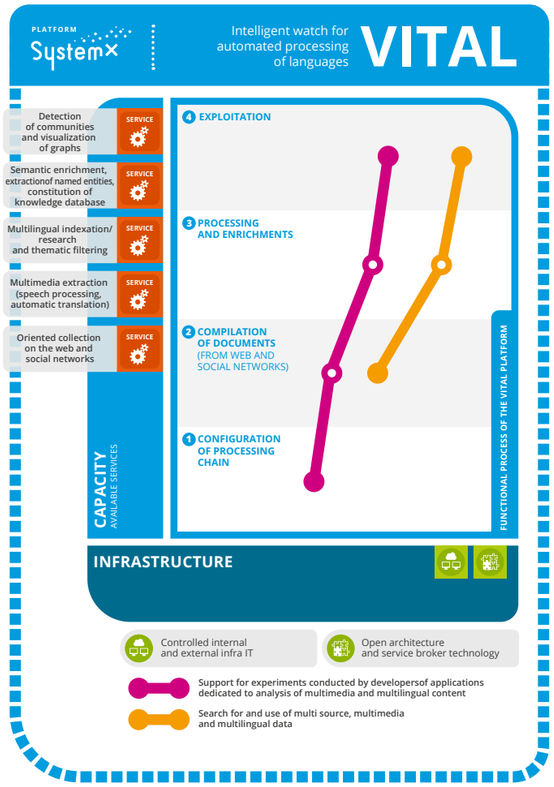
Platform for simulation and analysis for assessing system cybersecurity.

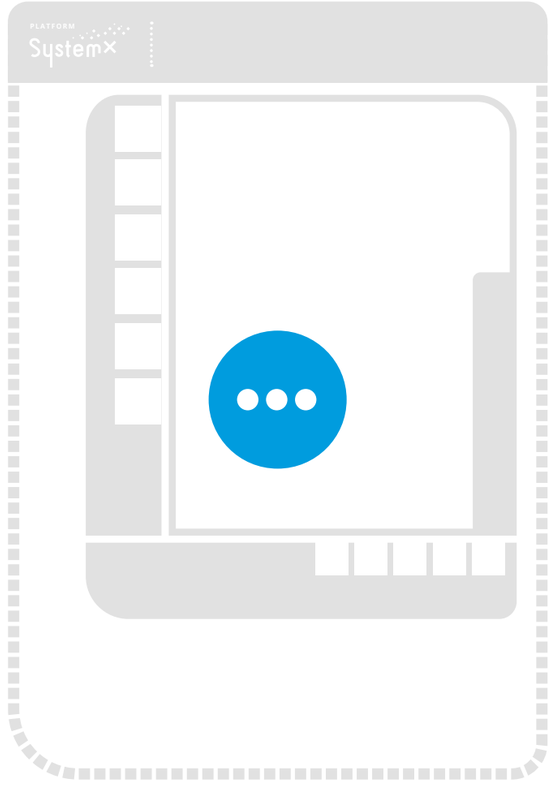
KUBIK

Platform for systems engineering and modeling for decision support and assessment of critical elements.









MOST

Platform for modeling and simulation for optimization and supervision of intelligent territories.

Dr SiHMI

Platform for simulation and augmented reality for assessment of man-machine interaction.

VITAL

Intelligent watch platform for automated processing of multimedia, multilingual data.

Daniel Krob
Scientific and Technological Director, Technological Research Institute (IRT) SystemX

"In the service of the Institute's programs and projects, the Scientific and Technological Board defines and implements SystemX's scientific strategy."

What are the Scientific and Technological Board's missions?

The Scientific and Technological Board of SystemX, created in February 2015, is at the service of the Institute's projects and programs. It defines and implements its scientific strategy. For this purpose, it identifies and structures the scientific problems to be resolved and the scientific solutions to address industrial issues.

Our division also has a role in scientific leadership of the Institute, supporting and assisting in its growth in scientific matters and coordinating relationships with partners in State research and higher education in our Institute.

Finally, the Scientific and Technological Board is responsible for coordination with the Scientific and Technological council and representing SystemX nationally and internationally in the field of digital systems engineering.

What are SystemX's main scientific subjects ?

Our Institute's scientific research is divided into three main transversal research axis, focusing on current industrial problems in digital transformation:

USAGES AND COLLABORATION

Any process of designing a complex system is based on understanding of the value of the system, for its interested parties, which requires first of all careful analysis of usages and needs. After this, collaborative methods for designing are also an essential requirement for "the right" design so that every point of view can be integrated into the system architecture.

MODELING AND OPTIMIZATION

The second stage of the design process for a system is systemic modeling where the various operational, functional, organic and dysfunctional views of heterogeneous multi-scale systems must be captured formally. There are several design choices and they must be compared so that an optimal system can be arrived at.
A verification stage makes it possible to validate that the modeled system corresponds to specifications.

SIMULATION AND INFRASTRUCTURESS

The final stage in the design process for a system is simulation and implementation of the system. This means that the multi-physical and hybrid dimensions of the system are simulated, at the same time coupling various scales and integrating human actions. The underlying digital infrastructures also play a key role because their technical performances are closely linked to the functional performances of the system simulations.

The three research axis of research occur one by one in the digital engineering chain of a complex system, the central hub around which all our research and transfer activities are organized.

What are the Board's plans from now until 2020?

Since our institute was launched, we have developed a critical mass of scientific knowledge in digital systems engineering. This knowledge, spread throughout our technological platform projects, includes many subjects (algorithms, cybersecurity, augmented reality, etc.) as well as many other sectors (transport, energy management, connected things, etc.). Our first goal is to consolidate this reference pool of skills by increasing our project expertise and identifying the new needs to help industry adapt to digital transformation.

The Scientific and Technological Board and Technology Division has fixed a second goal for the period to 2020: to foster SystemX's academic and scientific reputation amongst its peers at national and international levels. To do this, we will continue to rely on the innovating ecosystem of the Paris-Saclay campus, which by 2020 will capitalize some 20% of French research. We are also going to pursue our activities to promote our scientific activity via several communications actions.

SEMINAR @SystemX

Scientific seminars organized in 2015

29 JANUARY
Design Margins
Claudia Eckert,
Open University, United Kingdom

19 MARCH
From Flop to Success in Academic Software Development
Gaël Varoquaux,
Inria, France

23 SEPTEMBER
Architecture of Complex Systems
Daniel Krob,
SystemX, France

6 OCTOBER
What is complexity the name of?
Jacques Printz,
CNAM, France

20 OCTOBER
Safe Fully Automated Driving on Roads and Highways: Pie in the Sky or Future Reality?
Gérard Le Lann,
Inria, France

12 NOVEMBER
Agility in Scientific Projects
Christian Surace,
CNRS, France

25 NOVEMBER
R&D Partnership for Intelligent Solutions to Urban Problems
Sébastien Tremblay,
Université Laval, Canada

8 DECEMBER
Integrating Electric Vehicles in Existing Fleets
Jakob Puchinger,
SystemX, France

Étienne de Pommery
Director, "Systems Engineering" program, Technological Research Institute (IRT) SystemX
@edpom

"Assisting in the digital transformation of the engineer's job."

What are the main challenges for the Systems Engineering program?

Tomorrow's digital engineer will increasingly be required to work in interoperability. Today, it is clear that changes in industrial organization and methods are indispensable for those wishing to mutate to digital technology. Although the many players in the systems engineering field reason conceptually on the same subject, the decision is made in clearly differentiated technical spaces that do not facilitate contacts nor enable detection of possible differences of opinion. This separation causes technological disruptions between the various engineering fields. The result is that it is difficult to reason out a project as a single whole and manage the lifecycle of a product and a process properly, such that changes in needs and specifications can be addressed swiftly.

The Systems Engineering program will enable all the players in engineering to manage and optimize the design margins of their products and complex systems, using new tools and methodologies based on digital technologies.

What are the development prospects for your program?

Under our 2016-2020 roadmap, the Systems Engineering program will develop research projects on agile resolution of industrial engineering problems, management of risk and uncertainty and collaborative systems engineering, mainly with partners in the aeronautics, defense, automobile and naval fields.

More specifically, the program will work towards addressing the following industrial concerns:

- Modeling and simulating large scale heterogeneous systems for decision support and management of design margins.
- Designing modular, re-usable architectures via agile engineering methods.
- Developing methods and tools for "design correct" systems.
- Ensuring digital continuity in managing system lifecycles.
- Guaranteeing system service and performance quality.

What are the highlights of 2015 for you?

One of the highlights of last year was the launch of the Collaborative Systems Engineering (ISC) project in April 2015. Launched in the framework of defense projects, its purpose is to facilitate collaboration between the various interested parties and give them the tools needed to ensure overall consistency in the engineering data and better decision making.
Among the other projects in the Systems Engineering program, OpenAltaRica (OAR) arrived at maturity, not least by making available an initial version of the platform via a dedicated website. The Parallel Algorithmic (APA), Model Reduction and Multiphysics Optimization (ROM), Engineering and Multi-disciplinary Simulation (SIM) and PLM Interoperability & Standards (SIP) projects continued to develop and produce many technical results and scientific publications. They will be completed in 2016 and be followed by new projects capitalizing on their results and the experience gained.

The many scientific, technical and methodological results of these projects have fed into SystemX's technological platforms and the partners of these projects via industrial applications, but they have also been spread via scientific publications or presentations in national and international conferences.

APA

PARALLEL ALGORITHMICS

Project profile

PROJECT MANAGER:
Yves Tourbier

PROJECT DURATION:
36 months (launched December 2013)

INDUSTRIAL PARTNER:
ESI Group

ACADEMIC PARTNER:
CentraleSupélec

THESES:
- Domain decomposition methods on parallel architectures for car crash simulation

The current issue is to be able to make optimal use of massively parallel machines with over 200,000 cores and/or spread over distinct geographical sites (Cloud Computing). To use these new parallel architectures as best as possible, software is obliged to increase the degree of parallelism. Classic algorithms are ill-adapted to so many cores because most require regular, frequent synchronization. However, multiplying communications between cores limits their performance. That is why a-synchronous algorithms have appeared to be an attractive alternative today.

The goal of the APA project is to analyze and develop new a-synchronous algorithms that have been little developed and have few applications as yet. This is mainly due to the fact that existing a-synchronous algorithms are less efficient than classic ones in situations where communications are not the main constraint.

With the emergence of machines with over 200,000 cores, or spread over several sites, these algorithms now offer a certain interest, since they do not require regular, frequent synchronization between algorithms, subject to being able to develop strong, performing new a-synchronous algorithms.

HIGHLIGHTS 2015

- Demonstration for the Future@SystemX 2015 event to illustrate the problem of calculation time in engineering simulations.
- Publication of scientific articles.

PROSPECTS 2016

- Once the performances have been evaluated and consolidated, implementation can be envisaged for the industrial partner of the project so that the performances of the simulation solutions can be improved.
- A patent application is envisaged.

ISC

COLLABORATIVE SYSTEMS ENGINEERING

2015 PROJECT

Project profile

PROJECT MANAGER:
Laurent Descombes

PROJECT DURATION:
60 months (launched April 2015)

INDUSTRIAL PARTNER:
Dassault Aviation, DCNS, Thales

ACADEMIC PARTNERS:
Chaire Systèmes Complexes (Ecole polytechnique, Télécom ParisTech, ENSTA ParisTech)

These days, system complexity is an extremely pragmatic reality that more and more engineers must face and overcome throughout the life cycle of an industrial system. This complexity is in fact found in all the main engineering phases of a system, from needs analysis to final validation, including the integration phase.

The extremely heterogeneous needs and constraints affecting the definition of an industrial system leads in practice to definition of engineering solutions on a piecemeal basis. One consequence of this is the predominance of ad hoc engineering and completely informal specifications tools that do not allow optimum flow of exchanges.

The goal of the ISC project is to participate in the revolution in engineering practices, and assist in the digital transition for engineers by facilitating collaboration between the interested parties in a project (depending on the job, the stages in the life cycle, geographical areas, etc.) to ensure the overall consistency and efficiency of the system. With regard to defense projects, the goals will be:

- Mastery of complexity: fluidity of data flows between participants.
- Mastery of costs and risks: enhancing clients' strategic vision by reducing commercialization time via a high-performance collaborative tool.

HIGHLIGHTS 2015

- Setting up project governance in collaboration with partners.
- Progress on the state of the art and practices in terms first of collaborative processes and collaborative platforms and, second, architecture evaluation.
- Demonstrations at AFIS EMEA 2015 workshop.

PROSPECTS 2016

- On the basis of a usage case suggested by the partners, the services of a collaborative systems engineering platform will be identified, characterized and then prototyped.

OAR

OPENALTARICA

Project profile

PROJECT MANAGER:
Michel Batteux

PROJECT DURATION:
60 months (launched October 2014)

PREMIUM:
AltaRica Association, Apsys, Safran, Thales

ADHERENTS:
Alstom, Renault, Siemens

THESES:
- **Probabilistic verification of AltaRica 3.0 model properties**

AltaRica is a "high level" language for modeling dedicated to risk analysis (safety, reliability, performance). It lies in the field of Model-Based Safety Assessment (MBSA) the purpose of which is to reduce the considerable discrepancy between the specifications of the systems studied and the associated "low level" models for risk analysis (fault trees, plans, block diagrams etc.); this discrepancy has significant repercussions (in time lost and risk of mistakes) each time the specifications are changed.

AltaRica has evolved constantly since its creation in the late nineties. The latest version of the language, AltaRica 3.0, is at the heart of the OpenAltaRica project. It is an improvement on the second version AltaRica Data-Flow in its expressivity and ease of use.

The main goal of the OpenAltaRica project is to develop the ecosystem around the latest version of the language, AltaRica 3.0, for risk analysis of complex systems. This goal will be divided into two:

- Build the OpenAltaRica software platform, based on AltaRica 3.0, dedicated to risk analysis for complex systems.
- Federate the community by providing the opportunity to conduct experimental risk analysis based on AltaRica 3.0; and also increase the competitive edge of French industry in this MBSA field.

HIGHLIGHTS 2015

- Participation in the ESREL 2015 conference (European conference on issues of safety and reliability).
- Presentation of the OAR project's work at the Paris Region safety assessment seminar and at the AFIS EMEA 2015 workshop.
- Creation of a dedicated website and forum dedicated to the OpenAltaRica project: www.openaltarica.fr

PROSPECTS 2016

- Publications at the Lambda-Mu 2016 congress and the IMBSA 2016 workshop.
- Articles submitted to various specialized scientific journals.
- Organization of a workshop dedicated to the OpenAltaRica project.
- Now that an initial version of the OpenAltaRica platform has been made available on a dedicated website, the community of users and members of the project will continue to grow in 2016, thanks to further technical advances in the project and their dissemination.

ROM

MODEL REDUCTION AND MULTIPHYSICS OPTIMIZATION

Project profile

PROJECT MANAGER:
Yves Tourbier

PROJECT DURATION:
36 months (launched July 2013)

INDUSTRIAL PARTNERS:
Airbus Group, Cenaero, ESI Group, Renault, Safran

ACADEMIC PARTNERS:
CentraleSupélec, Inria, Supméca, Université de Versailles Saint-Quentin-en-Yvelines (UVSQ)

THESES:
- Surface shapes optimization under vibro-acoustic and endurance criteria
- Shape optimization of composite structures
- Aerodynamic or structure cost functions sensitivities calculation regarding the design parameters
- Methodology for the generation of dynamic reduced models; Application to the variable blade system of an aircraft engine
- Bayesian Optimization in high dimension

The aim of the ROM project is to improve the design process for complex systems in order to reduce costs and delay. This project concerns complex systems that have very large calculation times and design spaces. It is intended for the automotive and aeronautics markets more particularly.

The purpose of the ROM project is to:

- Provide a set of scientific and technological tools to allow design of complex multiphysical systems.
- Develop tools enabling evaluation of the quality of the developed models and the results of the simulations (model verification and validation).
- Set up an integrative and demonstrative platform integrating both scientific and technological tools developed by the project and software tools (freeware or proprietary) enabling industrial case tests to be carried out in the aeronautics and automobile sectors.

HIGHLIGHTS 2015

- Presentation to Renault of a shape optimization based on a parametered CAD and an adjoint solver in structure and Computational Fluid Dynamics (CFD).
- Teaching of a course in Master 2 at École Centrale de Lyon (Optimal design).
- Communications at several events: CSMA colloquium, ASME Congress in Boston.
- CFM in Lyon, JJCAB in Besançon, etc.
- Publication of articles in international scientific journals.
- Demonstrations for Future@SystemX 2015.

PROSPECTS 2016

- The model reduction methods we studied showed interesting potential and will be experimented in industrial projects at Renault in 2016. Furthermore, the advances in robust optimization or geometric optimization will be the subject of more detailed study, and of prototyped industrial applications under a future project in 2016.

SIM

ENGINEERING AND MULTI-DISCIPLINARY SIMULATION

Project profile

PROJECT MANAGER:
Yves Baudier

PROJECT DURATION:
36 months (launched June 2013)

INDUSTRIAL PARTNERS:
Airbus Defence & Space, Airbus Group, Esterel Technologies, Renault

ACADEMIC PARTNERS:
CentraleSupélec, ENSTA ParisTech, Supméca

THESES:
- Extension of the TTRS theory to multi-physics for architecture simulation of systems during conceptual design: thermal application
- Using Systems Engineering Methods to Support Multidisciplinary Collaborative Model Development Process
- Improving collaborative engineering design in a project context based on simulation exchange models in early development phases
- Theoretical modeling and associated processes for Model Architects in a multidisciplinary simulation environment
- Formalization and Validation of Complex Systems Architectures and associated Requirements within a Model Based Systems Engineering approach

The SIM project's aims to imagine the tools of "vehicle architecture" and multidisciplinary methods of collaboration based on models for the engineering of future vehicles (hybrid car, more electrical planes) meeting environmental criteria such as energy saving, and passenger comfort and safety.

Important issues for industry are to:

- Set up a large number of interoperable, multi-system, multiphysical and multiscale behavioral models.
- Build model hierarchies enabling the physical behavior of a system to be represented (vehicle or vehicle subset).
- Collaborate between architect/integrator and subsystem supplier in an integrated framework, sharing models. For example, be able to build a functional behavioral architecture for a hybrid vehicle with low environmental impact, based on interoperable, multiphysical and multiscale models, in a multi-company environment (be able to integrate models produced by partners/subcontractors), and provide a guaranteed degree of quality (of representativity with respect to reality).

Setting up tools at "system architecture" level based on different behavioral models is a key factor which, still today, hampers an effective approach to the performance analyses and multidisciplinary optimizations needed for system design.

HIGHLIGHTS 2015

- Demonstration on the subject of simulation-guided design at the annual Future@SystemX 2015 event and the AFIS EMEA 2015 workshop.
- Presentation of the project at the study day organized by SIA (society of automotive engineers) on the subject of digital simulation for decisions in engineering complex systems.

PROSPECTS 2016

- In 2016, the SIM project is to end and the results will be used in industrial applications developed in the context of the project. The Model Identity Card (MIC) concept is promising and its dissemination amongst the industrial community is one of the main goals of this future project. The first location is currently being prototyped with a software publisher. The works accomplished during the project will be capitalized on thanks to the KUBIK platform.

SIP

PLM INTEROPERABILITY & STANDARDS

Project SIP seeks to harmonize processes and PLM (Product Lifecycle Management) solutions in industry to create a new digital dynamic in the entire ecosystem, and facilitate exchanges on the subcontracting chain. The project aims to create new methods and a test platform to accelerate implementation of PLM standards and interoperability based on a COTS open source approach that will enable interoperability processes to be prototyped and validated at controlled costs.

The results of the project, not least the test bed for assessing the standards and their implementation, should enable the industrial issues associated with the standards to be better understood and steered according to the agreed implementation targets, with the appropriate level of maturity. Thus the SIP project should draw a community around its platform.

To set up the test bed architecture and validate it on initial industrial cases, a first circle of partners is needed. Then, a second circle will be required to feed the first version of the platform with new cases, in particular to extend the cases in a particular industrial field but also to other fields. The circle of academics comprises universities and laboratories interested by the subject. Some may belong to the first circle, the others will be regularly consulted and informed.

Project profile

PROJECT MANAGER:
Nicolas Figay

PROJECT DURATION:
36 months (launched October 2013)

INDUSTRIAL PARTNERS:
Airbus Group Innovations, Boost Conseil, Dassault Aviation, Datakit

ACADEMIC PARTNER:
Université Paris 8 (LISMMA)

THESES:
- Contribution to the establishment of an interoperability approach in the context of extended PLM
- Simulation software interoperability in a collaborative, multi-disciplinary and multi-organizational environment

HIGHLIGHTS 2015

- New industrial partnership with Dassault Aviation.
- Influence on the PLM ecosystem and application of the results to new partner projects.
- Presentation of our work in four articles published in the international press and five presentations in conferences.
- Consolidation of our links with organizations dealing with PLM standardization and its implementation by participating in over 20 events or working groups.

PROSPECTS 2016

- In 2016, a partnership between SystemX and AFNeT (French association of Net users and the Network Society) is to be concluded to step up publication of the project results and enable the circle of industrial partners to be extended. More especially collaboration with players in other fields will be initiated.

Paul Labrogère
Director, "Autonomous Transport" program, Technological Research Institute (IRT) SystemX
@PaulLabrogere

"We must make the autonomous vehicle's embedded intelligence secure."

What are the main challenges for the Systems Engineering program?

Today's city dweller wants to move around quickly and safely. Thus urban transport will probably change gradually. Our vehicles must be more connected and autonomous to meet this societal need. Equipped with sensors and innovative control systems, the new vehicle will contribute to better road safety and will ultimately save free or productive time for drivers in complete safety. They will also enable traffic to become more fluid and to develop new flexible public transport services adapted to traffic flows. Public transport will be more accessible for the disabled, the elderly and the most vulnerable customers. We are entering a technological revolution in system design and validation.

The Autonomous Transport program will enable all the players in the transport field to integrate digital technology into their products and systems, using new secure, safe architectures integrating the new usages, critical on-board and evolving infrastructures.

What are the development prospects for your program?

Under the 2016-2020 program, the Autonomous Transport program will meet the industrial challenges in development and deployment of autonomous transport services and solutions. It will conduct research projects in digital system architecture, alignment of sensors and decisions, autonomous, cooperative, safe and reliable vehicles, user interaction and ergonomy, and cybersecurity in intelligent transport.

More specifically, the program will be devoted to the following industrial challenges:

- Modelling and simulating autonomous transport systems.
- Designing safe architectures that can adapt to evolutions in autonomous transport.
- Developing secure, safe hard- and software platforms.
- Guaranteeing optimum traffic flow management.
- Ensuring consistent interactions between humans, vehicles and the environment.

What are the highlights of 2015 for you?

In 2015, the teams in the Autonomous Transports program completed a number of research and technological transfer tasks: development of the open source hypervisor for our partner Open Wide, completion of the Computer Aided Safety Methodology software (an integrated environment assisting engineers in analyzing operating safety), or again, enhancement of Esterel Technologies and Krono-Safe products on Alstom railway systems.

The program also joined several experiments on autonomous driver systems, new sensor technologies and digital identity modules. In addition, the SVA (autonomous vehicle security) project was initiated in 2015. The purpose of this project is to enable security and validation of the autonomous vehicle system, based on simulations.

The past year has been a busy one for the program, and the results have enabled relations between manufacturers and automobile equipment manufacturers to be improved. Moreover, competitiveness has been vastly improved (delays, costs and quality) by integrating PMI and ETI partners very early in the innovation cycle.

ELA

AUTOMOTIVE ELECTRONICS AND SOFTWARE

Project profile

PROJECT MANAGER:
Witold Klaudel

PROJECT DURATION:
36 months (launched July 2013)

INDUSTRIAL PARTNERS:
Continental, Intempora, Open Wide, PSA Peugeot Citroën, Renault, Valeo

ACADEMIC PARTNERS:
CEA, ESTACA, Institut Mines-Télécom, Université Paris-Sud

THESES:
- High integrity virtualization for multi-core platform
- Defining a metric of embeddability for computer vision algorithms applied to the ADAS
- Hierarchical scheduling for applications and virtual machines with multiple criticality in embedded ECU
- Methods for multicore realtime embedded application design in automotive

The ELA project meets the new technological challenges of the connected car and assisted driving systems (ADAS). Its main task is to propose new architecture for embedded electronics in the vehicle and to choose, adapt or develop technological components. Today's car can no longer be isolated in its environment.

The car has become more and more communicative, and is constantly changing. It offers new uses, which usually go with new threats. The car must be prepared for change, while maintaining safe operation and mastering costs. Current embedded architecture has not yet solved this challenge.

The ELA project will confront this issue and give a new impetus to French engineering by associating academic and the automobile equipment industry in a same location: SystemX.

HIGHLIGHTS 2015

- Demonstrations of our work on the occasion of several events: Future@SystemX, Systematic Convention and IRT Forum.

PROSPECTS 2016

- Finalization of all research works, implementation of all applications and creation of a common demonstrator combining all the applications in a common architecture.
- Adaptation of an open source virtualization solution to master the problem, encouragement of the automobile industry to adopt it.
- Methodological transfers to partners' engineering teams for design and fine tuning of embedded systems for autonomous and connected vehicles.
- Formalization of Cybersecurity analysis.

FSF

SAFE AND RELIABLE EMBEDDED SYSTEMS

Project profile

PROJECT MANAGER:
Élie Soubiran

PROJECT DURATION:
36 months (launched May 2013)

INDUSTRIAL PARTNERS:
Alstom, APSYS, Esterel Technologies, Krono-Safe, Scaleo Chip

ACADEMIC PARTNERS:
CEA, Inria, Institut Mines-Télécom, Université Paris-Sud

THESES:
- Definition of an execution platform for Mixed Criticality Systems integrating fault tolerance services in a multicore context
- Multiple-objectives architecture optimization by composition of model transformations
- Theorem Prover-Based Testing for Real-Time and Safety Critical Systems

The objective of the FSF project is to encourage the emergence of an industrial sector around execution platforms for rail systems, both main line and urban. Production volumes and development costs entail that greater quantities of generic products must be made and more Components Off The Shelf (COTS) in both hard and software should be used. Software COTS are typically real time operating systems, hypervisors or middleware components.

The COTS equipment studied in this project is essentially a system-on-chip for critical embedded use, with the particularity of integrating multi-core processors. The tools for the development, analysis, and system and software validation are also highlighted in the FSF project.

More precisely, the tool interface and integration in an industrial design process compatible with CENELEC (European Committee for Electrotechnical Standardization) standards for railways are enhanced. For instance, combining tools for formal analysis of operating safety and system specification tools provides added value to the two ranges of products. Another example is specialized tools for compiling and deploying railway apps on the FSF operating platform.

HIGHLIGHTS 2015

- Sixteen scientific publications and communications Demonstrations and presentations at several events:
  - Future@SystemX, Workshop AFIS EMEA 2015, Seminar held in the Paris region on operating safety, plenary meeting of the Systematic Paris Region Transport and Mobility group.
  - Co-organization of the OCL workshop 2015 satellite to Conference Models 2015.

PROSPECTS 2016

- Demonstration of project results at the SystemX annual event: Future@SystemX.
- Safety engineering environment prototype currently at the manufacturing stage by our industrial partners.
- Assistance in bringing new functions to maturity for partners supplying technologies.
- Creation and transfer of functions in the TREC platform for critical systems developed for a railway use case.

ISE

ITS SECURITY

Project profile

PROJECT MANAGER:
Brigitte Lonc

PROJECT DURATION:
36 months (launched July 2014)

INDUSTRIAL PARTNERS:
OpenTrust, Oppida, PSA Peugeot Citroën, Renault, Trialog, Valeo

ACADEMIC PARTNER:
Institut Mines-Télécom

Tomorrow's vehicles will be connected and communicating with their environment (vehicles and road infrastructures), thus fostering the development of new ITS (Intelligent Transport System) applications to improve traffic management, road safety and mobility and convenience services. This automobile revolution brings new technological and economic challenges: designing cooperative, inter-operable vehicles, a system for secure communications management, preparation of reliable and secure systems for the future connected and autonomous vehicle. These future V2V/V2I (vehicle-to-vehicle/vehicle-to-infrastructure) communicating systems will therefore require security and trust based digital systems.

The main goal of the ISE project is to implement the infrastructure for managing security in these ITS cooperative systems. The challenge is a major one because these ITS systems must be capable of processing thousands of fully secure messages per second and providing fully guaranteed protection of personal data in conformity with the national and European provisions.

The trust based infrastructure (ICP, Public Key Infrastructure) developed under the ISE project, must therefore meet the requirements of very large scale infrastructure, to be able to transmit billions of digital identities to the embedded ITS stations. Secondly, the ISE also aims to define process and test systems leading to certification of the security of our ITS cooperative systems.

HIGHLIGHTS 2015

- Presence at the World ITS Congress (Bordeaux) from 5 to 9 October 2015.
- Contribution to preparing deployment of the security system in a French and European context, not least in the European consortiums (Car2Car Communication Consortium), and contributions to the C-ITS platform at the European Commission.
- Participation in excellence networks and groups of experts on cybersecurity and advances in cryptography.
- Demonstrations at Future@SystemX 2015.

PROSPECTS 2016

- Presentation of project results at Future@SystemX 2016 and of C-ITS mobility plug test at ETSI in November 2016.
- Completion of modules of a digital identity manager in the SCOOP@F project for validation on bench, tracks and open roads.
- Setting up methodology for conformity and interoperability testing of V2X boxes.

LRA

LOCALIZATION – AUGMENTED REALITY

Project profile

PROJECT MANAGER:
Sabine Langlois

PROJECT DURATION:
36 months (launched October 2013)

INDUSTRIAL PARTNERS:
Alstom, Assystem, OKTAL, Renault, Sysnav, Valeo

ACADEMIC PARTNER:
CEA

THESES:
- Designing cooperation principles for autonomous driving system
- Augmented Reality adaptative Human-Machine Interface for the autonomous automotive driving

The LRA project is designed for automobile sectors, to develop an autonomous, connected vehicle, and for the railways sector, to track changes in signaling solutions, in a context where there is a major change in localization technologies and interaction between driver/vehicle/environment where a vehicle is automated. The combination of Localization and Augmented Reality offers automobiles and trains high performances and safe operation at lower costs.

Localization for guiding purposes today is mostly carried out by the GPS for automobiles, and costly sensors that are sensitive to the environment for railways. However, new driving aids such as autonomous operation of the automobile, which allows the driver to delegate driving to the vehicle, mean that the interaction between man and machine needs re-thinking.

The goal of the LRA project is to give the driver a localization system and improve the possibilities of interaction between man and machine by using augmented reality. The technological challenges in this project are the increasing complexity of localization and driving aid systems, with the emergence of new technologies for sensors and IHM (man-machine interface) and the cost.

HIGHLIGHTS 2015

- Presentations and demonstrations at NI Days, Future@SystemX and the Users Day at our partner Oktal.

PROSPECTS 2016

- User tests by using Dr SiHMI 's simulation platform on a user case of vehicle driving to assess the contribution of augmented reality.
- Experimental evaluation of a new odometric - tachymetric solution for detailed localization with safe operation for urban and suburban signaling systems.
- Proving object detection and recognition in railways to help drivers in improving knowledge of the line, including acquisition and video notes, creation of an image data base, learning.

SVA

SIMULATION OF AUTONOMOUS VEHICLE SAFETY

2015 PROJECT

Project profile

PROJECT MANAGER:
Jean van Frank

PROJECT DURATION:
48 months (launched February 2015)

INDUSTRIAL PARTNERS:
All4Tec, Apsys, Assystem, Continental, Oktal, PSA Peugeot Citroën, Renault, Sector, Valeo

ACADEMIC PARTNERS:
CEA, LNE, Université Technologique de Compiègne

THESES:
- Application of formal methods to mastering development of embedded systems in autonomous vehicles

The purpose of the SVA project, launched in February 2015 for the Autonomous Vehicle NFI plan (New Industrial France), is to respond to the challenge of complex demonstration of security in autonomous vehicles by digital simulation. This complexity, due to the large number of situations the driver meets on the road, their uncertainty, and the on board technology, makes validation using tests in real use very costly, indeed impossible for some.

Project goals are:

- To provide manufacturers and auto parts manufacturers with a methodology, a platform and simulation tools for designing safe autonomous vehicles and validating them.
- To specify, adapt or develop models of vehicle parts and environment to be able to simulate the vehicle's behavior in the event of a failure of one of the parts, and also the incidence on its operation of external factors such as absence of markings on road, rain, dazzling, etc.).

HIGHLIGHTS 2015

- Setting up the modular platform in advance of the project needs, and carrying out a demonstration for the partners.
- Launching of a thesis in collaboration with the LSV (specification and verification laboratory) at ENS Cachan on application of formal methods to design and validation of an autonomous vehicle.

PROSPECTS 2016

- Launching of a second thesis on this project.
- Implementation of a proof of concept for the validation platform of an autonomous vehicle based on a usage case eg. Traffic Jam Chauffeur.
- Extension of the work to reinforce operating safety in autonomous vehicles to the European field to adapt the platform and tools to the specificities of vehicles in an industrial context.

Charles Kremer
Smart Territories program Director, Technological Research Institute (IRT) SystemX
@CharlesAKremer

"Building tomorrow's Intelligent Territories."

What are the main challenges for the Smart Territories program?

The emergence of digital equipment, entailing new services, leads to new usages. Cities, and more generally socio-economic territories, will in the coming years deploy new, highly innovative solutions and services. They will rely on emerging digital technologies to contribute to making districts, cities, regions and countries, more habitable, sustainable, safe and attractive.

The Smart Territories program will enable all stakeholders in transport and energy to deploy new solutions and new services, relying on the decision aid tools required for the optimization and operational planning of future territories.

What are the development prospects for your program?

In the framework of the 2016-2020 roadmap, the Smart Territories program will place humans at the heart of tomorrow's territories by characterizing usages that carry value and conducting research projects based on modeling and optimization of mobility solutions, trust based Internet and intelligence of digital exchanges and data processing to optimize urban services.

More concretely, the industrial challenges that SystemX proposes to contribute to meet in 2016 to enable development and deployment of innovative services in smart territories are the following:

- Modeling and simulating intelligent territories integrating every scale.
- Designing sustainable architectures for changing territories.
- Developing platforms supporting services for all the players in the territory.
- Guaranteeing reliability and security in data processing.

Ensuring system interoperability and performances in a territory.

What are the highlights of 2015 for you?

Last year was very busy. One of the main events was undoubtedly the launching of the Anthropolis Chair, in collaboration with CentraleSupélec, and the main challenge was to define the new usages in tomorrow's urban mobility by developing eco-innovations.

In parallel, the research work carried out for the three projects in the Smart Territories program: MMI (Multimedia Multilingual Integration), MIC (Modeling - Interoperability - Cooperation) and SCE (Smart City Energy analytics) were the subject of two APP patent applications in 2015 and a patent currently being filed. I invite you to discover the results of these projects in more detail in the following pages.

ANTHROPOLIS CHAIR

2015 PROJECT

Project profile

PROJECT MANAGER:
Jakob Puchinger

PROJECT DURATION:
48 months (launched April 2015)

INDUSTRIAL PARTNERS:
Alstom, ENGIE, RATP, Renault, SNCF

ACADEMIC PARTNER:
CentraleSupélec

THESES:
- Human Centered Urban Mobility - Users, Usage Scenarios and Novel Services

The main challenge for the Anthropolis Chair, or HCU (Human Centered Urban systems design) project, is to define the new uses in tomorrow's urban mobility based on development of eco-innovations. SystemX has created the Anthropolis Chair in collaboration with the LGI (Industrial Engineering Laboratory) of CentraleSupélec, focusing on modeling and design of complex socio-technical systems. This chair will gather a pluridisciplinary team on the theme of urban mobility.

The overall objective is to build bricks of knowledge to develop modeling and simulation tools for sustainable urban systems, centering the approach on behavior and usage. The Chair will focus more particularly on mobility systems and their interactions with the other urban systems. It places human beings at the center of these new usages and mobilities, dividing the research into three main areas:

- **State of the art and usage scenarios:** identification of mobility behavior and usage typologies, and design of scenarios for the next thirty years.
- **Breakthrough subjects and innovation:** identification of existing or potential breakthrough subjects and innovations, in the service of urban systems (experiments, Living Lab, etc.).
- **Impact on urban systems:** adaptation of simulation tools to assess the impact of integrating breakthrough subjects into urban systems, and identification of changes entailed on the economic models of mobility solutions.

The chair also has a vital role in training and teaching since one of its purposes is to train students, engineering students, and masters and doctoral students at CentraleSupélec, not least in the energy and transport sectors, giving them in depth knowledge of the strategic, technological and socio-economic challenges in these sectors. Finally, the chair aims to achieve research excellence and will encourage collaboration with international researchers.

MULTIMEDIA MULTILINGUAL INTEGRATION

Project profile

PROJECT MANAGER:
Olivier Mesnard

PROJECT DURATION:
36 months (launched November 2013)

INDUSTRIAL PARTNERS:
Bertin Technologies, Capgemini, EXALEAD, Ministère de la Défense, OVH.com, Systran, Temis, Vecsys, Vocapia Research

ACADEMIC PARTNERS:
CEA, Inria, LNE, Université Pierre et Marie Curie (UPMC)

THESES:
- Real-Time analysis of diffusion processes on large scale social networks
- Towards coherent probabilistic knowledge bases

The IMM (Multimedia Multilingual Integration) project responds to the increase of data produced and disseminated throughout the world, doubling in volume every year. The project must meet the need for development of tools to assist the watch practitioner in extracting from the flow of unstructured data (mostly text and audio) the knowledge that can be used at a given moment to produce a report or take a decision.

The studies that will need to be carried out will address the passage to another scale, taking account of multiple data on the links and hubs of the network, and of its dynamic aspect. It will develop visualization tools adapted to large scale networks. The operating fields concerned will be crisis management, cyber security and strategic watch.

HIGHLIGHTS 2015

- Improved quality of results in base functions, automation of certain operations (manufacture/deployment), implementation of mechanisms for a move to a bigger scale and migration to new infrastructure with availability of resources on demand.
- Specification of a civil usage of watch case (marketing study, economic model, design) and implementation, especially in monitoring, of collection and innovative visualization of data jointly gathered with Air Liquide and Docapost.
- Presentation of solutions implemented in the Continuous Integration Platform (PIC) project, to automate manufacture and implementation at Temis.
- Systran used a demonstration of the IMM project to highlight its translation solutions in the framework of an international tour by its sales staff.

PROSPECTS 2016

- Construction of a product offer commercialisable by all the partners, using technological bricks developed and integrated into the VITAL platform.

MODELING - INTEROPERABILITY - COOPERATION

Project profile

PROJECT MANAGER:
Lionel Scremin

PROJECT DURATION:
42 months (launched June 2013)

INDUSTRIAL PARTNERS:
Alstom, Artelys, IDIT, Renault, SNCF, The CoSMo Company

ACADEMIC PARTNERS:
CEA, IFSTTAR, Inria, Université Pierre et Marie Curie (UPMC)

THESES:
- Positioning and sizing of an electric vehicle carsharing system in a multimodal transport environment
- Modeling of Multimodal transportation systems of large networks
- Supervision in Multimodal Transportation Systems

The MIC project focuses on multi-modal transportation, for which the challenge is to optimize multi-modal mobility by finding the right balance between transport time, cost, energy consumption and access to transports.

The goals of the MIC project are:

- To develop technologies enabling multi-modal travel to be facilitated, especially in urban areas, first by optimizing transport means and second, ensuring supervision of transportation such that operation is optimal in the daily reality of running requirements.
- To demonstrate the usability of the technological bricks developed via demonstrators representing use cases and assess the relevant economic models.
- To extend the capacity of the system development environments to take effective account of the Systems of Systems aspect while ensuring safe operation.
- To define the open Systems of Systems architecture with respect to a variety of motivating business models for the various players in transportation.
- To facilitate analysis of both business and technical alternative, building a modeling framework coupled to both these dimensions to enable description and verification of various "structured" scenarios so that they can be compared.

HIGHLIGHTS 2015

- Presentation of the second version of the demonstrators to Alstom and the SNCF.
- Organization of the MIC@SystemX Day on 26 November, 2015, to present the results to our partners.

PROSPECTS 2016

- Prospective industrialization of the tools for aid to passenger mobility that have been developed.
- Improving skills and maturity of the problem of multimodal supervision and continuation of the work with the IRT for a new project as of 2016.
- Industrialization of complex models of the mobility system.

SMART CITY ENERGY ANALYTICS

Project profile

PROJECT MANAGER:
Amira Ben Hamida

PROJECT DURATION:
48 months (launched October 2014)

INDUSTRIAL PARTNERS:
Alstom, Artelys, Ecogélec, ENGIE, G2 Mobility, GE Grid Solutions, Novener, OVH.com, Sherpa Engineering, Reuniwatt, The CoSMo Company

ACADEMIC PARTNERS:
CEA, CentraleSupélec, IFSTTAR

THESES:
- Management of a smart urban grid
- Data-mining tools for spatio-temporal energy data analysis

Energy management is a major concern for cities, not least for environmental reasons. With the energy transition and its goal of progressively integrating into the overall mix of new sources of renewable energy, the production of energy, transport and distribution networks, known as grids, will evolve from a vertical architecture with predictable running into an increasingly horizontal one called peer-to-peer, which is less and less predictable. It is therefore vital for cities to adopt more intelligent management so that energy consumption and also energy generation can be controlled as well as possible.

Given this evolution, data management has become a major issue for energy operators, so that the exponential growth of data produced by the various interested parties can be fully exploited. These include data on individual energy consumption, personal mobility, electrical vehicles, availability and generation of renewable energies and so on.

The new technologies of Big Data and their ability to extract meaning from global and local behaviors or capacities, it will become possible to develop interaction between buildings, districts, public transport and electrical vehicles, taking account of the constraints of the electricity grid. City dwellers and players will become more "intelligent" due to their capacity to measure and act more appropriately. The SCE project seeks to develop an open data analysis platform associating technology suppliers, system integrators, energy and transport services, operators and academic research. This platform will enable testing of the various energy management strategies and possible lead to new business models.

HIGHLIGHTS 2015

- State of the art covering the main research and development aspects addressed by the project.
- Implementation of a demonstrator for a Smart Home and implementation of a district energy rub out applied to an individual home. The first version of this demonstrator was presented at Future@Systemx in March 2015 and a more developed version was presented at the IRT Forum in October 2015.
- Highlighting of a number of results in international scientific publications (CSD&M 2015 and ICMLA 2015).
- New partners joined the project: Novener and Reuniwatt.

PROSPECTS 2016

- Implementation of the SCE platform architecture and its integration into the MOST technological platform.
- Building of the Smart Building demonstrator for the Future@SystemX 2016 event.
- Proof of concept developed for testing in the field for prospection/commercial enhancement purposes.

Paul Labrogère
"Internet of Trust" program Director, Technological Research Institute (IRT) SystemX
@PaulLabrogere

"Deploy an Internet of Everithing."

What are the main challenges for the Internet of Trust program?

The connected world is a vector of both immense innovations to come and also new risks. The Internet of Things has completely changed our working methods in rhythm with new technological evolutions enabling us, for instance, to control a production line remotely, or communicate in real time within a team scattered over several distant worksites. The opportunities offered by IoT are far from being fully used, and bear the promise of future great revolutions. Digital infrastructures are the basis of digital transformation and security must be at the heart of future industrial developments. The main challenge is to be able to deploy the Internet with machines and computers provided with the right security, and thus be able to attain essential "digital trust".

The Intertnet of Trust program will enable all the players in ICT to make digital infrastructures more flexible, high-performance and secure thanks to the development of new architectures and new software tools.

What are the development prospects for your program?

Under the 2016-2020 roadmap, the Internet of Trust program will enable us to confront the evolution in digital infrastructures by conducting research based on convergent and cloud-programmable architectures, steering by Network Function Virtualization (NFV) and the open experimental cybersecurity platform. More specifically, the program will work to address the following industrial challenges:

- Designing new convergent cloud/telecom programmable architectures.
- Modeling and simulating large distributed infrastructures, requests for resources for safe access.
- Develop tools and methods for control, management, orchestration and supervision of virtualized, secure functions.
- Guarantee fully secure performances, elastic usage and sharing of infrastructures.
- Conduct experiments on open platform to evaluate technologies and usages.

What are the highlights of 2015 for you?

The year 2015 was crucial for the Internet of Trust program because it marked its construction around two research projects:

- The ARE (Network Architecture) project, launched in May 2014, expanded this year with the arrival of new partners contributing skills in the field of network architecture.
- The EIC (Environment for Interoperability and Integration in Cybersecurity) project, launched in February 2015, dedicated to processing the scientific and technological obstacles in cybersecurity.

I invite you to discover these two projects in more detail in the following pages.

ARE

NETWORK ARCHITECTURE

Project profile

PROJECT MANAGER:
Luca Muscariello

PROJECT DURATION:
36 months (launched January 2014)

INDUSTRIAL PARTNERS:
Cisco, Expemb, Nokia, Orange

ACADEMIC PARTNER:
Institut Mines-Télécom

THESES:
- Applying Information Centric Networking Principles To today's Networking Challenges: Performance and Design

The ARE project is based on the observation that the Internet architecture designed over thirty years ago is no longer ideally suited to today's usages and applications, and is increasingly struggling to cope with the sustained growth of traffic (some 40% per year).

This project, sharing the second SystemX site in Paris under the strategic partnership concluded with the LINCS (Laboratory of Information, Networking and Communication Sciences), is part of the ecosystem of international research including industrial and academic players from all over the world already working on this area, and connects with many collaborative projects already under way in Europe, Asia and the United States.

The main goal of the project is to create the technical components of tomorrow's Internet which will enable continuous development of new communications and content diffusion services in the most favorable technological and economic conditions. For this purpose, ARE is developing new solutions for the Internet of the future by re-thinking network organization, distribution and function implementation, in order to define an architecture better meeting the requirements of the many players (users, infrastructure providers, content providers, service operators, etc.).

HIGHLIGHTS 2015

- Two new partners joined the project: Cisco and Expemb.
- Publication of eight articles in Congress proceedings, presentation of two articles in the form of posters.
- Presentations at international events: ACM SIGCOMM ICN (San Francisco), International Teletraffic Congress (Ghent, Belgium), ICNRG interim meeting (Boston).

PROSPECTS 2016

- Experimental center to be set up in the NDN testbed which now has some thirty spread over three continents: America, Europe and Asia.
- Information-Centric Networking proof of concept set up for low-cost corporate access routers.

EIC

ENVIRONMENT FOR CYBERSECURITY INTEROPERABILITY AND INTEGRATION

2015 PROJECT

Project profile

PROJECT MANAGER:
Philippe Wolf

PROJECT DURATION:
60 months (launched February 2015)

INDUSTRIAL PARTNERS:
Airbus, Bertin Technologies, ENGIE, Gemalto, Prove&Run

ACADEMIC PARTNERS:
CEA, Institut Mines-Télécom , Université Technologique de Troyes

THESES:
- Simulation of activities and attacks: application to cyber defense

Protection of information systems and the data they carry (Intelligent City, Smart Grids, Autonomous connected vehicles, Connected health, Internet of Things, Big Data, Cloud, etc.) require complex arbitrages between ease of use, cost of security, safe operation, compliance with ever changing digital law and understanding and anticipation of the market and its players.

The development of the cybersecurity market, one of the plans chosen by the NFI (New Industrial France) committee, requires advances in systems of systems engineering. The EIC project explores the risks in the cybersecurity of tomorrow's systems via an experimental technical cybersecurity platform called CHESS (Cybersecurity Hardening Environment for Systems of Systems).

The human, political and economic components cannot be separated from defense technologies for these new interconnected information systems. The EIC project is also conducting concerted, consistent research in economic and legal fields. For instance, it looks to anticipate the accepted ergonomics of security functions in the new intelligent systems.

HIGHLIGHTS 2015

- Labeling of the EIC project by the committee of the security industry arm (CoFIS) in February 2015.
- Construction of the CHESS platform.
- Launching of a thesis entitled "Simulation of activities and attacks: application to cyberdefense".
- Structuring concerted and consistent research in human and social sciences, in two interconnected fields: "economic and financial modeling of cybersecurity and insurance risk", and "Legal and regulatory Strategies and solutions in cybersecurity".
- Presentations and demonstrations at several events: "War and Geography" Colloquium: Cooperative Intelligent Transport Systems Security, "Cybersecurity in the intelligent city", 9th ARCSI meetings, IEEE World Forum on Internet of Things.

PROSPECTS 2016

- Launching of a thesis on the protocols and architecture for authorization delegation and token management for secure communications in the Internet of Things.
- Implementation of the CHESS (Cybersecurity Hardening Environment for Systems of Systems) platform for a demonstrator on a Smart Grid user case (digital energy usages).

SystemX concluded several collaboration agreements in 2015 to enrich its scientific and technological knowledge in many fields: cybersecurity, autonomous vehicles, embedded systems, Big Data, etc.

Training and communications actions will also result from these alliances, as well as greater cooperation when responding to calls for collaborative projects (H2020, FUI, etc.) and for NFI (New Industrial France) plans.

Created in 2010, the **"Cercle des Partenaires IHEDN"** (IHEDN Partners Circle) fund assists the development of these projects as part of its mission, as well as exceptional projects qualified by the IHEDN (Institut des Hautes Études de Défense nationale, school of higher studies in national defense).

ICT4V (Information and Communication Technologies for Verticals) is a Uruguayan multidisciplinary technology center specialized in the field of ICT.

The Institute of Technological Research (IRT) Saint Exupéry supports aeronautics, space and embedded systems and aims to accelerate the development of breakthrough technologies to make this industry more competitive globally by conducting research in three leading fields: high performance multifunctional materials, technology for more electrical aircraft, and embedded systems.

The **EFFICACITY** Institute is one of the ITEs (Institutes for energy transition) set up by the French government's PIA (Program for investments in the future). It mobilizes the R&D capacities of large international companies (EDF, ENGIE, Veolia, IBM France, RATP), engineering companies and State research organizations and specializes in the field of urban energy efficiency.

The **VEDECOM institute** (Communicating decarbonated vehicle and its mobility) is one of the ITE (Institutes for energy transition) set up by the French government's PIA (Program for investments in the future). Its purpose is to assist its entire ecosystem in creating high performance innovation in the field of mobility.

PHD CLOSE UP

SystemX allows its doctoral students to specialize in a field with promise for the future, after obtaining an engineering or master's degree. Throughout their theses, they will be in a dynamic environment combining the expertise of professionals from the industrial and academic worlds in the 17 research projects at the institute.

Plunged into the heart of a scientific and technical community at the leading edge of tomorrow's technologies, they are building up a strong network and are developing unique expertise which will be the key to their professional future. Over the year 2015 the institute assisted 34 doctoral students. We would like to introduce you to four of them: Raïssa, Laura, Thibault and Pierre-Marie.

Raïssa POKAM

Profile

- Age 24
- Thesis under the LRA (Localization - Augmented Reality) project
- 2nd year
- Engineering degree in operating safety / Master in Systems Optimization and Safety (Université Technologique de Troyes)

WHAT IS THE SUBJECT OF YOUR THESIS?

I am working on the design of an interface with augmented reality for automated driving of an automobile. In other words, I am looking for rules that will allow transmission of specific information following a certain modality, in the context of total delegation of the vehicle control. The added value of augmented reality is preferred in choices of visual representation.

WHY DID YOU JOIN SYSTEMX TO DO YOUR DOCTORATE?

I wanted to do a doctorate but on one condition: I did not want the thesis to be written in a single laboratory. Thus, when I discovered and analyzed the thesis proposal from the LRA project at SystemX, I was overjoyed at the number of partners involved in the project.
In my view, SystemX is a "labora-dustry". This neologism shows the institute's capacity to give a research environment worthy of a real laboratory while opening up to industrial collaboration in addressing today's issues. Among the problems is of course the autonomous vehicle which is currently in the spotlight with the strategy of the NFI (New Industrial France) program. Doing a doctorate at SystemX is thus the opportunity to work on a subject at the leading edge of innovation and collaborate with several academic and industrial partners.

CAN YOU DESCRIBE SYSTEMX IN THREE WORDS?

Pro-action, collaboration and innovation.

Laura ROA CASTRO

Profile

- Age 27
- Thesis under the SIM (Engineering and Multi-Disciplinary Simulation) project
- 3rd year
- Engineering degree in industrial engineering (INSA Lyon) and engineering degree in industrial engineering (Universidad Nacional de Colombia)

WHAT IS THE SUBJECT OF YOUR THESIS?

My thesis is about improving collaborative design in a context of model exchanging for the vehicle industry in the first development stages. More precisely, I am interested in modeling complex organizational systems.
I am trying to model the new collaborative systems intrinsically introduced into the organization as a consequence of the arrival of digital simulation. Once the system is modelled and understood, I interpret the problems to find a solution.

WHY DID YOU JOIN SYSTEMX TO DO YOUR DOCTORATE?

After taking my Masters and a few experiences in the industrial sector, I was attracted by the combination of the academic and industrial worlds. I wished to continue my studies while applying my knowledge to the industrial field, giving me concrete experience for the future. When I discovered the theses proposed by SystemX, I understood that it offered me the possibility of applying my research in several industrial companies, which would give more value to my work in terms of generalizing the problem and finding a useful solution.

CAN YOU DESCRIBE SYSTEMX IN THREE WORDS?

Ethics, pluridisciplinarity and multiculturalism.

Thibault GISSELBRECHT

Profile

- Age 27
- Thesis under the IMM (Multimedia Multilingual Integration) project
- 3rd year
- Engineering degree (SUPAERO)

WHAT IS THE SUBJECT OF YOUR THESIS?

The purpose of my thesis is to offer models of information diffusion in the social networks. Concretely, you have to anticipate how a content (for instance a hashtag, a video or an article) can spread from one person to another. Many applications are possible, such as detecting influential users or sources, or again maximizing the impact of an advertising campaign on the network. To do so, I and my research team study the relationships between people (friends, subscriptions and subscribers, etc.) their profiles (eg. their centers of interest) or their jobs. To test the models, Twitter is an excellent laboratory, because the data are globally public and accessible, contrary to those of other social networks.

WHY DID YOU JOIN SYSTEMX TO DO YOUR DOCTORATE?

I arrived at the start of SystemX, which partners the university where I'm doing my thesis, Université Pierre et Marie Curie. The institute offers an exceptional environment to its doctoral students because the work done under their projects has a very concrete application: the algorithms we develop are integrated into a tool that can serve industry. We work with researchers from many sectors, which offers us interesting prospects for collaboration.

CAN YOU DESCRIBE SYSTEMX IN THREE WORDS?

Pluri-disciplinarity, creativity and conviviality.

Pierre-Marie BAJAN

Profile

- Age 24
- Thesis under the EIC (Environment for Cybersecurity Interoperability and Integration) project
- 1st year
- Engineering degree from Télécom SudParis

WHAT IS THE SUBJECT OF YOUR THESIS?

I am working on "Simulation of activities and attacks: application to cyber defense". In practice, I am seeking to simulate the information system of a company to enable cyber-attacks to be studied and tested when the network is acting normally.

WHY DID YOU JOIN SYSTEMX TO DO YOUR DOCTORATE?

My thesis director presented SystemX as an institute offering a unique environment and prospects for working on research topics that would matter in the future, while also giving the opportunity to meet people in industry and keep up to date with corporate issues. In addition, the goals and research in the EIC project corresponded to my own interests spurring me on to join the IRT.

CAN YOU DESCRIBE SYSTEMX IN THREE WORDS?

Dynamism, entrepreneurship and conviviality

If I had to give a more precise description, I would say the Institute offers a unique combination of rich ambition and interesting technical resources, in a pleasant and inspiring work environment.

A Cloud-based Platform to Ensure Interoperability in Aerospace Industry	M. Khalfallah, N. Figay, C. Ferreira Da Silva, P. Ghodous	Journal of Intelligent Manufacturing
A cooperative control architecture for automated driving system	C. Guo	ITS
A meta-model for the Isabelle API	F. Tuong, B. Wolf	Archive of Formal Proof
A modal analysis oriented reduction methodology using component eigenmodes and Arnoldi enrichment	H. Tournaire, F.Renaud, J-L. Dion	CFM
Activity Analysis and Systemic Approach of Driving Delegation Situations: Value for the Understanding of the Autonomous Driving Activity	C. Poisson	SELF
Analysis of Latency-Aware Caching Strategies in Information-Centric Networking	G. Carofiglio, L. Mekinda, L. Muscariello	The 11th International Conference on emerging Networking EXperiments and Technologies
An Approximate Method For Routing In Road Networks	O. Dib, A. Caminada, M-A. Manier	ITSC 2015
A reduction methodology using free-free component eigenmodes and arnoldi enrichment	H. Tournaire, F.Renaud, J-L. Dion	ASME
Augmented Reality Interface Design for Autonomous Driving	R. Pokam	ICINCO
Augmented Reality Interface Design for Autonomous Driving	R. Pokam	FAST zero
Automatic selection and composition of model transformations alternatives using evolutionary algorithms	S. Rahmoun, E. Borde, L. Pautet	VAQUITA 2015
A Zeroing Methodology Using Proper Modes of Component and an Arnoldi Enrichment	H. Tournaire, F.Renaud, J-L. Dion	CSMA
Beam-Tracing Domain Decomposition Method for Urban Acoustic Pollution	G. Gbikpi-Benissan, F. Magoules	DCABES 2014
Car-Sharing System Optimization with Constraints of Vehicles Resettlement	A. Carlier, A. Munier-Kordon, W. Klaudel	16th ROADEF conference
Collaborative Model-Driven Engineering	L. Wouters	IRT SystemX
Cooperative-ITS Architecture and Security Challenges: a Survey	A. Boudguiga, A. Kaiser, P.Cincilla	22th ITS World Congress
Definition of the collaborative simulation system (CM&SS) from a systemic perspective in vehicle industry context	L. Roa Castro, J. Stal-Le Cardinal	International Conference On Engineering Design, ICED15, Milan, Italy, 2015
Design Complex Systems with Simulation: the SIM Project Quest	L. Gasser	SIA Days
Digital Factory System for Dynamic Manufacturing Network supporting Networked Collaborative Product Development	D. Tchoffa, N. Figay, P. Ghodous, E. Exposito, Lyes Kermad, T. Vosgien, A. El Mhamedi	Knowledge Engineering for Enterprise Integration, Interoperability and Networking: Theory and Applications

Driving Automation: Removal or Change of the Driver Activity?	C. Poisson	Epique
Dynamic Manufacturing Network, PLM Hub and Business standards testbed	N. Figay, E. Exposito, P. Ghodous, D. Tchoffa, A. El Mhamedi	Knowledge Engineering for Enterprise Integration, Interoperability and Networking: Theory and Applications
Dynamic Model for Assignment in "Sky-car" Transit System – Spatial Interactions with other Common Transport Modes	K. Sossoe, J-P. Lebacque	TGF15
Exact and Heuristic Resource Mapping Algorithms for Distributed and Hybrid Clouds	M. Machtri, M. Hadji, D. Zeghlache	IEEE Cloud Computing, Transactions On
FOCAL: Forwarding and Caching with Latency awareness in Information-Centric Networking	G. Carofiglio, L. Mekinda, L. Muscariello	GLobeco
Generalized mixed-criticality scheduling based on RUN	R. Gratia, T. Robert, L. Pautet	RTNS
Generating Executable Workflows from solution plans	M. Khalfallah, NFI Figay, P. Ghodous, M. Barhamgi	IEEE ICWS
Hierarchical Content Stores in High-speed ICN Routers: Emulation and Prototype Implementation	R. Mansilha, L. Saino,M. Barcellos, M. Gallo, E. Leonardi, D. Perino, D.Rossi	2nd ACM SIGCOMM conference
Improving performances of the AltaRica 3.0 stochastic simulator	B. Aupetit, M. Batteux, A. Rauzy, J-M. Roussel	ESREL 2015
Improving profit through cloud federation	S. Rebai, M. Hadji, D. Zeghlache	IEEE CCNC
LAC: Introducing Latency-Aware Caching in Information-Centric Networks	G. Carofiglio, L. Mekinda, L. Muscariello	The 41st IEEE Conference on Local Computer Networks (LCN),
Light Blind: Why Encrypt If You Can Share?	P. Cincilla, A. Boudguiga, M. Hadji, A. Kaiser	SECRYPT 2015
Management and Re-use of Simulation Datas: Towards a Verification and Validations Approach of Models	A. Ottino, J. Le Duigou, T. Vosgien, N. Figay, P. Lardeur, B. Eynard	CFM2015
Mathematical Programming Approach for Revenue Maximization in Cloud Federations	M. Hadji, D. Zeghlache	IEEE Cloud Computing, Transactions On
Memetic algorithm for computing one-to-one shortest path in multimodal transportation networks	O. Dib, A. Caminada, M-A. Manier	EWGT2015
Memetic algorithm for solving one-to-one shortest path problem	O. Dib, A. Caminada, M-A. Manier	16th ROADEF conference
Model Based Enterprise Modeling applied to Dynamic Manufacturing Network and PLM interoperability test bed within the Aeronautic, Space and Defense digital business ecosystem	N. Figay, P. Ghodous, B. Chariat, E. Exposito, T. Vosgien, L. Kermad, E M. Dafaoui	IWEI 2015
Multi-Objectives Refinement of AADL Models for the Synthesis Embedded Systems (μ -RAMSES)	S. Rahmoun, E. Borde, L. Pautet	ICECCS 2015
On the performance of i.MX6 Cryptographic Acceleration and Assurance Module	A. Boudguiga, W. Klaudel, J. Durand Wesolowski	Rapido'15

Organize the Design Guided by the Simulation in a Collaborative and Multidisciplinary Context. Case Study of an 0D-2D Aerothermal Couplage	L. Gasser	"Systems Simulation" NAFEMS Day, Noisy Le Grand, France
Pending Interest Table Sizing in Named-Data Networking	G. Carofiglio, M. Gallo, L. Muscariello, D. Perino	2nd ACM SIGCOMM conference
Performance and cost effectiveness of caching in the mobile access network	S-E. Elayoubi, J. Roberts	2nd ACM SIGCOMM conference
Performance Evaluation of Video Transcoding and Caching Solutions in Mobile Networks	S-E. Elayoubi, J. Roberts	27th International Teletraffic Congress
PLM standards modelling for enterprise interoperability: A manufacturing case study for ERP and MES systems integration based on ISA-95	E. Moones, T. Vosgien, L. Kermad, E M. Dafaoui, A. El Mhamedi, N. Figay	IWEI 2015
Policies for Contextual Bandit Problems with Count Payoffs	T. Gisselbrecht, Sylvain Lamprier and Patrick Gallinari	ICTAI 2015
Pragmatic PLM Process Interoperability for Aeronautic, Space and Defence DMN	N Figay, P. Ghodous, C. Ferreira Da Silva, S. Ghafour	Journal of Aerospace Operation
Presentation of Works on ISA 95	E. Moones	GT easy DIM
Product-Based Business Processes Interoperability	M. Khalfallah, M. Barhamgi, N. Figay, P. Ghodous	SAC '13 Proceedings of the 28th Annual ACM Symposium on Applied Computing
Product Life Cycle Management standards within a Dynamic Manufacturing Network: a successfull approach for interoperability of New Generation Enterprise Information Systems	N. Figay, D. Tchoffa, P. Ghodous, E. M. Dafaoui, A.E. Mhamedi	Model Based Systems Engineering for Next Generation Enterprise Information Systems
Provenance aware monitoring systems	M. Khalfallah, NFI. Figay, P. Ghodous	IEEE Transactions on services computing 2015
RACE: Risk Analysis For Cooperative Engines	A. Boudguiga, A. Boulanger, P.Chiron, Witold Klaudel, Houda Labiod and Jean-Christophe Seguy	NTMS 2015
Ray-tracing domain decomposition methods for real-time simulation on multi-core and multi-processor systems	F. Magoulès (Centrale Supélec), G. Gbikpi-Benissan (SystemX), and P. Callet (Mines Paris Tech)	Concurrency and Computation: Practice and Experience
Resolving Interoperability in Concurrent Engineering	N. Figay, P. Ghodous, R.Goncalvez, C. Ferreira Da Silva	Concurrent Engineering in 21st Century - Foundations, Development and Challenges
SDF Modeling of Simulink Communications	E C. Klikpo, Jad Khatib, A. Munier-Kordon	ETR 2015
Scalable Mobile Backhauling via Information-Centric Networking	G. Carofiglio, M. Gallo, L. Muscariello, D. Perino	The 21st IEEE International Symposium on Local and Metropolitan Area Networks
Scheduling of mixed-criticality systems with RUN	R. Gratia, T. Robert, L. Pautet	ETFA 2015
Security of C-ITS messages: A practical solution the ISE project demonstrator	P. Cincilla, A. Kaiser, B. Lonc, H. Labiod, R. Blancher, C. Jouvray, R. Denis, A. Boulanger	NTMS 2015
Shared Control with Haptic Feedback for Automatic Vehicle Longitudinal Control: A Use Case Study	C. Guo	IEEE-SMC
Simulation data management and reuse: toward a verification and validation approach	A. Ottino, T. Vosgien, J. Le Duigou, N. Figay, P. Lardeur, B. Eynard	PLM2015

Some considerations about privacy	P. Wolf	
Spectral Domain Decomposition Method for Natural Lighting and Medieval Glass Rendering	G. Gbikpi-Benissan, R. Cerise, P. Callet, F. Magoules	HPCC 2014
Spectral Domain Decomposition Method for Physically-Based Rendering of Photochromic/ Electrochromic Glass Windows	G. Gbikpi-Benissan, P. Callet, F. Magoules	DCABES 2014
Standards Compliant Platform for Product Design in Dynamic Environment	M. Khalfallah, N.Figay, M.Barhamgi, P. Ghodous	International Journal of Services Computing , ISSN 2330-4472
Systemic a priori patterns	L. Gasser	IARIA Patterns 15, Nice, France
TheReSE: SysML Extension for Thermal Modeling	R. Barbedienne, O. Penas, J-Y.Choley, L. Gasser	Syscon 2015, Vancouver, Canada
Towards a Formal Framework for Product Level Agreements	M. Khalfallah, NFI Figay, P. Ghodous, M. Barhamgi	to Int. J. Signal and Imaging Systems Engineering
Towards an actor based design for a collaborative modelling and simulation system	L. Roa Castro , J. Stal-Le Cardinal, M. Callot	Puresafe conference, Geneva, Switzerland 2015
Towards an adaptive model for collaborative simulation: from system design to lessons learned - a use case from Aircraft industry	L. Roa Castroa , J. Stal-Le Cardinal, M. Callot	Complex Adaptive Systems, San Jose, USA, 2015
Towards an extended interoperability systemic approach for dynamic manufacturing networks: role and assessment of PLM standards	N. Figay, E. Moones, T. Vosgien, F. Stephan, , Lyes Kermad, A. El Mhamedi, E M. Dafaoui	CS&DM 2014
Traffic flow within a two-dimensional continuum anisotropic network	K. Sossoe, J-P. Lebacque	EWGT2015
Vehicle relocation strategies for the dimensioning of a one-way carsharing system	A. Carlier, A. Munier-Kordon, W. Klaudel	EWGT2015
Vehicles Detection in Stereo Vision Based on Disparity Map Segmentation and Objects Classification	D. Dekkiche, A. MérigoT, B. Vincke	ISVC
WhichStreams: A Dynamic Approach for Focused Data Capture from Large Social Media	T. Gisselbrecht, L. Denoyer, P.Gallinari, S. Lamprier	ICWSM 2016

Operational Management

The Operational Management Team builds and puts into daily practice the strategy for SystemX. Its action comprises research, innovation, training, communication and operation. To help it in its duties the operating management relies on the various committees and councils that have been set up: the Board of directors, the Scientific and Technological Board, and the Committee for Program Orientation.

Name	Function
Éric PERRIN-PELLETIER	CEO
Luc D'ARCHIMBAUD	Chief Administrative Officer
François STEPHAN	Development & International Director
Daniel KROB	Science and Technology Director
Bruno FOYER	Platforms Director
Étienne DE POMMERY	"Systems Engineering" Program Director
Paul LABROGERE	"Autonomous Transport" and "Internet of Trust" Program Director
Charles KREMER	"Smart Territories" Program Director
Gaëlle BERTHOMIEU	Head of the Training & SME Relations Program
Virginie BOISGONTIER	Communications Director

Board of Directors

The SystemX Board of Directors manages the institute's affairs in its meetings. It approves the institute's development strategy supervises its execution. It decides on pluri-annual plans and its annual plan of action, votes the budget and approves the accounts at the end of the financial year.

Name	Function	Entity
Pascal CLÉRÉ	President	Alstom
Pierre GOHAR	Treasurer	Université Paris-Saclay
Éric BAISSUS	Member	Kalray
Jean-Luc BEYLAT	Member	Systematic Paris-Region
Gilles BLOCH	Member	Université Paris-Saclay
Bertrand BRAUNSCHWEIG	Member	Inria
Éric MONCHALIN	Member	Atos
Alban SCHMUTZ	Member	OVH.com
Jean-François SENCERIN	Member	Renault
Atilla YAZMAN	Member	Sherpa Engineering

Scientific and Technological Council

Twice a year, the Scientific and Technological Council meets to discuss the technological challenges the SystemX wishes to take up. It gives its expert advice on the R&D projects at the heart of the digital engineering of complex systems.

Name	Function	Entity
Yves CASEAU	President	Digital Agency, AXA
François BOURDONCLE	Member	FB&Cie
Henri CALANDRA	Member	TOTAL
Patrick GODFREY	Member	Université de Bristol
Marta KWIATKOWSKA	Member	Université d'Oxford
Rudy LAUWEREINS	Member	IMEC Academy
Michel MORVAN	Member	The CoSMo Company
Agnès PAILLARD	Member	Airbus Group
François PIERROT	Member	LIRM (Université de Montpellier 2 / CNRS)
Tom RODDEN	Member	Université de Nottingham
Frédérique SEGOND	Member	Viseo
Bruno SUDRET	Member	ETH Zürich
Patrick LEBOEUF	Permanent guest	Université Paris-Saclay
Guillaume POUPARD	Permanent guest	ANSSI (Agence Nationale de la Sécurité des Systèmes d'Information)

R&D Steering Committee

The R&D Steering Committee (COP) is chaired by the SystemX Development and International Director. Its mission is to consolidate the technological plans for the Institute's research programs and ensure consistency between scheduling, the guidelines laid down by the Board of Directors and the needs of the target economic sectors.

Name	Entity
Jean-Marc ALEXANDRE	CEA
François ALOUGES	École polytechnique
Éric BANTEGNIE	Esterel Technologies
Véronique BERTHAULT	RATP
Johan D'HOSE	Systematic Paris-Region
Philippe DAGUE	Université Paris-Sud
Alain DAURON	Renault
Jean-Marc DAVID	Renault
Hervé DEBAR	Institut Mines-Télécom
Catherine DEHAENE	Orange
Éric DUCEAU	Airbus Group Innovations
Jean-Pierre DUMOULIN	PSA Peugeot Citroën
Didier DUMUR	CentraleSupélec
Frédéric FEYEL	Safran
Pascal FOIX	Thales

Name	Entity
Étienne GEHAIN	ENGIE
Louis GRANBOULAN	Airbus Group
Thierry HOUDOIN	Orange
Athanasios KONTOPOULOS	Air Liquide
Thierry LE HAY	PSA Peugeot Citroën
Bruno MONSUEZ	ENSTA ParisTech
Laurent PAUTET	Institut Mines-Télécom
Gérard POIRIER	Dassault Aviation
Pascal POISSON	Alstom
Philippe ROY	Cap Digital
Marc SCHOENAUER	Inria
Yves SOREL	Inria
Samir THOMÉ	Université Versailles Saint-Quentin-en-Yvelines
Bernard YANNOU	CentraleSupélec
Élie ZNATY	Bertin Technologies

PARTNERSHIPS

AIRBUS GROUP	ALL4TEC	ALSTOM
ANSSI	APSYS	ARTELYS
ASSYSTEM	ATOS	BERTIN
BOOST CONSEIL	CAPGEMINI	CEA
CENAERO	CENTRALESUPÉLEC	CISCO
CONTINENTAL AUTOMOTIVE	DATAKIT	DASSAULT AVIATION
DCNS	DISTENE	DOCAPOST
ECOGELEC	ENGIE	ENSTA PARISTECH
ESI GROUP	ESTACA	ESTEREL TECHNOLOGIES
EXALEAD/3DS	EXPEMB	G2MOBILITY
GE GRID SOLUTIONS	GEMALTO	INSTITUT DU DROIT INTERNATIONAL DES TRANSPORTS
IFSTTAR	INRIA	INSTITUT MINES-TÉLÉCOM
INTEMPORA	KALRAY	KRONO-SAFE
LABORATOIRE NATIONAL DE MÉTROLOGIE ET D'ESSAIS	MINISTÈRE DE LA DÉFENSE	NOKIA CORPORATION
NOVENER	OKTAL	OPENTRUST
OPENWIDE	OPPIDA	ORANGE
OVH.COM	PSA PEUGEOT-CITROËN	PROVE & RUN
RATP	RENAULT	REUNIWATT
SAFRAN	SCALEOSHIP	SECTOR
SHERPA ENGINEERING	SNCF	SYSTEMATIC PARIS-REGION
SUPMECA	SYSNAV	TEMIS
SYSTRAN	THALES	THE COSMO COMPANY
TRIALOG	UNIVERSITÉ DE VERSAILLES SAINT-QUENTIN-EN-YVELINES	UNIVERSITÉ PARIS-SACLAY
UNIVERSITÉ PARIS-SUD	UNIVERSITÉ PIERRE ET MARIE CURIE	UNIVERSITÉ PARIS 8
VALEO	VECSYS	VOCAPIA
WALLIX		

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