

# GENERAL OVERVIEW

# A research and technology organization



**Institute of Research and Technology (IRT)**  
Non-profit Scientific Cooperation Foundation

Paris-Saclay • Lyon • Singapour



**100**

Economic partners  
of which **1/3** are large  
groups and **2/3** are SMEs



**+25**

Academic  
partners

Leads market-driven and applied  
research projects for the digital  
transformation of industry,  
services and territories:

- 1 Expertise: analysis, modeling,  
simulation and decision  
management
- 2 Own skills
- 3 Own assets: software, cyber-  
physical and tool-based  
platforms

## 4 main application sectors



Mobility and  
autonomous transport



Industry of the future

## 8 scientific and technical fields



Data science  
and AI



Human-machine  
interaction



Scientific  
computing



Optimization



System engineering  
and software design



Safety  
of critical systems



Digital security  
and blockchain



IoT  
and future networks



Defense and security



Environment and  
sustainable development

## Founding members

ALSTOM

Bull

COSMOTEC



GRUPE RENAULT

SAFRAN

SHERPA

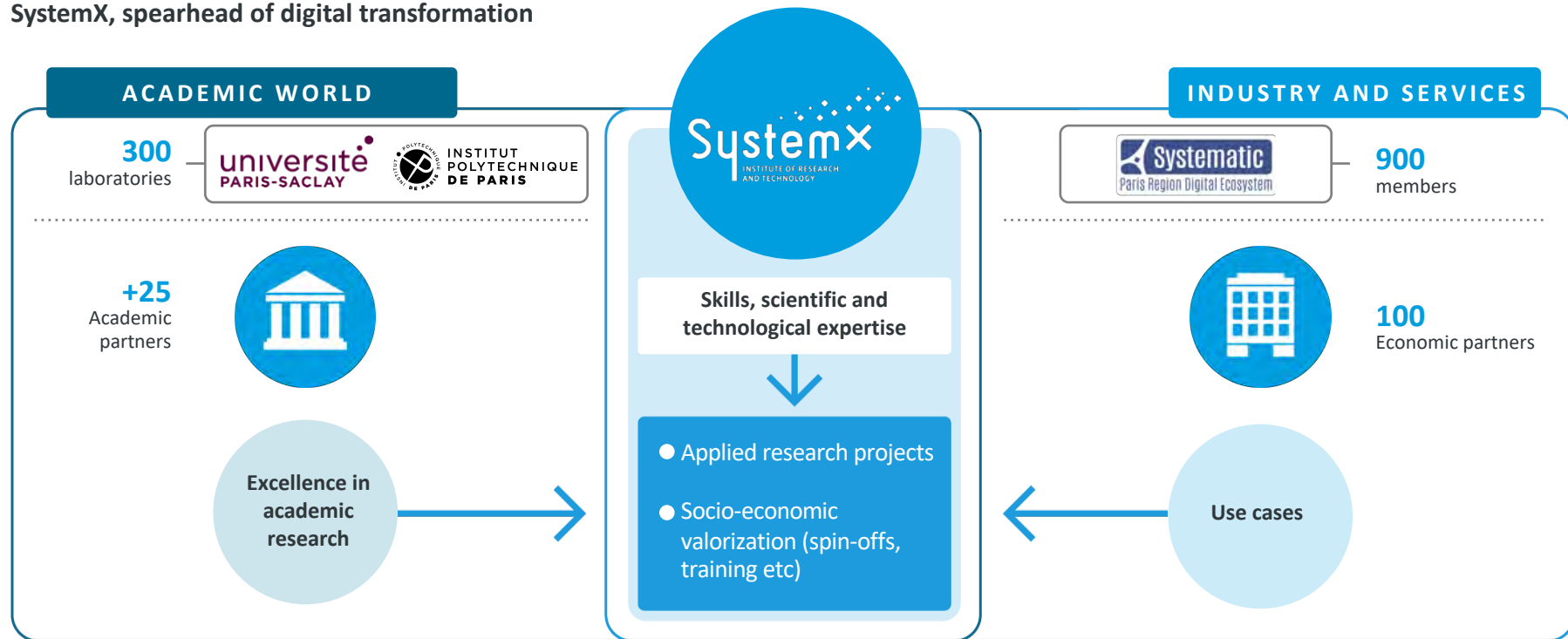
Systematic  
Paris Region Digital Ecosystem

Inria

Ministère de l'Enseignement Supérieur et de la Recherche

université  
PARIS-SACLAY

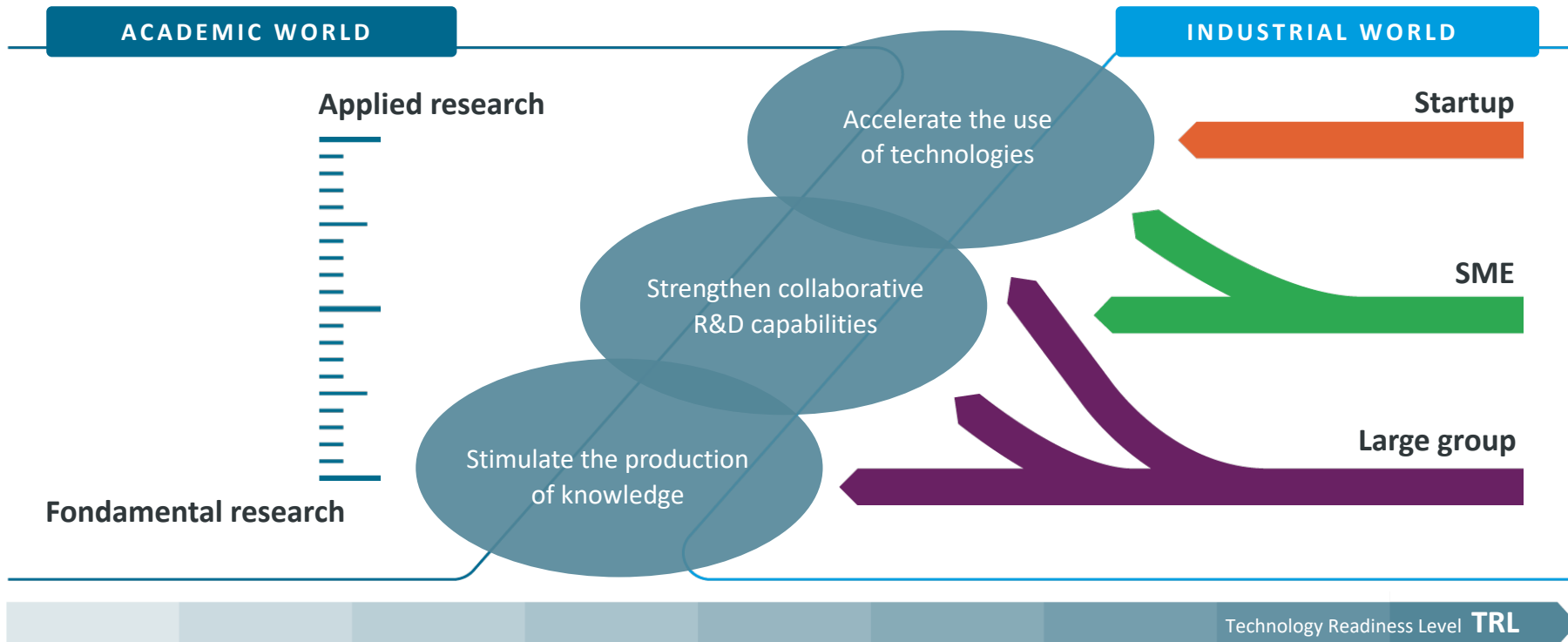
## SystemX, spearhead of digital transformation



# A UNIQUE VALUE PROPOSITION

# A melting pot of interaction between the academic and industrial worlds

SystemX, spearhead of digital transformation





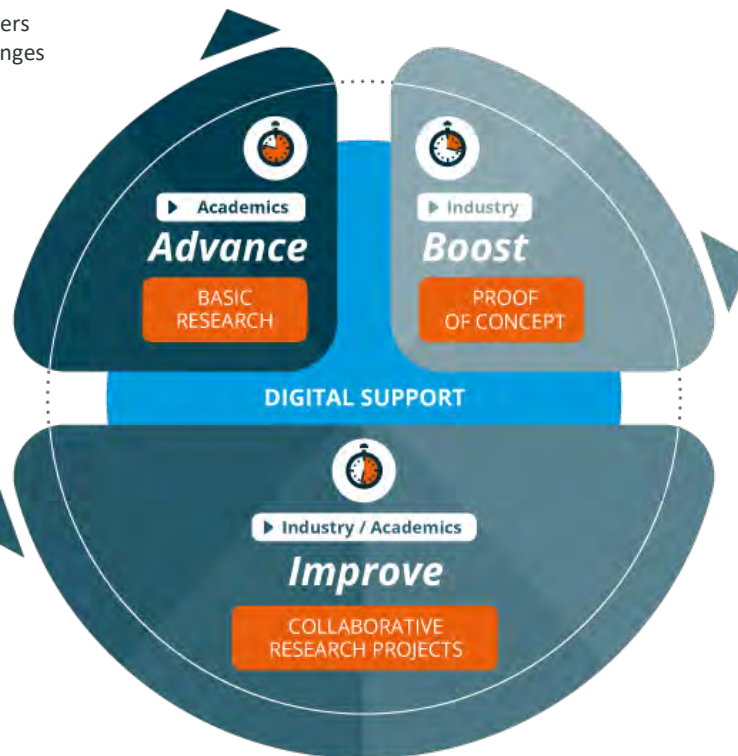
# A threefold value proposition

## Stimulate the production of knowledge

- Federation of academic partners around major scientific challenges
- Coordination and support of doctoral programs

## Strengthen the collaborative R&D capacities of companies

- Resolving scientific and technical obstacles
- Accompanying the rise in skills of partners



## Accelerate the use of technology for the value creation

- Responding to innovation challenges
- Carrying out pre-industrial proofs of concepts

# More than 150 committed partners

## LARGE GROUPS



## STARTUP



## ADMINISTRATIONS



## COMPETITIVENESS CLUSTERS



## TERRITORIAL ACTORS



## SME / ETI



## ACADEMIC



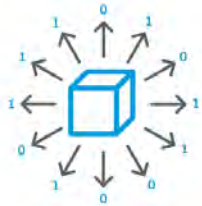
## INDUSTRIES



# Scientific and technical structuring

## DATA SCIENCE AND INTERACTION

Understanding the real world through data



Data science  
and AI



Human-computer  
interaction



## SCIENTIFIC COMPUTATION AND OPTIMIZATION

Understanding the real world through physical modeling



Scientific calculation

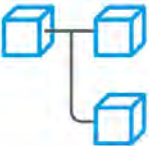


Optimization



## SYSTEMS AND SOFTWARE ENGINEERING

Formalizing complex systems design



System Engineering and  
Software Design



Dependability of  
critical systems



## INFRASTRUCTURE AND NETWORKS

Ensuring exchanges between  
information system components



Digital security  
and blockchain



IoT and  
networks of the future

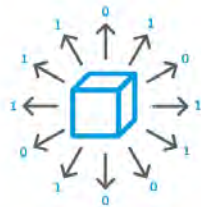




# Seven Research & Technology teams

## DATA SCIENCE AND INTERACTION

Data science, AI and Interaction



**Loïc CANTAT**  
Team Manager

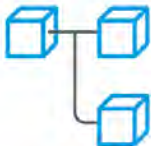


**Georges HEBRAIL**  
Head of the Data science  
and Interaction axis

19 research engineers

## SYSTEMS AND SOFTWARE ENGINEERING

System engineering and Safety



**Mohamed TLIG**  
Team Manager



**Ali KOUDRI**  
Head of System  
Engineering and  
Dependability axis

13 research engineers

## Software & DevOps digital support



**Bruno FOYER** (*acting*)  
Director of Research  
and Technologies

13 research engineers

## SCIENTIFIC CALCULATION AND OPTIMIZATION

Scientific computation and Optimization



**Rim KADDAH**  
Team Manager



**Jakob PUCHINGER**  
Head of Scientific calculation  
and Optimization axis

8 research engineers

## INFRASTRUCTURES AND NETWORKS

Digital security

Blockchain

IoT and future  
networks



**Reda YAICH**  
Team Manager



**Nicolas HEULOT**  
Team Manager



**Makhlof HADJI**  
Team Manager and Head of Digital  
Infrastructures axis

10 research engineers

11 research engineers

7 research engineers

# MAIN APPLICATION SECTORS

# Towards the digital transformation of industry, services and territories



## Mobility and Autonomous transport

Proposing innovative mobility solutions to support the transformation of territories and uses



## Industry of the future

Anticipating the evolution of systems life cycles to reinforce industry performance



## Defense and Security

Developing complete security solutions for a trusted digital economy



## Environment and Sustainable development

Harnessing the potential of digital technology to support the ecological transition

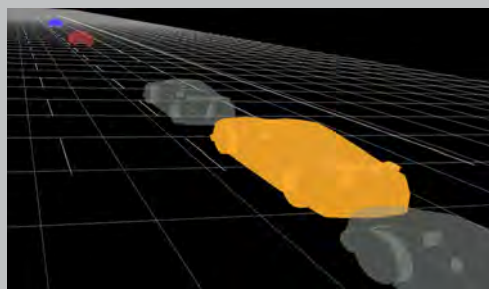


## Mobility and Autonomous transport

Proposing innovative  
mobility solutions to  
support the  
transformation of  
territories and uses

### Issues addressed:

#### 1 Security



#### 2 Adaptability



#### 3 Durability



### Coupling scientific / industrial challenges:

New approaches to the demonstration of autonomous transport safety using rolling data and numerical models.

New architectures of connected and secure interoperable autonomous transport systems.

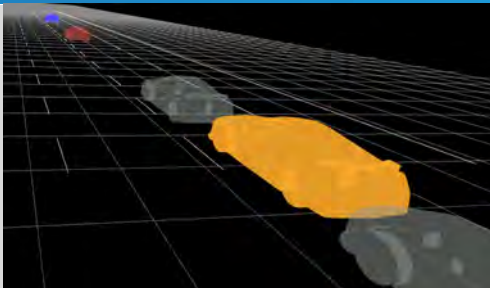
Agile operation and real-time adaptation of shared public transport plans integrating knowledge and load prediction.

HMI design adaptable to sensory multi-modality to reduce users' cognitive load and improve their intuitiveness.

Multicriteria optimization for the route request and their achievements in a Mobility as a Service (MaaS) context.

Interoperability of carpooling platforms and management of combined offers of multimodal mobility.

# Mobility and Autonomous transport



## Security

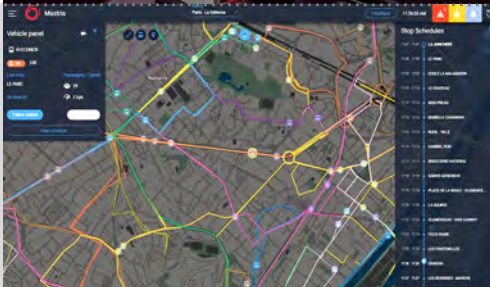
Design and validate increasingly autonomous and connected transport systems in operational, complex and open contexts.

Strengthen performance control in the face of the cyber vulnerability of these communicating, interoperable and evolving systems.



## Adaptability

Improve the acceptability of autonomous and connected transport systems by addressing the "human factors" and "human-machine interactions" aspects for systems that are customizable and adaptable to the context of the environment.



## Durability

Plan, design and supervise mobility systems by integrating the evolution of urban transport uses. IRT SystemX is part of a Mobility-as-a-Service (MaaS) context, offering users an individualized, door-to-door service integrating different modes of transport with a unified payment method.



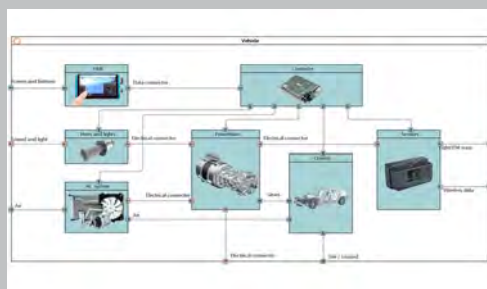


Industry of the future

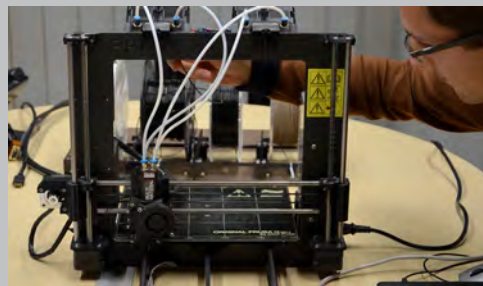
Anticipating the evolution of systems life cycles to reinforce industry performance

## Issues addressed:

### 1 Capitalization on the data



### 2 Digitalization



### 3 Connection



## Coupling scientific / industrial challenges

Piloting additive manufacturing with new learning methods using heterogeneous data.

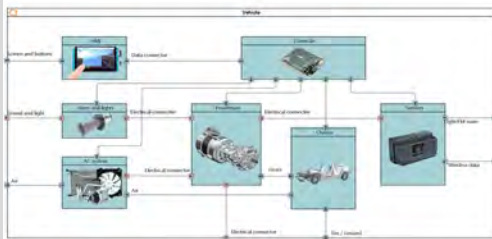
Construction and optimization of large multi-physical models and improvement of design margins.

Performance evaluation of cyber-physical systems in the design phase and choice of architectures.

Continuity of the digital chain and collaborative engineering for the workshop of the future and its supply chain in the extended enterprise.

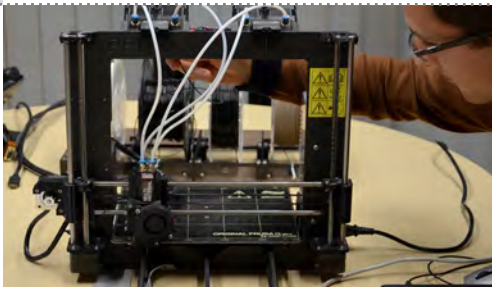
Modeling and optimization of forecast maintenance policies for connected systems.

Detection of heterogeneous weak signals from Internet of Things (IoT) networks for predictive maintenance.



## Capitalize

Capitalize on the data generated throughout the life cycle to enable the analysis, forecasting and anticipation of behavioral anomalies of products, processes and equipment and therefore an optimized, simple and robust design.



## Digitize

Digitize processes and standardize exchanges through collaboration platforms for the extended enterprise.



## Connect

Connect the physical world and the virtual world by collecting operational data in real time to develop digital twins. The aim is to make the best use of products, equipment and infrastructure and to automate and remotely control production or testing processes.

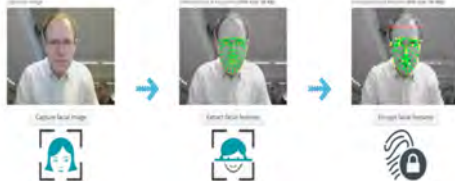


Defense and Security

Developing complete security solutions for a trusted digital economy

## Issues addressed:

### 1 Digital protection



### 2 Detection



### 3 Supervision



## Coupling scientific / industrial challenges:

Securing the software life cycle for maintaining the safety of industrial infrastructures.

Light cryptography for Internet of Things (IoT) ensuring the integrity of data exchange.

Optimized deployment of anomaly detection probes in heterogeneous information systems.

Authentication mechanism to ensure the digital identity and associated access rights of third-party maintenance operators.

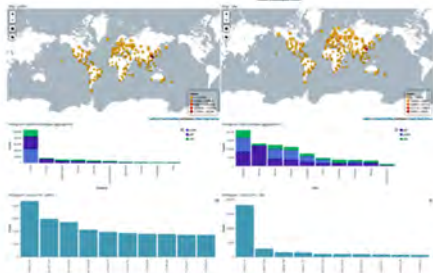
Performance evaluation of remote-controlled autonomous mobility systems and design of adequate supervision systems.

Massive processing and visualization of multi-source data for Supervision and Security Centers (SOC).



## Protection

Accelerate the integration of a holistic approach to cybersecurity systems.  
Improve data and digital identity-based trust driven by current regulations and future developments.



## Detection

Study the development of intrusion detection capabilities.  
Promote multi-source approaches to build more relevant decision spaces from artificial intelligence technologies.



## Supervision

Exploit steering information in supervisory systems to detect "abnormal" behavior and trigger remediation actions.  
Integrate the latest proposals for graphical representation of data and convergence of infrastructures within the new generation of supervision centers.



**Environment and  
Sustainable development**

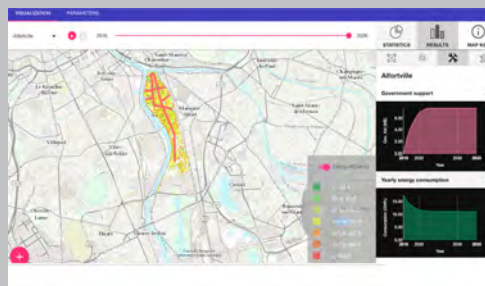
Harnessing the potential  
of digital technology to  
support the ecological  
transition

## Issues addressed:

### 1 Circular economy



### 2 Prediction and planning



### 3 Systemic transition



## Coupling scientific / industrial challenges:

Design of decision support systems to optimize the management and treatment of recyclable products in a territory.

Establishment of a green bond market place.

Modeling and predicting the demand for citizen consumption and the management of massive data and their visualization.

Use of individual energy production / consumption data for collective optimization while preserving privacy.

Evaluating scenarios of systemic temporal, spatial and technological changes at the territorial scale.

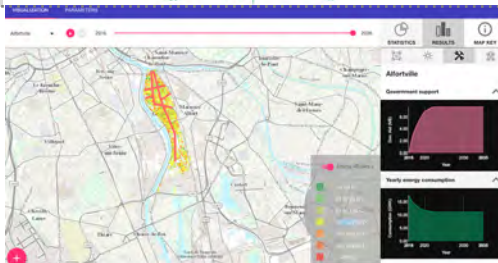
Construction of predictive models of behavioural changes and their impacts on the evolution of infrastructures.





## Circular economy

Analyze and model the life cycles and dynamics of large-scale, complex socio-technical systems in order to help manage them in a circular economy perspective. Propose decision support tools and appropriate performance indicators to optimize the circular economy of the territories.



## Prediction and planning

Explore and exploit heterogeneous multi-source data to understand territories and urban systems integrating and user behaviors to predict future patterns and propose recommendations for ecological behavior. Propose decision support tools to make territorial policy recommendations that promote sustainable development.



## Systemic transitions

Evaluate the benefits and implications of structural changes in interdependent systems (such as energy and transport), industrial and private uses. Propose recommendations and good practices to accompany systemic transitions.

# A SCIENTIFIC DYNAMIC



**355**  
Publications



PhD students /  
Trained doctors



**4**  
Docent  
Habilitation  
(HDR)



**27**  
Partner  
laboratories



**46**  
Seminar@SystemX



**22**  
Workshops organized  
or sponsored

Data science  
and AI



Human-computer  
interaction



Scientific computation



Optimization



Systems engineering and  
safety



Dependability of  
critical systems



Digital security  
And blockchain



IoT and  
future networks



Data science  
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Human-computer  
interaction



GRETTIA – Ifsttar

Scientific computation



Optimization



GRETTIA – Ifsttar

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IoT and  
future networks





Data science  
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Human-computer  
interaction



GRETTIA – Ifsttar

LRI – Inria

Scientific computation



Optimization



LRI – CNRS

GRETTIA – Ifsttar

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LRI – CNRS

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Dependability of  
critical systems



LRI – CNRS

LTCI – TPT

Digital security  
And blockchain



IoT and  
future networks



LTCI – TPT

LTCI – TPT

## Data science and AI



GRETTIA – Ifsttar

LRI – Inria

## Human-computer interaction



## Scientific computation



## Optimization



LGI - CS

LRI – CNRS

GRETTIA – Ifsttar

## Systems engineering and safety



## Dependability of critical systems



## Digital security And blockchain



## IoT and future networks



LTCI - TPT

LTCI - TPT

LGI - CS

LRI – CNRS

LTCI - TPT

## Data science and AI



LSS - CS  
GRETTIA – Ifsttar  
MICS - CS  
LRI – Inria  
LIP6 – Paris 6

## Human-computer interaction



LIMSI – CNRS  
CEA List  
IMS - ENSC

## Scientific computation



MICS - CS  
LURPA – ENS PS  
QUARTZ – Supmeca  
JLL – Paris 7  
LMV – UVSQ

## Optimization



CERMICS - ENPC  
LGI - CS  
LRI – CNRS  
GRETTIA – Ifsttar  
LIX – X

## Systems engineering and safety



U2IS - ENSTA  
LGI - CS  
LTCI - TPT  
DAVID - UVSQ

## Dependability of critical systems



LSV – ENS PS  
LRI – CNRS  
Heudiasyc – UTC

## Digital security And blockchain



LTCI - TPT  
Samovar - TPT  
CEA List  
Grace - Inria

## IoT and future networks



LTCI - TPT  
Samovar - TPT  
LINCS

# Involvement in ambitious upstream initiatives



Member of the largest  
French research collective  
dedicated to blockchain

Partners:



Co-chairing a Chair  
on eco-innovations  
for user-centered  
mobility systems

Partners:



Partner of LINC'S,  
International Laboratory  
on Networks and Services  
of the Future

Partners:





# A NATIONAL AND INTERNATIONAL STRATEGY

# Becoming a reference at the global and international levels



Mobility and  
Autonomous transport



Industry of the  
future

## Boost

- Develop new use scenarios and perform remarkable experiments
- Expand our circle of industrial partners
- Associate our collaborative system with regional structures (e.g. competitiveness clusters)
- Address the scientific barriers with the laboratories of the territory

## Improve

- Accelerate technological use for the regional fabric of SMEs
- Value our assets
- Combine our ability to produce proof of concepts with regional tools
- Position our regional skills in European projects



Mobility and  
Autonomous transport



Industry of the  
future



Defense and security



Environment and  
Sustainable  
development

## Advance

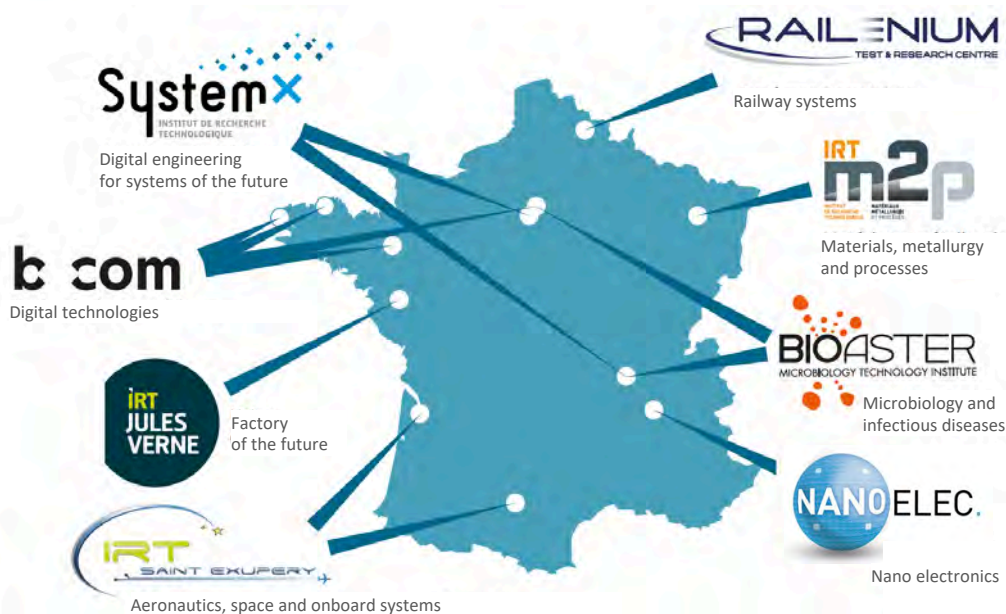
- Partner with academic actors of excellence
- Develop our talents

## Improve

- Assist the development of our industrial partners in Asia
- Perform innovative experiments in France

## Boost

- Accompany FIT member institutes
- Technically support our industrial partners



## Four objectives:

Attractiveness of the IRT as a model that can be promoted

Relations with the European Commission

Cooperation and sharing of best practices

Consistency among the various objectives in the Future Investment Program

## Key figures:

8 IRTs established since 2012

10-year budget of €2.5 billion

500 partners

1200 employees

## Characteristics of the model:

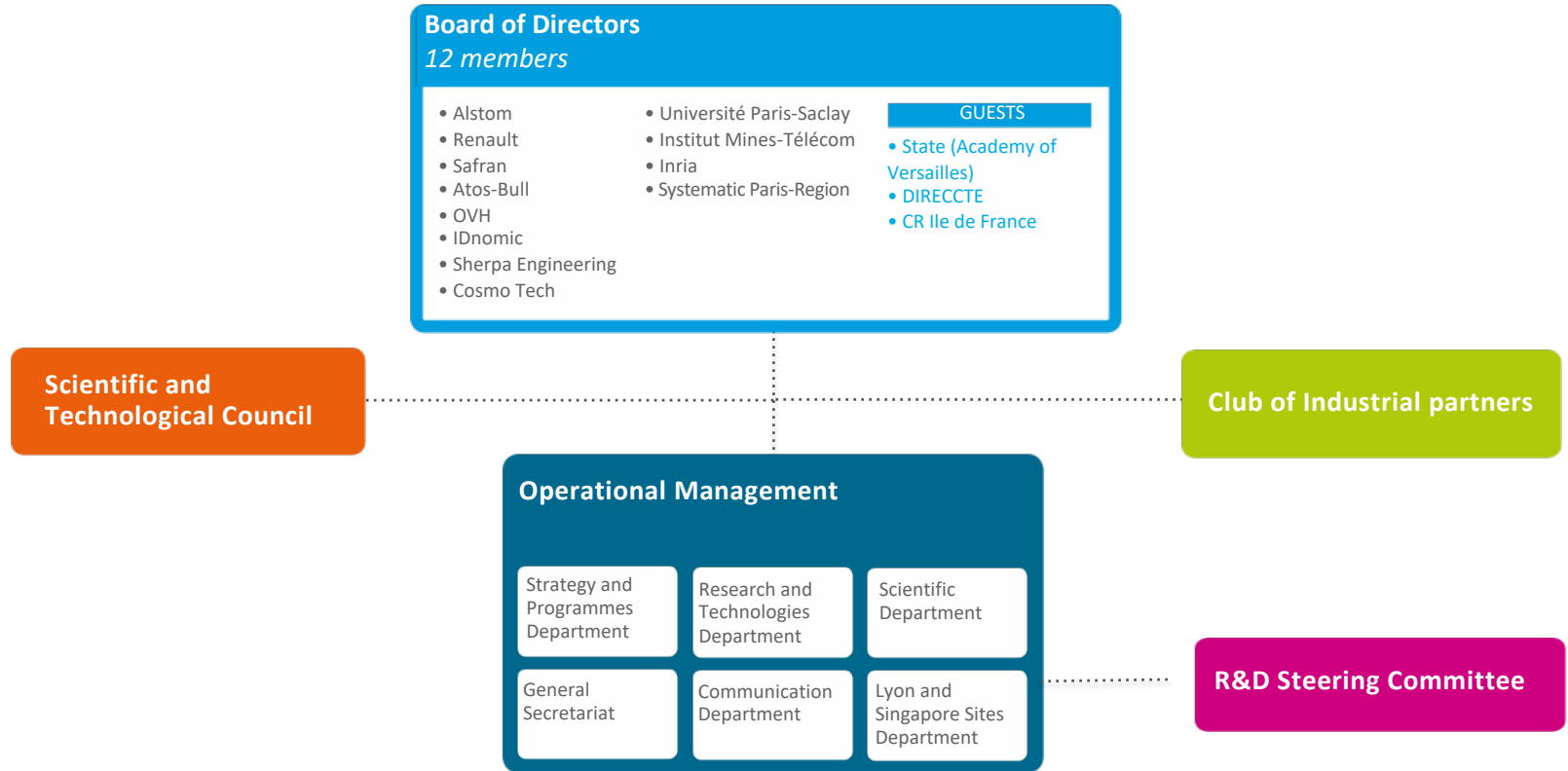
Close ties with a research hub

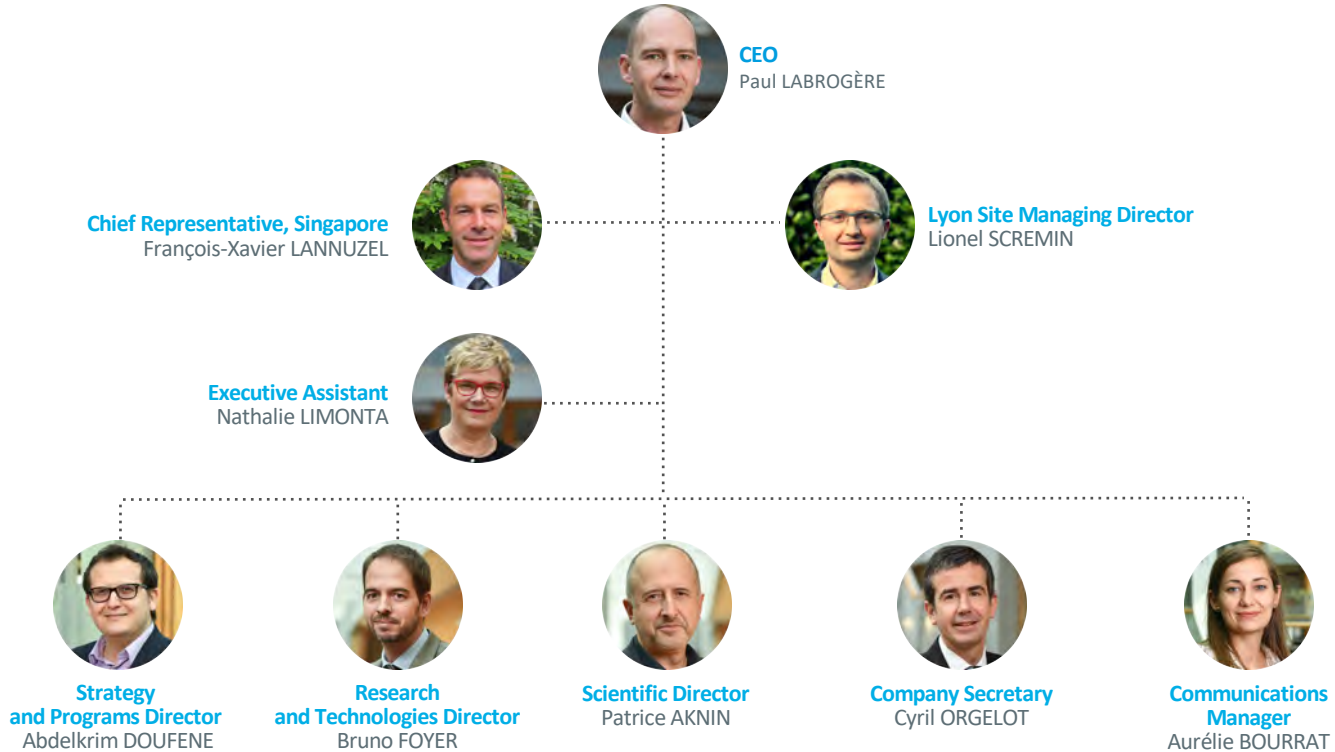
Partner personnel working side by side at one site

Funding (Future Investment Plan) for 50% of costs



# AN ADAPTED GOVERNANCE







**Yves BAMBERGER**  
Académie des  
Technologies  
Founding Member



**Patrick BASTARD**  
Renault  
Responsible for an  
operational department  
covering ADAS and chair of  
3EA activities



**Nozha BOUJEMAA**  
Median Technologies  
Chief Science &  
Innovation Officer



**Olivier CAPPÉ**  
CNRS  
Research Director,  
Director of the  
Université Paris-Saclay  
STIC department



**Yves CASEAU**  
Michelin  
Chief Information  
Officer



**Gilles DOWEK**  
Inria et ENS Paris-Saclay  
Research Director



**Serge FDIDA**  
Université Pierre  
et Marie Curie  
Professor



**Jean-Claude BOCQUET**  
*President of Scientific  
and Technological Council*  
CentraleSupélec  
University Professor



**Denis GARDIN**  
MBDA Systems  
Director of Innovation in  
Forward-Looking Technology



**Bertrand MAURY**  
Université Paris-Sud  
University Professor



**Michèle SEBAG**  
CNRS, LRI, Académie  
des Technologies  
Research Director,  
Deputy Director of LRI



**Bruno SUDRET**  
ETH Zürich  
Professor and Director of  
research and strategy at  
Phimeca Engineering



**Alain Bravo**  
Académie des Technologies  
President



**Guillaume POUPARD**  
ANSSI  
CEO

## 2 permanent guests





**Jean-Noël PATILLON**  
CEA LIST



**Didier DUMUR**  
CentraleSupélec



**Bernard YANNOU**  
CentraleSupélec



**François ALOUGES**  
École polytechnique



**Bruno MONSUEZ**  
ENSTA ParisTech



**Brigitte DUEME**  
Inria



**Yves SOREL**  
Inria



**Hervé DEBAR**  
Institut  
Mines-Télécom



**Laurent PAUTET**  
Institut  
Mines-Télécom



**Samir TOHME**  
Université de Versailles-  
Saint-Quentin-en Yvelines



**Philippe DAGUE**  
Université Paris-Sud



**Éric DUCEAU**  
Airbus Group



**Louis GRANBOULAN**  
Airbus Group



**Anthanasios  
KONTOPOULOS**  
Air Liquide



**Pascal POISSON**  
Alstom



**Jacques DUYSENS**  
ANSYS



**Élie ZNATY**  
Bertin Technologies



**Nathalie  
MERCIER-PERRIN**  
Naval Group



**Philippe CALVEZ**  
ENGIE



**Catherine DEHAENE**  
Orange



**Helene Bachatene**  
Thales



**François Gaillard**  
PSA Groupe



**Ludovic Noirie**  
LINCS/Nokia



**Véronique BERTHAULT**  
RATP



**Alain DAURON**  
Renault



**Jean-Marc DAVID**  
Renault



**Frédéric FEYEL**  
Safran



**Michel Pinget**  
Dassault Aviation



**Philippe ROY**  
Cap Digital



**Johan D'HOSE**  
Systematic Paris-Region

THANKS FOR YOUR ATTENTION

