Collaboration between Rutgers & Paris 6

Supervised by :

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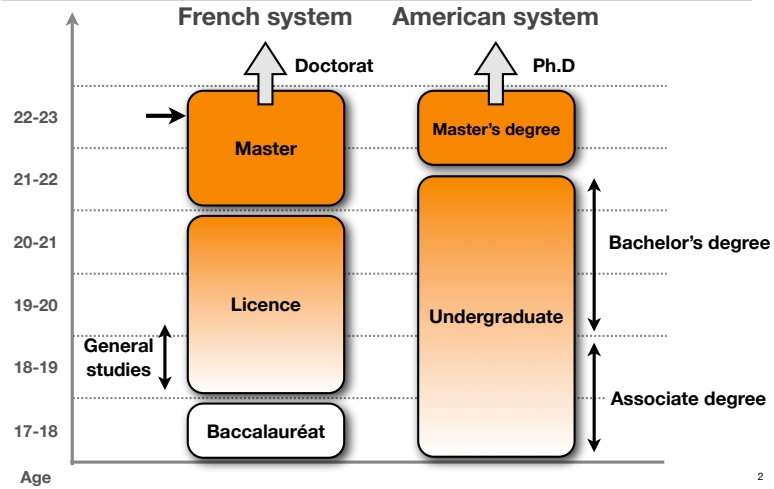
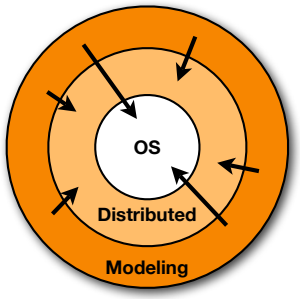
French & American Educational System



M.S. : Distributed Systems & Applications

- **Courses :**
  - **Operating System aspects :**
    - Linux Kernel and Posix systems
    - Embedded and Real Time
    - Middleware internals
  - **Distributed aspects :**
    - Algorithms : Proof & Complexity
    - Interoperability with middlewares
  - **Modeling aspect**
    - Modeling Theory, Verification, Performances...
  - **"Development" transversal approach**



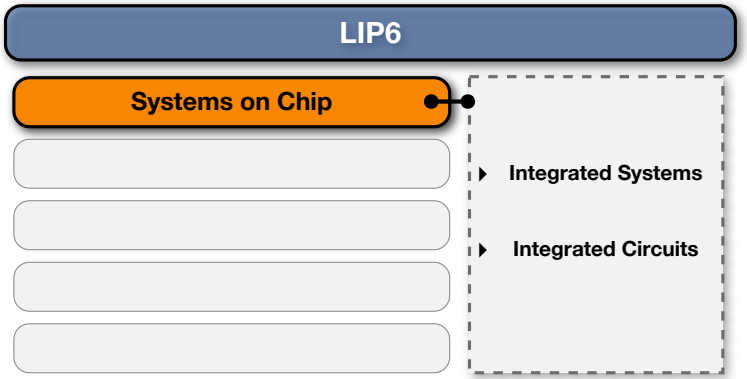
University Pierre & Marie Curie

- **Based in the Latin Quarter, in Paris**
- **One of the largest university of science and medicine in France, and indeed in Europe**
  - **4.000 teaching academics / researchers (+6.000 staffs)**
  - **180 laboratories**
  - **30.000 students (including 8.000 in PhD)**
  - **About 15 campus all over France (10 around Paris)**
  - **6 Centers of Excellence selected by the European Commission**
  - **Major strengths :**
    - Mathematics (first university in the world - *source : SourceWatch*)
    - Computer science (top-3 in France)
    - Physics

Our laboratory : LIP6

- **Administrative aspect (*some statistics...*):**
  - **150** academics + **250** Ph.D students + **30** engineers
  - Budget : **8 millions euros** / year
  - **9** start-up : Ucopia, Avertec, Surf Technology...
  - **36** softwares
  - Active participation in **numerous European Projects**

LIP6 : Thematics Departments



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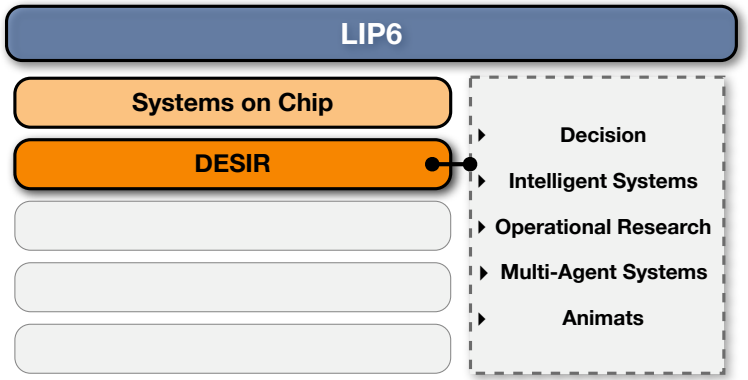

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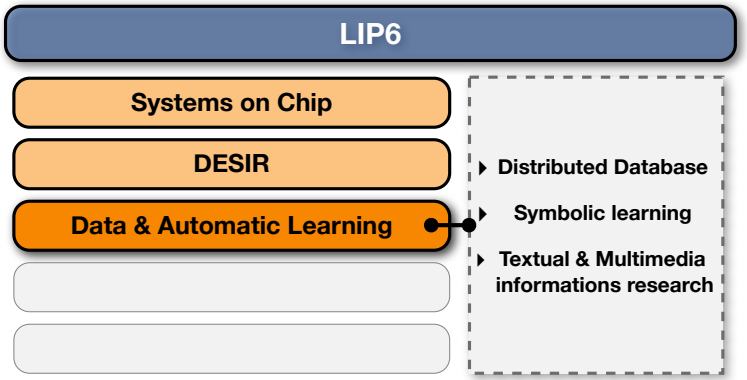

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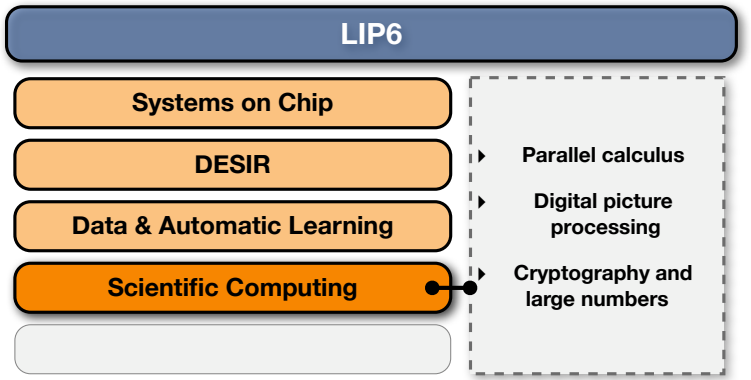

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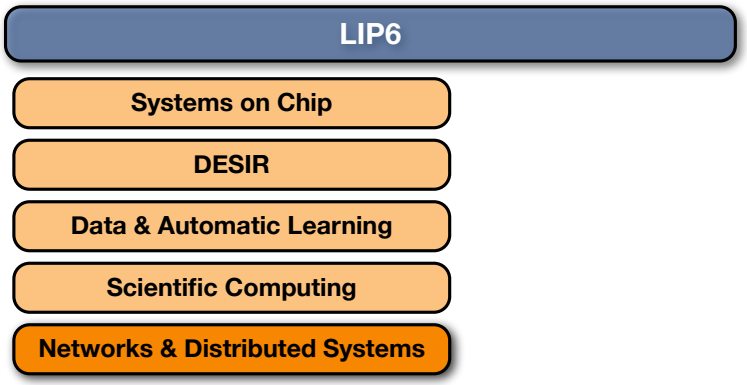


The Network & Distributed Systems department

- **Overview**
  - **Problems : Interoperability, heterogeneous environment, adaptability, QoS**
  - **Goal : Development and design of future networks and systems**
  - **4 Teams (head : Bertil Folliot):**
    - **MoVe** (Modeling and verification) - F.Kordon
    - **Regal** (Distributed algorithms and large scale applications) - P.Sens
    - **NPA** (Networks and Performance analysis) - S.Fdida
    - **Phare** (Networks infrastructures for mobility) - G.Pujolle
    - ~ **105** members :
      - 41 teaching academics / researchers
      - ~9 staff
      - 3 Post Doc.
      - 52 PhD

MoVe Team (Modeling and Verification)

- **Presentation**
  - **Scientific Head : Fabrice Kordon *(fabrice.kordon@lip6.fr)***
    - 21 faculty members
    - 17 Ph. D.
    - about 10 M.S. students/engineers/post-doc
  - **Focus : Modeling & Analysis of Distributed Systems**
    - **interoperable components**
    - **execution infrastructure (middleware)**
  - **Goal : Ensure reliability on software development using models**
  - **Context : MDD (Model Driven Development)**
    - Applied to distributed systems and applications

MoVe : Projects & Cooperations

- **Internal Projects**
  - ModFact
  - Spot
  - MetaScribe
  - CPN-AMI
  - PolyORB
  - ITS

- **Industrial cooperations**

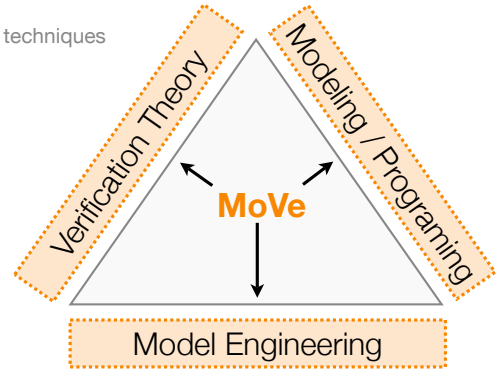
THALES COFIROUTE SOFTEAM Aonix EDF AIRBUS SAGEM france telecom R&D

- **Academic cooperations**
  - University of Geneve
  - University of Zaragoza
  - University of Turin
  - University of Luxembourg
  - Naval Postgraduate School
  - University of Québec
  - University of Rutgers
  - etc...

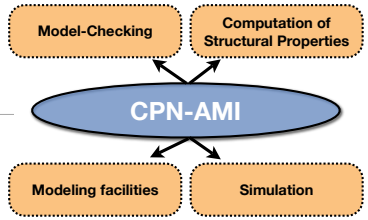
- **International consortiums and organizations**
  - ObjectWeb, OMG, ISO

MoVe : Research axes

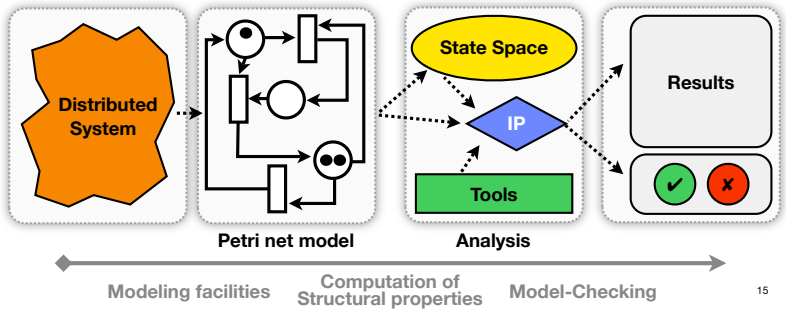
- **Modeling / Programing**
  - Languages / Modeling techniques
  - Paradigms
  - Infrastructures
- **Verification Theory**
  - Petri nets
  - Structural verification
  - Model-checking
- **Model Engineering**
  - Meta-Model
  - Advance Programing Techniques



MoVe : A few projects



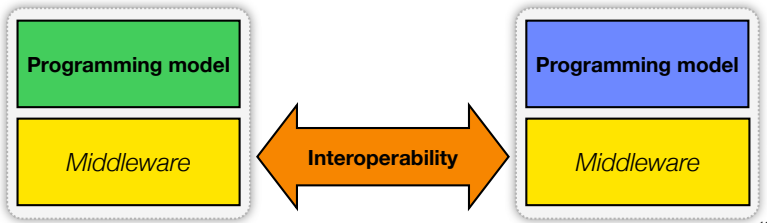
- **CPN-AMI**
  - **Petri net based CASE environment**
  - **Groups tools suitable for Petri net modeling and verification**
    - Embedded LIP6 tools and other partners contributions



MoVe : A few projects

LIP6 TELECOM PARIS

- **PolyOrb : A schizophrenic middleware (with Telecom Paris)**
  - **A polymorphic, reusable infrastructure for building or prototyping new middleware adapted to specific application needs.**
  - **Provides middleware-to-middleware interoperability (M2M)**



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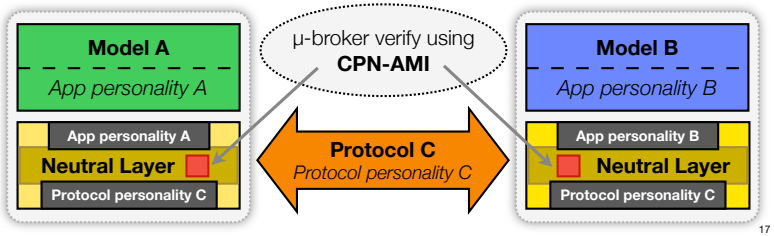

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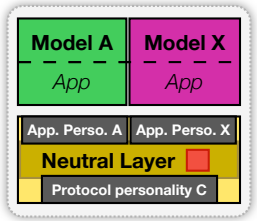
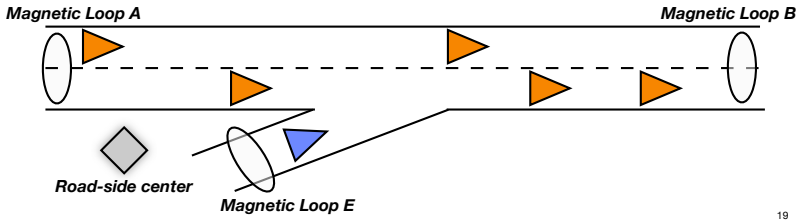


MoVe : A few projects

- Intelligent Transportation Services (ITS) analysis:
  - **Context :** Automated motorways (to provide driver assistance).
    - Approach centered on communication between cars (P2P organization).
    - Use of the motorway infrastructure.
  - **Needs :** How to design and analyze such systems



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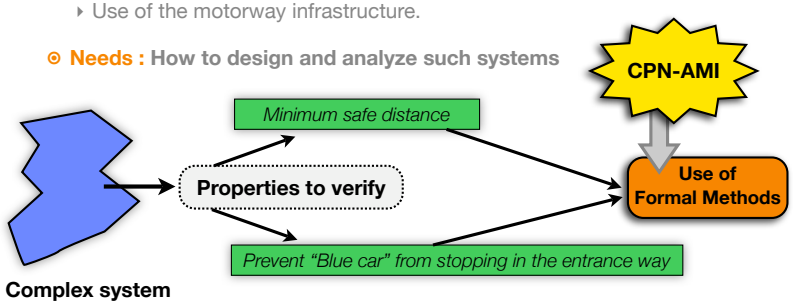
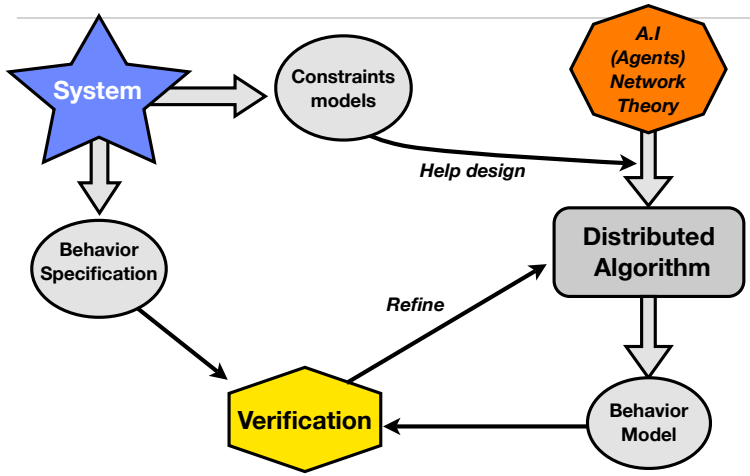


Stage about outdoor computing

- Context
  - Vehicular computing, ad-hoc networks
  - Smart Messages (and Spatial Programming paradigm)
- Problem
  - Avoid traffic congestion
  - Find out a distributed algorithm
  - How to use formal methods ?

Approach

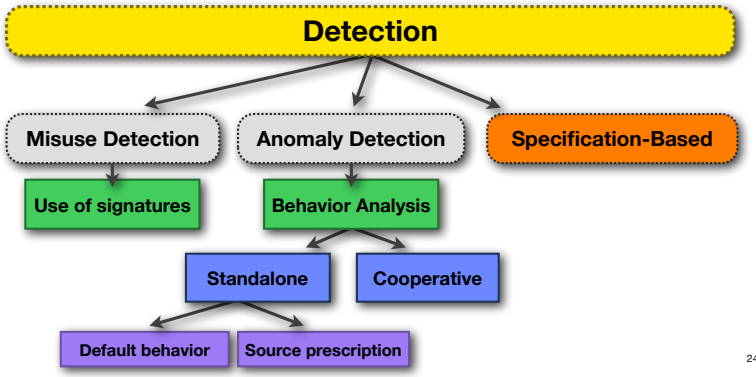


Roadmap

- **Identify** scenarii to help the behavior's specification
- **Hypothesis** (to make the work feasible)
  - Use of Smart Messages Platform
  - Data about other cars are available (no data aggregation)
- **Constrains** : informations available, threshold, etc...
- **Verification** may be a problem, according to the complexity
- Future work :
  - Handle data aggregation, relax some other hypothesis, ...

Use of formal methods to improve monitoring strategies

- Context
  - Intrusion Detection System (IDS)



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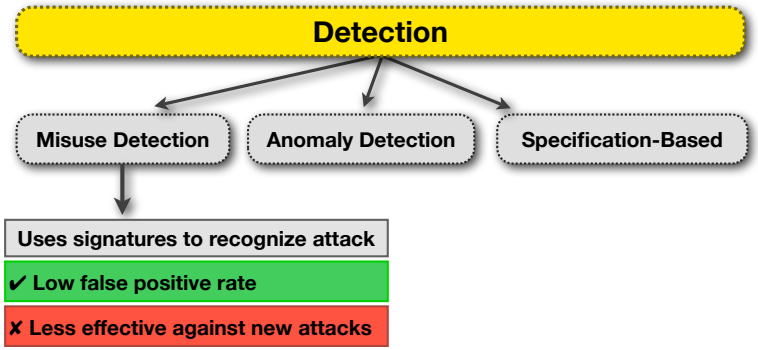

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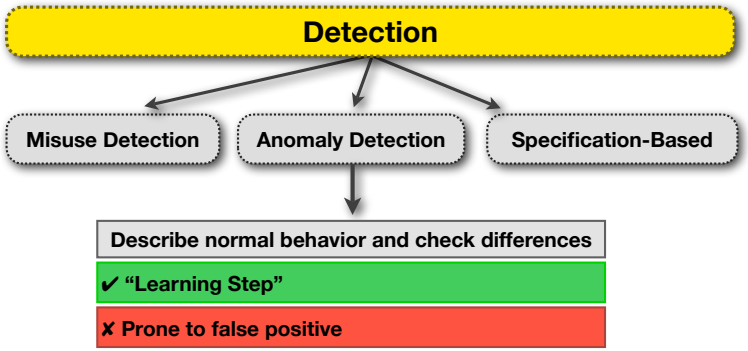

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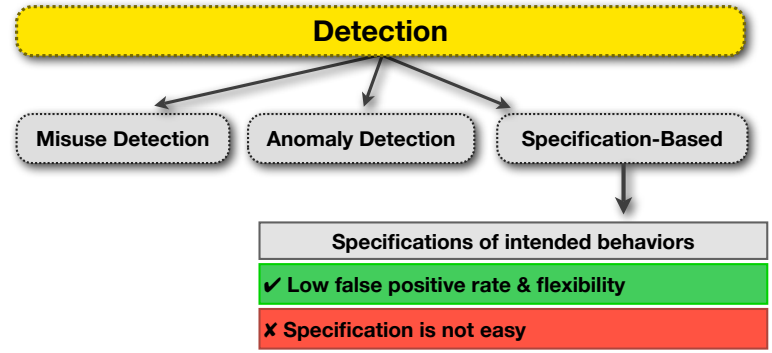
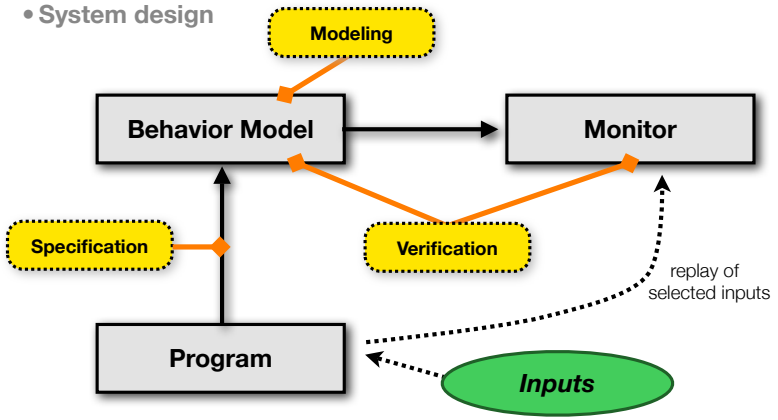


Use of formal methods to improve monitoring strategies

- Specification & Verification aspects
  - **Specification :**
    - How to define a **behavior** ?
    - Which **system parameters** do we have to monitor ?
    - What kind of **responses** do we propose to block or stop an attack ?
  - **Use of a Domain Specific Language (DSL) ?** (high level language)
  - **Verification :**
    - ✓ Give guaranties on **program behavior** before execution
    - ✓Give guaranties on **program behavior** while running
    - ✓ Ensure responses are **let to reach a “correct” system behavior**

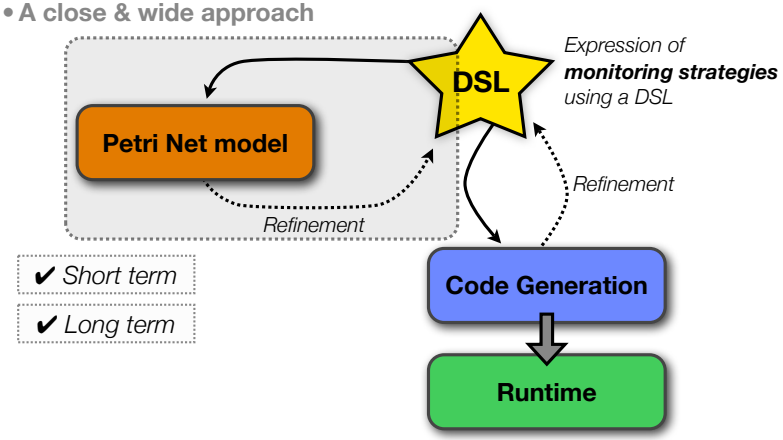
Use of formal methods to improve monitoring strategies

- System design



Use of formal methods to improve monitoring strategies

- A close & wide approach



Conclusion

- The beginning of a cooperation between our two universities
- Each university brings its own knowledge
- Two projects - Use of formal methods
  - Outdoor computing
  - Online-monitoring
- Workshop : June 2006
  - First results ?

Questions

- Any questions ?