

Collaboration between Rutgers & Paris 6

Supervised by :

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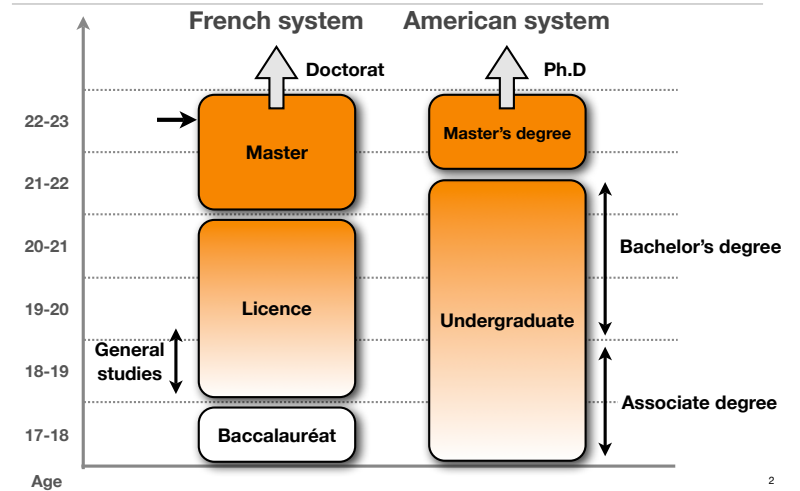
Prof. Fabrice Kordon - Univ. Pierre & Marie Curie (UPMC) (fabrice.kordon@lip6.fr)

M.S. Students from UPMC :

Xavier Renault (xavier.renault@etu.upmc.fr)

Jean-Baptiste Voron (jean-baptiste.voron@etu.upmc.fr)

French & American Educational System



M.S. : Distributed Systems & Applications

• Courses :

◉ Operating System aspects :

- ▶ Linux Kernel and Posix systems
- ▶ Embedded and Real Time
- ▶ Middleware internals

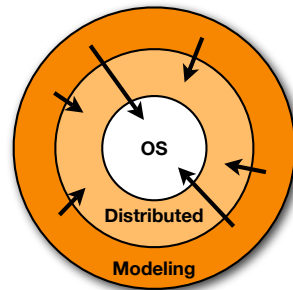
◉ Distributed aspects :

- ▶ 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

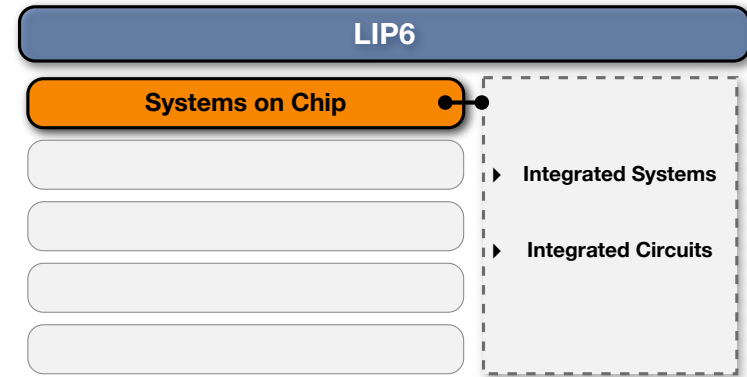


• Administrative aspect (some statistics...):

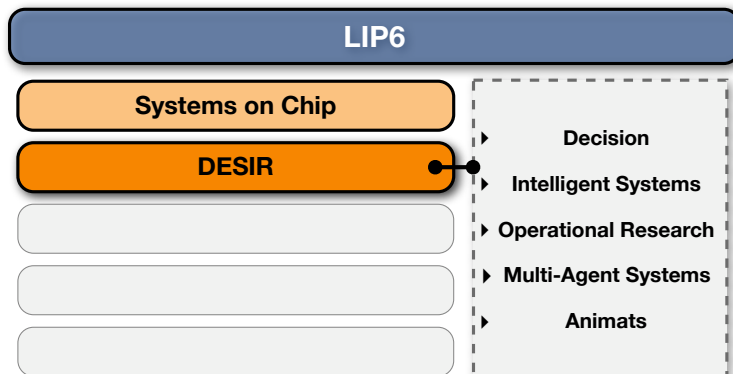
- ◉ 150 academics + 250 Ph.D students + 30 engineers
- ◉ Budget : 8 millions euros / year
- ◉ 9 start-up : Ucopia, Avertec, Surf Technology...
- ◉ 36 softwares
- ◉ Active participation in numerous European Projects



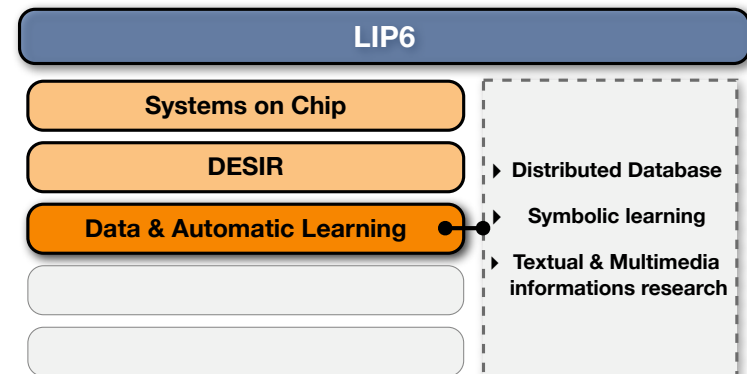
LIP6 : Thematics Departments



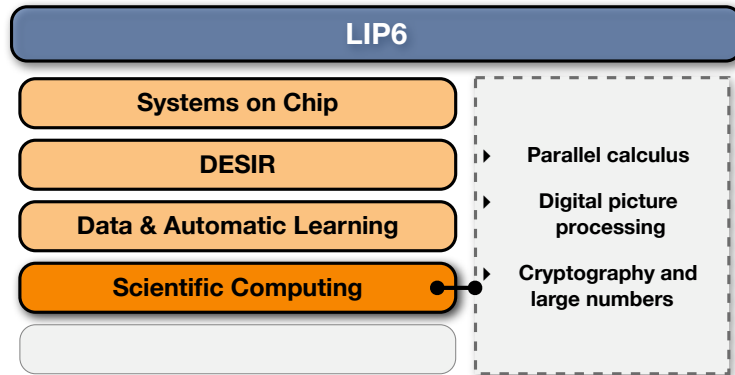
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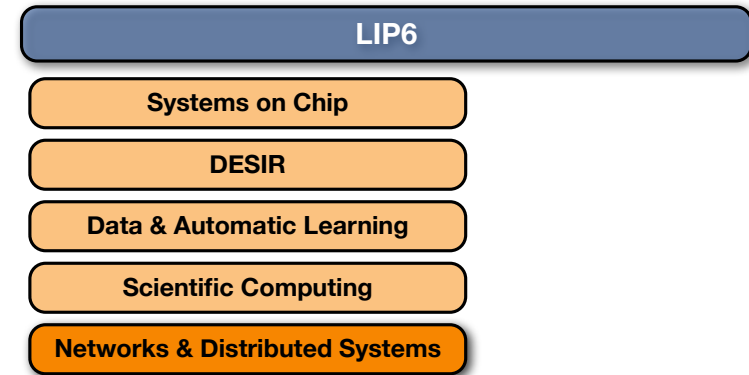
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The Network & Distributed Systems department

• 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

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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

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MoVe : Projects & Cooperations

• Internal Projects

- ◉ ModFact
- ◉ Spot
- ◉ MetaScribe
- ◉ CPN-AMI
- ◉ PolyORB
- ◉ ITS

◉ Industrial cooperations



◉ 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

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MoVe : Research axes

◉ Modeling / Programing

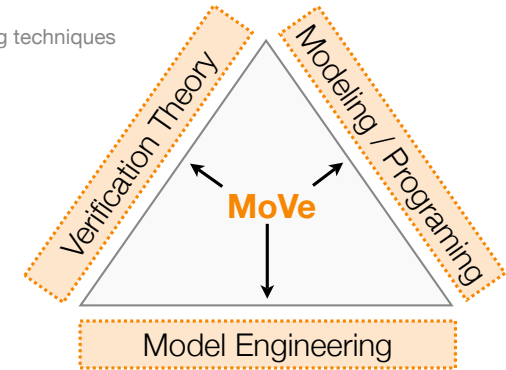
- ▶ Languages / Modeling techniques
- ▶ Paradigms
- ▶ Infrastructures

◉ Verification Theory

- ▶ Petri nets
- ▶ Structural verification
- ▶ Model-checking

◉ Model Engineering

- ▶ Meta-Model
- ▶ Advance Programing Techniques

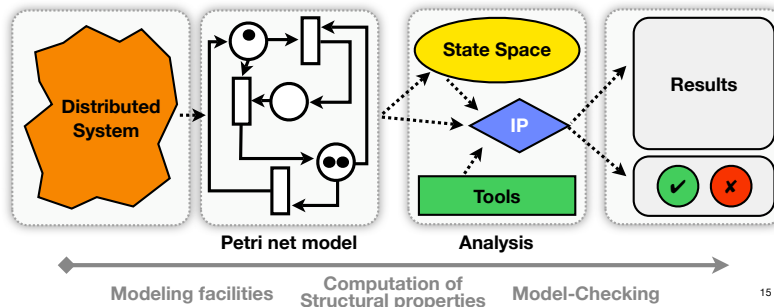
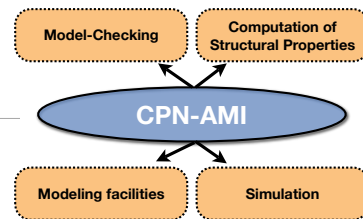


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MoVe : A few projects

• CPN-AMI

- ◉ Petri net based CASE environment
- ◉ Groups tools suitable for Petri net modeling and verification
 - ▶ Embedded LIP6 tools and other partners contributions



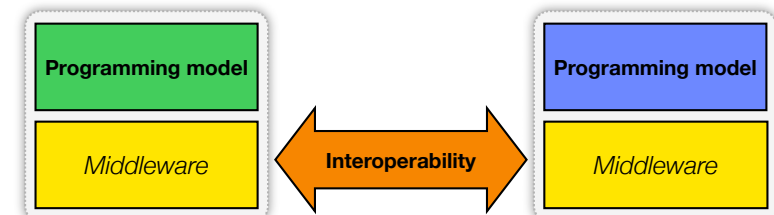
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MoVe : A few projects



• PolyOrb : A schizophrenic middleware (with Telecom Paris)

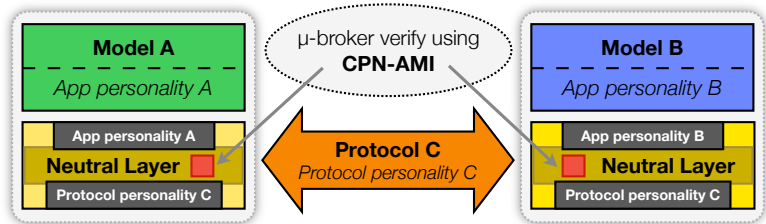
- ◉ A polymorphic, reusable infrastructure for building or prototyping new middleware adapted to specific application needs.
- ◉ Provides middleware-to-middleware interoperability (M2M)



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MoVe : A few projects

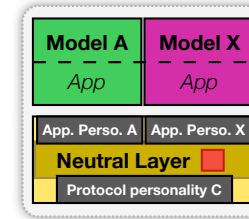
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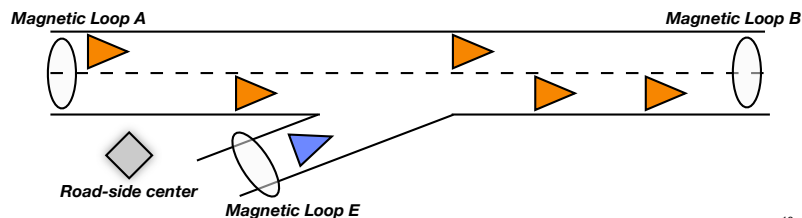
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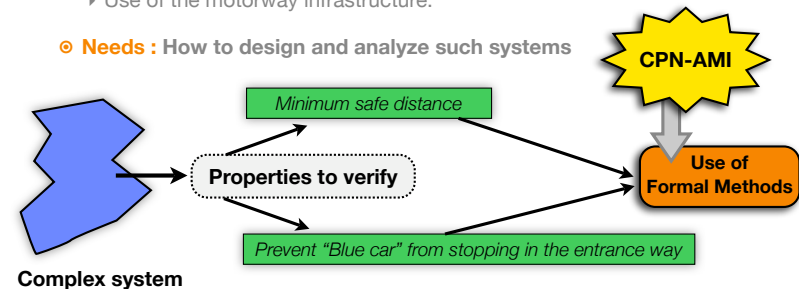
- Intelligent Transportation Services (ITS) analysis:
 - ⊙ Context : Automated motorways (to provide driver assistance).
 - Approach centered on communication between cars (P2P organization).
 - Use of the motorway infrastructure.
 - ⊙ Needs : How to design and analyze such systems



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MoVe : A few projects

- ITS (Intelligent Transportation Services) :
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Stage about outdoor computing

- Context

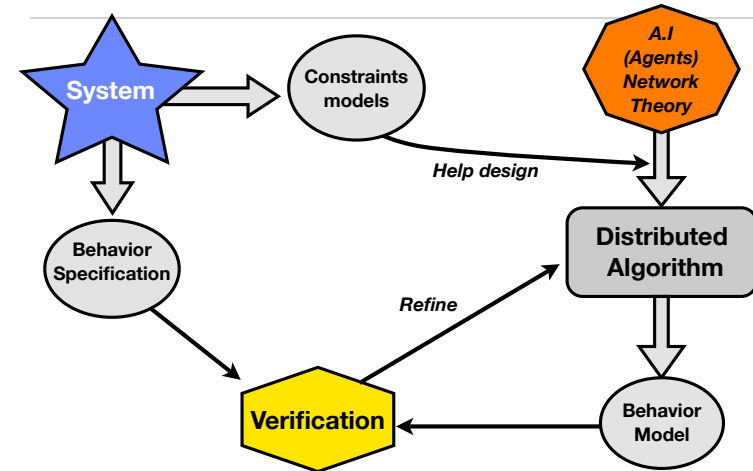
- ◉ Vehicular computing, ad-hoc networks
- ◉ Smart Messages (and Spatial Programming paradigm)

- Problem

- ◉ Avoid traffic congestion
- ◉ Find out a distributed algorithm
- ◉ How to use formal methods ?

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Approach



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Roadmap

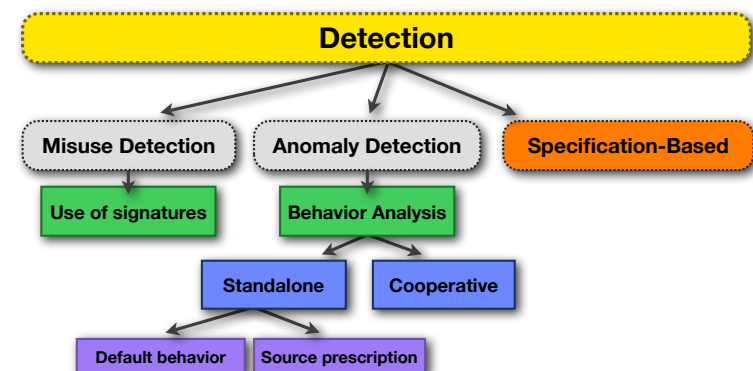
- **Identify** scenarii to help the behavior's specification
- **Hypothesis** (to make the work feasible)
 - ◉ Use of Smart Messages Platform
 - ◉ Data about other cars are available (no data aggregation)
- **Constrains** : informations available, threshold, etc...
- **Verification** may be a problem,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

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Use of formal methods to improve monitoring strategies

- Context

- ◉ Intrusion Detection System (IDS)

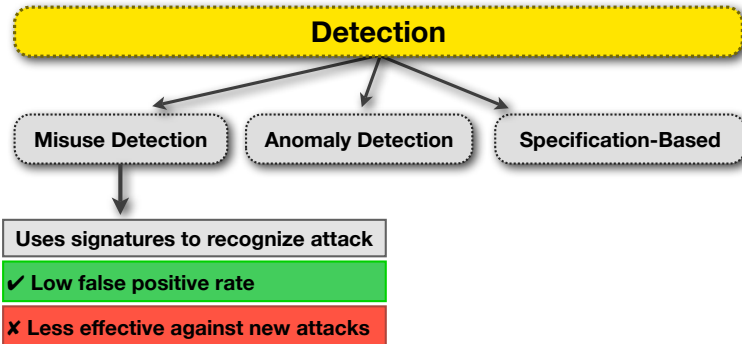


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Use of formal methods to improve monitoring strategies

• Context

◉ Intrusion Detection System (IDS)

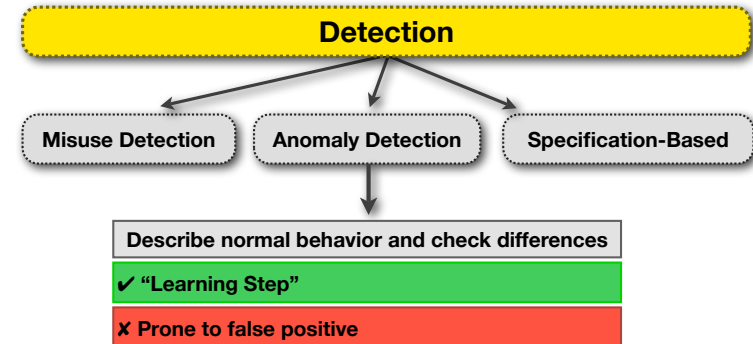


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Use of formal methods to improve monitoring strategies

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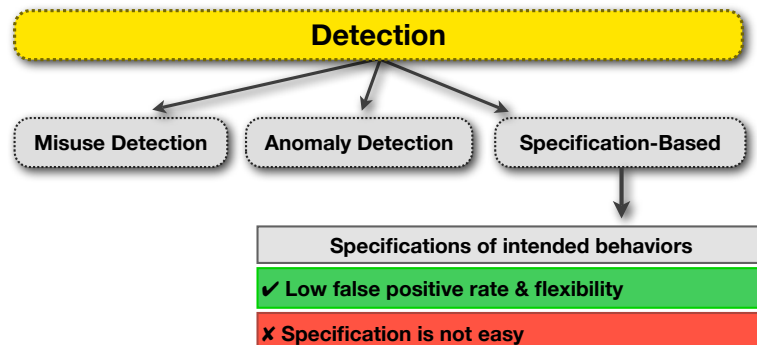


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Use of formal methods to improve monitoring strategies

• Context

◉ Intrusion Detection System (IDS)



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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)

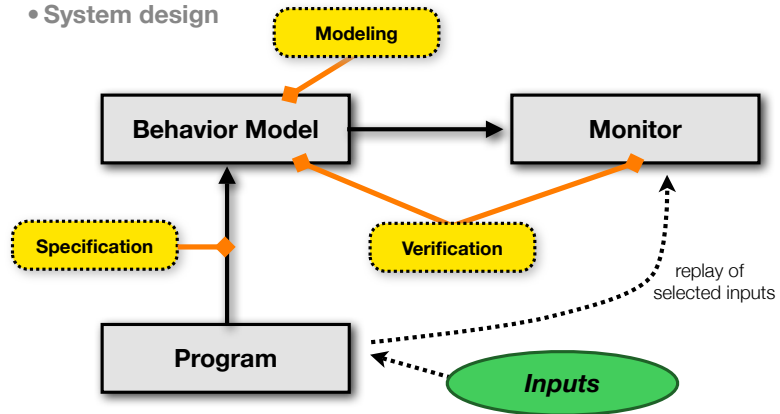
◉ Verification :

- ✓ Give guaranties on **program behavior** before execution
- ✓ Give guaranties on **program behavior** while running
- ✓ Ensure responses are **let to reach a "correct" system behavior**

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Use of formal methods to improve monitoring strategies

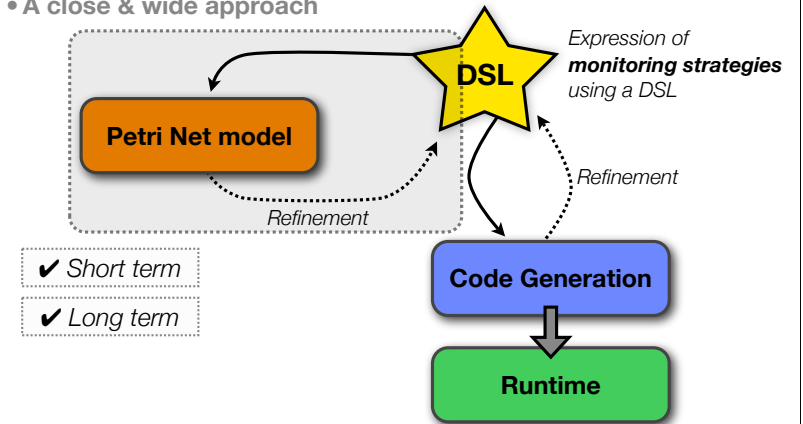
• System design



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Use of formal methods to improve monitoring strategies

• A close & wide approach



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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 ?

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Questions

- Any questions ?

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