Collaboration between Rutgers & Paris 6

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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 middleware
  - 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

- Systems on Chip
  - DESIR
  - Decision
    - Intelligent Systems
    - Operational Research
    - Multi-Agent Systems
    - Animats
  - Distributed Database
  - Symbolic learning
  - Textual & Multimedia informations research

- Integrated Systems
- Integrated Circuits

LIP6: Thematics Departments

- Data & Automatic Learning
- DESIR
- Systems on Chip
- Integrated Circuits
- Distributed Database
- Symbolic learning
- Textual & Multimedia informations research
LIP6 : Thematics Departments

- Systems on Chip
- DESIR
- Data & Automatic Learning
- Scientific Computing

LIP6

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
  - COFROUTE
  - SOFTEAM

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

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

MoVe : Research axes

- **Modeling / Programming**
  - 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

- **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)
MoVe : A few projects

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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

MoVe : A few projects

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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)
Use of formal methods to improve monitoring strategies

- **Context**
  - Intrusion Detection System (IDS)

  **Detection**
  - Misuse Detection
  - Anomaly Detection
  - Specification-Based

  Uses signatures to recognize attack
  - ✓ Low false positive rate
  - X Less effective against new attacks

- 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 guarantees on program behavior before execution
    - ✓ Give guarantees 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
  - Modeling
  - Verification
  - Specification
  - Behavior Model
  - Monitor
  - Inputs

- A close & wide approach
  - Petri Net model
  - DSL
  - Expression of monitoring strategies using a DSL
  - Code Generation
  - Runtime

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?