

---

# French Activities Presentations

First French Asian Workshop on  
Next Generation Internet

INRIA Sophia Antipolis

September 21<sup>st</sup>-23<sup>rd</sup>

*Walid Dabbous*



---

# Outline

- The context
  - the STIC-ASIA project
- Teams involved in this workshop
  - LAAS, LIP6, LSIIT (CNRS)
  - Armor, Hipercom, Planète (INRIA)



# STIC ASIA Project

## Internet Nouvelle Generation

(2004 - 2005)

Thomas Noël  
(contact : [noel@lsiit.u-strasbg.fr](mailto:noel@lsiit.u-strasbg.fr))



---

# STIC ASIA ING Project : Overview

- **Goals**

- Start or reinforce research cooperation between french laboratories and some identified Asian research laboratories
- Definition of several common research topics (but should restrict the number of topics to achieve significant results)
- Already identified some issues (IPv6 and Rural connectivity, Multicast, NEMO, Internet Measurement)

- **How can we do that ?**

- Organization of workshops
- Researchers invitation (from France to Asia – from Asia to France)



---

# STIC ASIA ING Project : Challenges

- **Expected results**

- Demonstration of strong research interaction between partners
- Students exchanges (co-supervision)

- **Discussions during the 1st French-Asian Workshop ?**

- How to define a common partnership program ?



---

# STIC ASIA ING Project : Members

- French laboratories

- CNRS

- » LAAS (Michel Diaz)
    - » LIP6 (Serge Fdida)
    - » LSIIT (Thomas Noel)
    - » LTCI (Michel Riguiedel)

- INRIA

- ARMOR (Laurent Toutain)
    - ARES (Stéphane Ubéda)
    - HIPERCOM (Philippe Jacquet)
    - MADYNES (Olivier Festor)
    - PLANETE (Walid Dabbous)

- GET, Renater, LIX : are interested

- Asian laboratories (not limited to)

- Asian Institute of Technology - Thailand (Kanchana Kanchanasut)
  - Seoul National University - Korea (Yanghee Choi)
  - WIDE - Japan (Jun Murai)



---

# Participating Teams

- LAAS – CNRS
- LIP6 – CNRS
- LSIIT – CNRS
- ARMOR – INRIA
- HIPERCOM – INRIA
- PLANETE – INRIA



---

# **LAAS - CNRS (Toulouse)**

**Software and Tools for Communicating Systems**

**“Outils et Logiciels pour la Communication” (OLC)**

38 persons (21 research staff , 17 PhD students)

## **Studies : Formal Design of Hypermedia Cooperative Communication Systems**

- **Main research directions**
  1. Concepts, Formalization and Analysis
  2. Communication Architectures and Protocols
  3. Cooperation, Components and Services





---

# Communication Architectures and Protocols

- **Design and validation of protocols and architectures for next generation Internet**
  - **New Transport Layer (FPTP)**
    - » QoS, Multicast, Multimedia, Partial order/reliability
  - **QoS in heterogeneous Networks**
    - » Multi-domains multi-technos (wired, wireless, satellite networks)
  - **Network monitoring and metrology techniques**
- **Current Platforms**
  - **Simulation (OPNET, NS-2, Tau G2)**
  - **Emulation : Local (NINE) & using WAN (GEANT)**
  - **Deployment based on active networks**



# MAIN PROJECTS

RN  
TL  
-  
CO  
TR  
E

(De-  
sign  
Me-  
thod)

MMedia et  $\mu$ Systems  
(LAAS Project  
on Tele-Engineering)

IST - EC  
Lab@Future  
(Tele-Teaching)

IST - EC : EuQoS  
(QoS in Multi-technologies)

RNRT: SAFE-  
CAST (Security)

IST - EC :  
SatIP6 (Satellite)

RNRT : METROPOLIS





# Network & Performance

**Serge Fdida**

**LIP6-CNRS / Université Paris 6**

**<http://www.lip6.fr/rp>**

**French Asian Workshop for Next Generation Internet    *October, 2003, Sophia-Antipolis***  
***LIP6 – Réseaux & Performance - Présentation***



---

# Network & Performance

Head : Serge Fdida

- LIP6 : <http://www.lip6.fr>
  - 400 researchers
  - 9 research areas, from micro-electronics to theoretical Computer Science
- Research group in Networking
  - A group of 40 people (research and staff)
  - An international visibility
  - A Global presence
  - Many strong industrial cooperations
  - A continuous valorization to a Joint Industry-Research lab (Euronetlab) and a Start-up (QosMos)



[www.euronetlab.net](http://www.euronetlab.net)



[www.qosmos.net](http://www.qosmos.net)

- Innovative research test-beds (IPv6, Mcast, Mobility, ...)
- An active contribution to Education and Research Management



---

# N&P Impact

- National (Public and Private)
  - RNRT, GDR, RTP
  - Thales, EADS, Ericsson, Sprint, 6WIND
- European Projects and Actions
  - IST (EDISON, DSE, GCAP)
  - ITEA /Eureka (RTIPA, AMBIENCE)
  - COST (Cost 264), ENEXT (FP6 NoE)
- International
  - Cooperation with US, Brazil, Korea, Canada, Tunisia ...
  - Participation to many Journal Editorial Boards and Conference Program Committees, TestBeds



---

# LSIIT Research Activities

Contact ( [noel@lsiit.u-strasbg.fr](mailto:noel@lsiit.u-strasbg.fr))



---

# LSIIT/Japan collaboration

- Jun Murai Lab - Keio University - Japan
- Nautilus project (<http://www.nautilus6.org>)
  - NEMO
  - Seamless Mobility
  - Multihoming (IETF proposals)
  - Multicast
- University Project
  - Deployment of IPv6/MIPv6 on Strasbourg University Campus
    - » IPv6 core network
    - » 100 IEEE 802.11b/g access points



---

# INRIA teams

- Armor
- Hipercom
- Planète





---

# ARMOR

## Architecture de Modèle de Réseaux (Architectures and models of networks)

Jean-Marie.Bonnin@irisa.fr



---

# ARMOR Members

- G. Rubino, DR INRIA  
(Scientific Leader)
- B. Sericola, CR INRIA
- B. Tuffin, CR INRIA
- F. André, prof. Rennes 1
- B. Cousin, prof. Rennes 1
- R. Marie, prof. Rennes 1
- L.-M. Le Ny, MdC Rennes 1
- C. Viho, MdC Rennes 1
- M. Molnar, MdC INSA Rennes
- J.-M. Bonnin, MdC ENST B
- F. Dupont, MdC ENST B
- D. Ros, MdC ENST B
- L. Toutain, MdC ENST B
- A. Boudani, ATER Rennes 1
- L. Guillo, Research Eng.  
(shared with the TEMICS team)
- 4 Temporary Eng.
- 25 PhD students

ARMOR has been created at the end of 1999



---

# ARMOR

## Architecture de Modèle de Réseaux (Architectures and models of networks)

- **ARMOR works on**
  - QoS analysis
    - » using models
    - » measuring
    - » testing
  - QoS design
    - » protocols
    - » architectures
- **Main global domain: IP**
  - focus on IPv6-related topics
  - focus on IP and QoS
  - specific domains:
    - » mobility, security
    - » testing
    - » routing, multicast
    - » pricing
- **Model analysis using**
  - queuing theory
  - discrete event simulation
  - (Quasi-)Monte Carlo
- **Scientific foundations**
  - Distributed algorithms in multicast, in QoS routing, in mobility
  - Game theory in pricing problems
  - Graph theory in routing and QoS routing problems, in WAN design techniques
  - Labelled transition systems in testing
  - Markov chains theory in performance and dependability evaluation of networks, in probabilistic test generation techniques
  - Monte Carlo and Quasi-Monte Carlo techniques in rare events problems
  - Optimization in WAN design techniques, in routing, in pricing
  - Queuing theory in deriving closed-forms, at the packet level, at the burst level (fluid models)



---

# ARMOR goals

- To develop
  - methodologies for QoS analysis
    - » dimensioning, network design, metrology, ...
  - techniques for achieving QoS goals
    - » protocol design, path computations, AQM, ...
  - to analyse and/or design specific systems
- To obtain momentum from the collaboration between modelling and networking people,
  - specificity: joint project between GET and INRIA
  - goal for next period: to expand this cooperation by exploring other areas of possible collaboration between ENST B and IRISA (e.g. mobility)
- Other keywords in the period (99-03):
  - heterogeneous contexts, focus on IPv6
  - several new areas added
  - ... together with increasing the size of the team



---

# Some results

- **Fluid models:**
  - algorithmic complete solution for [a general simulator](#), and a first prototype running
  - [stability conditions](#) and main [distributions](#) of important classes of fluid [queues](#)
  - first similar results on [networks](#) of fluid nodes
- **Queuing analysis:**
  - a “[stationarity detection](#)” [computing technique](#)
  - first results on [a new approach for closed-forms](#) derivation for basic queues
- **WAN design (associated team PAIR):**
  - a [new GRASP-based method](#) for core network design
- **Routing, multicast:**
  - a [new family of heuristics](#) for the Steiner problem
  - a [new extension to the Xcast](#) protocol
- **Quality evaluation:**
  - a [new approach to quantify the perceived quality](#) of a stream, based on queuing networks (as learning tools) and working in real time
- **Pricing:**
  - a [new auction-based scheme](#)
  - an [optimality result](#) concerning GPS versus priority schemes



# Some results

- **Coexistence IPv4-IPv6:**
  - the **DSTM** solution and associated tools
- **IP and QoS:**
  - *diffserv* techniques to deliver multimedia flows
  - analysis, improvements, evaluation and (first and only) BSD IPv6 implementation of **ROHC**
  - a new network-controlled **micro-mobility protocol**
- **Foundations of interoperability testing:**
  - a first **formal framework**
  - a new **coverage** test model (based on a concept of labelled Markov chains)
- **In standardization:**
  - strong activity at the **IETF** on IPv6 (mobility, DSTM, IPsec, DNSsec, compression, ...), at **ETSI**, at **3GPP**
  - ARMOR is the leader of the technical side of the recent international *IPv6 Logo Prog.*
- **Dependability, performability:**
  - new expression of the distribution of the general **accumulated reward** metric (on  $[0, t]$ ) and a stable associated algorithm
  - a **Quasi-Monte Carlo method** and a family of **Monte Carlo techniques** for transient analysis of Markov chains



---

# Software

- Main software in the period:
  - **Adserv**: first implementation of a *diffserv* router on BSD
  - **DSTM**: transition mechanism (IPv4-IPv6)
  - **ROHC**: complete implementation of ROHC for IPv6
  - **SPNP 6.0**: stochastic Petri net package (Duke)
  - **NCHMIPv6**: network-controlled HMIP (with FT R&D)
  - prototypes at different stages:  
**QMCLib**, **FluidSim**, **FluidSolve**, **DEPENDlib**, **BB**, **Ons**, ...
- Some indicators:
  - 25 on-going PhD + 11 finished PhD in the period
  - among them, 12 with public funds, 24 with contracts
  - 23 industrial collaborations (listed in the report) with a global funding of 2.2 M€ for ARMOR in the period; partners are public and private, in France and in Europe



---

# Collaborations

- Main industrial partners:
  - FT R&D, Alcatel, Ericsson, Philips, Thales, 6WIND, AQL, Sagem, Onera, CRIL, CISCO, Juniper, DGA, EDF, AFNIC, ...
- Academic Collaborations:
  - TEMICS; R2D2; ARES; MISTRAL; HIPERCOM; ARCs TCP and PRIXNET
  - G6; TAROT; “multicast community”; AS CNRS in Perf. Eval.; PRISM & IMAG (ACI Security); Univ. Savoie; LSIIT
  - Associated Team PAIR on WAN design (with Univ. Montevideo)
  - Associated Team MOCA6 on IPv6 and Mobility (with WIDE/Nautilus6)
  - WIDE Project; NoE Euro3Gi; WG 7.3; Duke Univ.; Univ. of Montréal; IBM Watson; Univ. of Budapest; CalPoly in Pomona; “matrix geometric community”; ITAM at Mexico; UNAM at Mexico; ENSI at Tunis; SEU at Nankin in China; ETRI in Korea, SEU in Korea.





# Hipercom project team

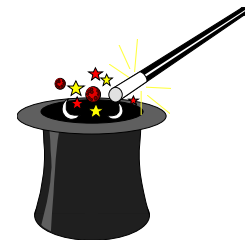
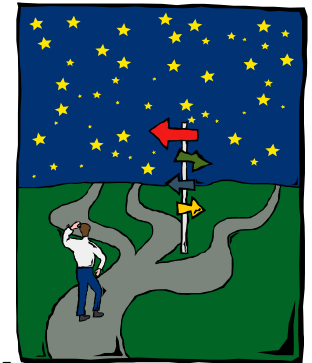
Philippe Jacquet

# Who are we?

- We are a project team located in Rocquencourt
  - Philippe Jacquet, scientific leader
  - Paul Mühlethaler, permanent leader
  - 3 CR
  - 9 PhD
  - 2 engineers

# Domain of activity

- **Area:** telecommunication protocols and algorithms (1B)
- **Targets:** Routing, QoS, dynamic networks, mobile *ad hoc* networks, cable TV, backbone internet.
- **Tools:** performance evaluation, optimization, experimentation

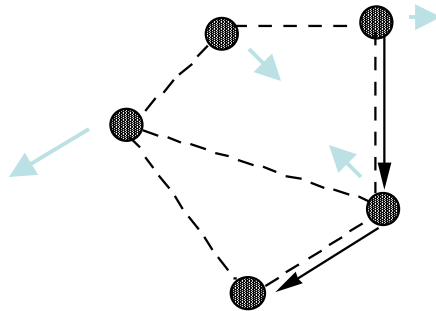


# Main Contributions

- Wireless Internet standard: **OLSR**
  - **Optimized Link State Routing** (RFC 3626)
  - **DARPA** Reference for tactical networking.
  - Many implementations and tests outside INRIA
  - Extensions for multicast, QoS

# Mobile Ad hoc NETWORK (MANET)

- A **manet** is a network made by the meeting of several **mobile** nodes **without** pre-existing **infrastructure** for communication.



# A very hot topic

- Algorithms for **wireless** networks
  - Short range, scarcity & versatility
  - Need for efficient multihop broadcast and routing
- Most CS and IE research centers and universities work on **manet** and **sensor networks**
  - 10600 google hits for mobile+ « ad hoc »+defence
  - Litterature, many special issues
  - Conferences Mobicom, mobihoc, etc
- **INRIA** among the **pioneer** centers
  - Patents and publication in the early 90s
  - **HIPERLAN 1**

---

# Planète team: Main objectives

- Design, implement and evaluate enhanced Internet **protocols, applications** and **services** that enable
  - seamless mobility,
  - group communications,
  - efficient multimedia transmission,
  - QoS and security support
- over an heterogeneous network integrating new transmission media



---

# The team

INRIA researchers	Walid Dabbous (S), Claude Castelluccia (G), Thierry Turletti (S), Vincent Roca (G), Chadi Barakat (S), Arnaud Legout (S).
Exterior collaborator	Hossam Afifi (Professor INT Evry).
Specialist Engineers	Hitoshi Asaeda (S), Thierry Parmentelat (S).
Expert Engineers	Alexis Gourdon (S), Julien Labouré (G), Christoph Neuman (G).
PhD students (8S+4G)	Vijay Arya, Lina Al-Chaal, Laurent Fazio, Zaynab Khallouf, Hahnsang Kim, Mohamed Malli, Hossein Manshaei, Abdel Basset Trad.
Post Doc	Ceilidh Hoffman
Admin. Assistants	Françoise De Coninck (G), Aurélie Richard (S).





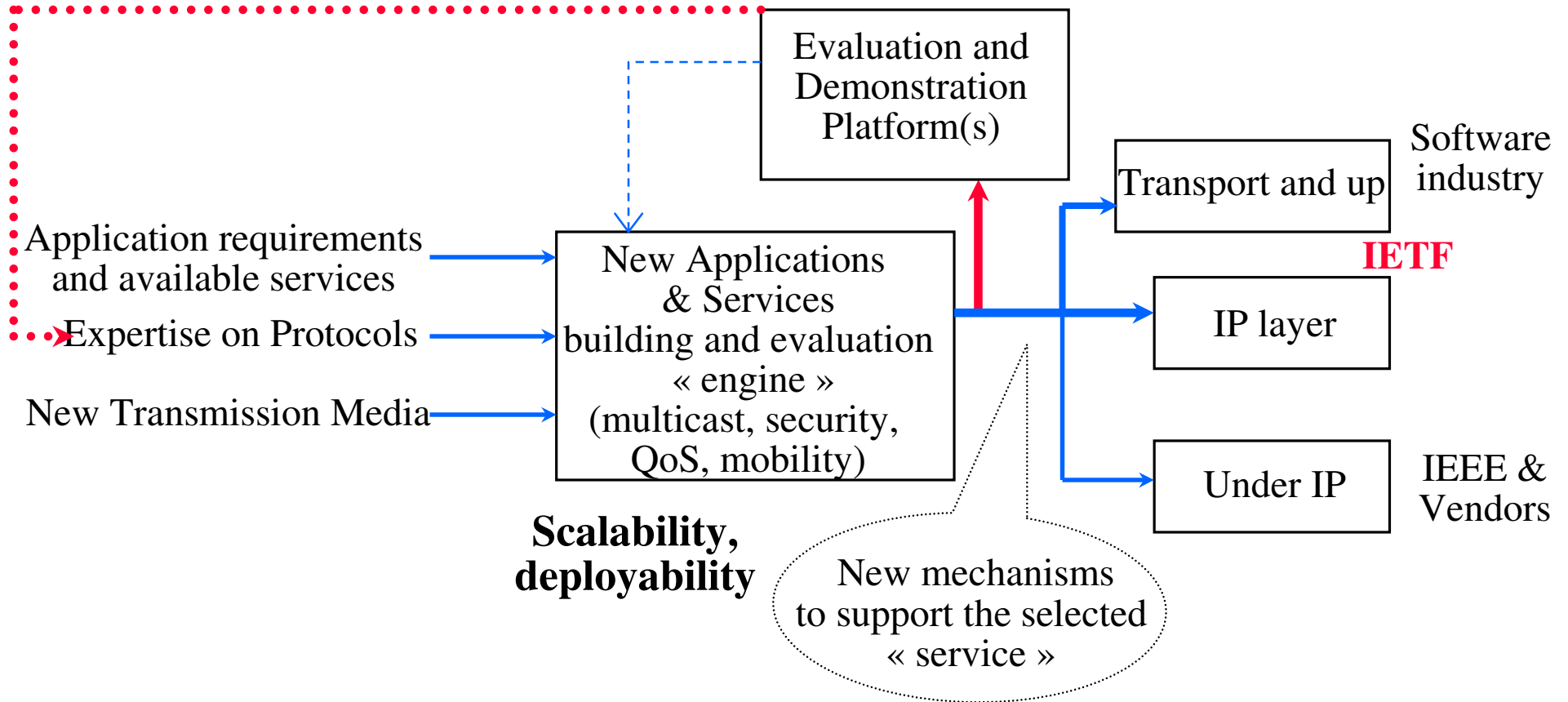
---

# Methodology

- Design protocols and mechanisms
  - on top of IP network service
  - following the end2end argument
  - tailored to networking applications requirements
- Evaluate them by
  - implementation
  - simulation
  - and modeling
- Participate to standardization (mainly the IETF)



# How do we work



---

# Research domains

- Mobile Communications (reducing activity)
  - Hierarchical Mobile IP (mobileip WG/Ericsson Labs)
  - Network Mobility (nemo WG/ Motorola Labs)
  - Internet Paging (seamoby WG/Docomo Labs)
  - Mobility IPv6 Security
- Group Communications (changing to p2p multicast)
  - **Multicast routing and group management** (magma & mmusic WGs)
  - MLD Security (IRTF SMUG WG/ SunLabs)
  - Reliable multicast and FEC codes (rmt WG)
  - Application level multicast



---

# Domains (contd.)

- New Transmission Media
  - Enhancement of the QoS support in 802.11 LANs
  - Multicast routing and transport support over satellite links (Alcatel, Hitachi)
  - TCP performance in heterogeneous network environments
- Multimedia Applications and New Services
  - Optimization of large group video transmission over hybrid wired/wireless networks
  - **Communication architecture for LSVE**
  - Scalable video streaming
  - Resource sharing in router buffers and QoS support
  - Efficient inter-domain authentication architecture



---

# Relations to other groups

- Build and learn expertise on protocols
- INRIA groups: Mistral, TREC, Temics, Porquerolles TF
- French groups: LIP6, GET, IMAG, ENSICA, LSIIT, LAAS
- International groups: MIT, UC Irvine, U. Arizona, RPI, EPFL, U. Berne, U. Lancaster, Keio Univ, WIDE, etc.
- Industrials: Ericsson, Nokia, SUN, Docomo, Hitachi, Alcatel, FT R&D, CS Telecom, Esterel Technologies, STM, Motorola, Netcelo, etc.
- Member of the E-Next NoE



---

# Collaborations with Asian groups

- Collaboration with NEC (95-97) on multimedia conferencing over high speed wireless LANs
- Collaboration with Hitachi (2001-2002) on Unidirectional Link Routing
- Collaboration with Hitachi (2003-2004) on security in heterogeneous environments
- Strong collaboration with the WIDE group in the context of the IETF udlr working group
- Participation to STIC-Asia project (WIDE-INRIA-AIT)



---

# Future directions

- Group Communication for interactive multimedia applications on top of overlay networks.
  - focus on peer to peer
- Security
  - SUCV/CGAs applications
  - Heterogeneous platforms



---

# Multimedia Applications

- Multimedia LSVE applications:
  - SSM, Peer-to-peer + experimentation on PlanetLab test-bed
  - Support host (PDAs, laptops ) and access technologies heterogeneity (ADSL, WLAN, etc. ) (MUSE IP)
- Cross Layering approaches for increased adaptation
  - Application-aware rate selection algorithms
  - Transmission on multiple interfaces (802.11) (TEMICS)





---

# Multimedia Applications - cntd

- **Infer the topology of the Internet**
  - Better control (for ISPs), enhance overlays (for service providers), and resource look-up algorithms (for users)
  - Topology of IP routers or address prefixes, or links characteristics: active or passive approach
- **Enhanced FEC code**
  - secure LDPC and Unequal Protection schemes
- **Scalable Video Transmission**
  - build on ALC/LCT, LDPC and security



---

# Security

- Statistically Unique and Cryptographically Generated Addresses (SUCV)
  - proposed by INRIA/SUN and Microsoft
  - protect against IP address stealing
  - applications: Mobile IP security, MLD security, MANET, Opportunistic encryption, P2P security
- Mobile Ad-hoc Network security
  - routing protocol security
  - provide security & privacy
  - Collaboration with Eurecom and UC Irvine (Splash project)

