

DIONYSOS

(Dependability, Interoperability
and performance analysis of networks)

INRIA Rennes, France

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Analytic techniques

- **Dependability and performability measures**

Moments and distributions of transient measures combining both performance and reliability aspects.

$\{X_t, t \geq 0\}$ CTMC.

Reward rate $\rho(i)$ associated with state i .

Impulse reward $c(i, j)$ associated with transition (i, j) .

Y_t : accumulated reward over $[0, t]$,

$$Y_t = \int_0^t \rho(X_u) du + \sum_{0 \leq s \leq t} c(X_{s-}, X_s).$$

Collaboration: F. Castella and G. Dujardin (Ipsos Inria-Rennes project team), J. Ledoux (Insa, Rennes), J. Carrasco and V. Sunié (Barcelona University, Spain), H. Nabli (Sfax University, Tunisia).

Analytic techniques

- **Transient and stationnary analysis of fluid queues**

Buffer level distribution, sojourn times distributions, maximum level reached in a busy period.

Fluid queue fed by a CTMC $X = \{X_t\}$.

- Buffer level at time t when X is a birth and death process.
- Stationary sojourn times distributions.
- Stationary distribution of second order fluid models.
- Maximum level and hitting time distributions
(Matrix differential Riccati Equations).

Collaboration: F. Guillemin (France Telecom, France), M. Telek (Budapest University, Hungary), D. Manini and M. Gribaudo (Torino University, Italy), M.-A. Remiche (Namur University, Belgium).

The MAPI group (Applied Maths for Computer Science)

6 members : B. Sericola (leader), G. Rubino, F. Castella, P. Chartier, M. Basseville, F. Le Gland.

Goal : Improve collaboration between computer scientists and mathematicians at INRIA.

Visiting Committee Report 2009 : "reenforce the synergy between computer science and applied mathematics".

MAPI group validated by the Inria Rennes project committee.

Topics : Performance and dependability analysis of large scale distributed systems, P2P systems, cluster-based distributed systems, targeted attacks, churn, distributed assessment of nodes importance in complex networks, self-stabilization in wireless networks, auto-configuration

Results : Since 2006 : **8** Inria teams concerned (**3** from Rennes and **5** outside = **15** people), **19** joint publications (7 journals, 8 int. conf., 4 nat. conf.) **1** industrial contract with Technicolor and **1** PhD student.

Future

- Dependability and Performability measures : consider new transient measures coming from the probabilistic model checking domain (context of the MAPI group).
State space explosion : compute bounds of such measures.
- Networks of fluid queues : is there some simple transient formula as in the case of single queues ?
- MAPI Group
 - Develop a stochastic theory of cluster-based large scale distributed systems.
Behavior of one cluster : A Markov chain (≈ 2500 states).
 n clusters in competition for resources (transitions, ...).
Evolution of the system : branching processes ?
Behavior of the system when $n \rightarrow \infty$.
 - Improve visibility inside Inria : should the group not become the first scientific service ?