

Technologies For Adding Resiliency to Dynamic Distributed Systems

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Initial Statement

Distributed systems are rapidly evolving, into new classes of applications such as VANET, Smart Environments, P2P, and distributed cloud services

Mastering this complexity is an industry need

Common denominator: Dynamicity of the system model e.g.

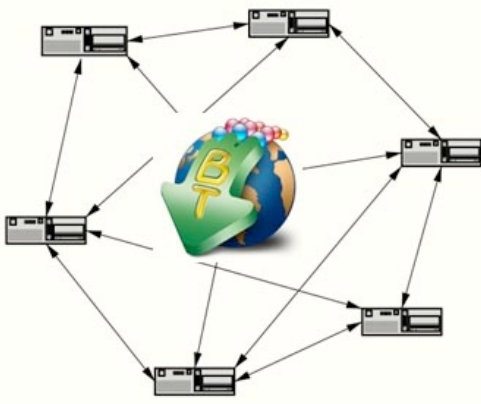
Underlying communication structure self-defined at any instant by entities

Continuous arrival and departure of participating entities

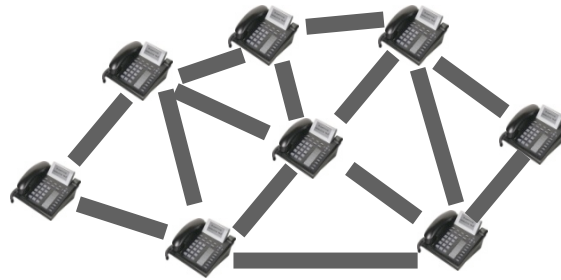
it may not be possible to assume anything about the universe of participants, their identities, capabilities, or reliability.

What is a dynamic distributed systems?

Internet-scale Applications

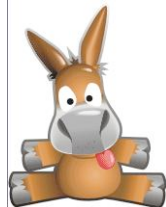
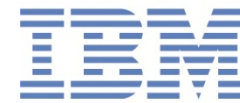
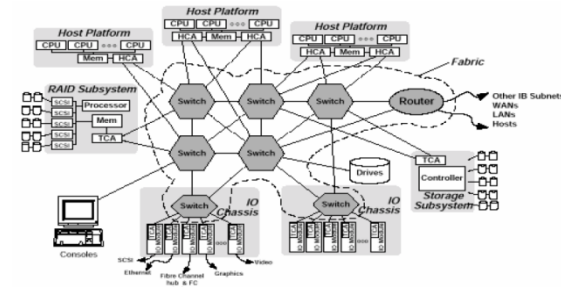


Scalable QoS-constrained applications



P2P SIP

Enterprise Data Centers



What is a dynamic distributed systems?

Very different system models

Internet-scale Applications

- unmanaged environment
- shortlife peers
- High churn

Enterprise Data centers

- managed environment
- longlife peers
- low churn

Scalable QoS-Constrained Application

- partially managed environment
- shortlife peers at network edges,
longlife peers in the core
- high churn only at network edges,
low churn in the core

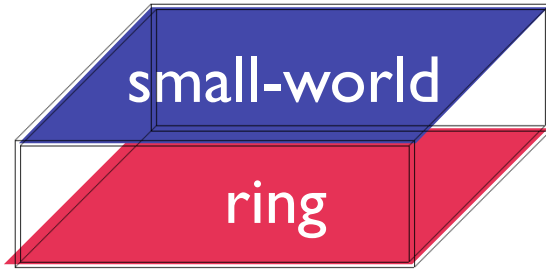
P2P systems based on overlay networks

- self-organize and partial view of the whole system
- gracefully tolerate peer failures and churn
- avoiding single point failures and bottlenecks

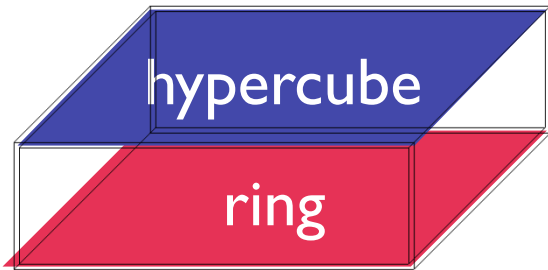
Each application has requirements that
impact the design of the overlay

Overlay Networks Substrate as superimposition of graphs

Structured overlay



Chord [SMKKB03]



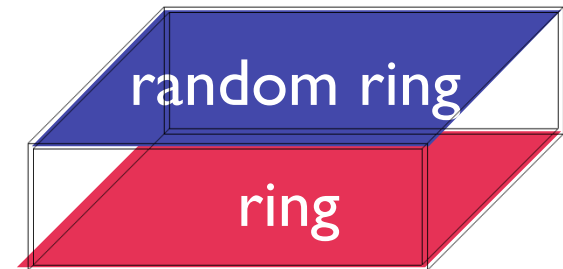
Pastry [RD01]

Unstructured overlay



GosSkip
[GHHKFR06]

Hybrid overlay



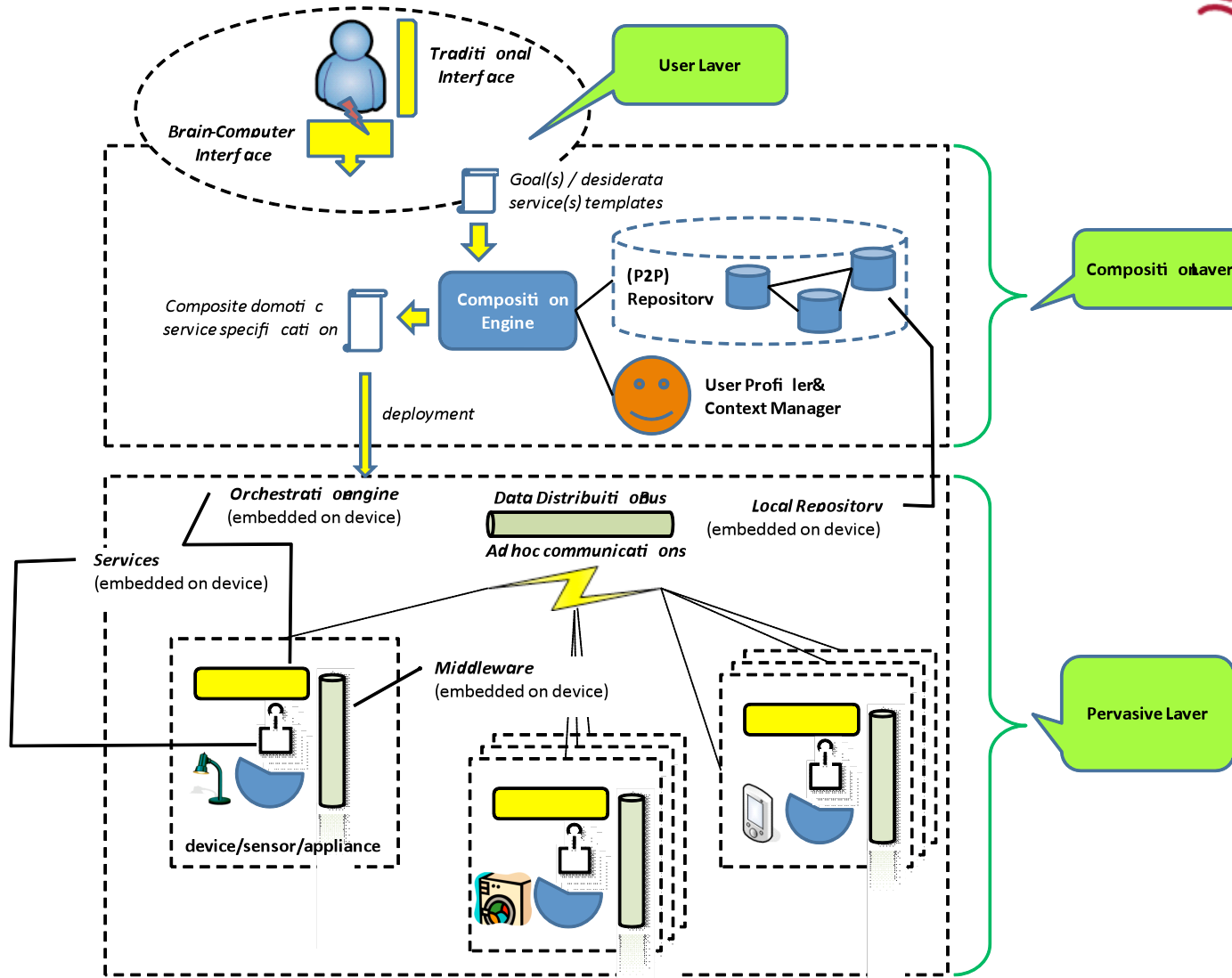
BISE [TCS06]

P2P technology has started in Internet based applications such as file sharing and IP telephony a-la-skype but there has not be wide diffusion of other applications due to the difficulty of handling the dynamicity of the internet based model

This technology has much more potential if looking at domain specific enviroments where some of the dimension of dynamicity can be managed by some provider.

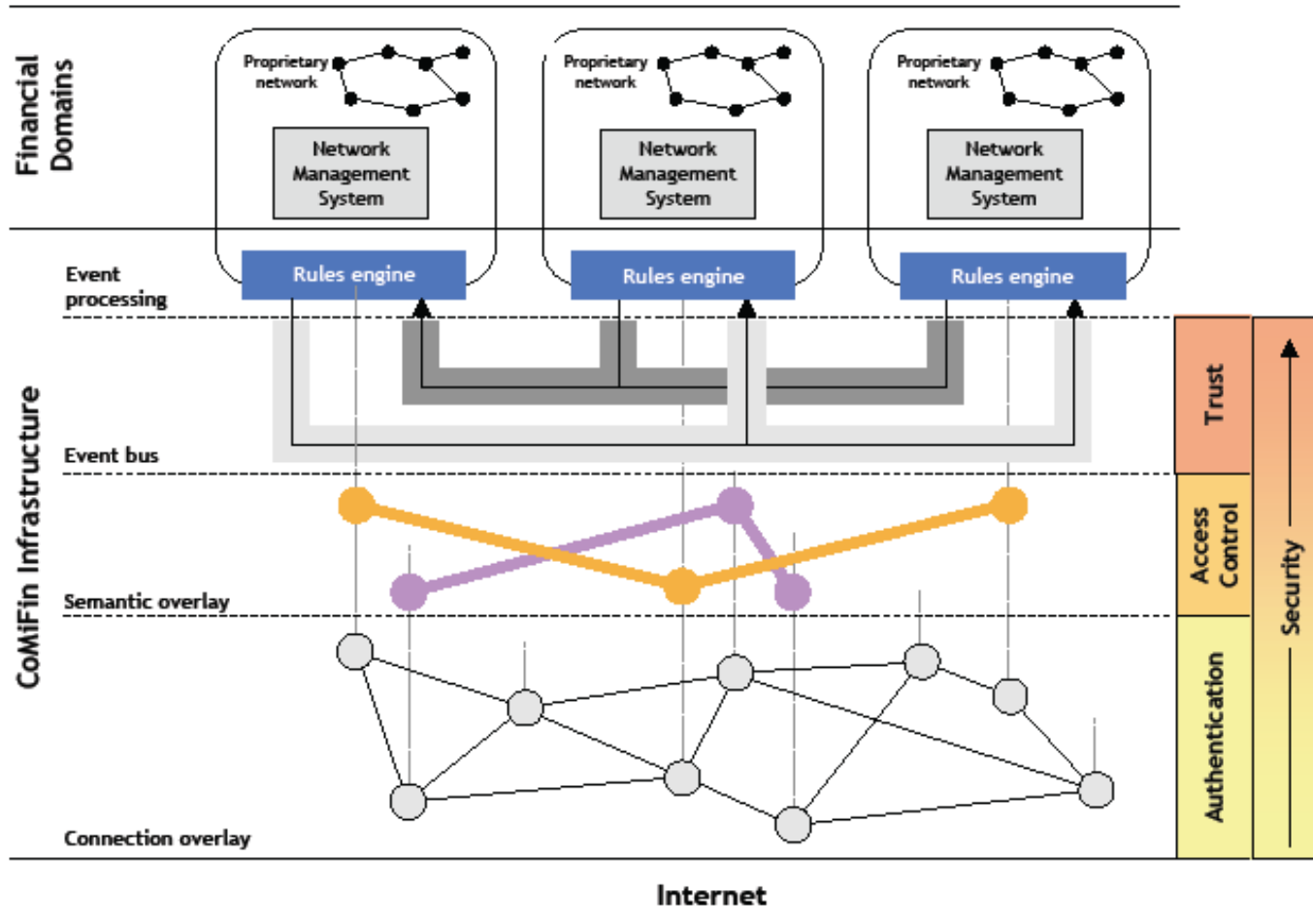
Future scenarios for superimposed Overlay network

Smart Houses (The SM4ALL Project):



Future scenarios for superimposed Overlay network

Financial Infrastructures (the CoMiFin Project):



Future scenarios for superimposed Overlay network

SOFIA (Artemis 30Me Project in FP7 led by NOKIA). Smart Objects for Intelligent applications

eDiana (Artemis 15Me Project in FP7 led by Acciona, Spain) on cooperative building for energy saving.

Conclusion

Understanding the fundamentals of how to master this dynamic dimension is of primary importance to design of robust, dependable, and predictable distributed systems.

From the theory side (PODC/DISC) we have basically no common background on that
(Theoretical Aspects of Dynamic Distributed Systems Workshop will be held in September in Spain)

Problem coming from industry, technology leading, lack of shared theoretical background

There are all the ingredients for having fun in the next years!!