Architecture for Digital Ecosystems, when SOA does not scale

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Soluta.net is constituted by a team of IT professionals that have a worldwide experience in Component-Based Development and Enterprise Architectures since 1994. Founders of Soluta.net have provided technical and architectural leadership for several European projects using advanced Internet-related technologies, component-based development, Web Services and wireless technologies in a number of domains, including telco, pharmaceutical, healthcare, facility management, CRM, EAI and tourism.
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Dr. Ferronato has provided technical and architectural leadership for several European projects using advanced Internet-related technologies, component-based development, webservices and wireless technologies in a number of domains, including telecoms, pharmaceutical, ERP, CRM, EAI and tourism.

He is a Senior Consultant for the Cutter Consortium
He is a Consultant for the Ministry of innovation in Italy
He has defined the architecture of the Italian Electronic Healthcare System
SOA has been designed and envisioned for inside Enterprise integration as a means to bridge systems and to create a governance layer on top of existing platforms as either legacy or assets. Now the industry is heavily moving to B2B environments where the parties are not single department applications but rather Enterprises. Inside Enterprises there is administration ability of the SOA infrastructure, ability to handle the network, gain control over resources and IP, and everything is reasonably under control. Between enterprise this is not true any more – IPs may change, protocols are subject to be replaced without notice, UDDI needs to be shared among parties, UDDI becomes vital for indexing and discovering services, and models need to change at a pace which is faster than any ability to maintains coherence and harmonization via a coordination process. The entire B2B becomes a very loosely coupled community which brings news challenges in SOA architecture, and dealing with this reality requires re-thinking of the founding principles and technology of SOA. This talk will address these and other issues facing the next generation of projects that are already ingoing. The presentation will delve into these issues, tackling SOA and proposing new techniques, and borrowing concepts from real industrial and research projects that are currently under development and that the speaker is leading as an Enterprise Architect. He will describe P2P based approaches for service registry, decentralized model repositories, scale free network, and additional references to cutting edge technologies in the Business Ecosystem arena.
SOA

- SOA is an architectural style that evolved from EAI, RPC, CORBA, where the focus was on Application, Procedures, Objects to Services plus:
  - Loose coupling, aligning business with the services
  - It does scale up, inside an enterprise
    - Communication is hierarchical
    - Central control
      - A single functional reference model is feasible
      - The infrastructure is centrally managed and under control
  - Functional and infrastructural changes are driven by the enterprise sole goal of increasing its business and revenue, hence those changes are harmonic and harmonized at the end, even though still hard to control

- But...how does it scale up across enterprises?

- Is it a SOA of SOAs another SOA?
Ecosystem Architecture

Ecosystem Oriented Architecture
“Hic sunt leones”
“There be tygers”

Service Oriented Architecture

Application Architecture

Design

Adapted with permission from Mike Rosen
Issues
What is this about?

- Focus is moving from “intra enterprise” to “across enterprises”
  - Business communities are overlapping, it is not a partition
  - From Newtonian to Quantum Mechanics
- We have to leverage what apparently are the weakness of IT
  - Dynamism, flexibility
- When a problem increases in scope or complexity, there is always a time when the “usual” solution takes you to the “what the heck?!?”
  - It means, it does not scale
  - It's not the same problem but just bigger, it's a new one!
  - We need a new solution space
- “IF the only thing you have is a hammer, everything you see is a nail”
  
  We need a new mindset
B2B
b2B
A different set of problems

- A different mind-set that is partially a technological problem
- Real B2B is about:
  - complex Business transactions which are “money driven”
  - “Coopetition”
  - Absence of a Central Reconciliation Point
  - *Newtonian vs Quantum physics*

- Functional Reference Models
- Services
- Technology
The “single reference model” is not a feasible objective (even if it was attempted in the past, aka “Big Picture”)

Standard reference models for each business domain

- Lack of universal standard vocabulary: **folksonomy, taxonomy**

Ontologies?

- mind the plural, how to reconcile Ontologies?
- “Competing standards” exists today (notice the oxymoron?)

Communities (mind the plural)

- Overlapping models
- Intelligent **Recommendation** Search engines

The owner of models and registries need to be the community itself
Across enterprises requires a new set of business services

- Payment
- Business Contract & Negotiations
- Billing
- Trust
- Reputation
- Legal compatibility

Re-think:

- Service Discovery
- Reliability-guaranteed delivery
- Security
- Long running Transactions
- XML Firewall
Multi registry (as in UDDIv3) is hierarchical
- there is no “root” node in the Internet
- It represents a single point of failure (SPoF)

Registry replication need to be driven by requests not statically defined
- It's too Administrative intense

Registry of end-points
- IP does not scale
- Registry need to be updated
- Support mobile devices, dynamic IP's, lease management (Jini like)

Registry of service specifications
- MDA: need to be a MOF compliant Model Repository
- Semantic Research
Model dependency, versioning, inheritance, merge, copy of

- It's structure can not be managed
  - It can be barely done in a single ERP project, with great effort, this is of a great debate in IT, books, methodologies, approaches...
  - It does not scale up!

- Again we need to shift to a new mind set
  - Evolutionary based, “digital darwinism”
  - Create the rules (or better: meta rules) under with the system self sustains an self regulate
  - The chaos do converge to a stable status if we enable the right handles

- Meta-modelling! Meta models do change!!

- It represents a single point of failure (SPoF)
Topology
ESB is conceived for intra organizations

- It assume a set of features that does not met the requirement and rule of the Internet
- We have to assume there is no “Common Pipe”

http://www.sei.cmu.edu/isis/guide/gifs/soa.gif
There can not be a central governing administrator or institution

The owner of models and registries need to be the community itself

Would you give the keys of your house to an external entity for the benefit of the community?

Features required

- scalable
- owned by the community, no “big brother” issue
- Redundant, hence resilient to disasters
- self configurable, self healing

DECENTRALIZED

- Air traffic Control
- Healthcare
- Which topology?
Exponential

- Average linked nodes and no extremes
- Fixed inventory of nodes
- Random attachment of links

Scale Free

- Few linked nodes, few with many
- Grow over time
- Preferential attachment

Random vs Scale Free

- Clustering is not enough
- Need a shift in the approach
  - Scale free Networks
  - “Small world”: six level of separation

http://iv.slis.indiana.edu/lm/lm-networks.html
Software engineering?

- We do not have to seek the solution in other Engineering sectors
- What if civil engineers build bridges as we build software?
- Why the process is so different?
- Cost or build vs cost of changing
  - Changing a pillar position costs 10 times more then building it
  - In IT changes cost a fraction of the cost of building
- Gives a false sense of security:
  - First we build then we change
  - Wrong
- There the need to assume the changes as part of the process not as an exception
The way to go: pills

- Apply the Ecosystem metaphor
  - Self sustains, reliable to external forces, self organize

- Decoupling SOA registry
  - Model Repository (design time)
  - Information Registry (runtime)
    - information -> logical name of service
  - Service Registry (runtime)
    - logical name of service -> end-point of the services

- Implementing a evolutionary based schema for model repository
  - Folksonomy, Dependency, versioning, inheritance, merge...

- Adopting a decentralized architecture: e.g. Decentralized data storage

- Dynamic network architecture: P2P architecture can help
  - e.g. DHT (Don't have a prejudice)
Conclusions
Conclusions

- SOA or SOAs is not another SOA, rather it is an **Ecosystem Oriented Architecture (EOA)**

- Across Enterprises
  - Not easy to solve
  - We are just scratching the surface
  - No clear answers yet

- Paradigm shift:
  - From modelling a machine to modelling a living organism
  - From building machines to nurturing digital species

- P2P has some strong prejudices:
  - File sharing, (c) infringing
  - Low performance in search

- Suggested ideas are not without side effects for early adopters
We need a new mindset, a Digital Copernican Revolution in IT is due to come

DBE official Web Site
http://www.digital-ecosystem.org

Paper "Pervasive Service Architecture for a Digital Business Ecosystem"

Paper "Toward a Semantically Rich Business Modelling Language for the Automatic Composition of Web Services"
http://www.ebrc.info/kuvat/2072.pdf


DBE Paper by the EU
http://tinyurl.com/nrjb8

DBE Project Summary
http://tinyurl.com/oqgg6

Architecture for Digital Ecosystems: Beyond Service-Oriented Architecture, P. Ferronato, 01 June 2007, Enterprise Architecture
http://www.cutter.com/content/architecture/fulltext/summaries/2007/06/index.html

Digital Ecosystems
www.digital-ecosystems.org
“It is not the strongest of species that survive, nor the most intelligent, but the one most adaptable to change.”

Charles Darwin
1809 - 1882