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Tackling with SOA when scaling up to integrating between Enterprises

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Who we are

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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Who am I

Pierfranco Ferronato is the Chief Architect and founder of Soluta.net. He has over 15 years of experience in all aspects of distributed systems development and is internationally recognized as an expert in large-scale architectures and object-oriented/component development.

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

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Abstract

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.

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Flexibility

- The need for adaptation is due to the fast change rate in marketing, economy, market grow,...
- IT is growing rapidly, and we find ourself struggling with lots of problems and still find that everything has still to be invented
- Not mentioning the old annoying stories about:
  - "technology changes"
  - the integration of over 20 years of IT systems (legacy)
- Focus is moving from "intra enterprise" to "across enterprises"
  - ... and now across communities
  - Business communities are overlapping, it is not a partition
- We do not have to seek the solution in other Engineering sectors
- We have to leverage what apparently are the weakness of IT
  - Dynamism, flexibility

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IS SOA the silver bullet?

- 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, 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 or SOAs another SOA? 
  - Is it the same problem but just bigger or a new one?

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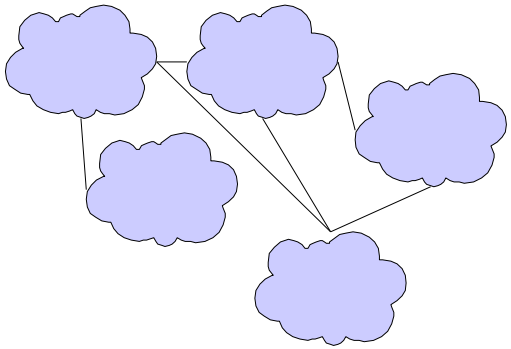
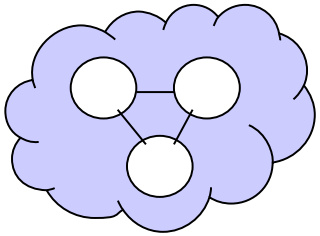
Ecosystem Architecture

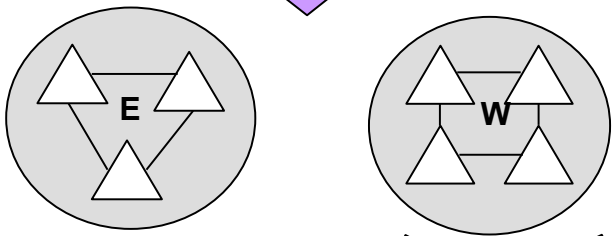


Across Enterprises Ecosystem

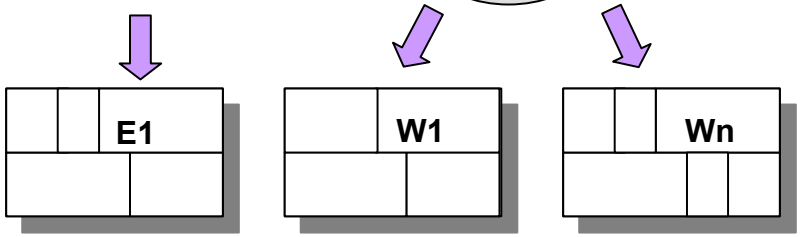
"Hic sunt leones" "Here there be tygers"



Enterprise Architecture



Application Architecture



Design

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Issues

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A different set of problems

- Across enterprises requires to support a new set of functional specifications
  - Simple and complex Business transactions which are "money driven"
- Functional Reference Models
- Services
- Technology

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A different set of problems - FRM

- The "single reference model" is not a feasible objective (even if was attempted in the past, aka "Big Picture")
- Community
- Standard reference models for each business domain
  - Lack of universal standard vocabulary
  - Standards exists
  - Domain Ontology
- Communities (mind the plural)
  - Ontology based intelligent Search engines
- Domain Ontologies (mind the plural)
  - But "Competing standards" exists today (notice the oximoron?)
- The owner of models and registries need to be the community itself

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A different set of problems - Services

- Across enterprises requires a new set of business services
  - Payment
  - Negotiations
  - Billing
  - Trust
  - Reputation
  - Legal compatibility
- Re-think:
  - Guaranteed delivery
  - Security
  - Long running Transactions
  - XML Firewall

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A different set of problems - Technology

- The graph of the services connected is a mesh like topology, it's not a hierarchy
- Protocols/ports/IPs changes in the network changes at a pace faster that any administration can cope with
  - IP does not scale
  - Registry need to be updated
  - Need automatic mechanism
- No central administrator

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Technology - Registries

- Multi registry (as in UDDIv3) is hierarchical
  - there is no “root” node in the Internet
- Registry replication need to be driven by requests not statically defined
  - It's too Administrative intense
- Registry of end-points
  - 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
- It represents a single point of failure (SPoF)

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Technology - Repositories

- Model dependency, versioning, inheritance, merge
- 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
- It represents a single point of failure (SPoF)

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Tackling

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Single point of failure in SOA

- 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

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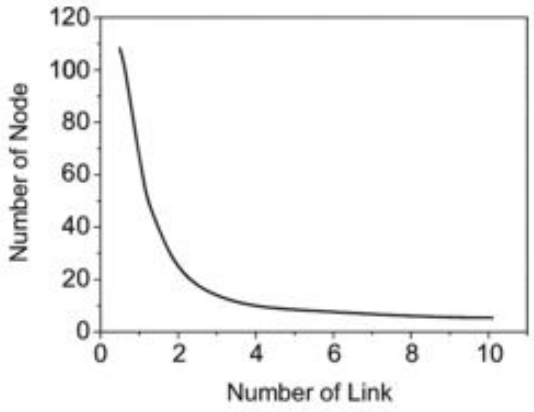
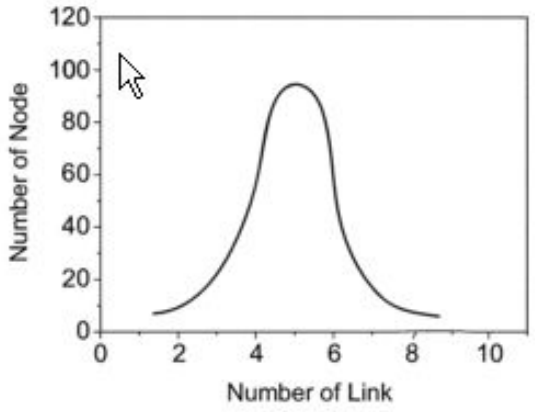
A consideration about "network topology"

- 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



(Exponential)



(Gaussian)

http://mikilab.doshisha.ac.jp/dia/research/report/2003/0716/013/report20030716013.html

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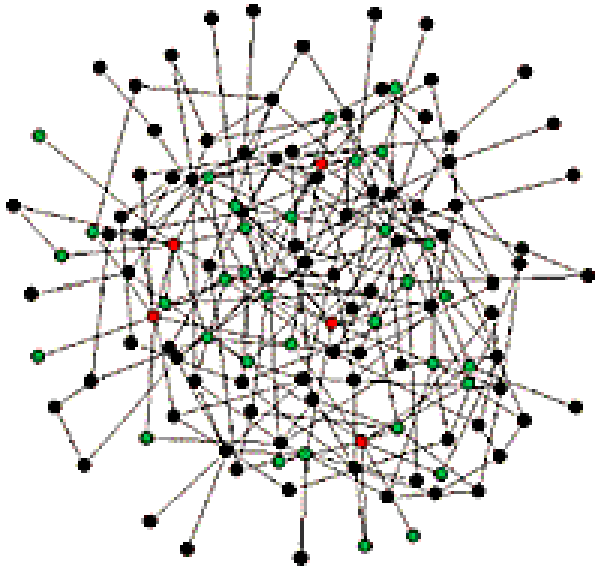
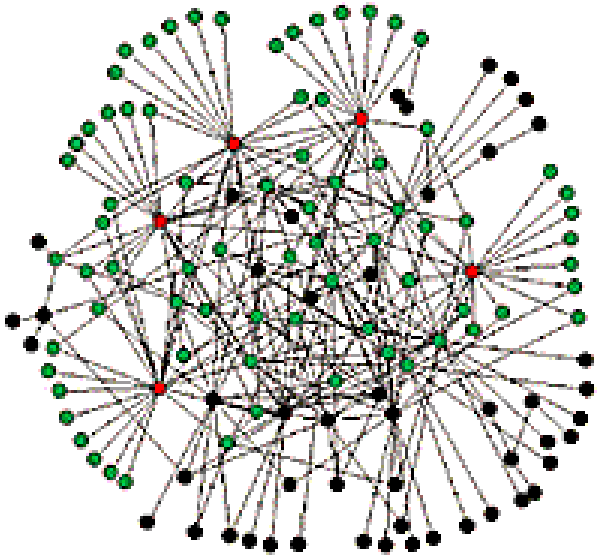
Random vs Scale Free

- 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

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The way to go: pills

- 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*
- Adopting a decentralized architecture
  - Distributed data storage
  - e.g. Tuple Space , Sun's Jini Network Technology, GigaSpaces(c)
- Dynamic network architecture
  - P2P architecture can help *(Don't have a prejudice)*
- Implementing a evolutionary based schema for model repository
  - Dependency, versioning, inheritance, merge...

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Case Studies

Facility Management

Healthcare

Digital Ecosystem

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Fast Start MODEL DRIVEN ARCHITECTURE

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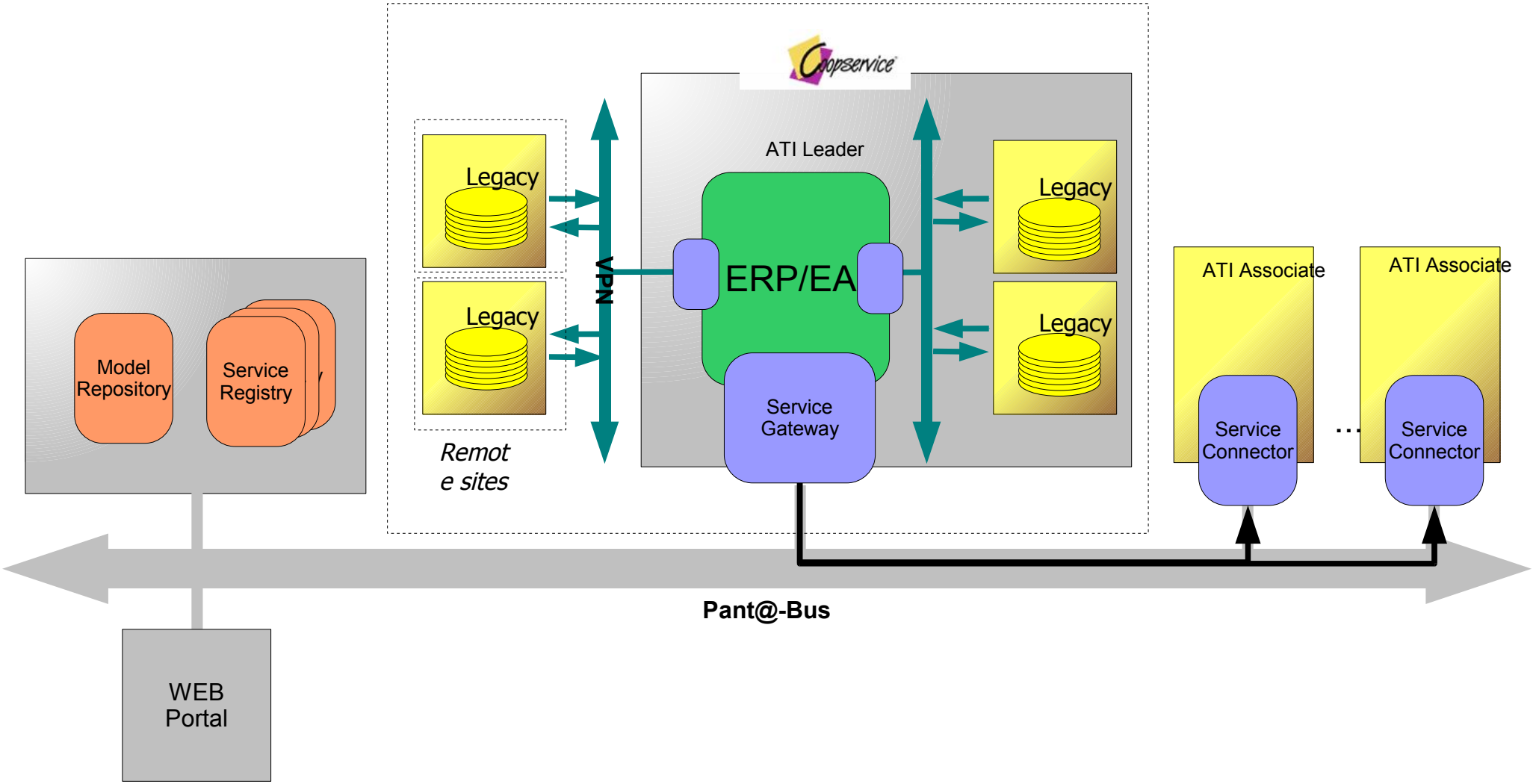
Wider SOA



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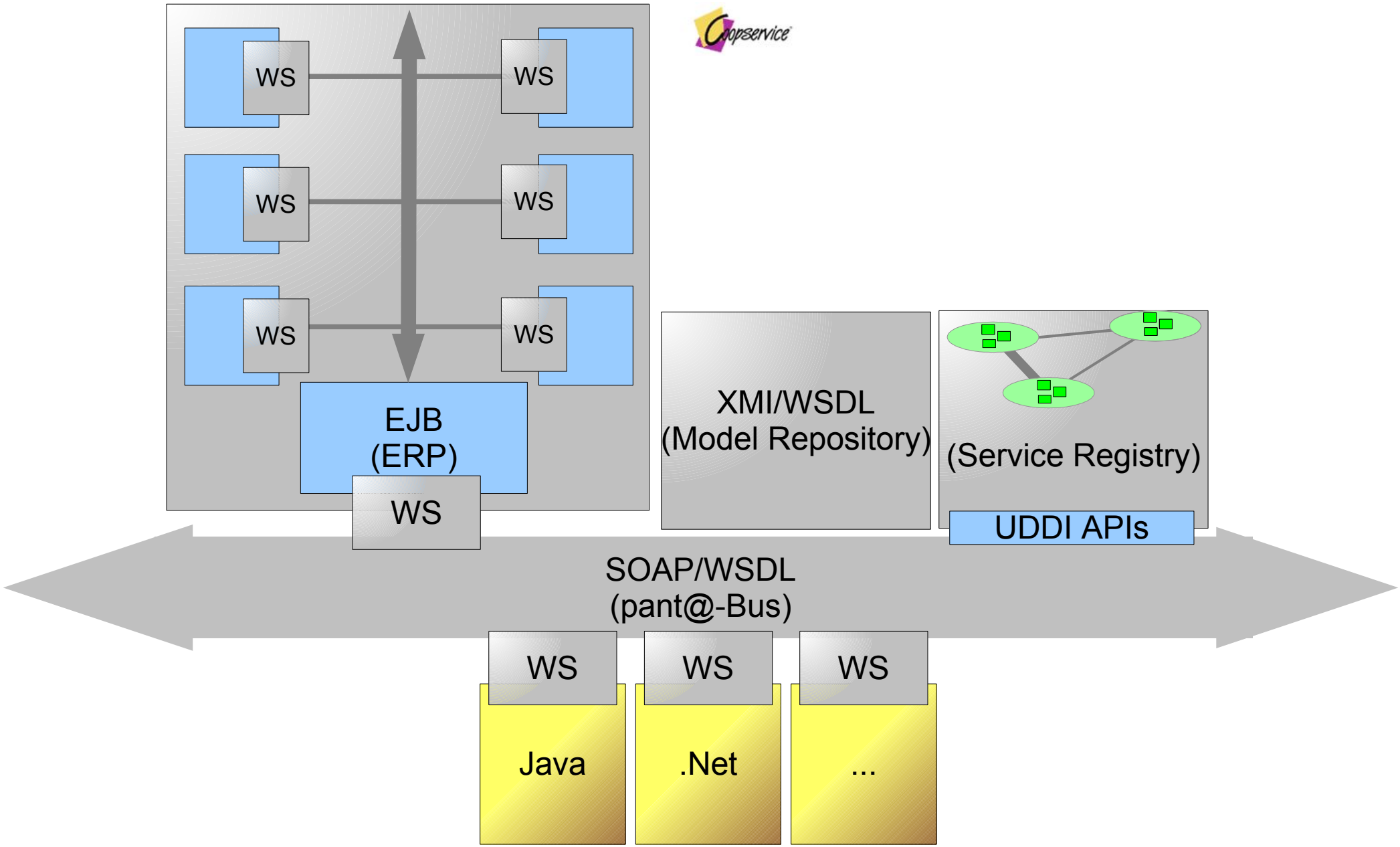
Behond SOA



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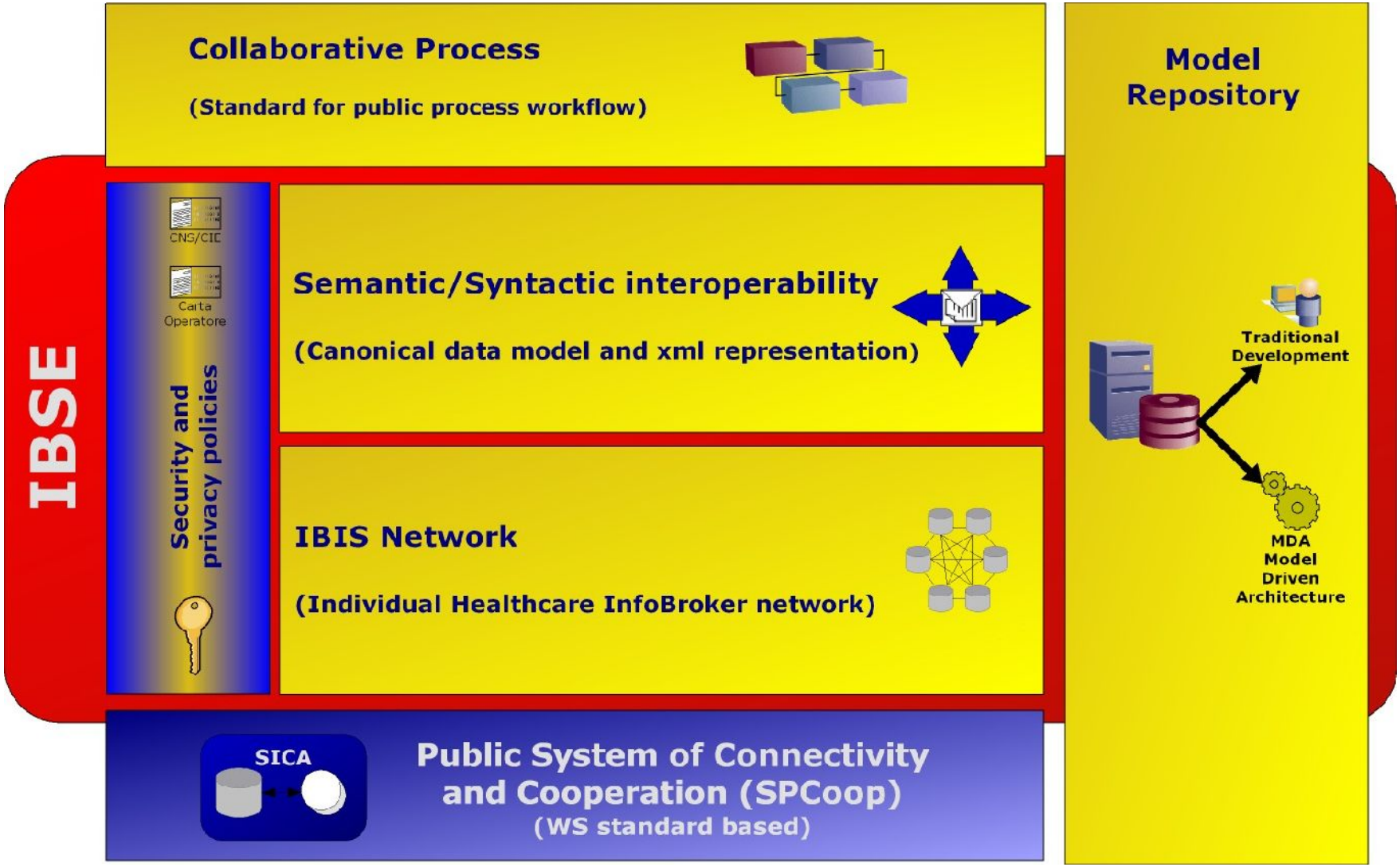
IBSE: the Italian Healthcare System

- Unique in its kind, the architecture has been approved by the Italian Ministry of Health



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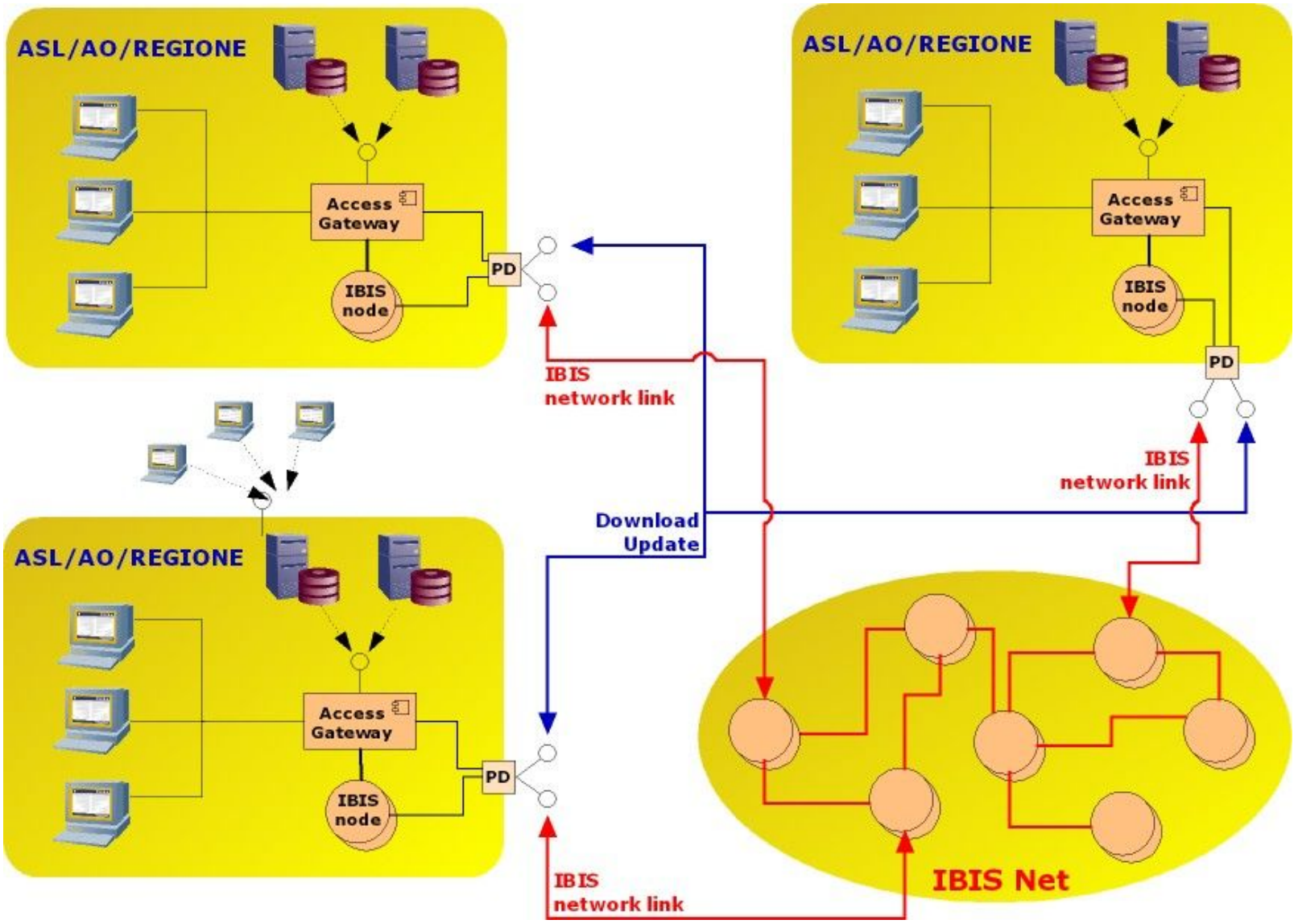
Registry of the Health Records



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Digital Business Ecosystem



- The Digital Business Ecosystem is being created by the DBE Project, which is a 3-year, €14M pan-European project, involving 120 researchers and specialists from 20 organisations, including some of the big names in computing and business. The project is supported by the European Commission's 6th Framework Programme for research and development in Information Society Technologies.

- The DBE project is currently developing the 'evolutionary' technology that is the key to the DBE. This involves harnessing the principles of self-organisation and self-optimisation from the various fields of science and nature and applying them to interactions between businesses. These interactions form value chains that can be thought of as the 'organisms' that inhabit the ecosystem and that will change and evolve over time. The project integrates expertise from the worlds of science, computing, business, and economic development.

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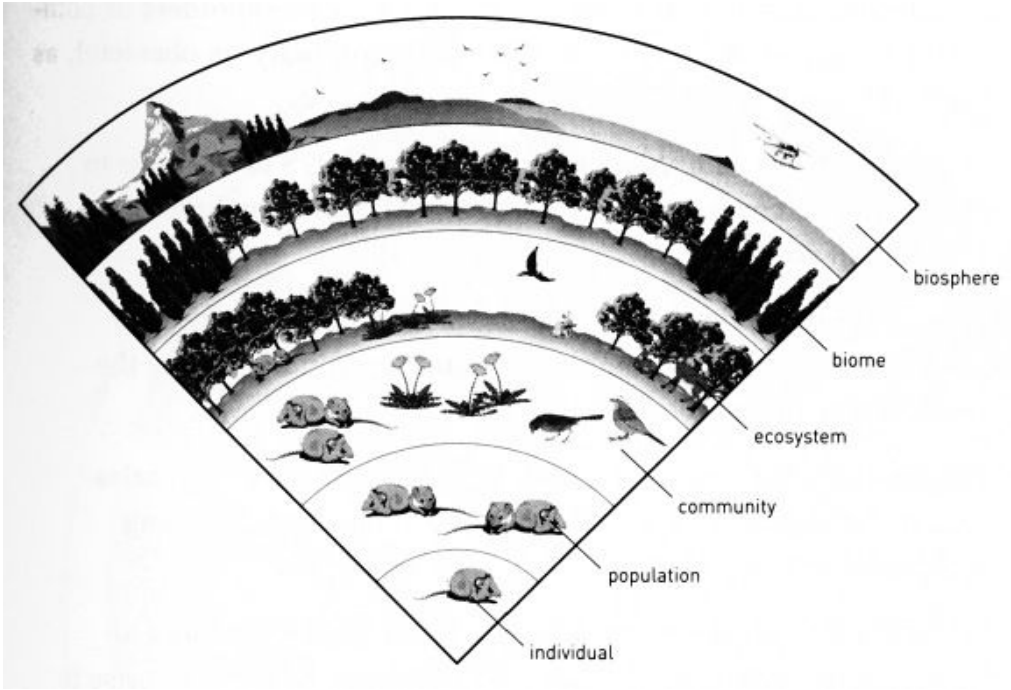
Digital Ecosystem

- No central control, no plans defined in advance
- Fault tolerant: No central point of failure
- Diversity and autonomy
- Adaptation to the local conditions
- Auto selection and evolution
- **But** you need an
  - infrastructure supporting the life (composed of living organisms too - rec. Concept)
  - a critical mass of individuals and biodiversity (bootstrap problem)



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Conclusions

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Conclusions

- SOA or SOAs is not another SOA, rather 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
- Suggested ideas are not without side effects
- P2P has some strong prejudices:
  - File sharing, (c) infringing
  - Low performance in search

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More Information

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"
http://arxiv.org/pdf/cs.CE/0408047

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

“Linked: The New Science of Networks”, Albert-Laszlo Barabasi, Jennifer Frangos. ISBN: 0738206679

Digital Ecosystems
www.digital-ecosystems.org

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

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

Thanks to Oliver Sims for revisioning the draft

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