

Digital Business Ecosystem Software Factory and MDA

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Fostering the Research and Technological Development, the DBE Project is an Integrated Project presented under the first call of the VI EU Framework Programme. The initial activities have started in November 2003.



Information Society

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Digital Business Ecosystem

Note about the Author

- 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, web services and wireless technologies in a number of domains, including telecoms, pharmaceutical, CRM, EAI and tourism. He is an active member of the OMG and a frequent speaker at conferences worldwide.
- Soluta.net is constituted by a team of IT professionals that have a worldwide experience in Component-Based Development and Enterprise Architectures. They 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 telecoms, pharmaceutical, CRM, EAI and tourism.



Assumptions

- Even if this presentation has a rather technical “style”, and it is aimed at technical people and project leaders with some MDA skills, it is valuable also for a non-technical audience
- Given the complexity of the project and the small time-frame available, it has been necessary to simplify some detail of the architecture and of its components but it is still coherent and correct
- The main objective is
 - to present this very challenging project with specific details on the Service Factory
 - to describe how MDA as been leveraged



Digital Ecosystem

J.F. Moore describes a Business Ecosystem as "An economic community supported by a foundation of interacting organizations and individuals - the organisms of the business world. This economic community produces goods and services of value to customers, who are themselves members of the ecosystem. Over time, they co-evolve their capabilities and roles, and tend to align themselves with the future directions..."

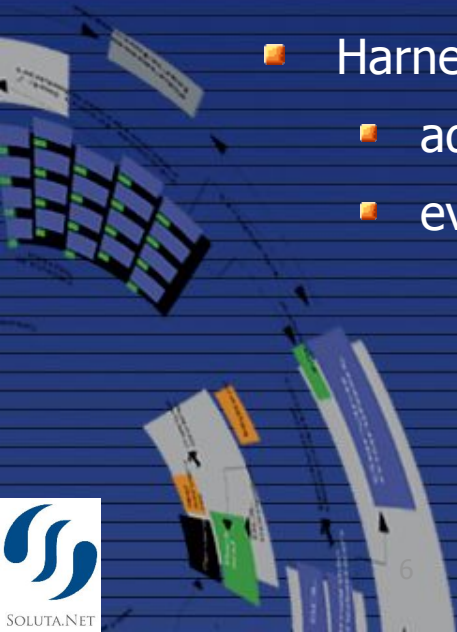
(J.F. Moore, The Death of Competition, 1996, pag.6-7)



Digital Business Ecosystem

Quick project description

- Proving Europe's advantage in innovative software application development through its SME industry
- Creating an open-source distributed environment to support
 - spontaneous evolution
 - adaptation
 - composition of
 - software components which embed business rules
 - services.
- Harnessing the complexity of software production through
 - advanced information technology
 - evolutionary self-organising systems



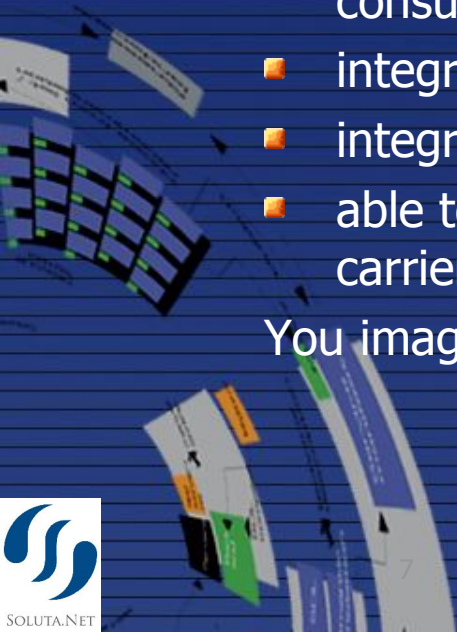
Digital Business Ecosystem

Imagine

Imagine your offer/service/product to be

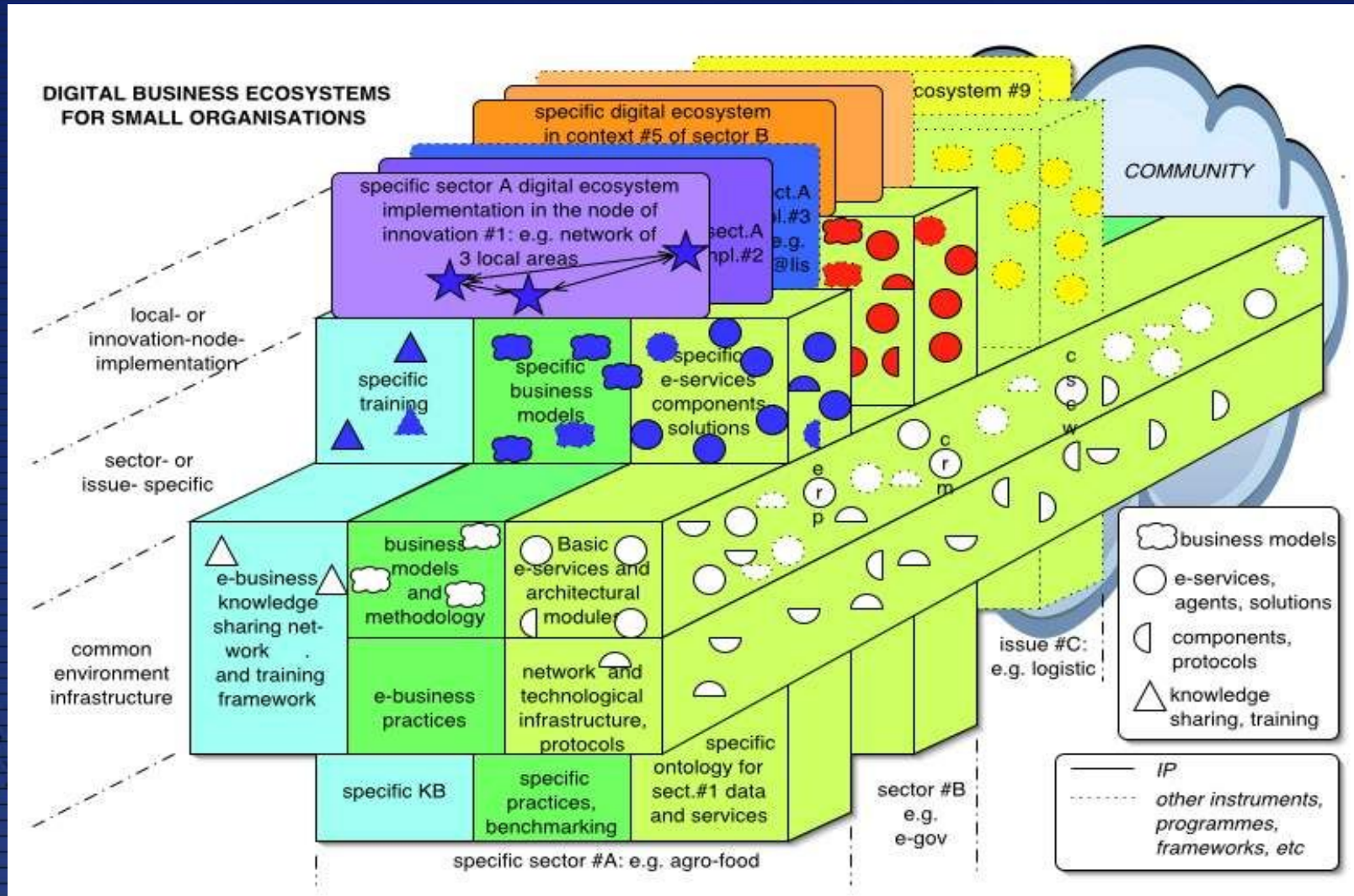
- described solely in business terms (What it does, how it does it, location, price, services...)
- visible to a wide business audience at the same level of titans companies
- discoverable by means of its Business specification and not by its technical specification
- competing with other similar offers and be reused, integrated and consumed in an automatic way
- integrated automatically in the customer back-office
- integrated with your back-office with minimum effort
- able to reuse payment systems, accounting, billing, security, information carriers, reputation, recommendation,...

You imagine the Digital Business Ecosystem



Digital Business Ecosystem

DBE Conceptual model



Courtesy of Francesco Nachira

Digital Business Ecosystem

The Context



4) InterCommunities

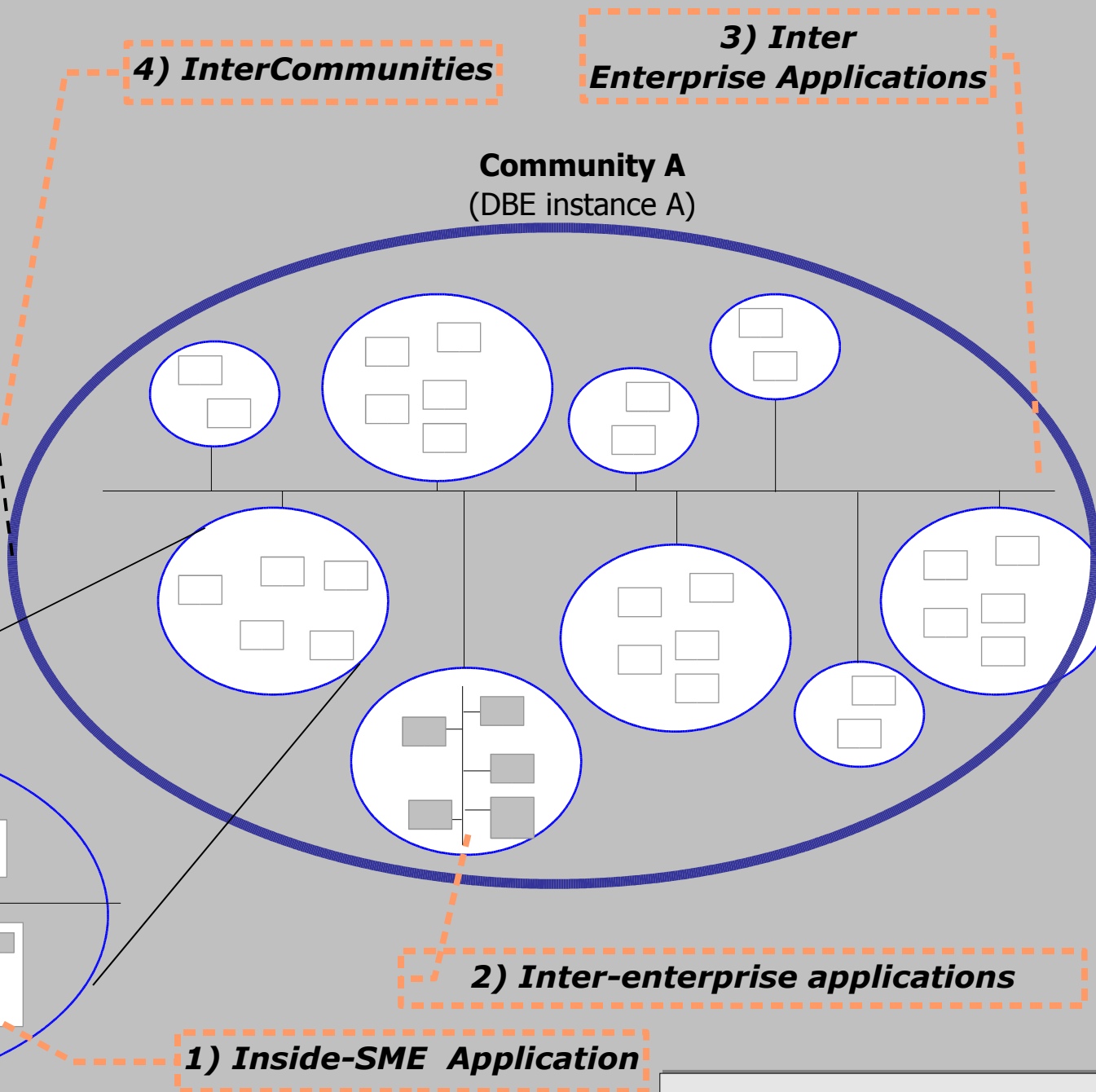
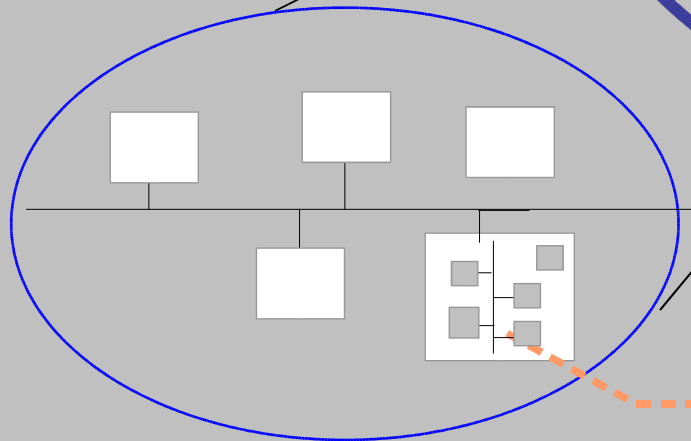
**3) Inter
Enterprise Applications**

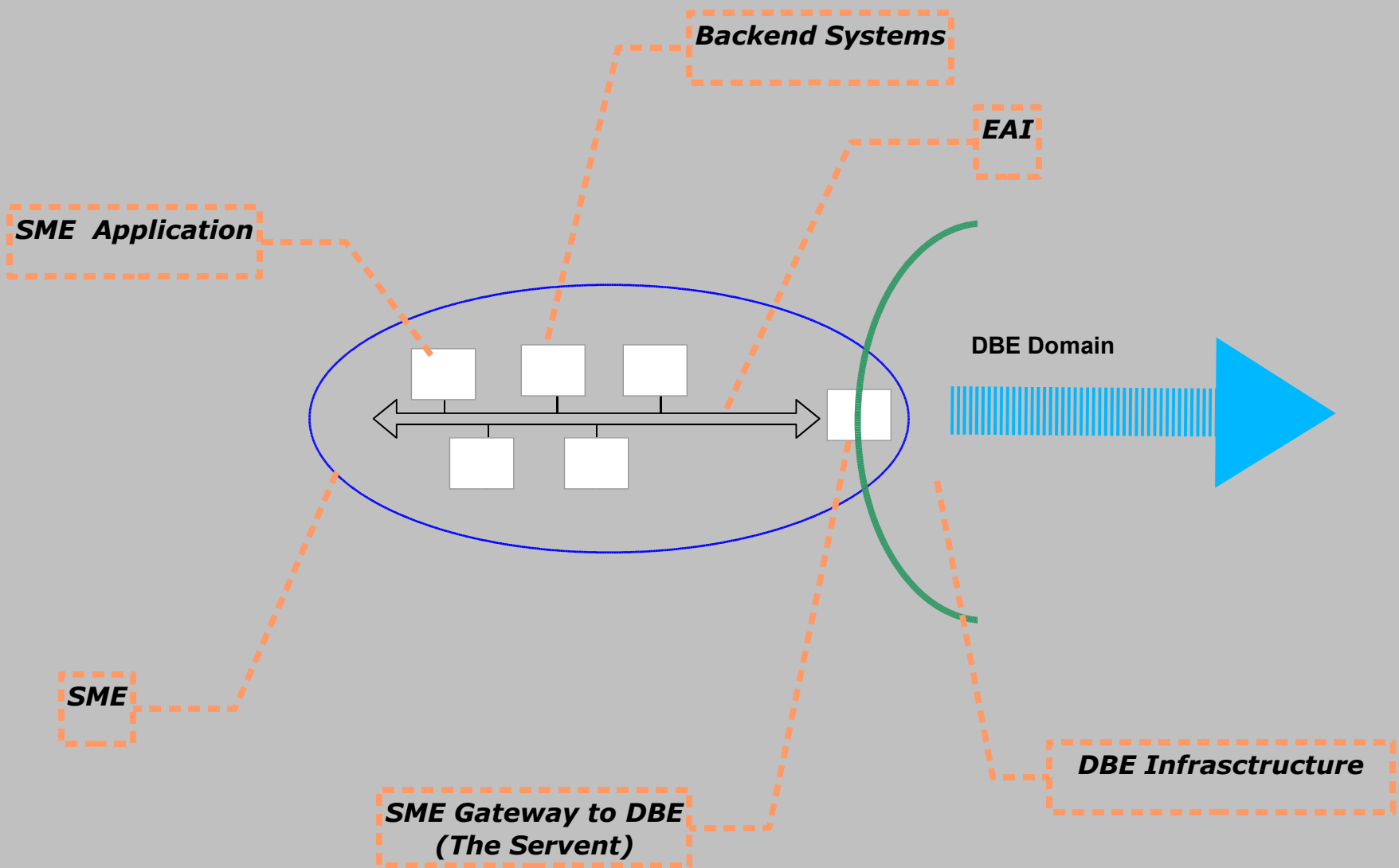
Community A
(DBE instance A)

Community B
(DBE instance B)

2) Inter-enterprise applications

1) Inside-SME Application

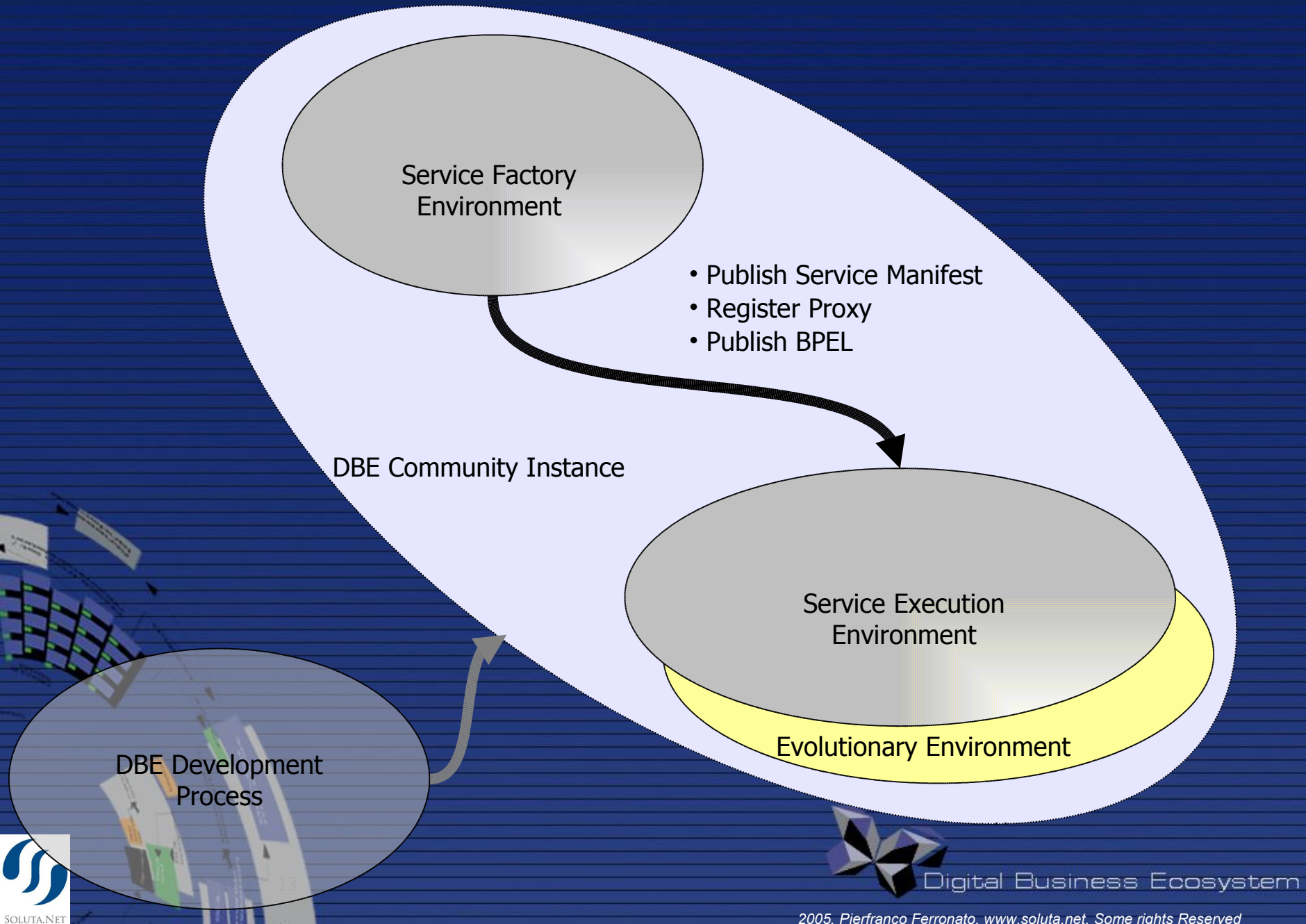




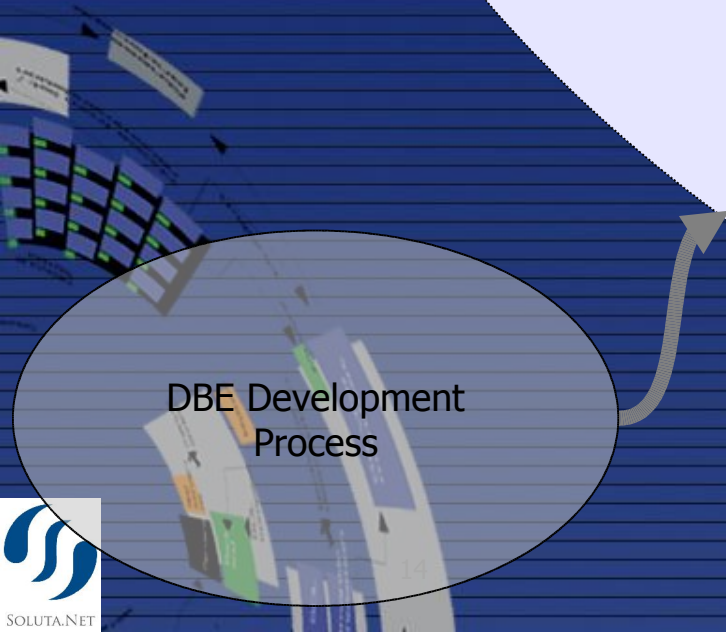
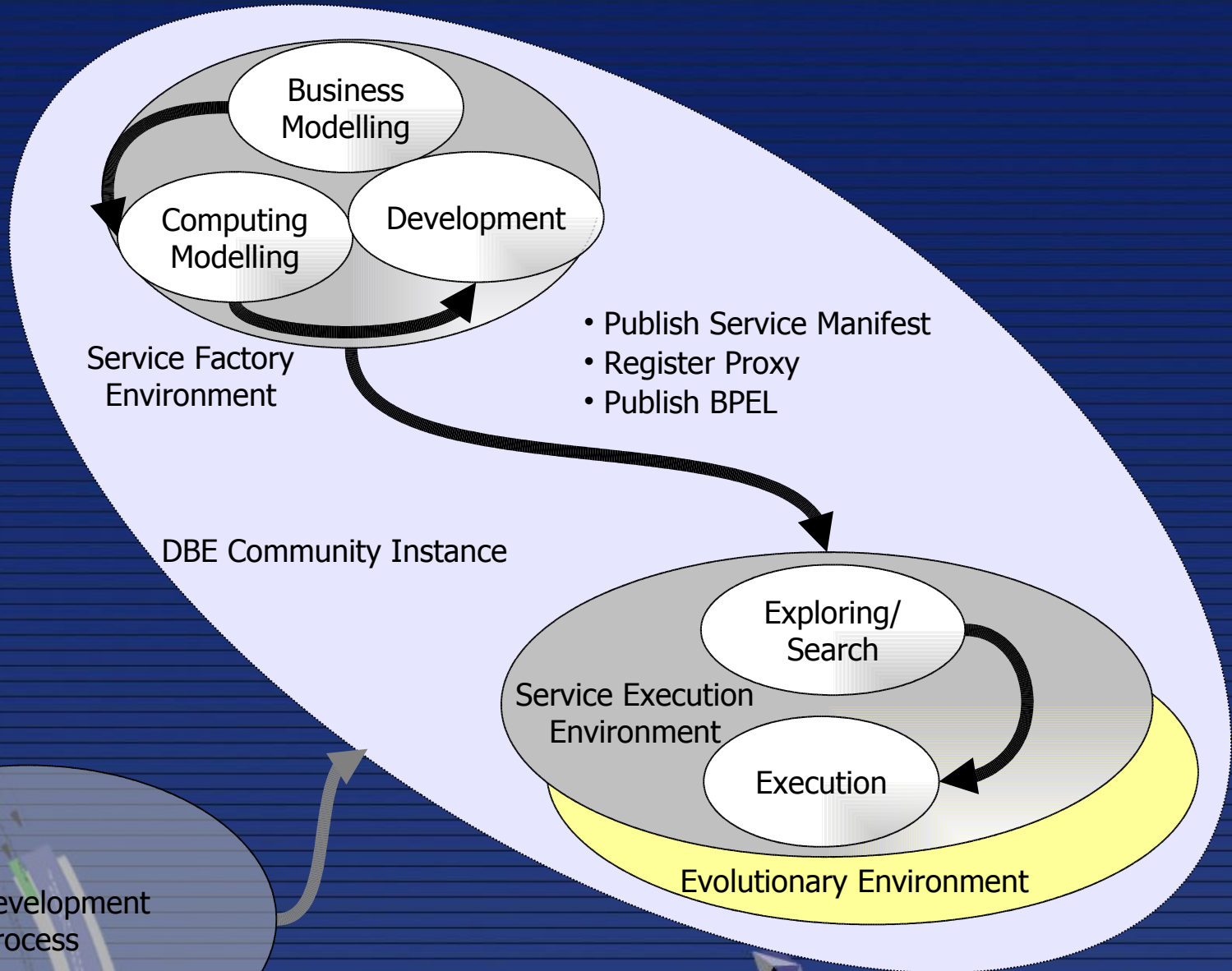
The Environments



DBE Software Process

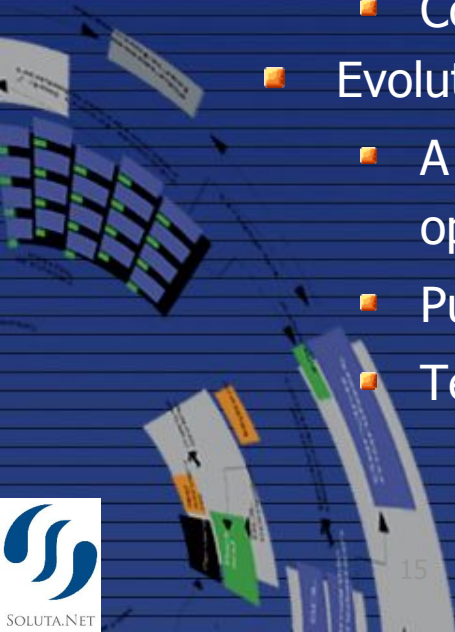


DBE Software Process



Environments

- Service Factory Environment (SF)
 - Where services are described and developed
 - Business modeling, Computational modeling, Java coding, test, deployment,
- Execution Environment (ExE)
 - Where services are published and then discovered, retrieved and executed
 - Contains a Servent (DBE Application Server)
- Evolutionary network (EvE)
 - A parallel environment where service chains are created and optimized
 - Push approach
 - Testing harness



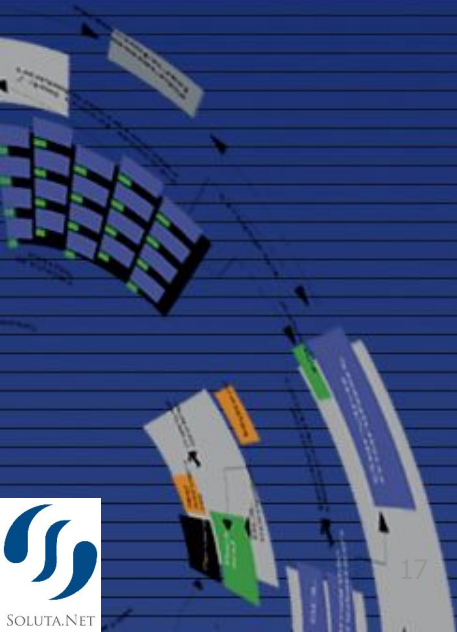
Components

- Service Factory Env.
 - Service Modelers/Editors
 - Development environment
 - Repository of models
 - Service Composer
- Service Exec. Env.
 - Decentralized P2P Service Registry
 - Decentralized P2P network for service deployment
 - Structural Services
 - Basic Services



Basic Services

- Accounting
- Payment Systems
- Information carriers
- Identity Management
- Recommendation
- Reputation Management and rating
- Products Catalogue



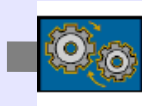
Service Factory



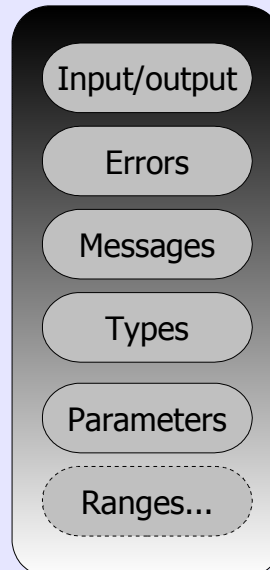
**Integrated
CIM Editor**



Computational Independent
Viewpoint



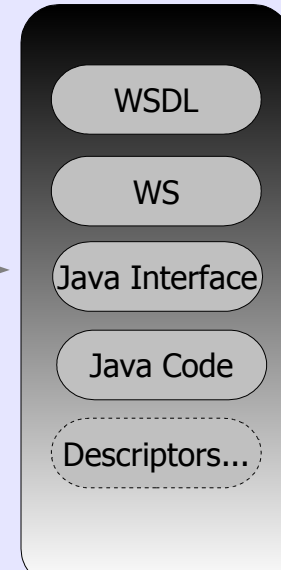
**Integrated
PIM Editor**



Platform Independent
Viewpoint



**Integrated
PSM Editor**



Platform Specific
Viewpoint



**Software
Artifacts**
Digital Business Ecosystem

Code Generation

From CIM to PIM	Declarative	Imperative
Functional Code	50% (>50% is AI applied)	0% from CIM (>0% if action languages are used)
Structural Code	-	-

From PIM to PSM	Declarative	Imperative
Functional Code	100%	0% (~100% if action languages are used)
Structural Code	100% (hard-coded)	100% (hard-coded)



Misconceptions

The DBE IS NOT

- A development environment like EJB
 - It does not execute services
 - Service are implemented somewhere else, outside the DBE boundaries
- The DBE IS a smart, “business driven”, semantically rich middleware
 - A mediator from consumer to provider
- The DBE is not just a Project
- The DBE is not just a creating a community of users
 - The DBE can be instantiated many times
 - IL4



Digital Business Ecosystem

Service Description

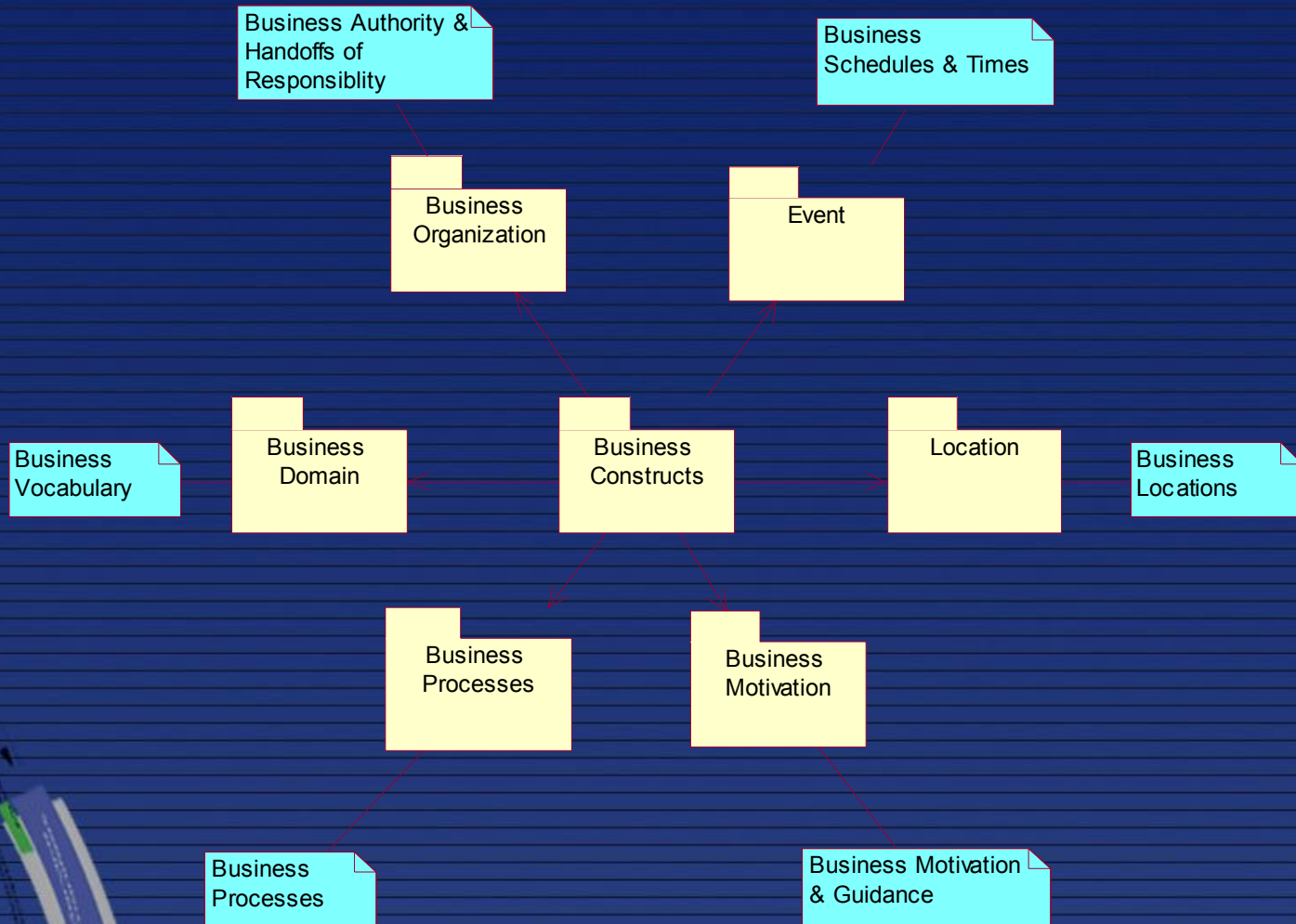


CIM Languages

- Ontology Definition Metamodel
 - Allow reasonings on models
- Business Modeling Languages (BML)
 - CIM description of the business side of firms and the services offered
 - DBE project requires a business modelling language to represent the business organisation, its products and services, contractual and agreement basis and to model business service descriptions
 - The BML contains information like: service offered and requested, resources, processes, business model and motivation, contract and agreement, policies, location and events related to business.
- Regulatory framework
 - Model national legislations and associate it with business models
 - Imagine a Negotiation process that, given the related contract regulations, is able to investigate the legal feasibility of an agreement with two parties

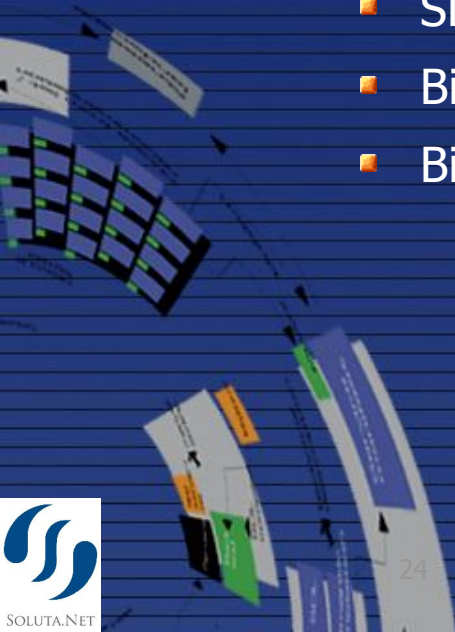
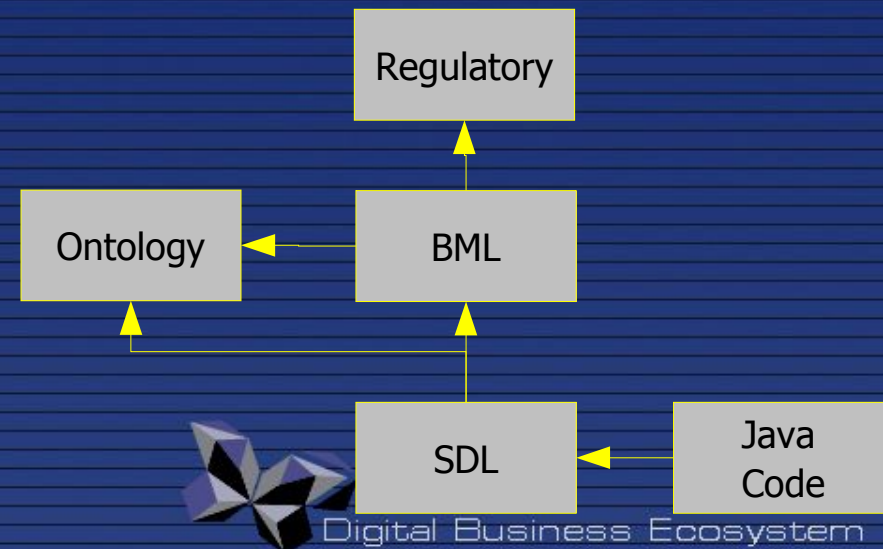


OMG Business Modelling Architecture



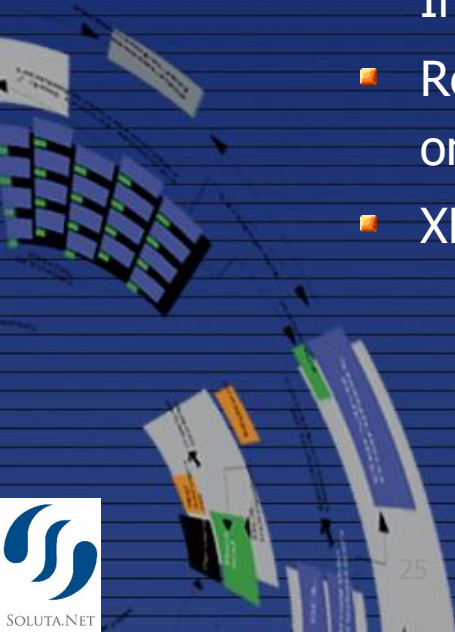
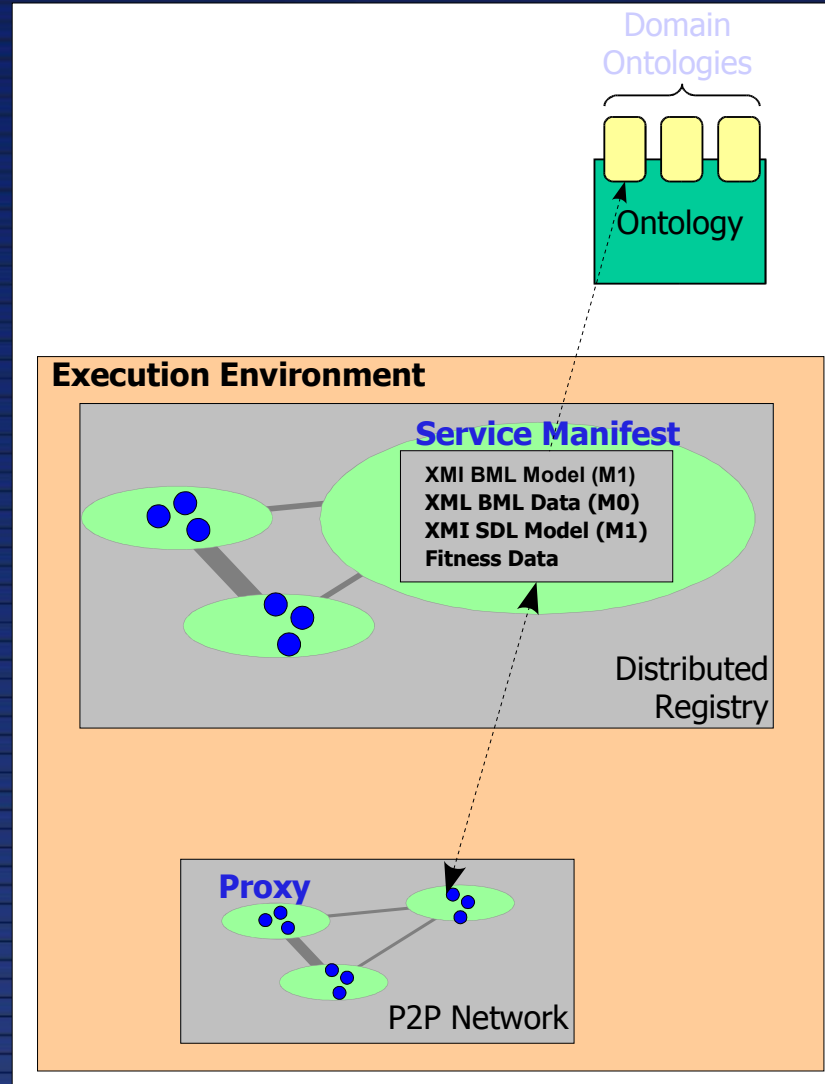
PIM Languages

- Service Description Language (SDL)
 - PSM description of a service
 - The SDL describes the technical specification of a DBE service.
 - The SDL is able to describe the DBE service in a double-faceted fashion. One facet refers to the Semantic Description of DBE Services and the other refers to the description of the DBE Service Interaction Specification.
- SDL is a semantically rich abstraction of the WSDL
- Binded with BML
- Binder with Ontology



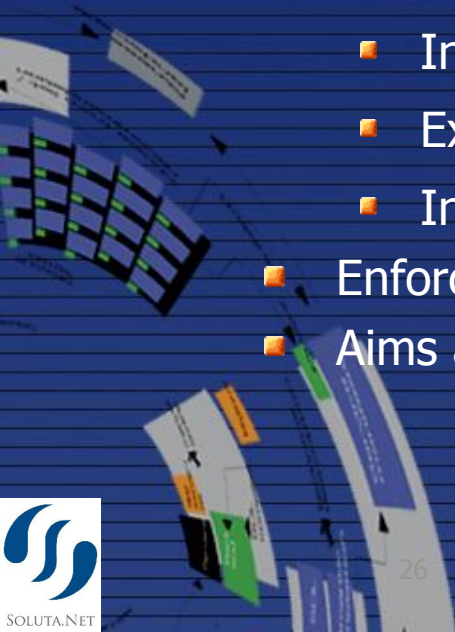
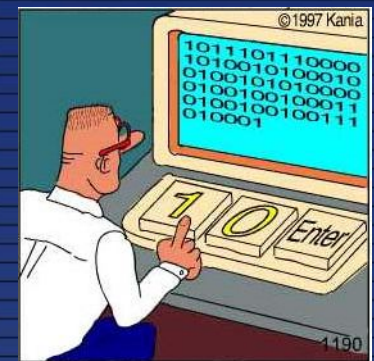
The Service Manifest

- Service Manifest
 - PIM of a Service
- It contains
 - Complete representation of a Service
 - Business models + computational model + Information
 - Reference to 'foreign' ontology
 - XMI encoding of the models



Need for a Model Driven Architecture

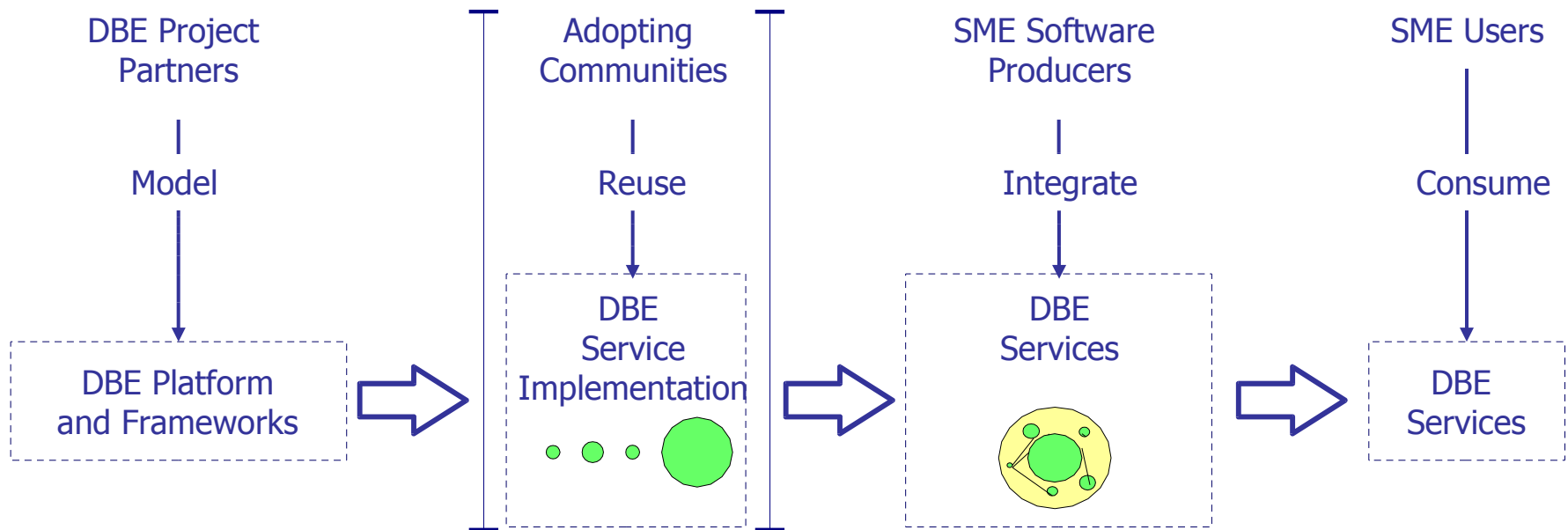
- We do not fight changes, we accept them as normal
- DBE has a plethora of languages/meta-models
 - Ontology, Business models, Business rules, Regulatory frameworks, Computational dependent models, Test frameworks
- DBE needs Model transformation
- DBE needs Code Generation
- We cannot avoid creating a meta-modelling platform if we want to achieve interoperability
 - Inter DBE For Structural components
 - External for reusing/importing foreign models
 - Intra DBEs
- Enforcing separation CIMs-PIMs-PSMs
- Aims at CIMs->PIMs->PSMs (Code)



DBE Process



Process



Use Case Models

<<useCaseModel>>

BML Editor

- ☐ Create BOM
- ☐ Create BML
- ☐ Create SSL
- ☐ Retrieve Recommendation

<<useCaseModel>>

Model Repository

- ☐ Retrieve BML Models
- ☐ Retrieve SDL Models

<<useCaseModel>>

SDL Editor

- ☐ Create SDL model
- ☐ Associate Ontology
- ☐ Browse ontology
- ☐ Select SSL

<<useCaseModel>>

Development Environment

- ☐ Service Generation
- ☐ Generate Proxy
- ☐ Proxy development
- ☐ Add UI

<<useCaseModel>>

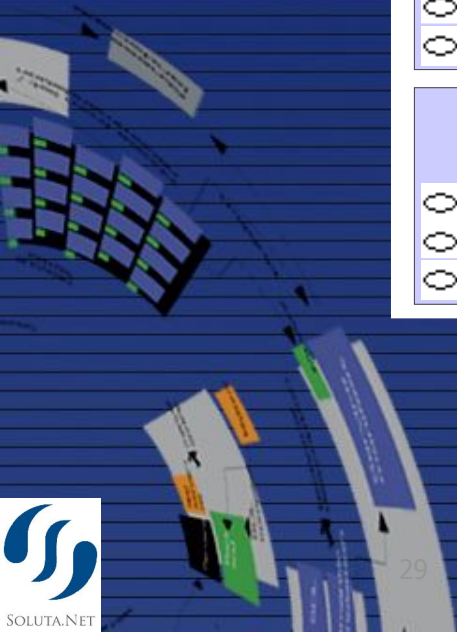
Deployment

- ☐ Register Service
- ☐ Select Proxy Classes
- ☐ Publish Service

<<useCaseModel>>

Authoring tool

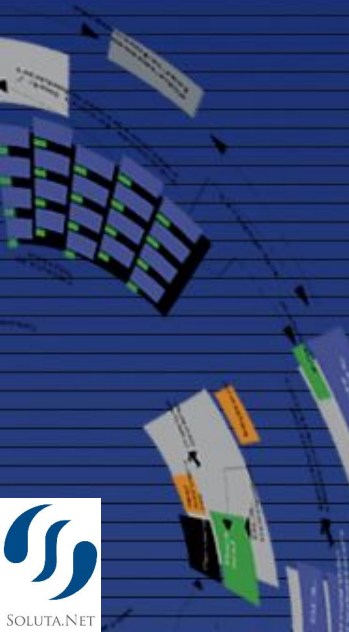
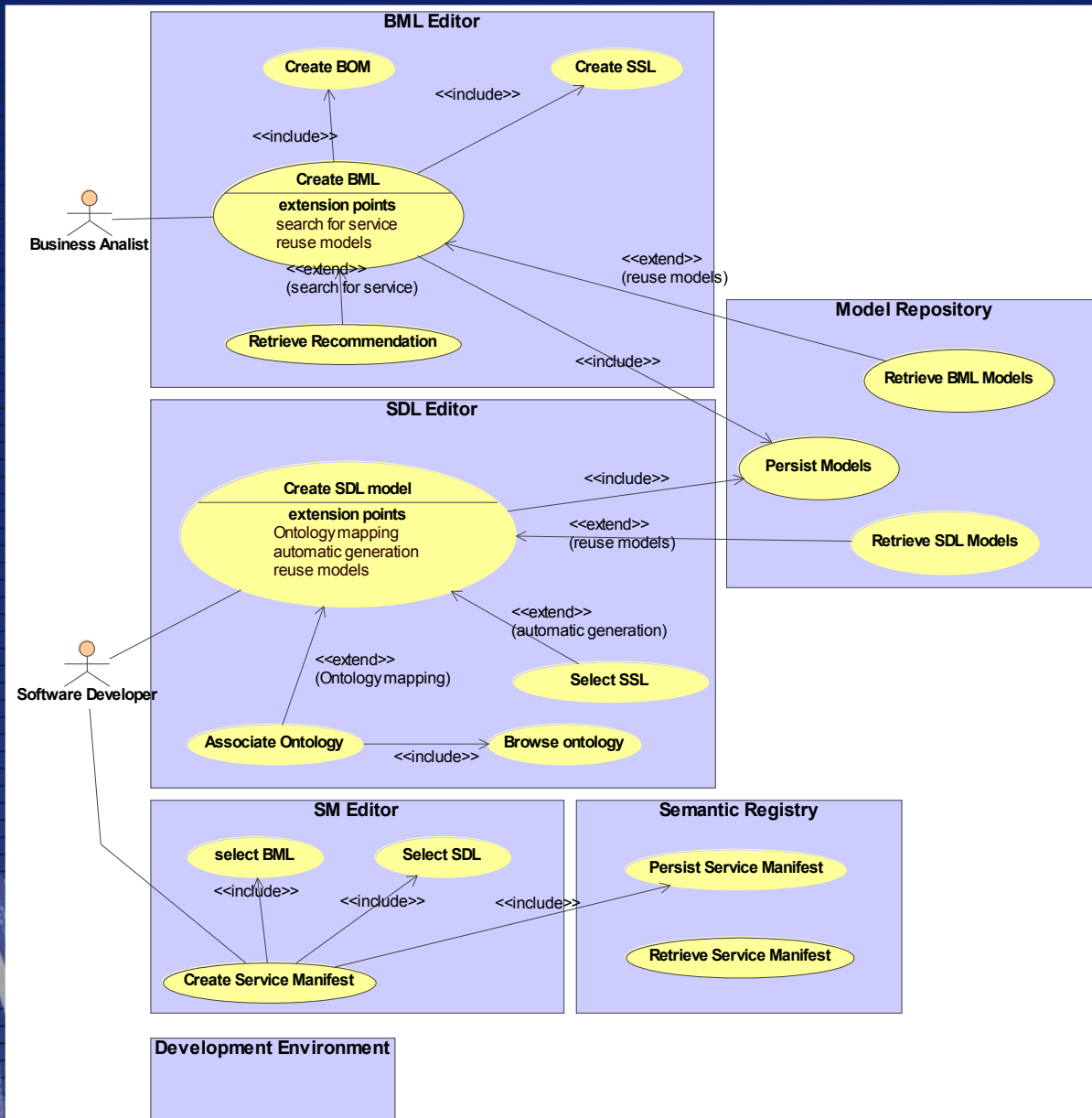
- ☐ Insert Data in the SM



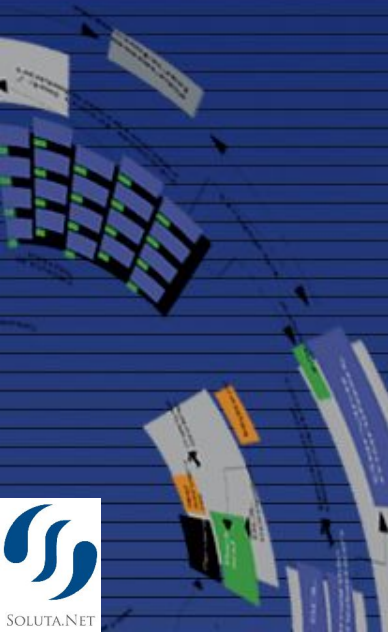
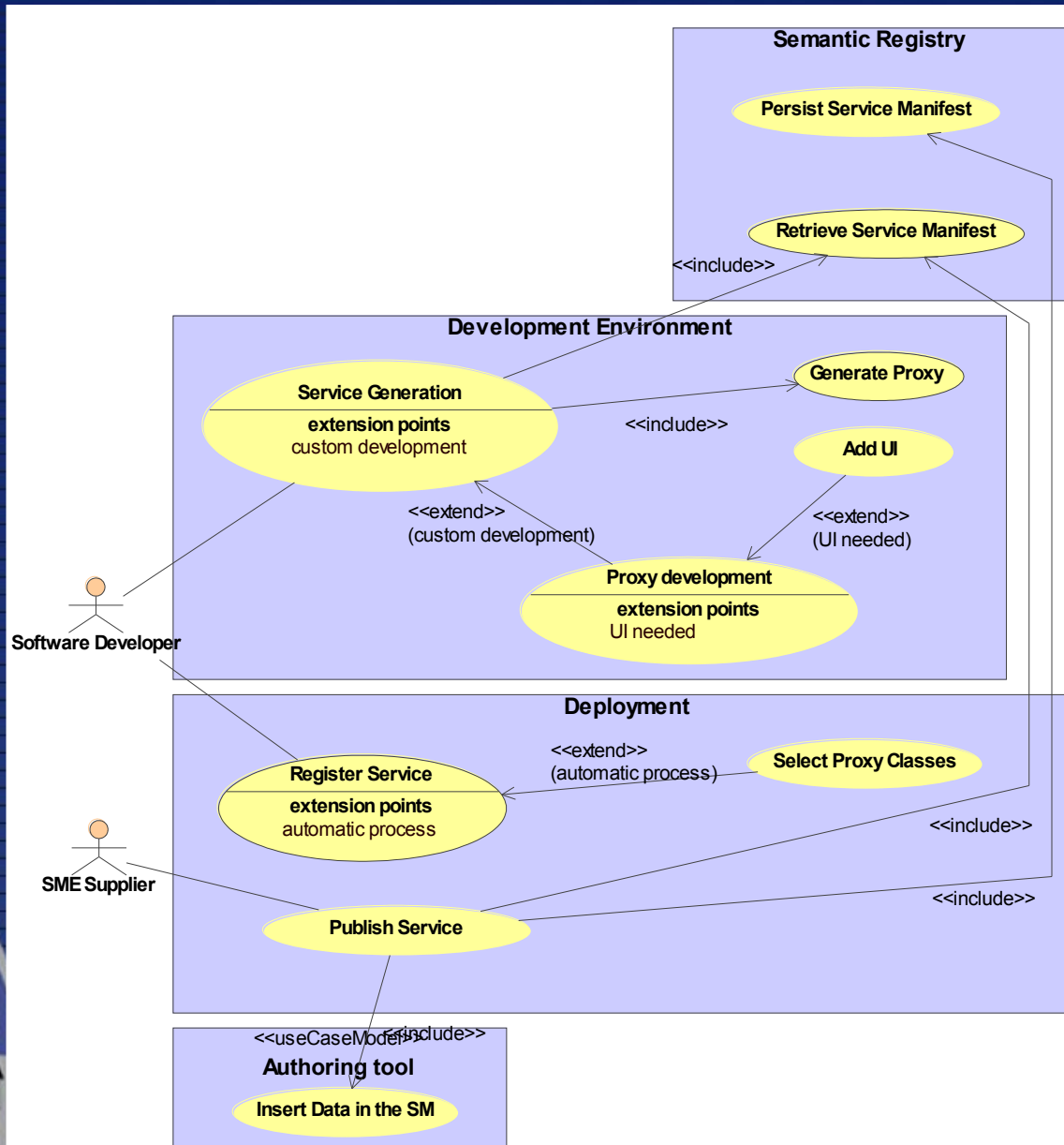
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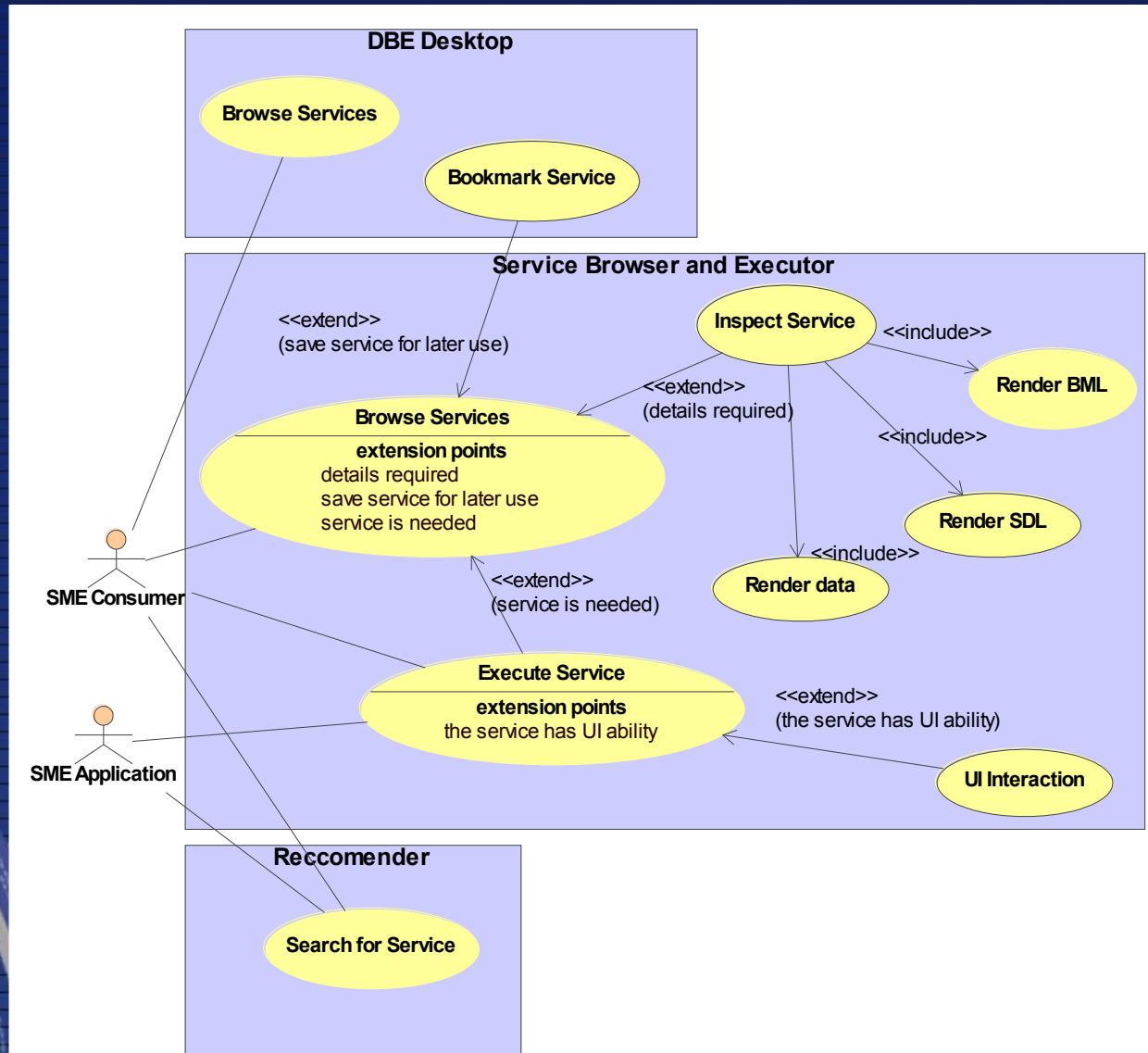
CIM & PIM Modelling



PSM Modelling



Execution Environment



Driving Principles



Principles

- Owned by the communities
 - Functional specifications are Open
 - No Intellectual property
- No single point of failure
 - Technical issue
 - Political issue
- All the storage areas are decentralized, P2P based
- All the resources are redundant
- Each EMS offer some resources to the community
- No Governor
 - Technical
 - No database/network DBE Admin!
 - Functional
 - There is NOT a Master functional reference model



Evolutionary model repository...

- The DBE does not want to over impose a reference model for both business and computation
 - Previous EU projects failed here
- No DBE Commission or committee
 - "A camel is a horse designed by a Comitee"
 - Thousands of millions of users vs a 10 people committee
- "Let's the marked decide"
 - Models become standard because of market need and pressure
- "As fast as the market"
 - Do not wait for commission standardization
 - It is ready when it is needed and applied

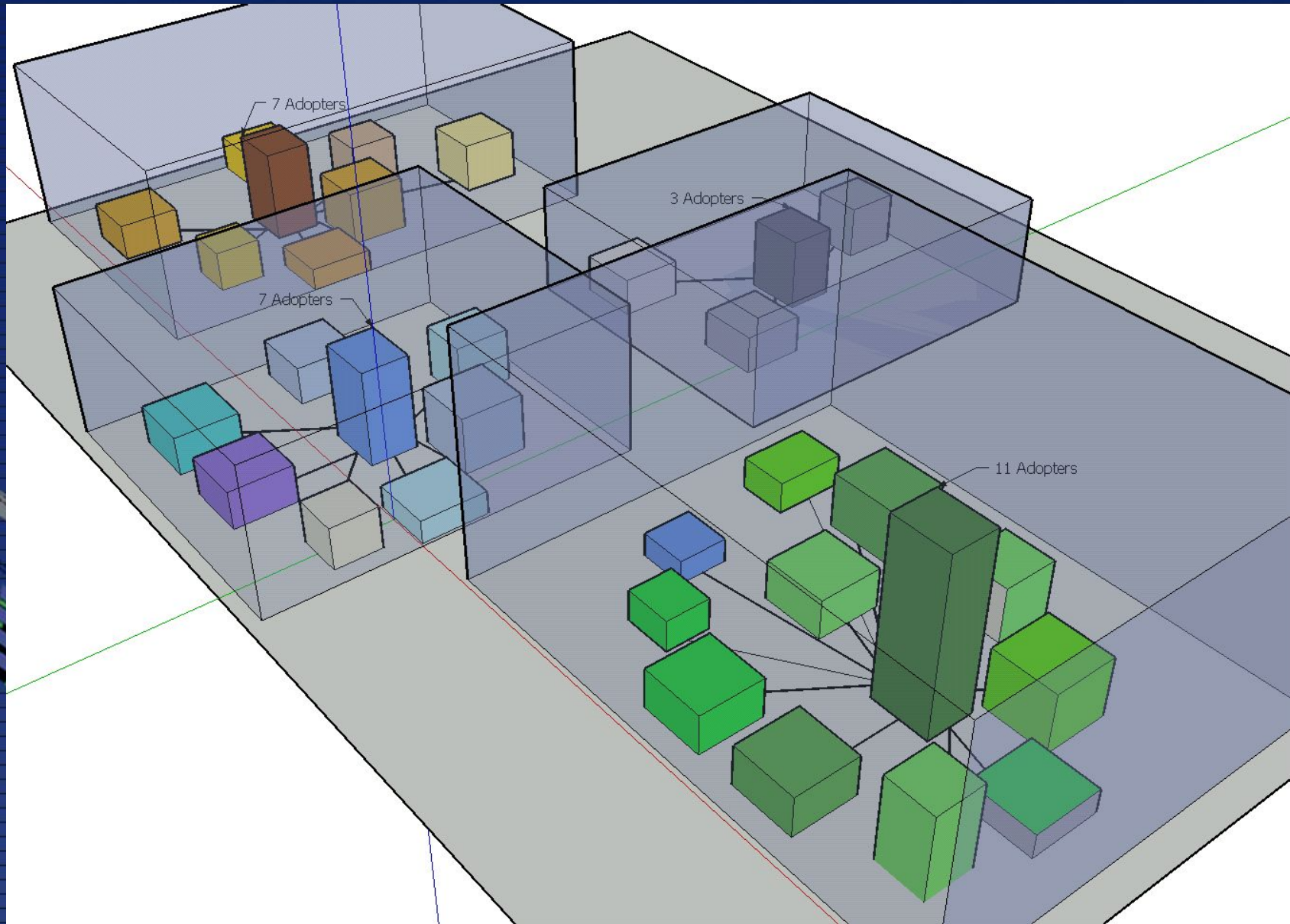


...Evolutionary model repository

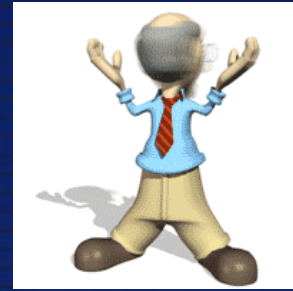
- Scenario
 - “Based on a profile information, the DBE recommendation process finds a more convenient taxi service that is promptly replaced with no fuss”
- A more convenient service BUT with a different SDLs will create inertia in the adoption
- Effective business models will be reused over and over
- Models will be enhanced and will “evolve” to address the market more closely
- We expect that services pertaining to the same domain, will naturally converge to cluster of models



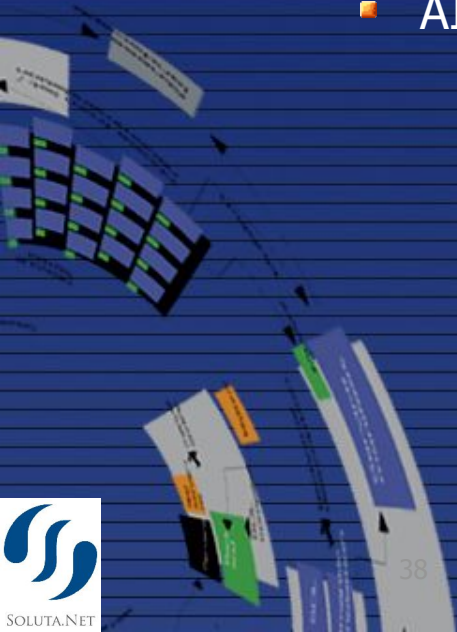
Models Adoption, interoperability barriers and competitions



It is not as easy



- The critical mass is “critical”
 - How many SME users are needed?
 - Which is the critical mass?
- It takes a long time to converge
 - Will it converge?
- Science partners will try to provide answers
 - AI, Neural Network



DBE Architecture Details



MDA Stack

higher

(M3)

"The" MOF Model

CIM & PIM Metamodels
(BML, SDL, Ontology, Regulatory)

(M2)

CIM & PIM Models

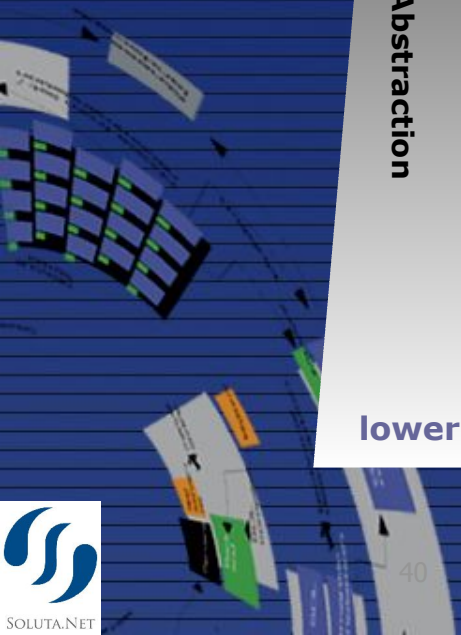
(M1)

Information

(M0)

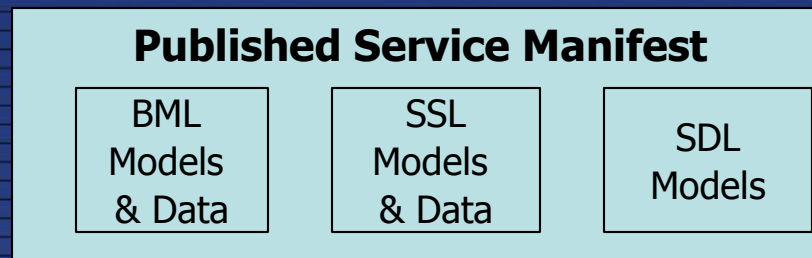
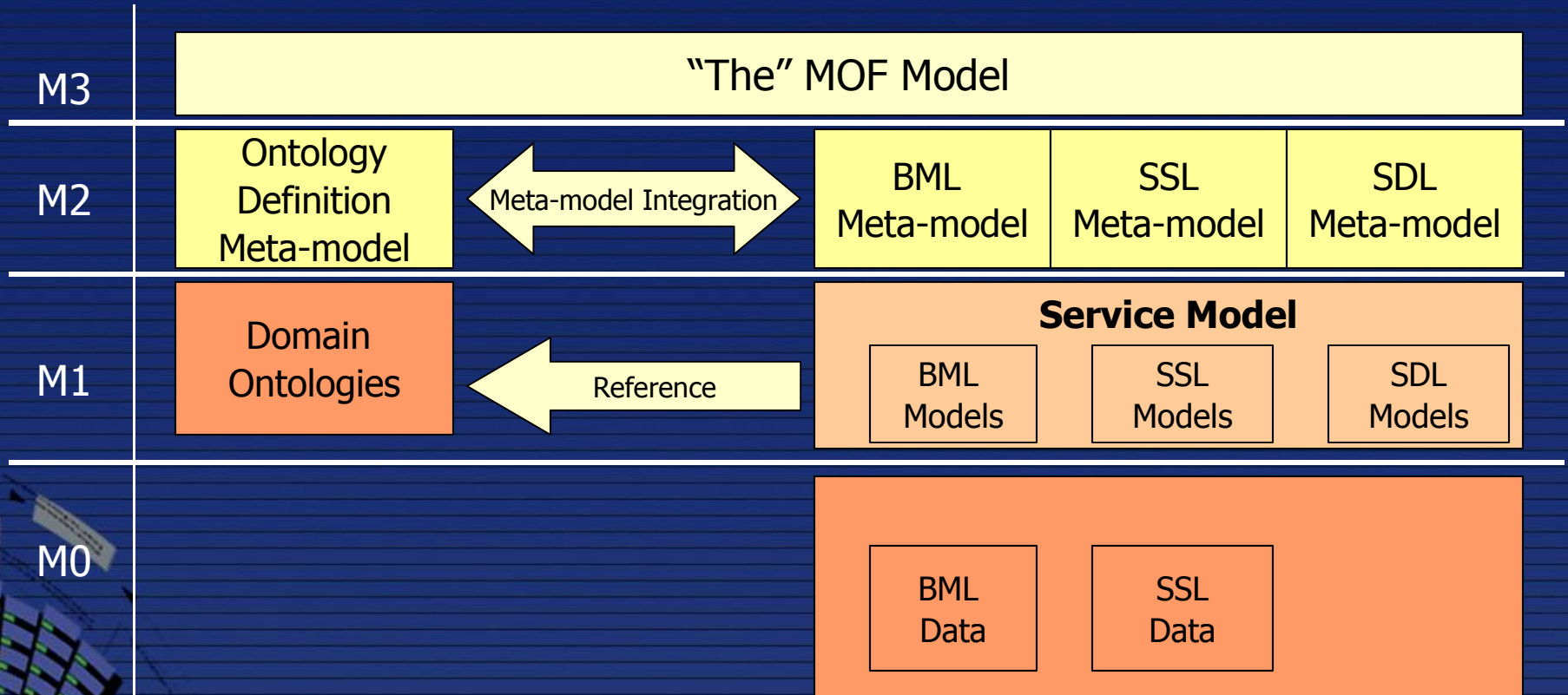
Abstraction

lower

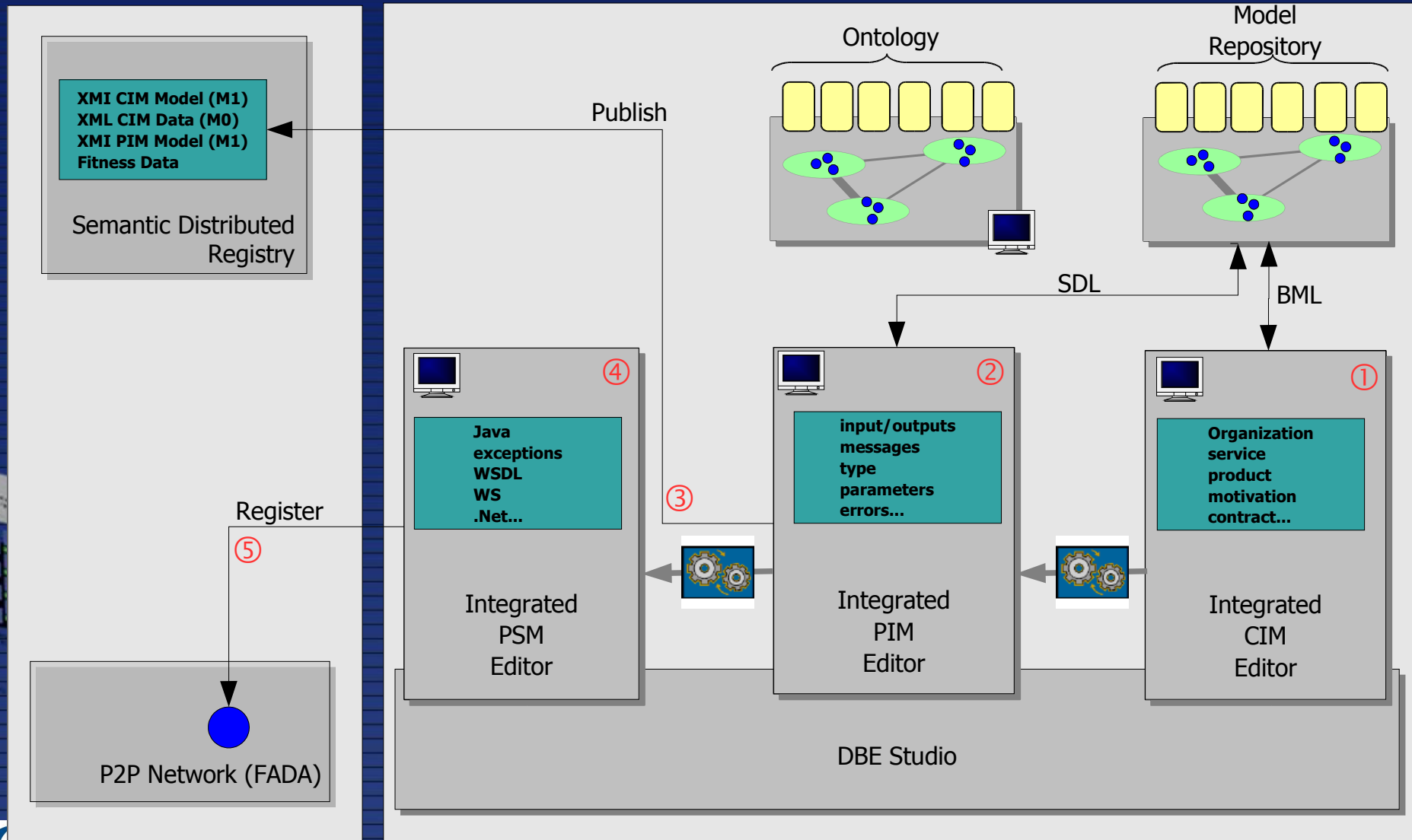


Digital Business Ecosystem

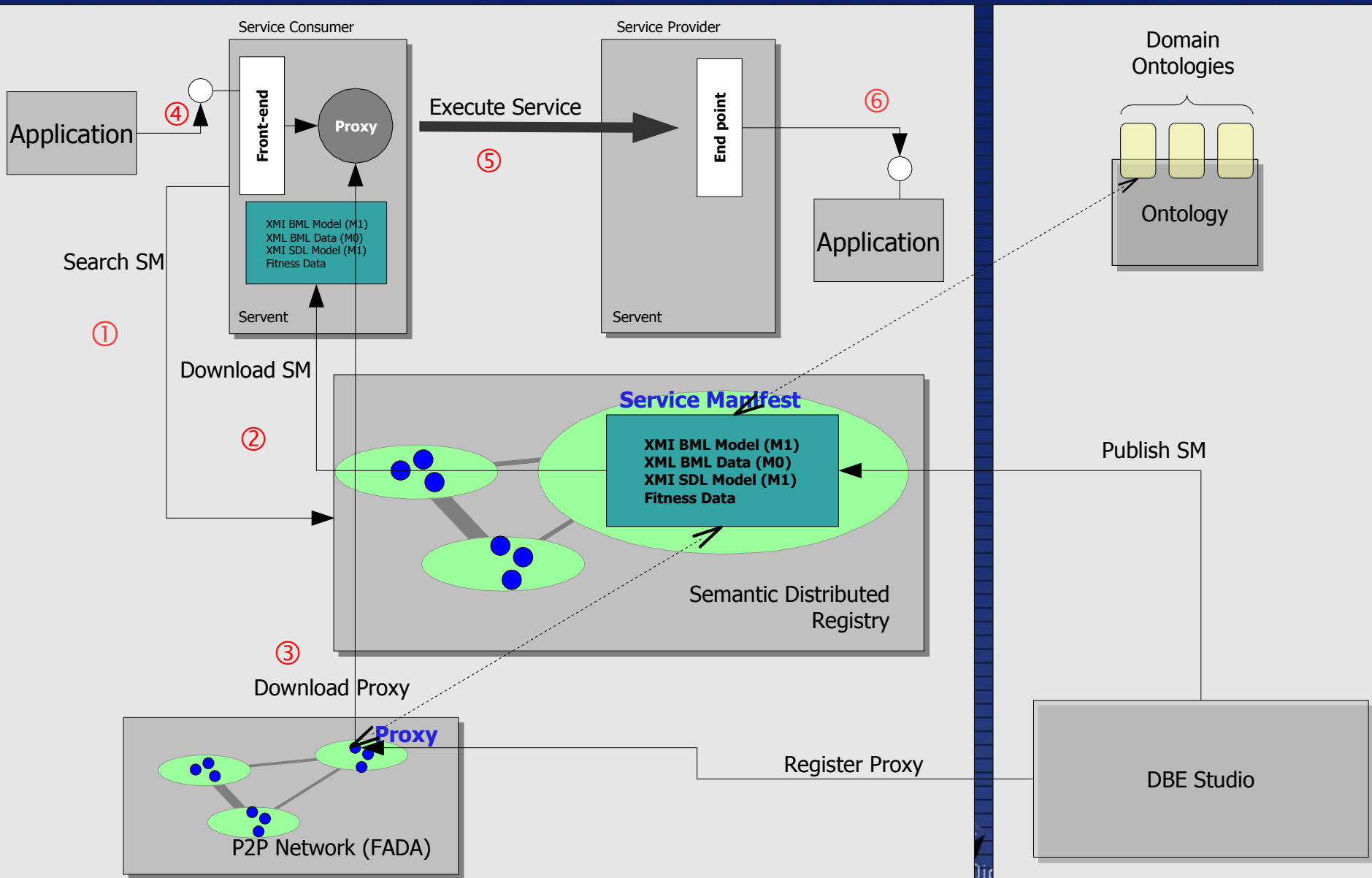
MDA-based Models Representation in DBE



Service Factory

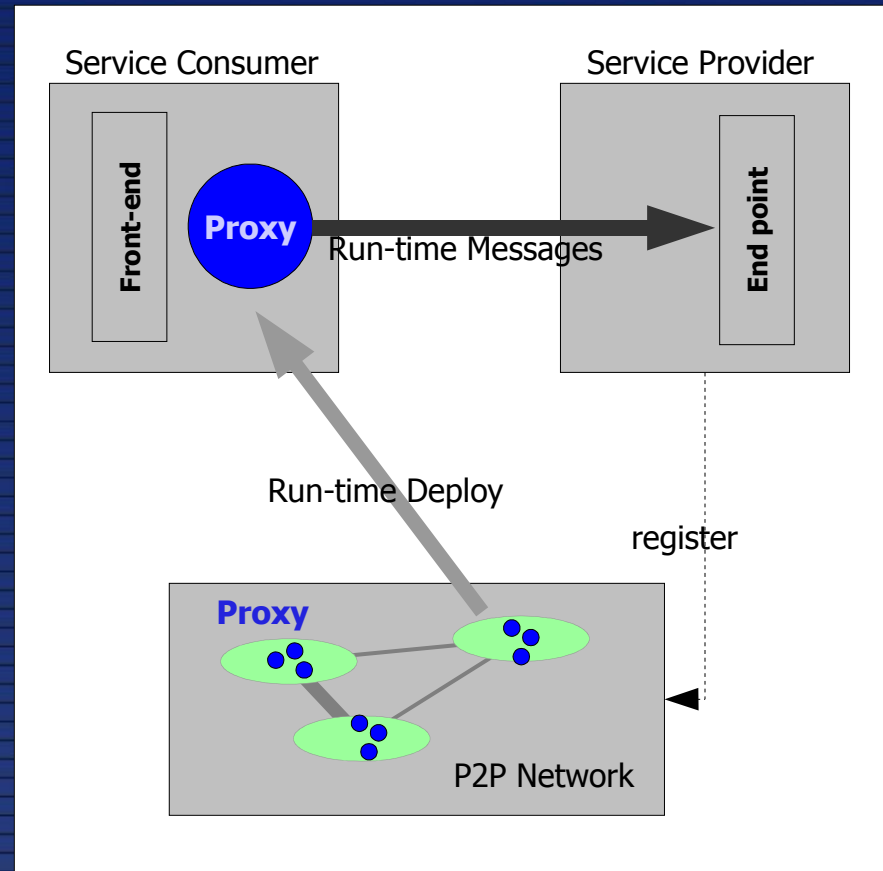


Execution Environment



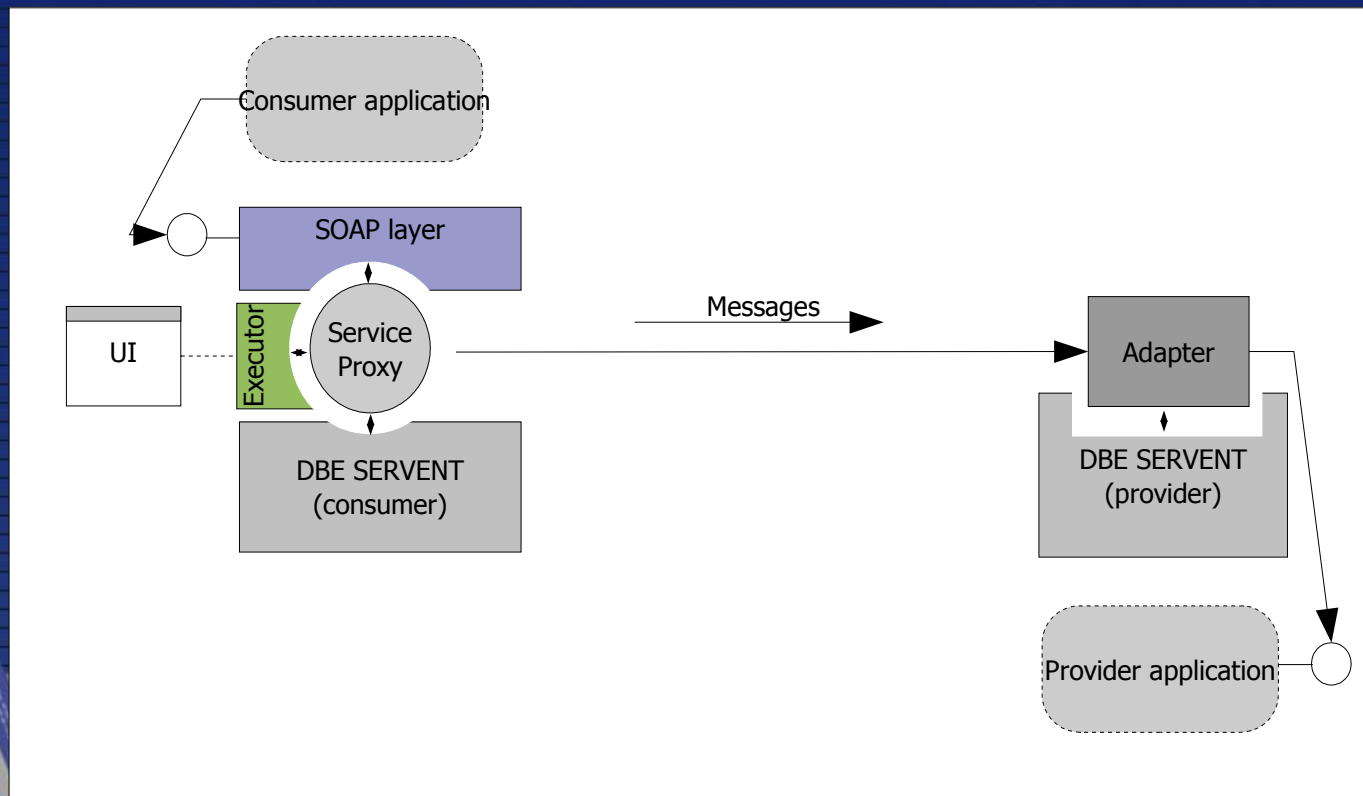
Service Proxy

- Technical Architecture
- Smart proxy
 - Serializable Java imperative code
 - Run-time distributed
 - Concept borrowed from Jini
- End-point mediator
- It keeps a reference to its Service Manifest
- DBE will allow a non-Java proxy to take advantage of the ecosystem



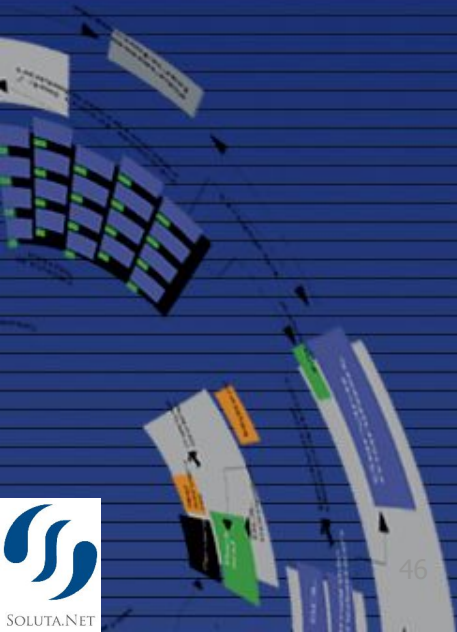
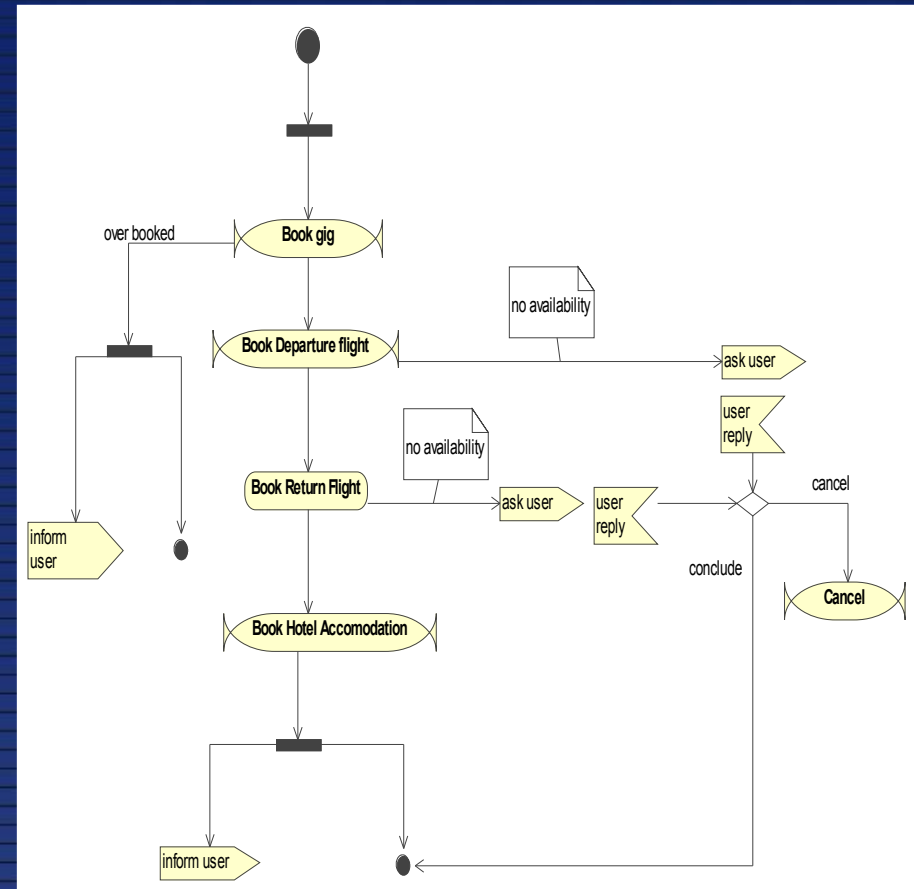
The servent

- The XMI nature of the service manifest will allow the DBE Servent to be able to dynamically generate the proxy

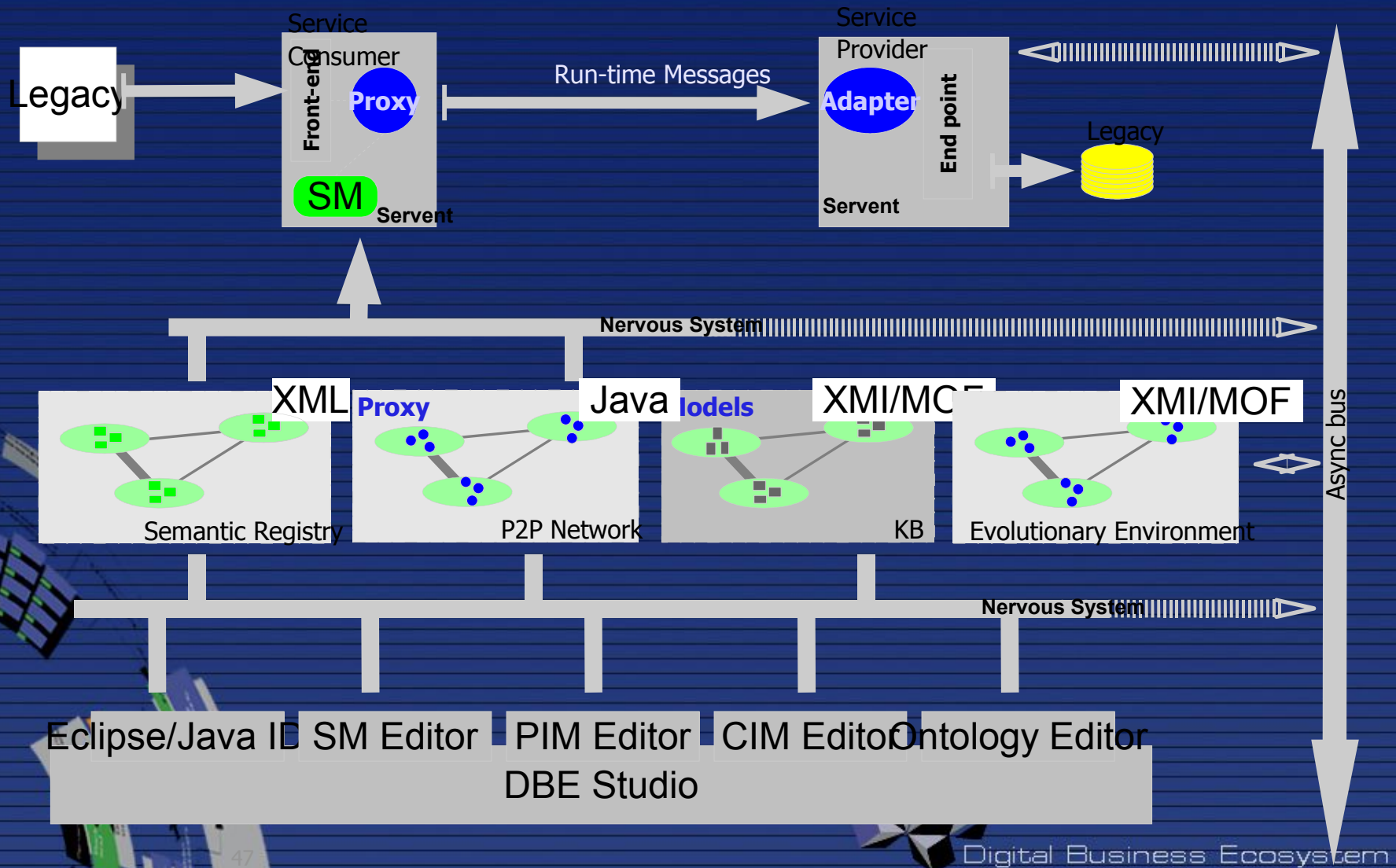


Service Composer

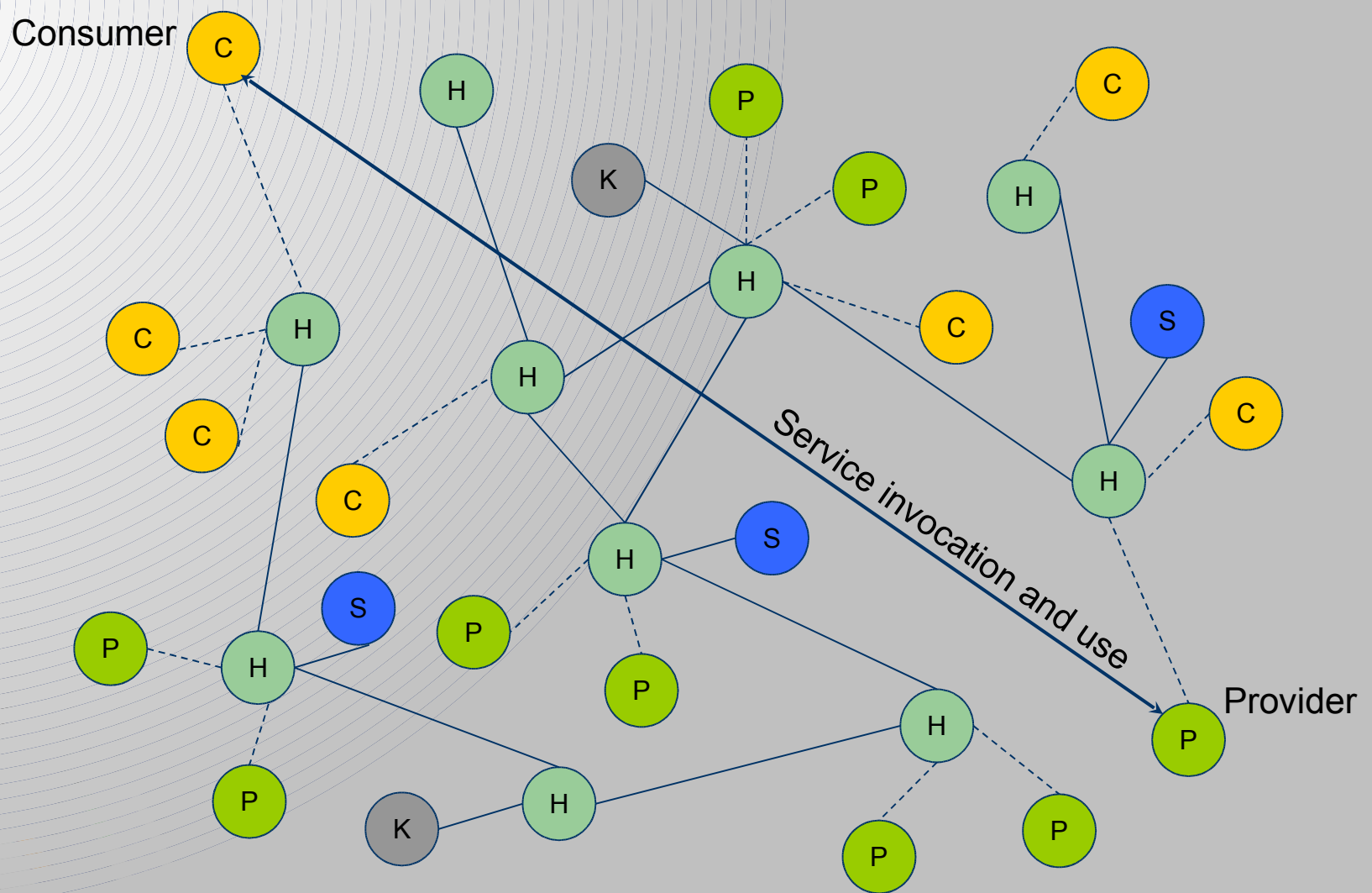
- Service definitions defined at composition-time
- Real services binded at run-time



Topology

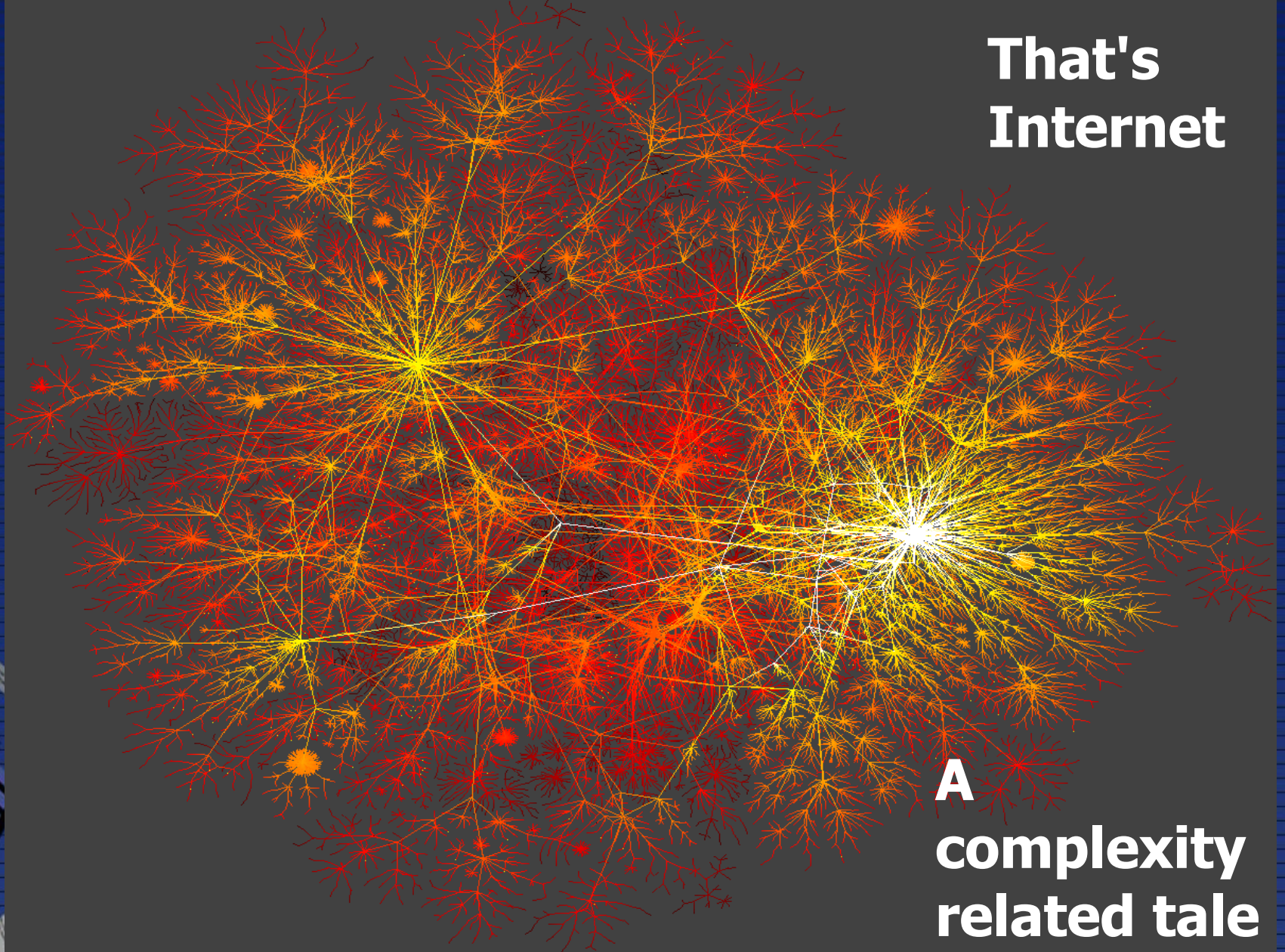


Network Topology



P Provider
 H Nervous System
 C Consumer
 S TWFM
 K Knowledge base

That's Internet

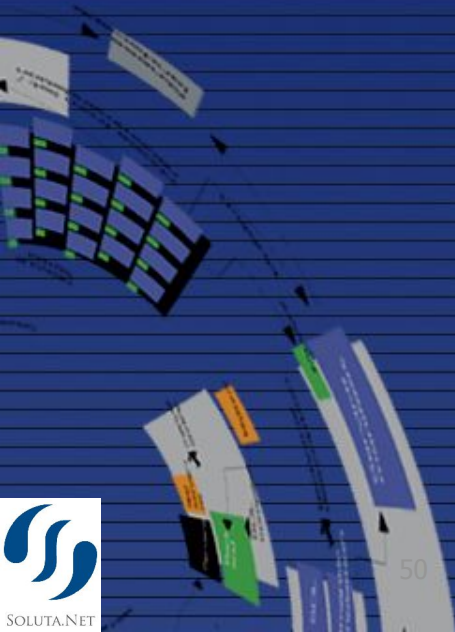
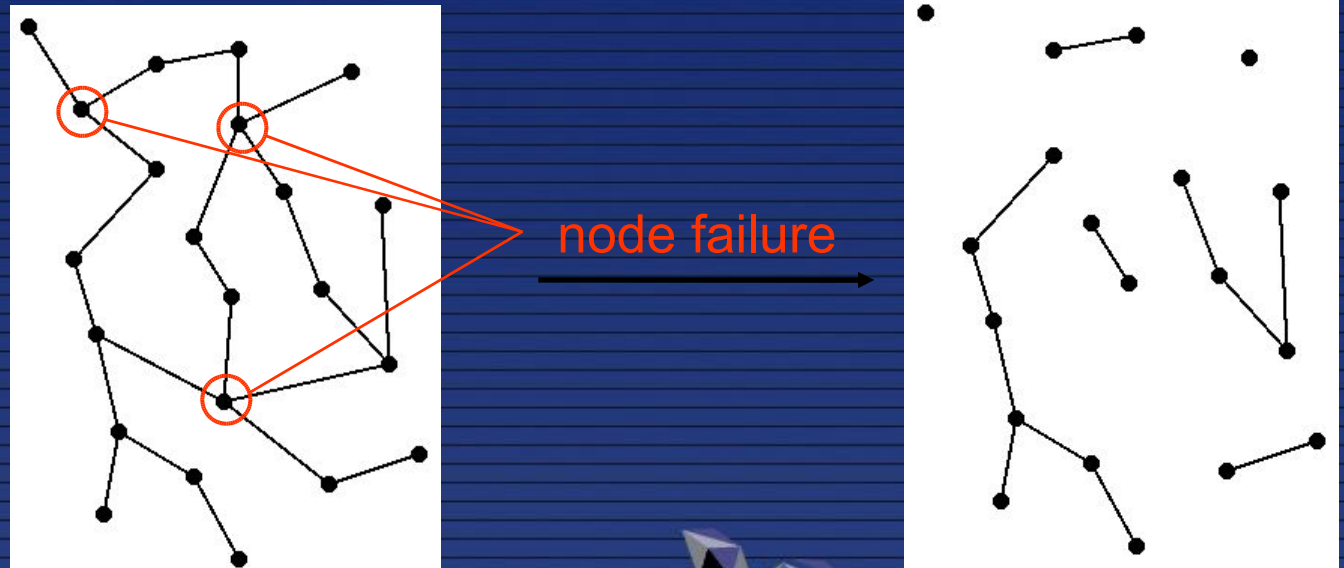
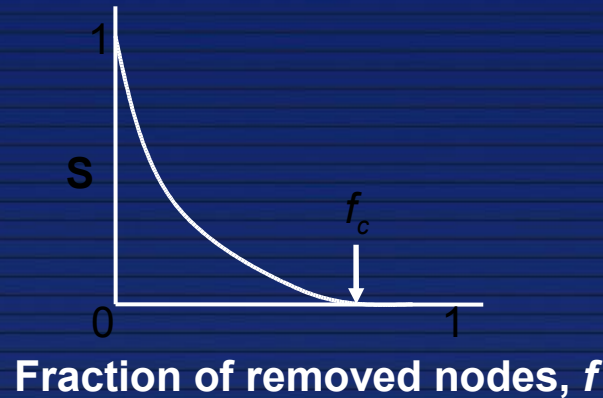


A
complexity
related tale



Robustness

Complex systems maintain their basic functions even under errors and failures (cell → mutations; Internet → router breakdowns)



Standards Stack

SMEs Services

Intelligent Recommendation System

Evolutionary Environment

Service Composer

Usage

History

Statistics

Knowledge Base

Adoptions

Profiles

Requests

Ontologies

Process

Motivation

Rules

Operation

DataTypes

Event

Business Models

Organization

Computational Models

Identification/Authentication

Authorization

Certification Authority

DBE Virtual Machine

P2P Architecture

Conclusions



MDA, “the silver bullet” ?



- MDA is bringing great advantages to the project
- MDA is tackling the project complexity
- We constantly refer to MDA, OGM standards and MOF models as a common framework and approach to interoperability
- We reuse and provide value added to Open Source projects
- “we are not alone out there”

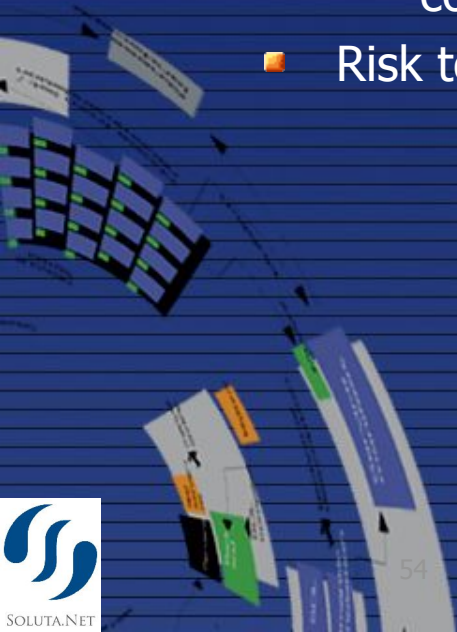
BUT

- The standards are not stable yet, different communities are doing things their own way with XMI/MOF bases repositories
 - Modelling Tools and MOF repositories are in their early stages: lack of documentation
 - Modelling Tools and MOF repositories are barely interoperables
- ... more to come in the II session

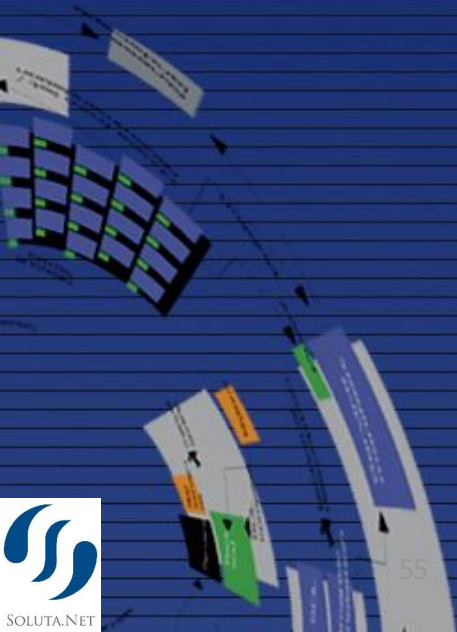


MDA Current limits

- No versioning support
- No model dependencies support
- Lacks Symbol semantics
- Except for CORBA there is no distributed MOF interchange interface
- No strict compliance with OMG standard out there
 - No validation process (W3C does provide validators)
 - MDA product standard compliance, it is hard to tell the level of MDA compliance in tools
- Risk to MDA Vendor lock-in



Questions?



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Research fields



The future research directions

- Support Scale Free Networks in:
 - Repository management
 - Optimizations in ExE (P2P)
 - Optimizations in EvE
- Apply OMG forthcoming “QVT” and “MOF to Text”
- Develop a MDA tools that
 - Supports CIM
 - Generates PIM from CIM
 - Supports debugging on PIM models
- Composing service



Roadmap

- DBE to play with
 - Goes Open Source the first week of June 2005
- Testing environment
 - FADA, Semantic Registry, Model Repository
 - September 2005
- Business Models and Ontologies
 - November 2005
- Testing services
 - February 2006
- Service Composer
 - February 2006
- EvE
 - June 2006

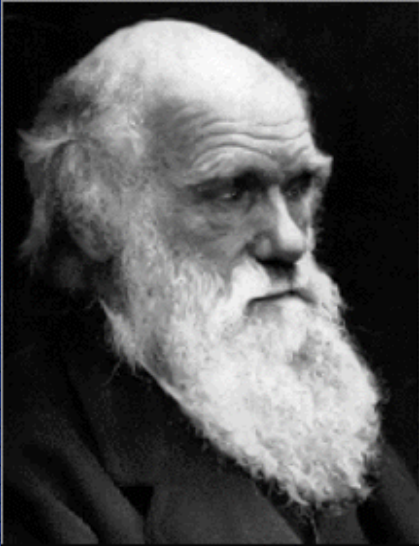


More Information

- Official Web Site
 - <http://www.digital-ecosystems.org>
- EU Project Officer
 - <http://www.nachira.net/de/index.htm>
- 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>
- http://www.bim.tut.fi/opetus/kurssit/2920425/S2003/swbus240903_DBE_dini.pdf
- DBE Paper by the EU
 - http://europa.eu.int/information_society/topics/ebusiness/godigital/sme_research/doc/dbe_discussionpaper.pdf
- Project Summary
 - http://www.ee.ic.ac.uk/philippe/dbe_summary_cc.pdf
- IST Project Fact Sheet
 - http://dbs.cordis.lu/fep-cgi/srchidadb?ACTION=D&CALLER=PROJ_IST&QM_EP_RCN_A=71142

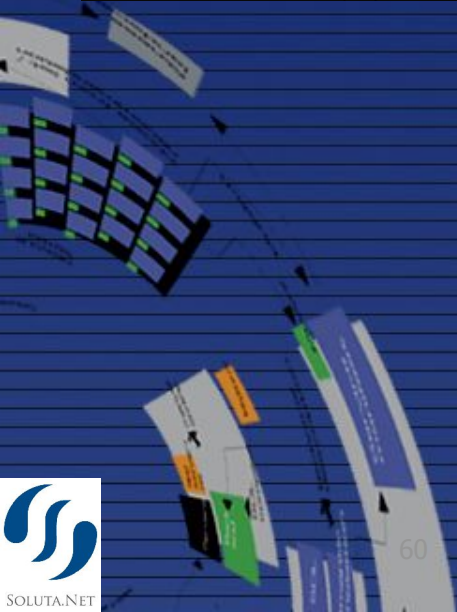


Digital Darwinism



“It is not the strongest of species that survive, nor the most intelligent, but the one most adaptable to change.”

Charles Darwin
1809 - 1882



Digital Business Ecosystem