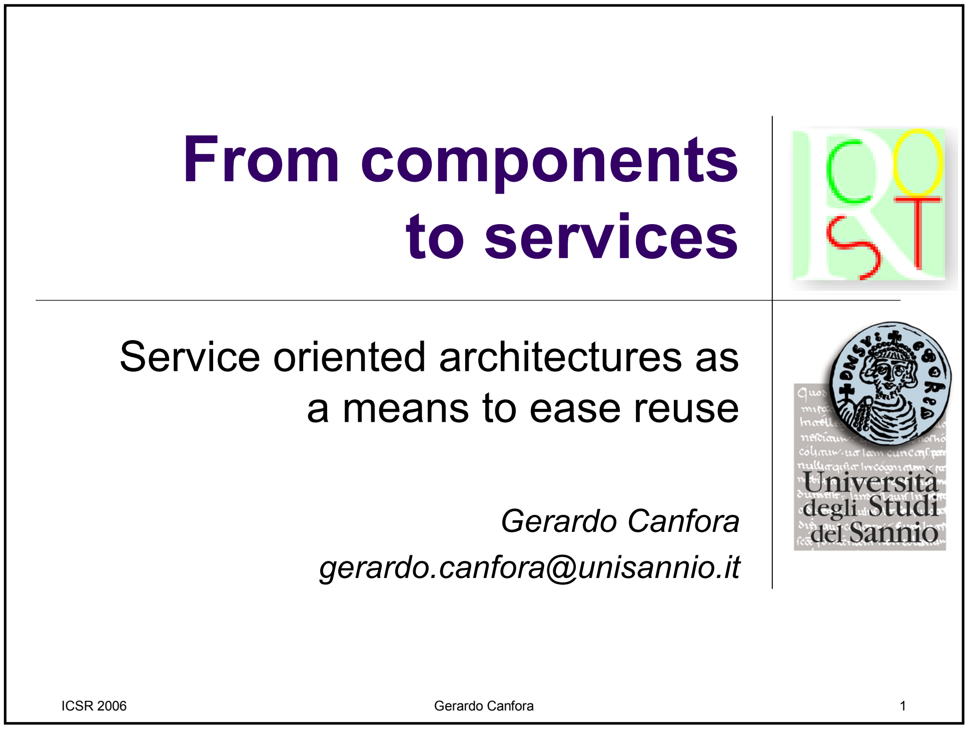
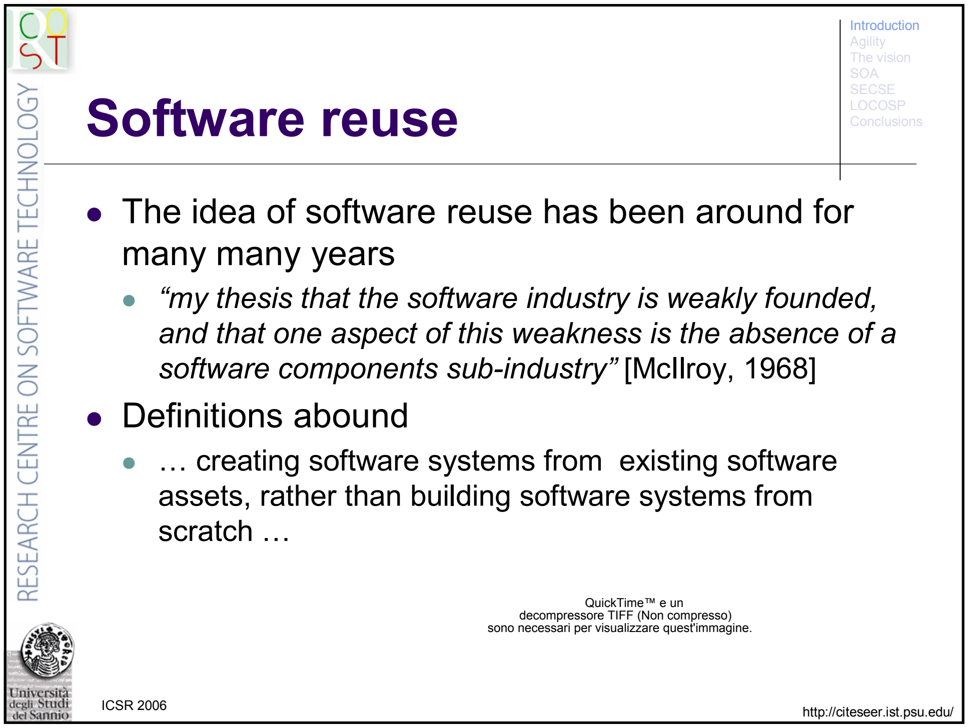


From components to services

Service oriented architectures as a means to ease reuse

Gerardo Canfora
gerardo.canfora@unisannio.it



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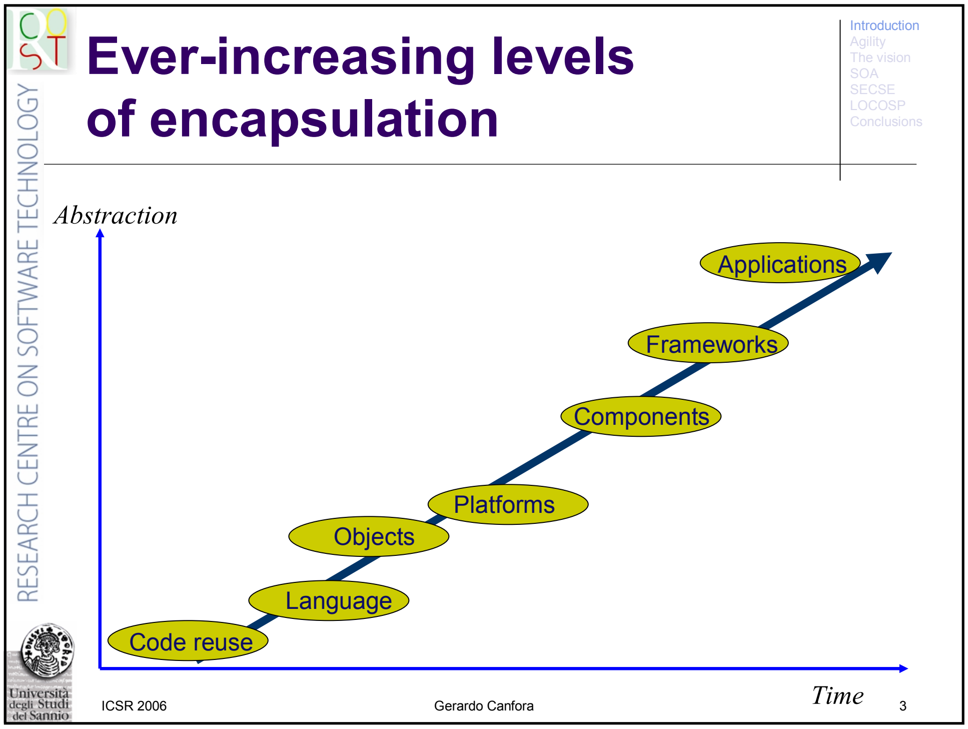
Software reuse

- The idea of software reuse has been around for many many years
  - *“my thesis that the software industry is weakly founded, and that one aspect of this weakness is the absence of a software components sub-industry”* [McIlroy, 1968]
- Definitions abound
  - … creating software systems from existing software assets, rather than building software systems from scratch …

QuickTime™ e un
decompressore TIFF (Non compresso)
sono necessari per visualizzare quest'immagine.



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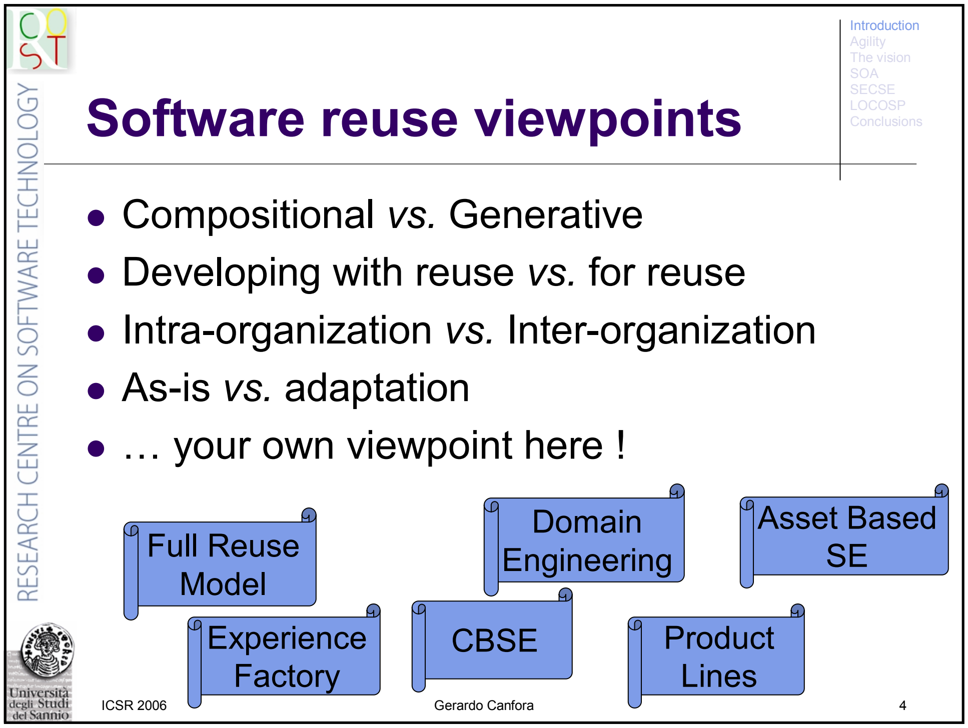
Ever-increasing levels of encapsulation



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Software reuse viewpoints

- Compositional *vs.* Generative
- Developing with reuse *vs.* for reuse
- Intra-organization *vs.* Inter-organization
- As-is *vs.* adaptation
- … your own viewpoint here !

Full Reuse Model

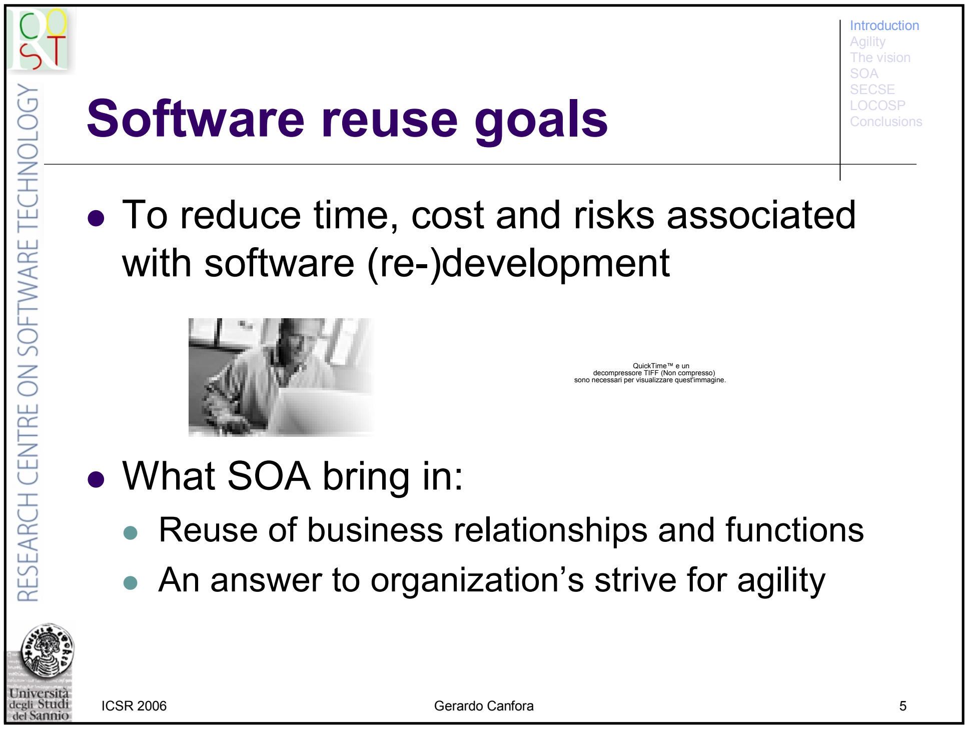
Domain Engineering

Asset Based SE

Experience Factory

CBSE

Product Lines



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Software reuse goals

- To reduce time, cost and risks associated with software (re-)development

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decompressore TIFF (Non compresso)
sono necessari per visualizzare quest'immagine.

- What SOA bring in:
  - Reuse of business relationships and functions
  - An answer to organization’s strive for agility

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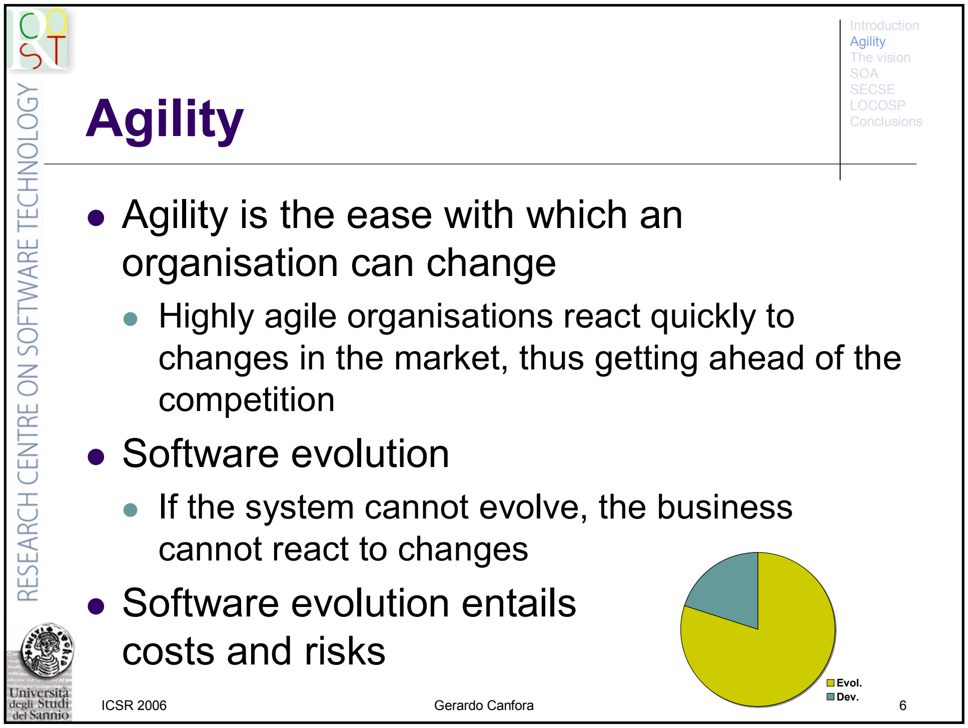

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Agility

- Agility is the ease with which an organisation can change
  - Highly agile organisations react quickly to changes in the market, thus getting ahead of the competition
- Software evolution
  - If the system cannot evolve, the business cannot react to changes
- Software evolution entails costs and risks

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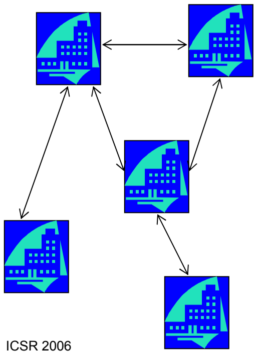
Agility

- Unprecedented levels of change
  - often unanticipated
- Virtual organizations



- Interacting applications belong to multiple administrative domains
- Internal applications increasingly exchange functions with the external of the enterprise
- Many potential providers can be found for each required function
- Web based interactions become pervasive

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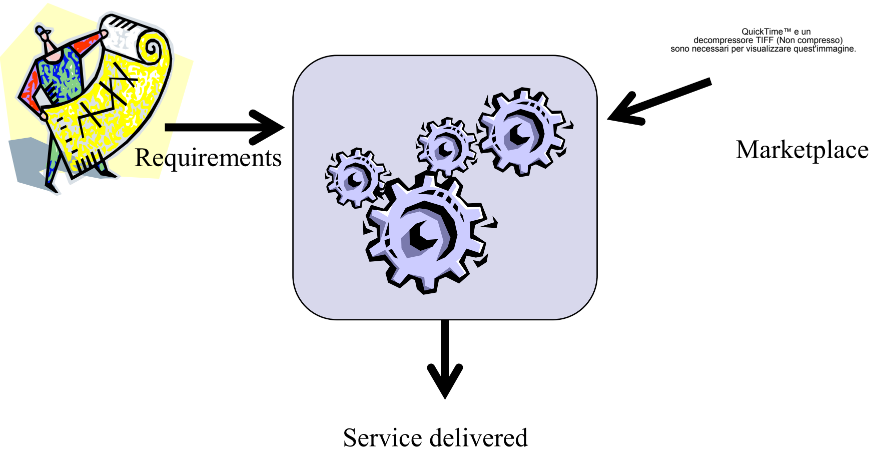

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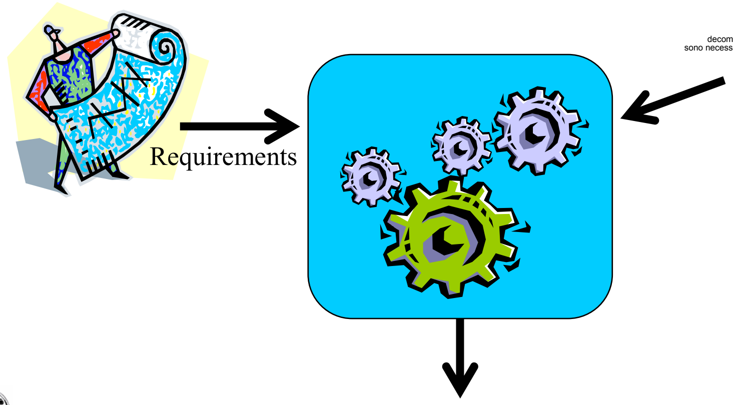

Requirements

QuickTime™ e un
decompressore TIFF (Non compresso)
sono necessari per visualizzare quest'immagine.

Marketplace

Service delivered

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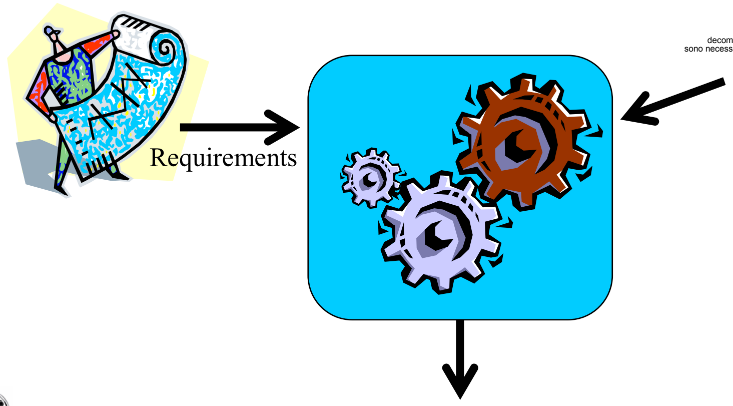

Requirements

QuickTime™ e un
decompressore TIFF (Non compresso)
sono necessari per visualizzare quest'immagine.

Marketplace

Service delivered

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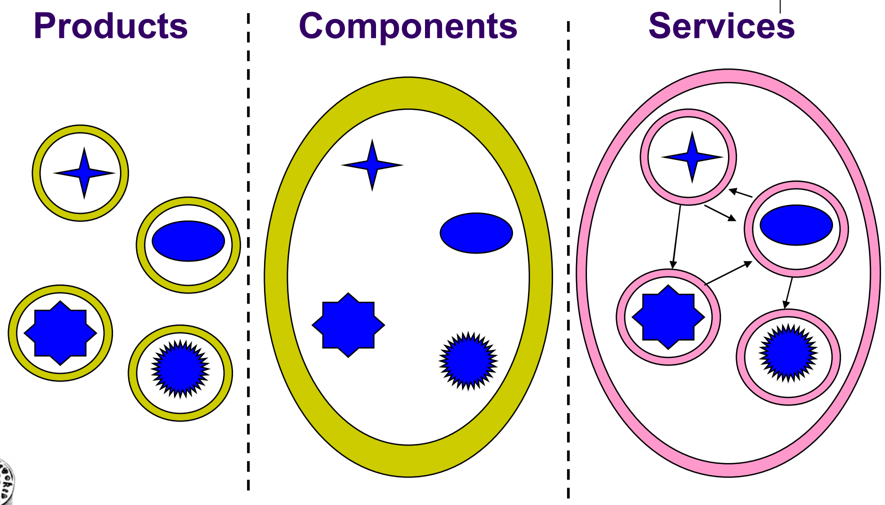
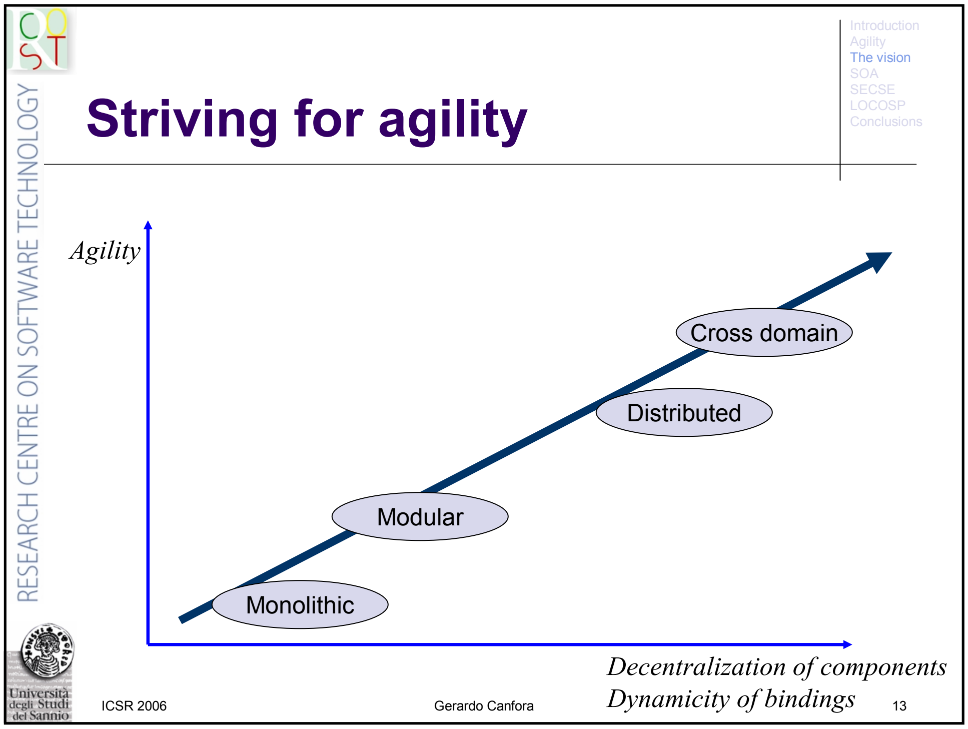
Isn't this component-based development ?



In this only another form of distributed systems ?

- Execution is distributed . . .
- . . . but also costs and risks are distributed
- Organization ability to evolve business
  - depends on the marketplace ability anticipate trends and needs and provide the right services at the right time
  - does not depend on ability of a software vendor to change a piece of software
- Services are realized by software
  - need for development / maintenance
  - this is a vendor concern
- Shared risks
  - SLAs



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Striving for agility

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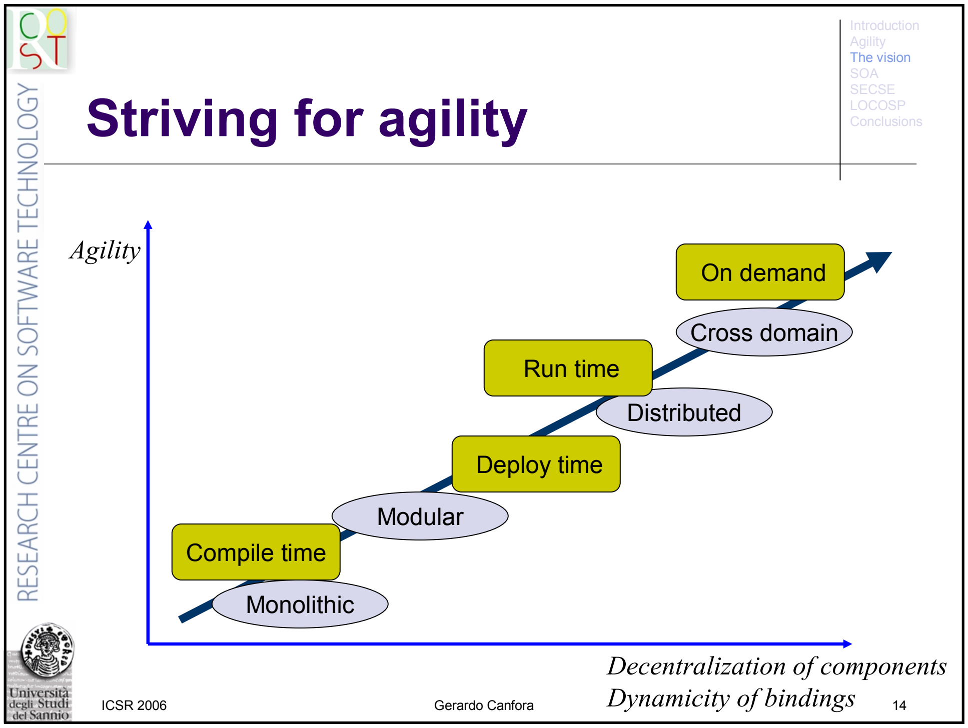

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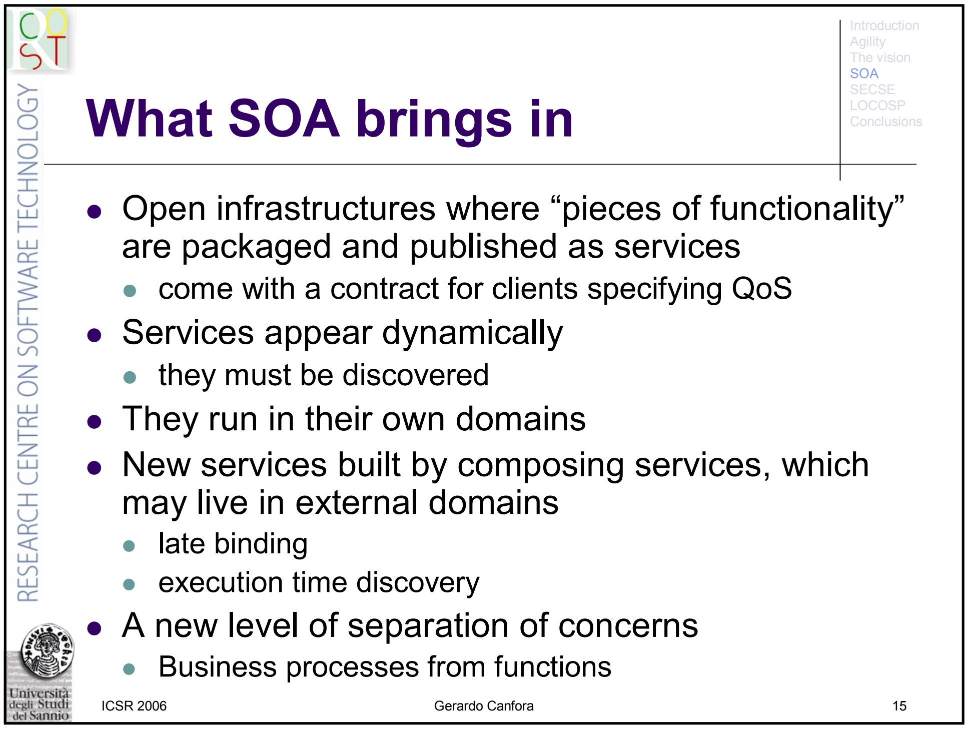
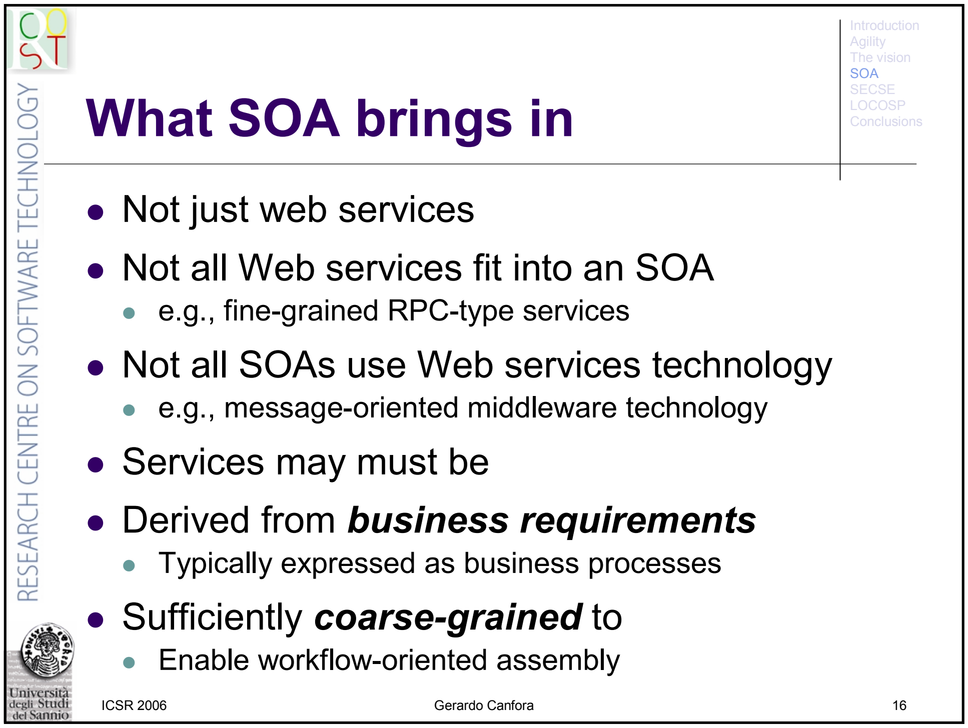


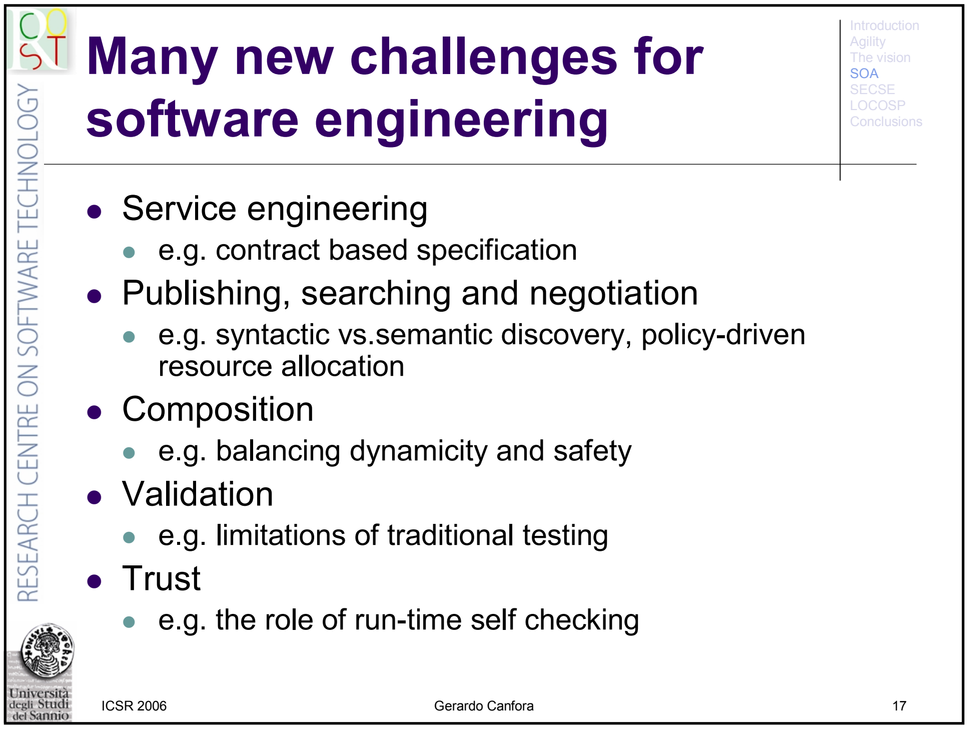
What SOA brings in

- Open infrastructures where “pieces of functionality” are packaged and published as services
  - come with a contract for clients specifying QoS
- Services appear dynamically
  - they must be discovered
- They run in their own domains
- New services built by composing services, which may live in external domains
  - late binding
  - execution time discovery
- A new level of separation of concerns
  - Business processes from functions



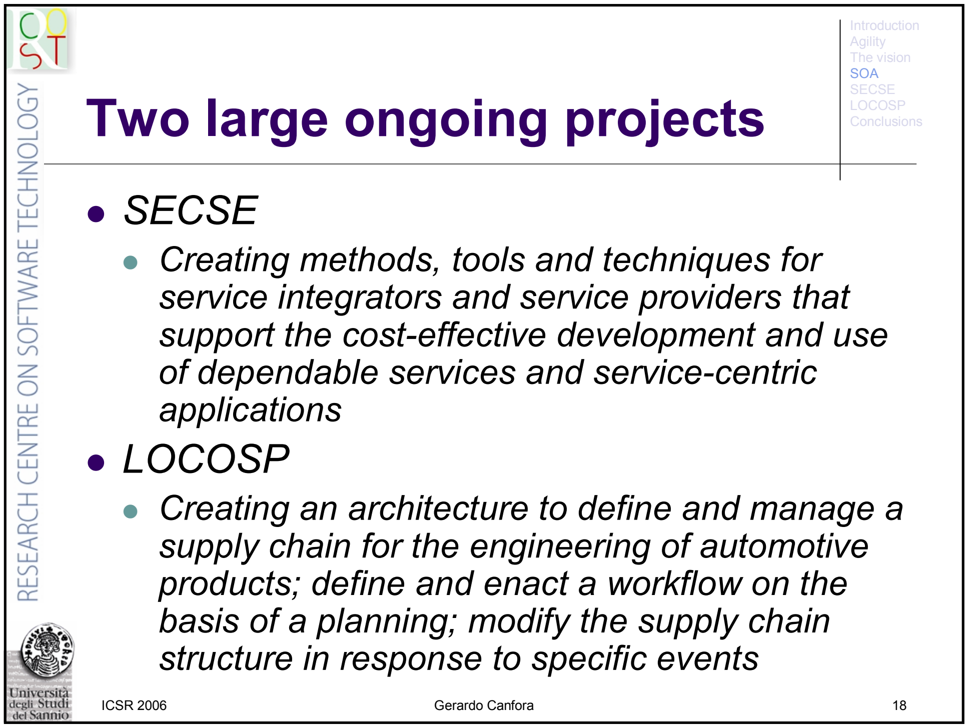
What SOA brings in

- Not just web services
- Not all Web services fit into an SOA
  - e.g., fine-grained RPC-type services
- Not all SOAs use Web services technology
  - e.g., message-oriented middleware technology
- Services may must be
- Derived from ***business requirements***
  - Typically expressed as business processes
- Sufficiently ***coarse-grained*** to
  - Enable workflow-oriented assembly



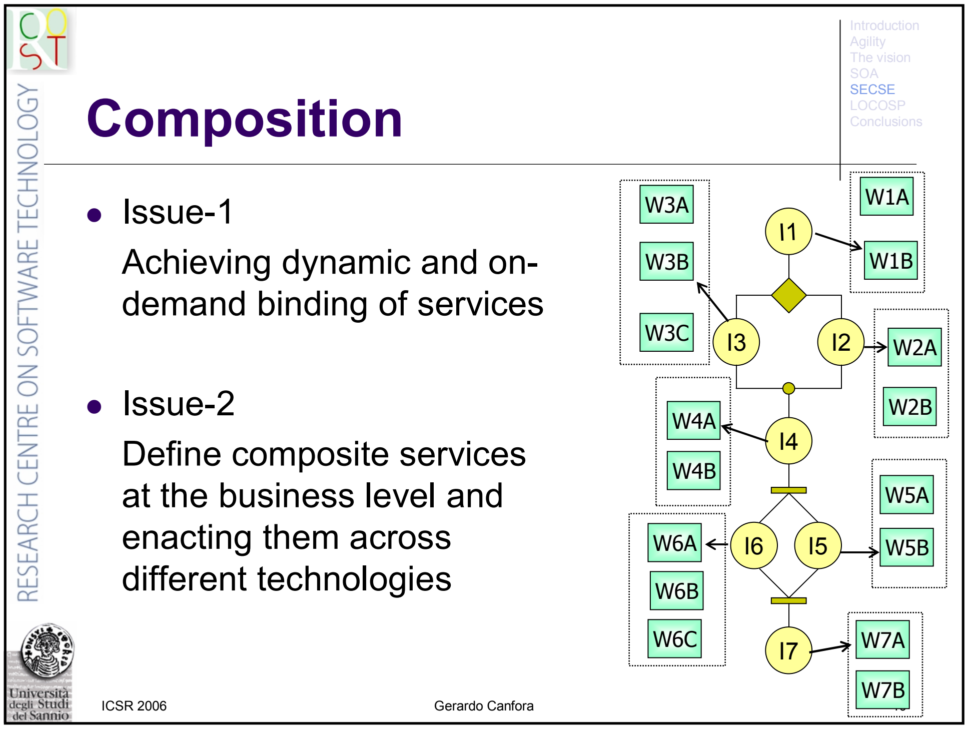
Many new challenges for software engineering

- Service engineering
  - e.g. contract based specification
- Publishing, searching and negotiation
  - e.g. syntactic vs.semantic discovery, policy-driven resource allocation
- Composition
  - e.g. balancing dynamicity and safety
- Validation
  - e.g. limitations of traditional testing
- Trust
  - e.g. the role of run-time self checking



Two large ongoing projects

- *SECSE*
  - *Creating methods, tools and techniques for service integrators and service providers that support the cost-effective development and use of dependable services and service-centric applications*
- *LOCOSP*
  - *Creating an architecture to define and manage a supply chain for the engineering of automotive products; define and enact a workflow on the basis of a planning; modify the supply chain structure in response to specific events*



Composition

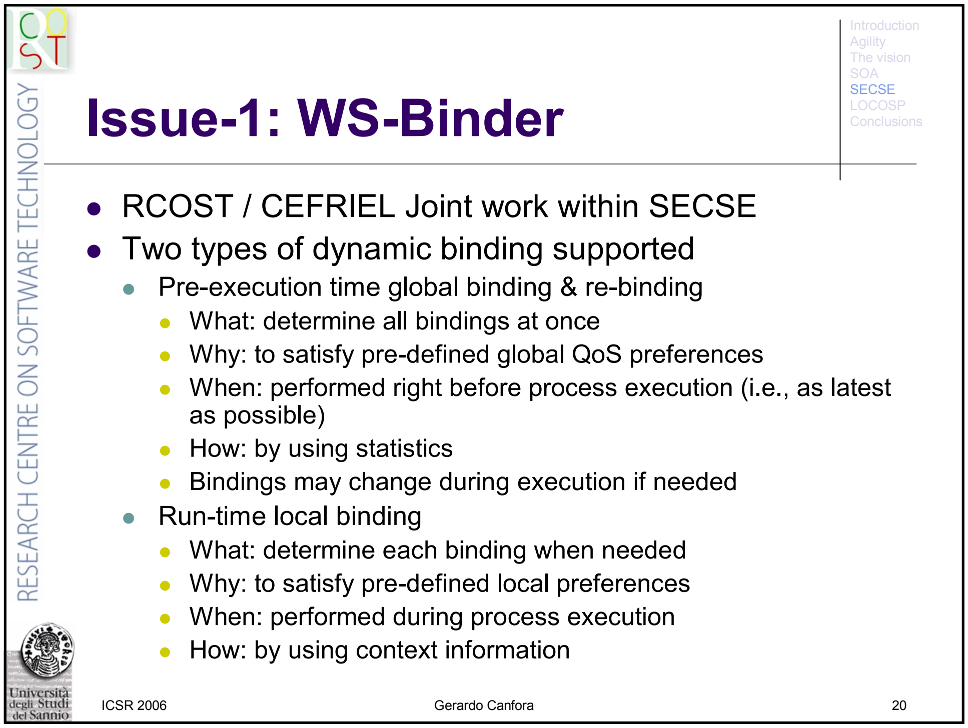
- Issue-1

  Achieving dynamic and on-demand binding of services

- Issue-2

  Define composite services at the business level and enacting them across different technologies

W3A
W3B
W3C
I1
W1A
W1B
I3
I2
W2A
W2B
W4A
W4B
I4
W5A
W5B
W6A
W6B
W6C
I6
I5
I7
W7A
W7B



Issue-1: WS-Binder

- RCOST / CEFRIEL Joint work within SECSE
- Two types of dynamic binding supported
  - Pre-execution time global binding & re-binding
    - What: determine all bindings at once
    - Why: to satisfy pre-defined global QoS preferences
    - When: performed right before process execution (i.e., as latest as possible)
    - How: by using statistics
    - Bindings may change during execution if needed
  - Run-time local binding
    - What: determine each binding when needed
    - Why: to satisfy pre-defined local preferences
    - When: performed during process execution
    - How: by using context information

Example: global QoS preferences

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Travel Planner

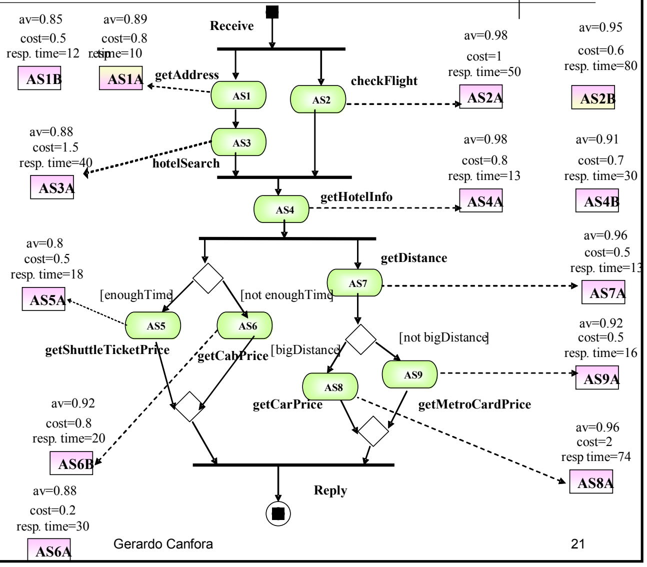
- Flight/hotel search to destination
- Local transport pricing information

Constraints

- Cost < 5$
  AND
- Resp Time < 2 min

Objective function

- Maximize availability



Example: context-based local binding

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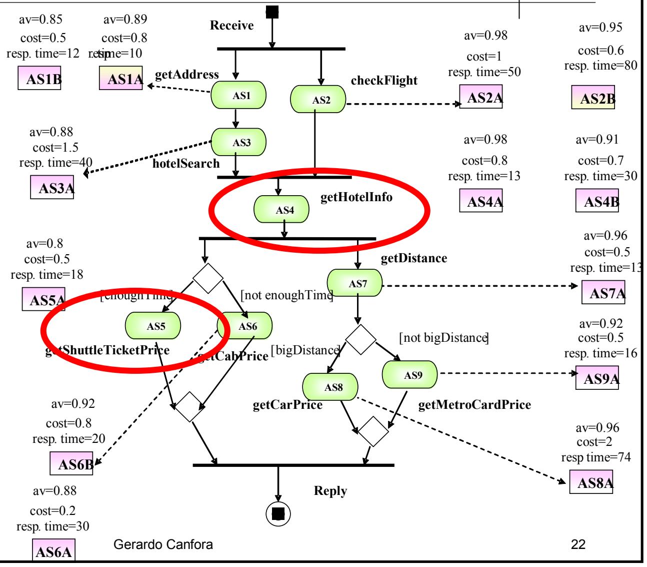
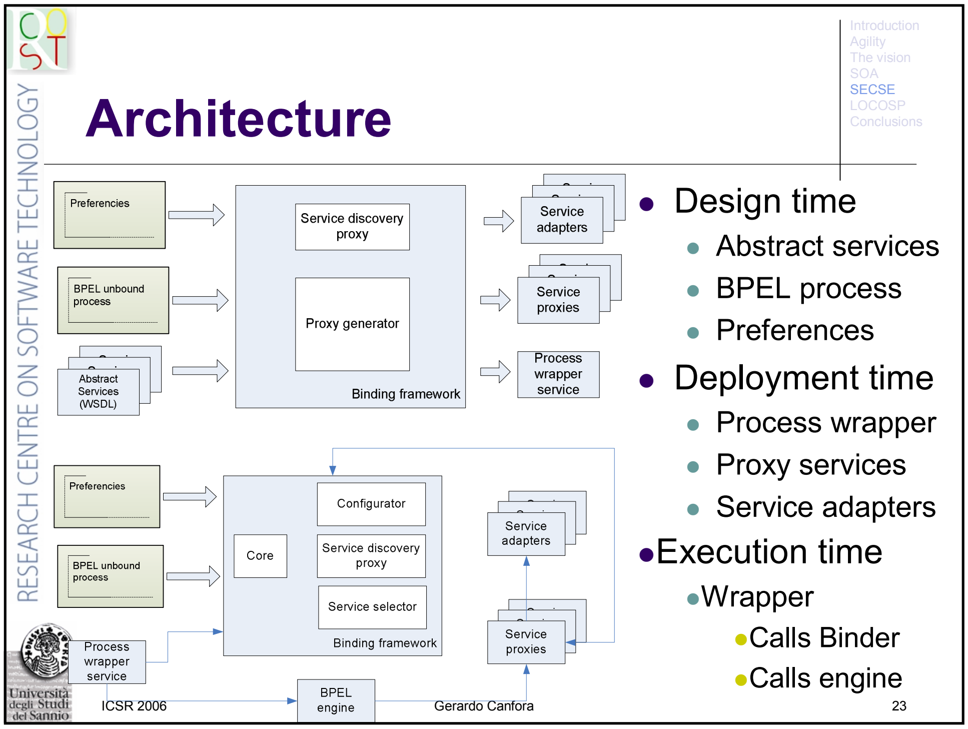
Shuttle provider service selected based on the hotel





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Architecture

- Design time
  - Abstract services
  - BPEL process
  - Preferences
- Deployment time
  - Process wrapper
  - Proxy services
  - Service adapters
- Execution time
  - Wrapper
    - Calls Binder
    - Calls engine

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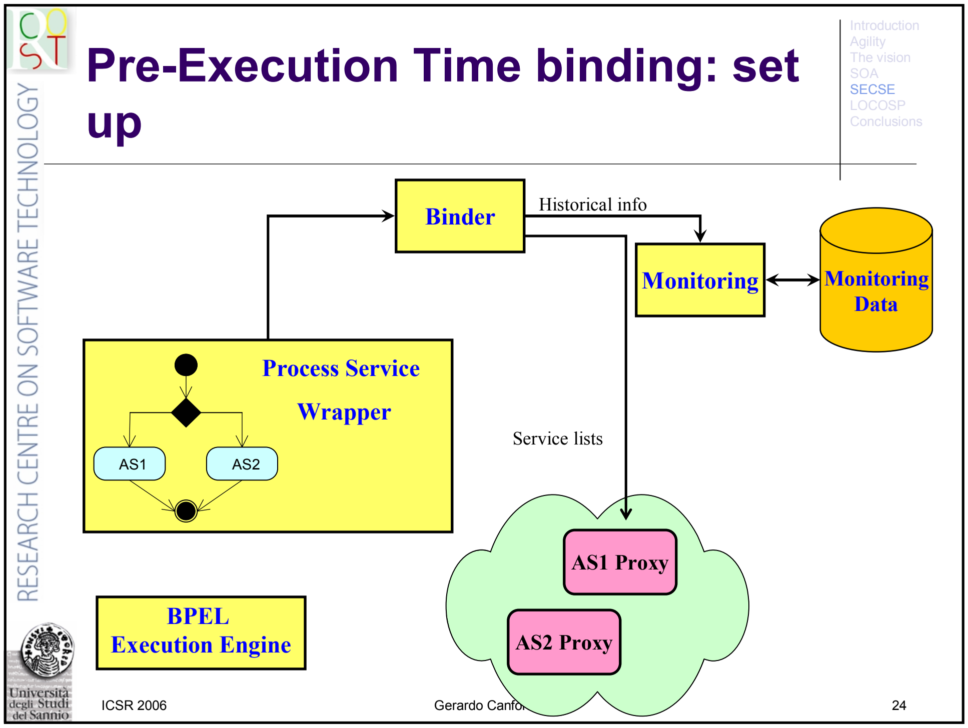

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Pre-Execution Time binding: set up

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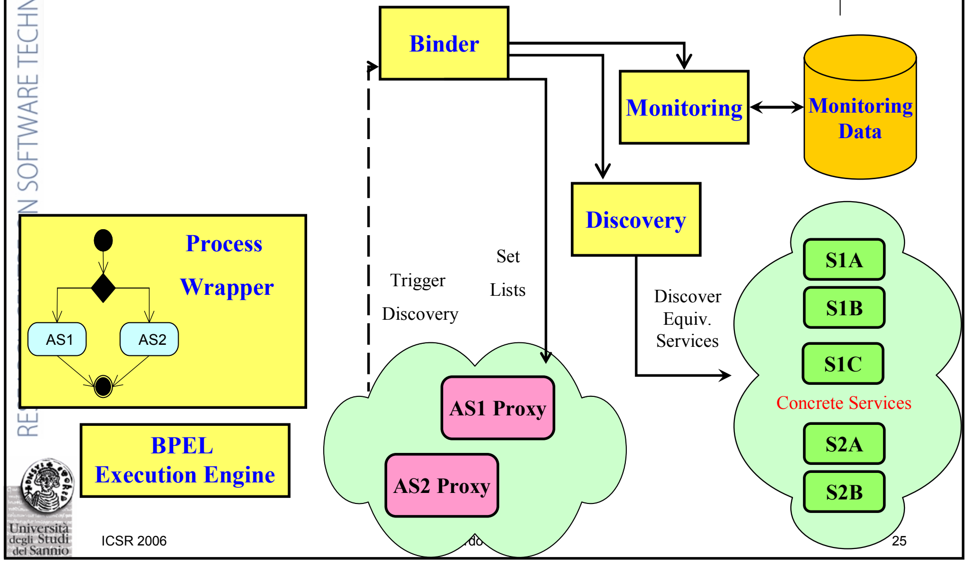
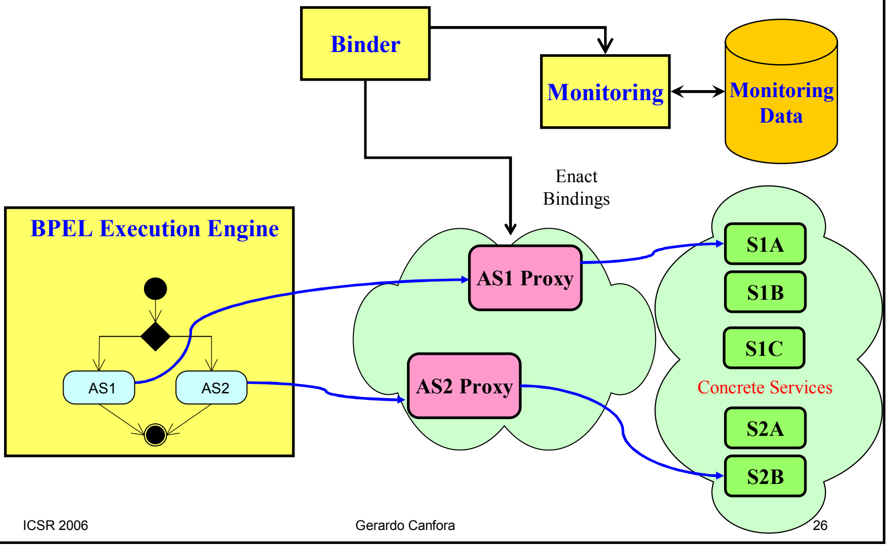
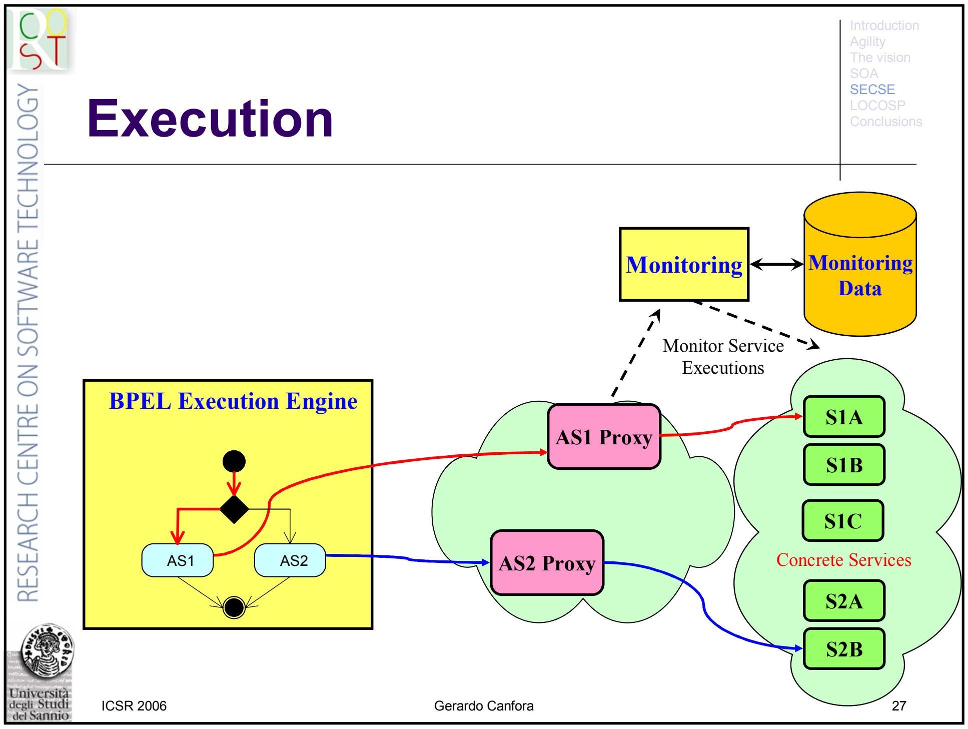
Service Discovery



Enact bindings





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Execution

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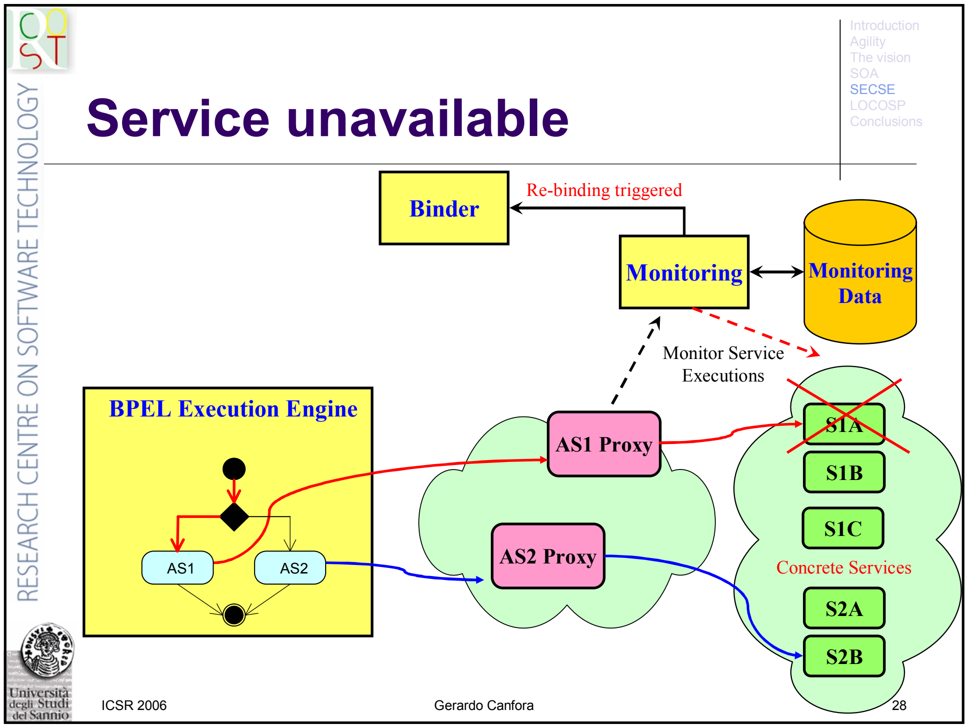

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Service unavailable

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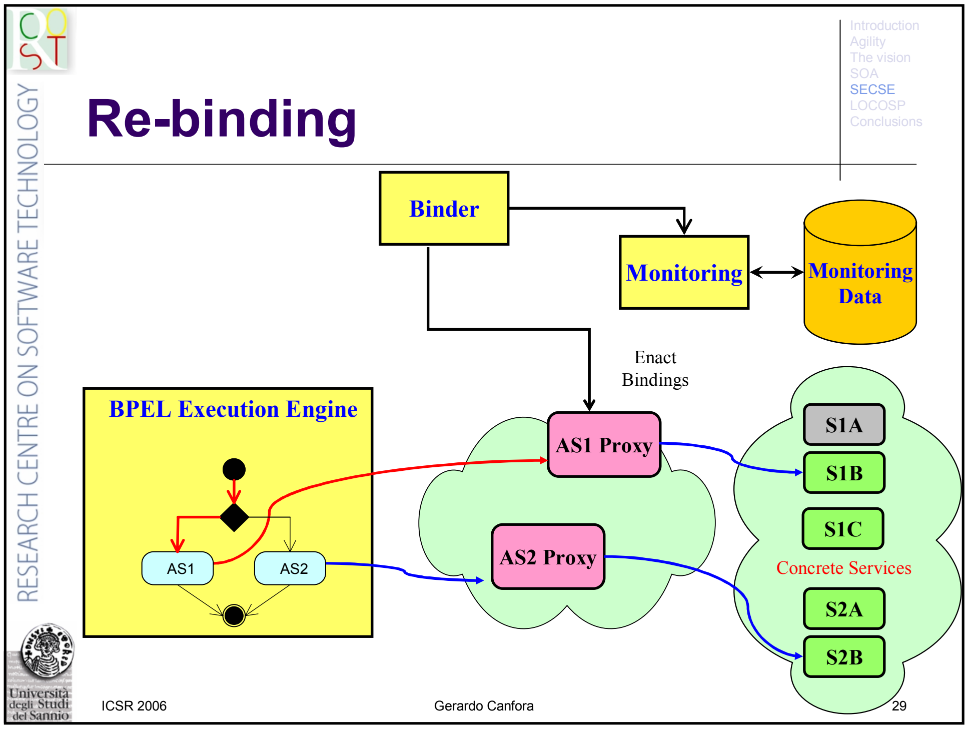

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Re-binding

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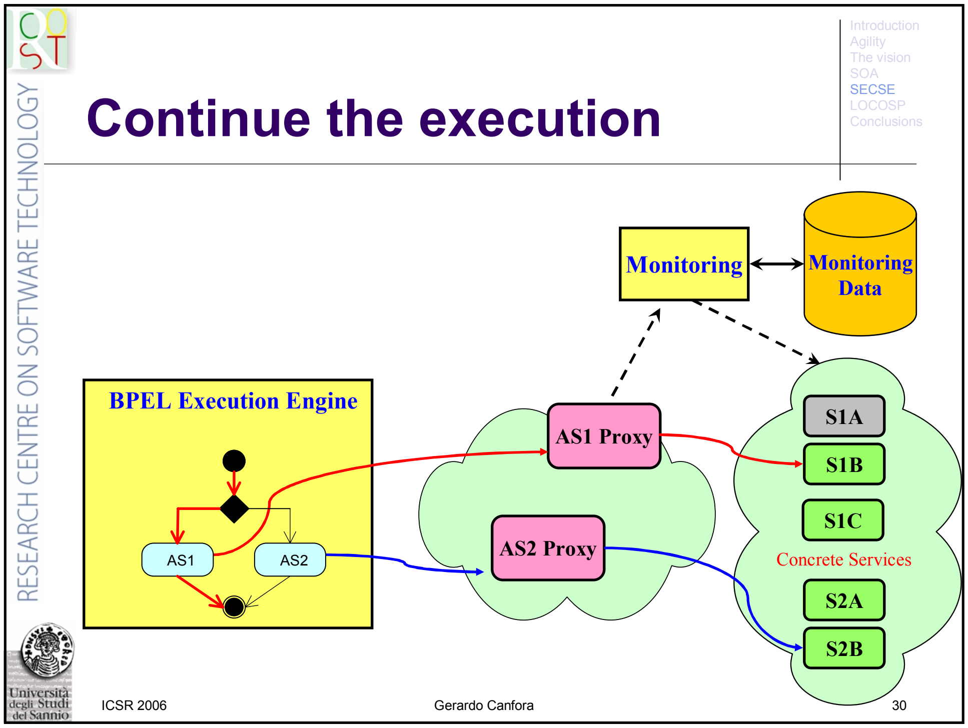

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Continue the execution

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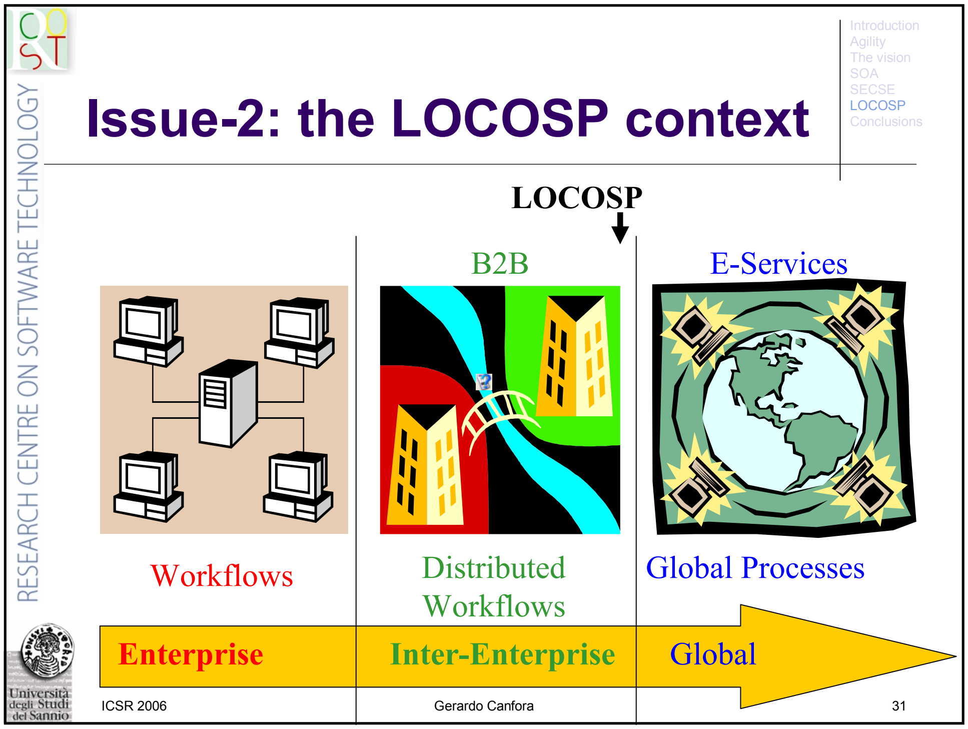

Issue-2: the LOCOSP context

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LOCOSP

B2B

E-Services

Workflows

Distributed Workflows

Global Processes

Enterprise

Inter-Enterprise

Global

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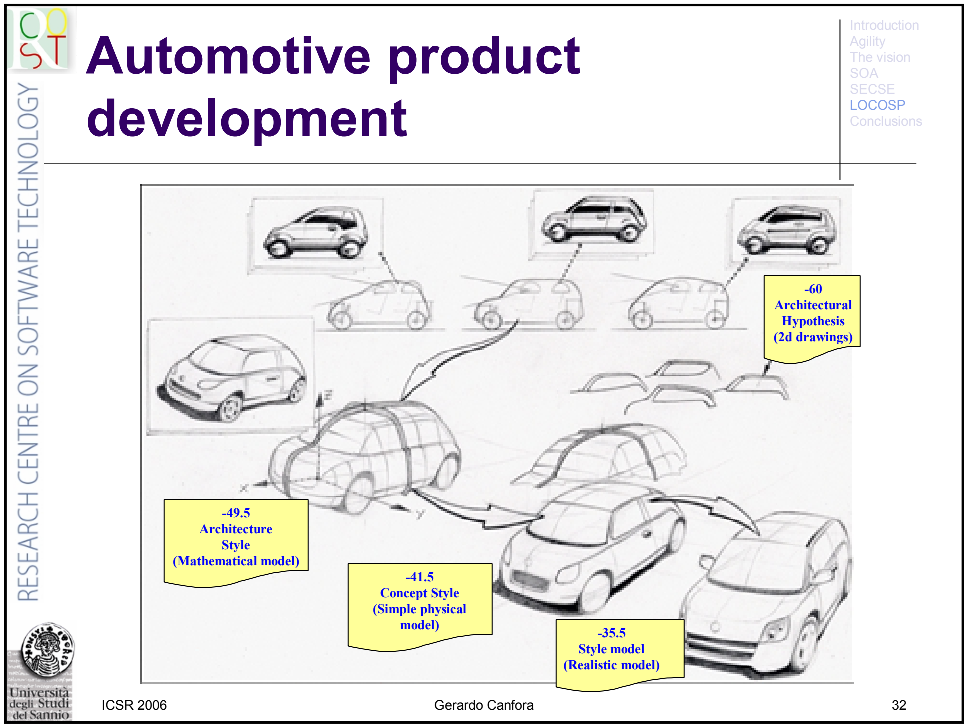

Automotive product development

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-60
Architectural Hypothesis
(2d drawings)

-49.5
Architecture Style
(Mathematical model)

-41.5
Concept Style
(Simple physical model)

-35.5
Style model
(Realistic model)

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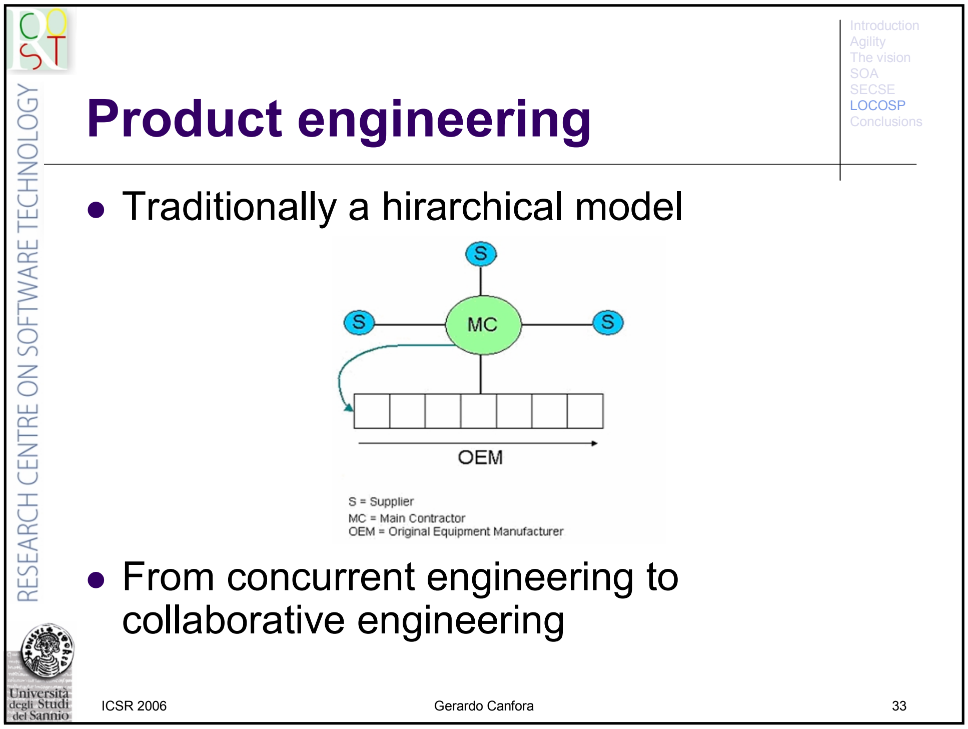
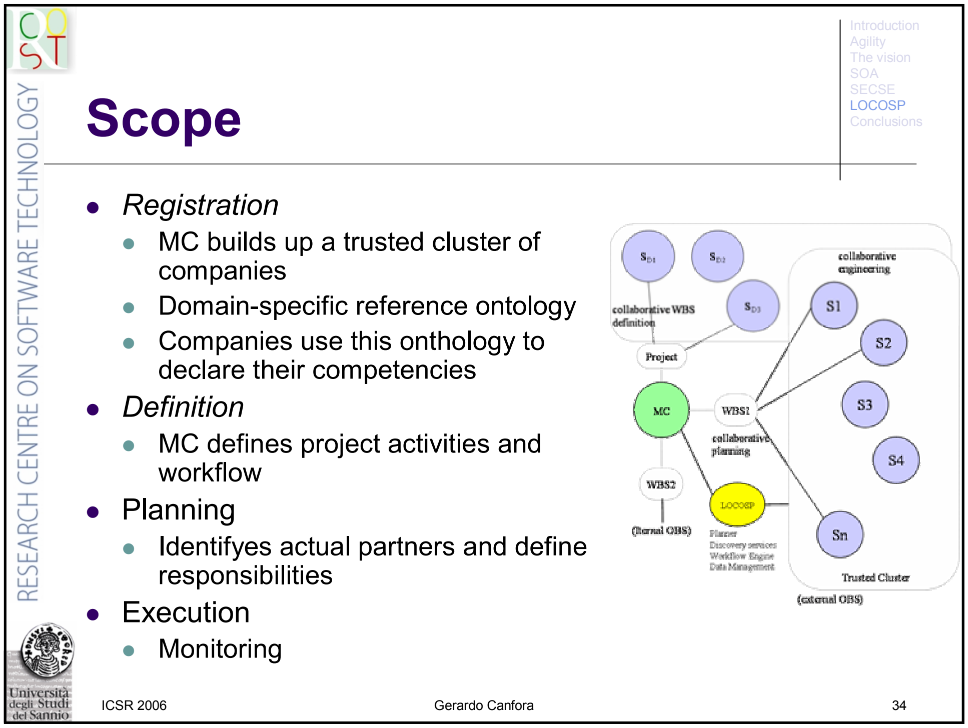


Product engineering

- Traditionally a hirarchical model

- From concurrent engineering to collaborative engineering



Scope

- *Registration*
  - MC builds up a trusted cluster of companies
  - Domain-specific reference ontology
  - Companies use this onthology to declare their competencies
- *Definition*
  - MC defines project activities and workflow
- Planning
  - Identifyes actual partners and define responsibilities
- Execution
  - Monitoring

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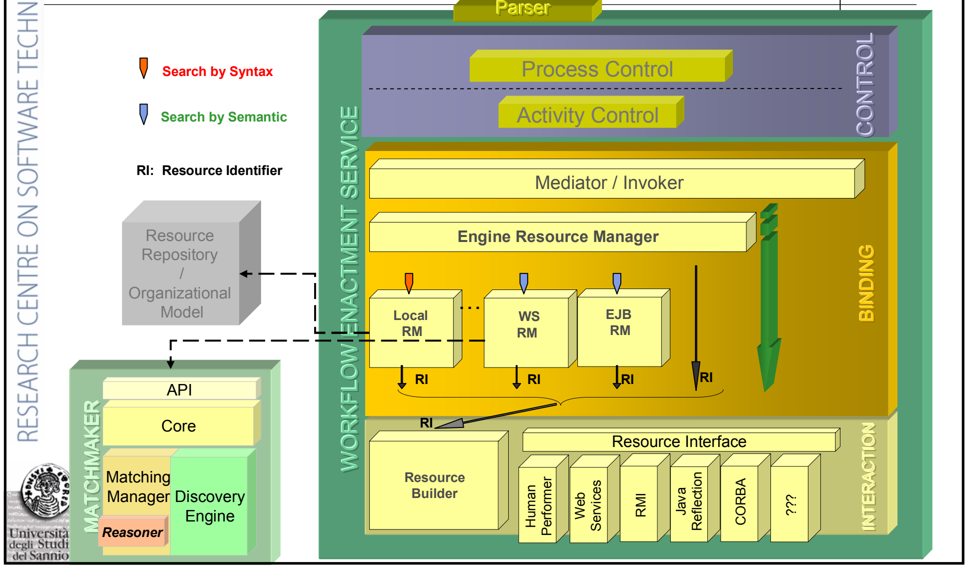
Workflow enactment



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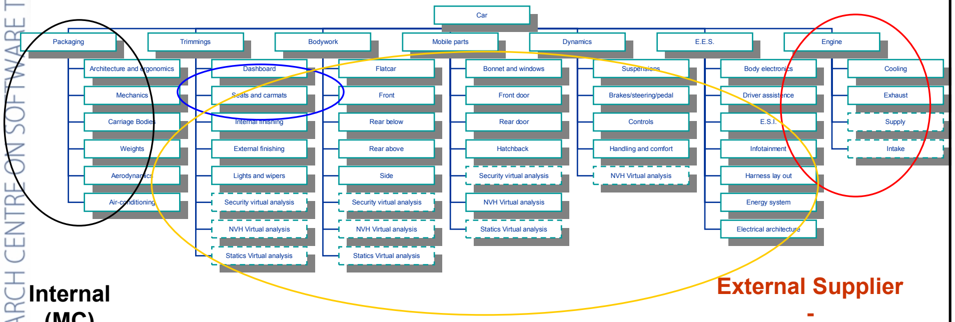
A scenario: decomposition of design activities



Internal (MC)
intra-enterprise, intra-division

External Engineering Supplier
(not fully specified in this phase)

Extra-division Engineering Supplier
intra-enterprise, extra-division

External Supplier - *"turnkey condition" development*
extra-enterprise

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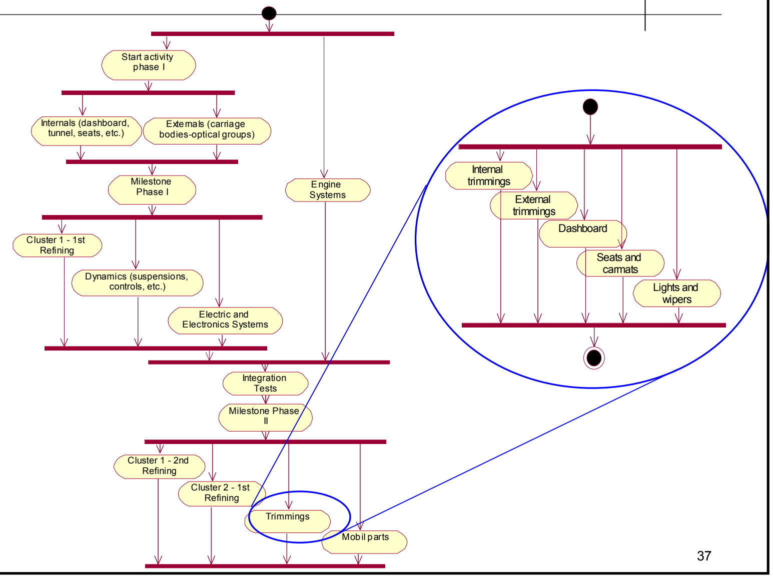
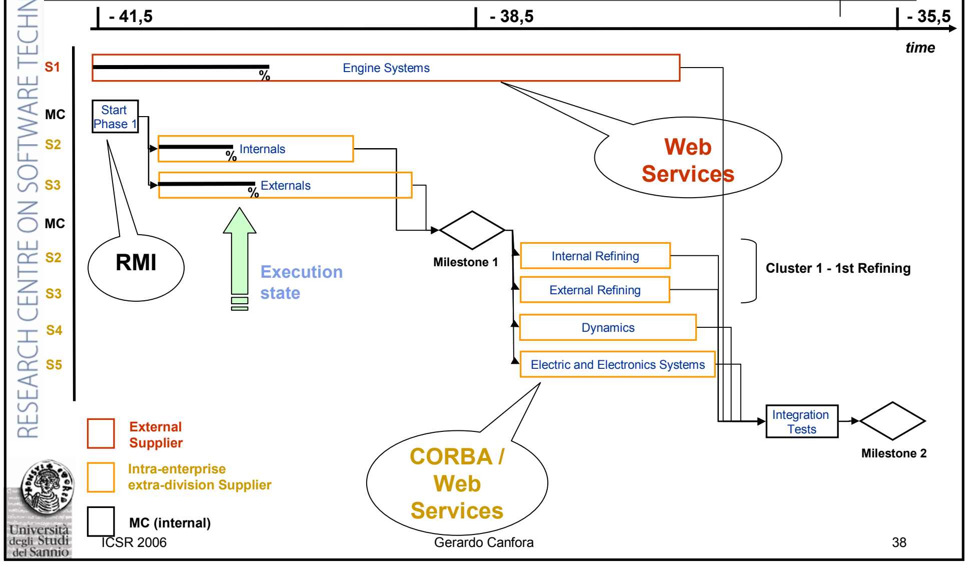
Workflow



Sample Gantt



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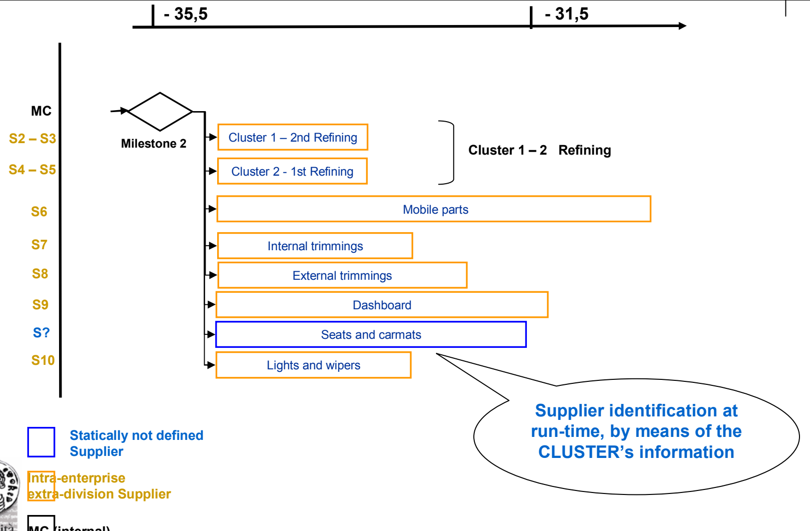
Sample Gantt (2 / 2)



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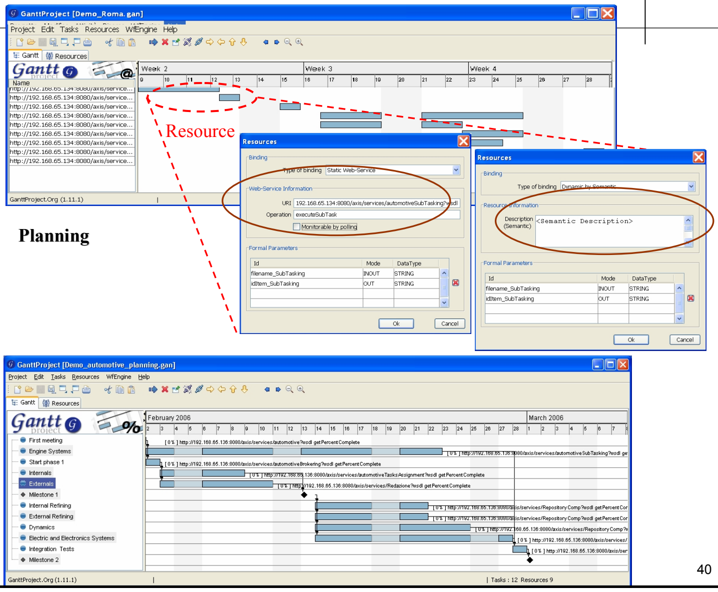
GanttProject Extensions



GanttProject [Demo_Roma.gan]
Project Edit Tasks Resources WfEngine Help
Gantt
Resources
Week 2
Week 3
Week 4
Resource
Planning
Resources
Ok
Cancel
GanttProject [Demo_automotive_planning.gan]
February 2006
March 2006

Name
http://192.168.65.134:8080/axis/service...
http://192.168.65.134:8080/axis/service...
http://192.168.65.134:8080/axis/service...
http://192.168.65.134:8080/axis/service...
http://192.168.65.134:8080/axis/service...
http://192.168.65.134:8080/axis/service...
http://192.168.65.134:8080/axis/service...
http://192.168.65.134:8080/axis/service...
http://192.168.65.134:8080/axis/service...

GanttProject.Org (1.11.1)

Resources

Binding
Type of binding: Static Web-Service

Web-Service Information
URI: 192.168.65.134:8080/axis/services/automotiveSubTasking?wsdl
Operation: executeSubTask
□ Monitorable by polling

Formal Parameters

Id	Mode	DataType
filename_SubTasking	INOUT	STRING
idItem_SubTasking	OUT	STRING

Resources

Binding
Type of binding: Dynamic by Semantic

Resource Information
Description (Semantic): <Semantic Description>

Formal Parameters

Id	Mode	DataType
filename_SubTasking	INOUT	STRING
idItem_SubTasking	OUT	STRING

Project Edit Tasks Resources WfEngine Help

- First meeting
- Engine Systems
- Start phase 1
- Internals
- Externals
- Milestone 1
- Internal Refining
- External Refining
- Dynamics
- Electric and Electronics Systems
- Integration Tests
- Milestone 2

[0%] http://192.168.65.136:8080/axis/services/automotive?wsdl getPercentComplete
[0%] http://192.168.65.136:8080/axis/services/automotiveSubTasking?wsdl ge
[0%] http://192.168.65.136:8080/axis/services/automotiveBrokering?wsdl getPercentComplete
[0%] http://192.168.65.136:8080/axis/services/automotiveTasksAssignment?wsdl getPercentComplete
[0%] http://192.168.65.136:8080/axis/services/Redazione?wsdl getPercentComplete
[0%] http://192.168.65.136:8080/axis/services/RepositoryComp?wsdl getPercentCor
[0%] http://192.168.65.136:8080/axis/services/RepositoryComp?wsdl getPercentCor
[0%] http://192.168.65.136:8080/axis/services/RepositoryComp?w
[0%] http://192.168.65.136:8080/axis/services/
[0%] http://192.168.65.136:8080/axis/ser

GanttProject.Org (1.11.1) | Tasks : 12 Resources 9

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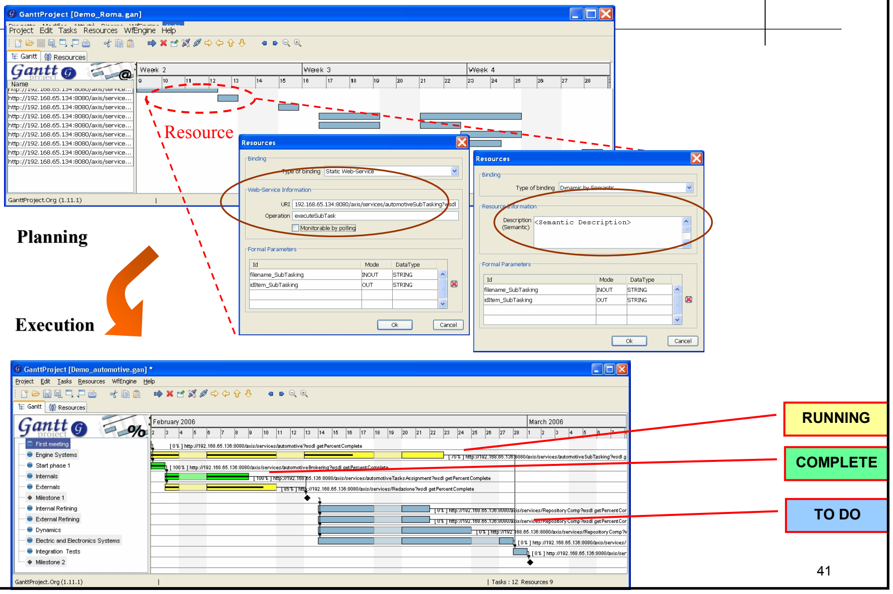
LOCOSP
Conclusions

GanttProject Extensions



GanttProject [Demo_Roma.gan]

Project Edit Tasks Resources WfEngine Help

Gantt | Resources

Name

http://192.168.65.134:8080/axis/service...
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http://192.168.65.134:8080/axis/service...

GanttProject.Org (1.11.1)

Resource

Resources

Binding
Type of binding: Static Web-Service

Web-Service Information
URI: 192.168.65.134:8080/axis/services/automotiveSubTasking?wsdl
Operation: executeSubTask
□ Monitorable by polling

Formal Parameters

Id	Mode	DataType
filename_SubTasking	INOUT	STRING
idItem_SubTasking	OUT	STRING

Ok Cancel

Resources

Binding
Type of binding: Dynamic by Semantic

Resource Information
Description (Semantic): <Semantic Description>

Formal Parameters

Id	Mode	DataType
filename_SubTasking	INOUT	STRING
idItem_SubTasking	OUT	STRING

Ok Cancel

Planning

Execution

GanttProject [Demo_automotive.gan] *

Project Edit Tasks Resources WfEngine Help

Gantt | Resources

February 2006 | March 2006

- First meeting
- Engine Systems
- Start phase 1
- Internals
- Externals
- Milestone 1
- Internal Refining
- External Refining
- Dynamics
- Electric and Electronics Systems
- Integration Tests
- Milestone 2

[0%] http://192.168.65.136:8080/axis/services/automotive?wsdl getPercentComplete
[70%] http://192.168.65.136:8080/axis/services/automotiveSubTasking?wsdl g
[100%] http://192.168.65.136:8080/axis/services/automotiveBrokering?wsdl getPercentComplete
[100%] http://192.168.65.136:8080/axis/services/automotiveTasksAssignment?wsdl getPercentComplete
[85%] http://192.168.65.136:8080/axis/services/Redazione?wsdl getPercentComplete
[0%] http://192.168.65.136:8080/axis/services/RepositoryComp?wsdl getPercentCor
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[0%] http://192.168.65.136:8080/axis/services/RepositoryComp?w
[0%] http://192.168.65.136:8080/axis/services/
[0%] http://192.168.65.136:8080/axis/ser

GanttProject.Org (1.11.1) | Tasks : 12 Resources 9

RUNNING

COMPLETE

TO DO

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RESEARCH CENTRE ON SOFTWARE TECHNOLOGY

Introduction
Agility
The vision
SOA
SECSE
LOCOSP
Conclusions

The talk in four bullets

- Agility of business will be the main driver for reuse in the future
- This requires (once again) raising the abstraction level of the reuse artefacts
- SOA are a (possible) enabling technology
- Important results have been achieved . . .

  . . .a lot more to come

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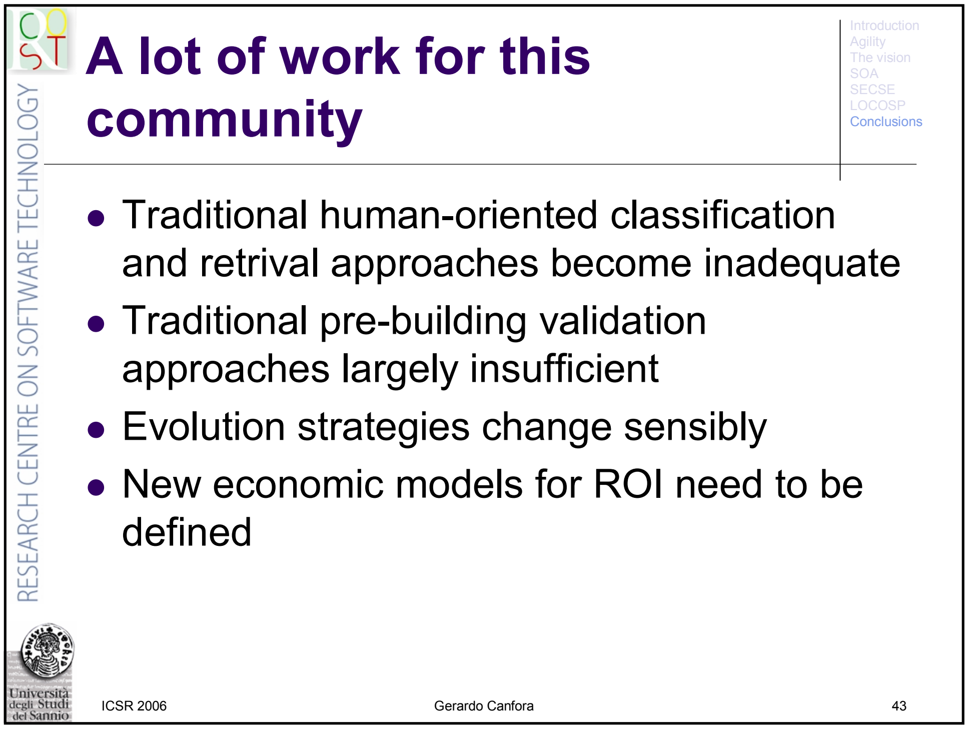

RESEARCH CENTRE ON SOFTWARE TECHNOLOGY

A lot of work for this community

- Traditional human-oriented classification and retrival approaches become inadequate
- Traditional pre-building validation approaches largely insufficient
- Evolution strategies change sensibly
- New economic models for ROI need to be defined

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