Situational Awareness:
Discovering the Dependencies

Software Dependency Analysis using DSM and UML Models

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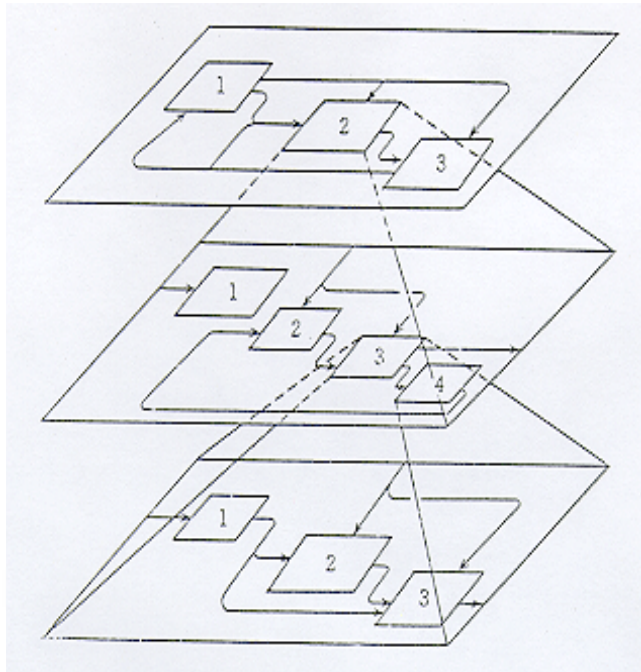
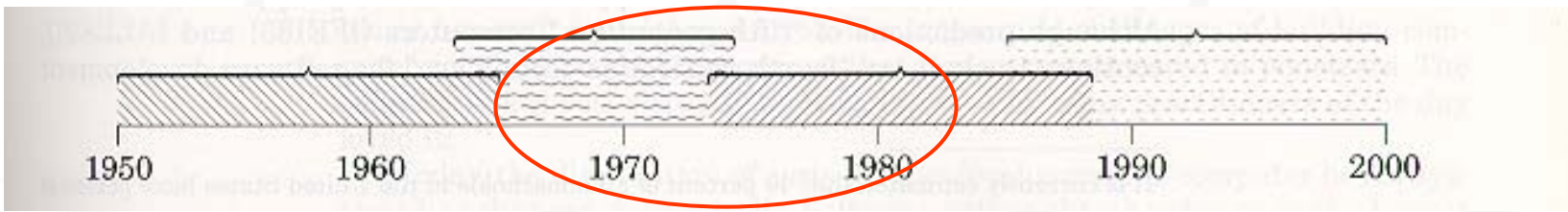
Outline

- Introduction
- Unified Modeling Language (UML)
- Creating dependency matrix using Reverse Engineering
- DSM analysis for software dependency
- DSM software – Acclaro Scheduler
- Case Study

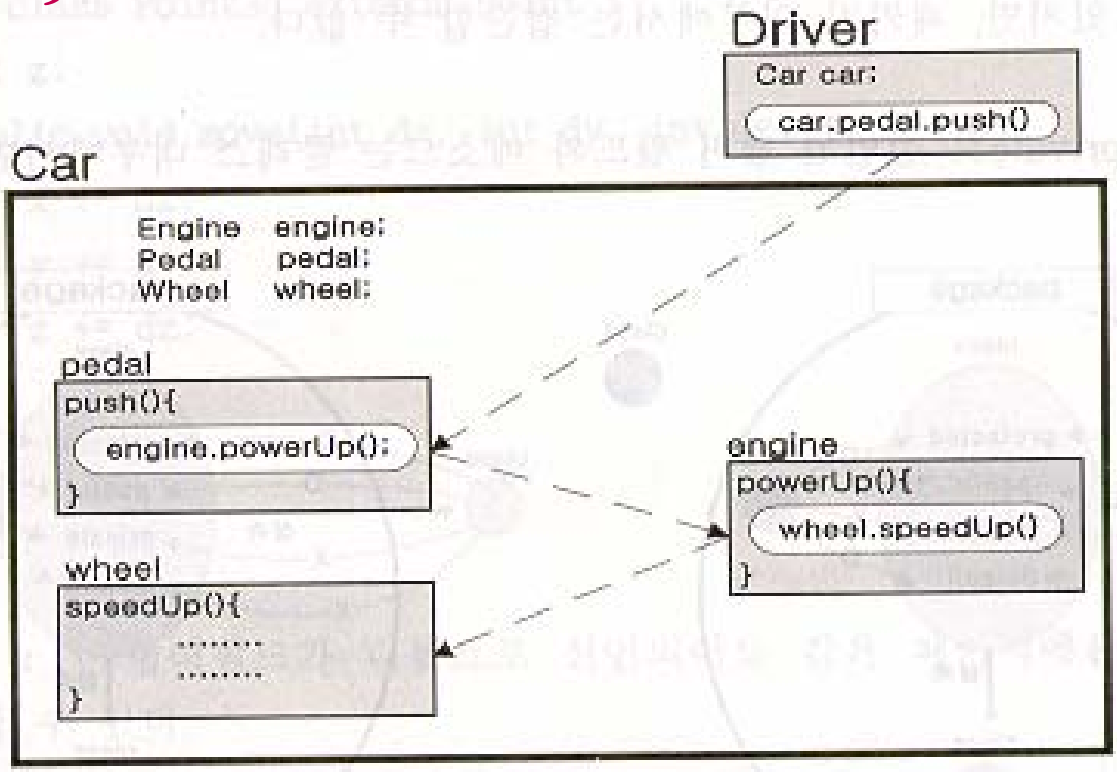
Software Design:
Overview - Structured programming method

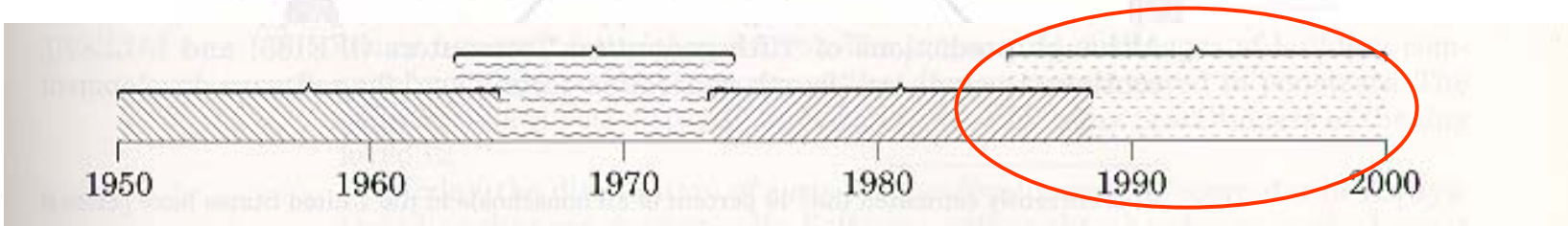
- Modular programming
  - Function abstraction
  - Requires data structure
- Top-Down programming
- Less reusability for the developed module





Software Design:
Overview - Object-Oriented programming (1/2)



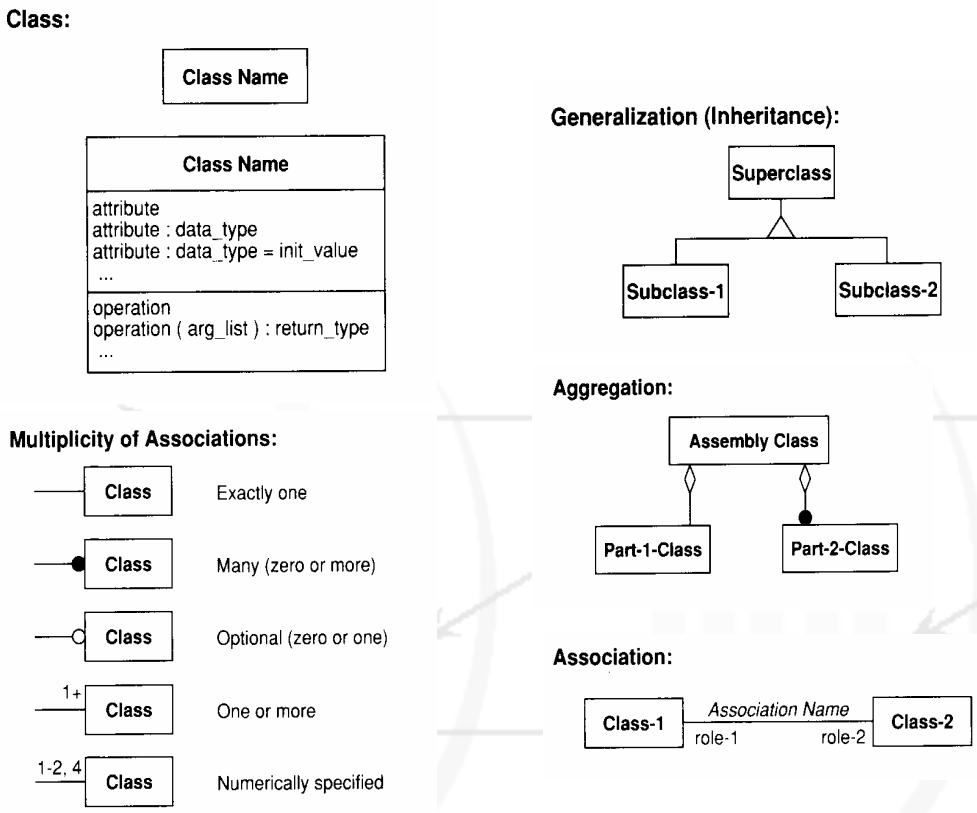


Software Design:
Overview - Object-Oriented programming (2/2)

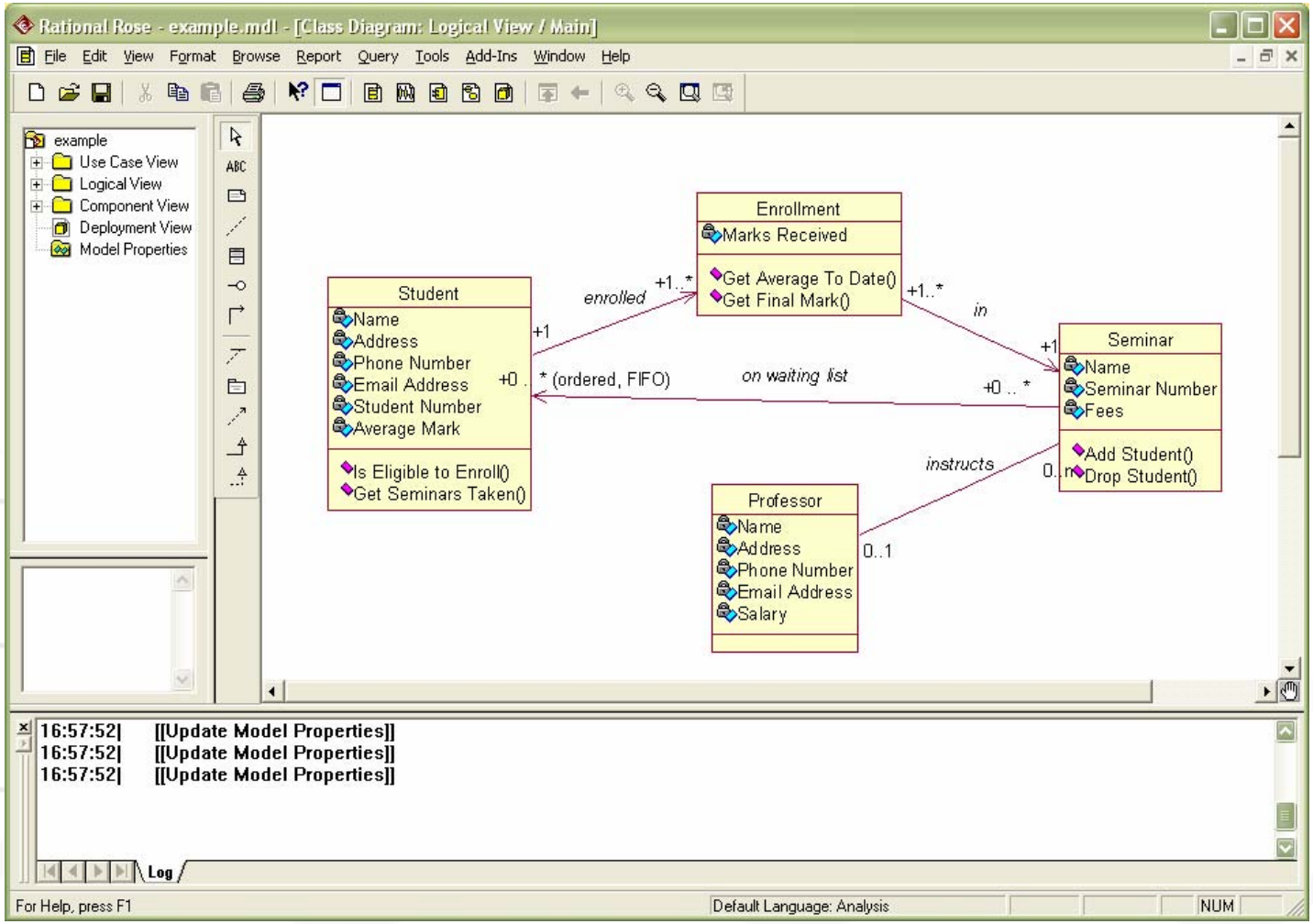
- Modular programming
  - Data abstraction
  - Data(attribute) is included in each module
- Bottom-Up programming (component base)
- Each object is reusable
- Relationship (e.g. association, whole-part, generalization-specialization) between each objects is much more important

Unified Modeling Language

↗ Rumbaugh's Object Model Notation



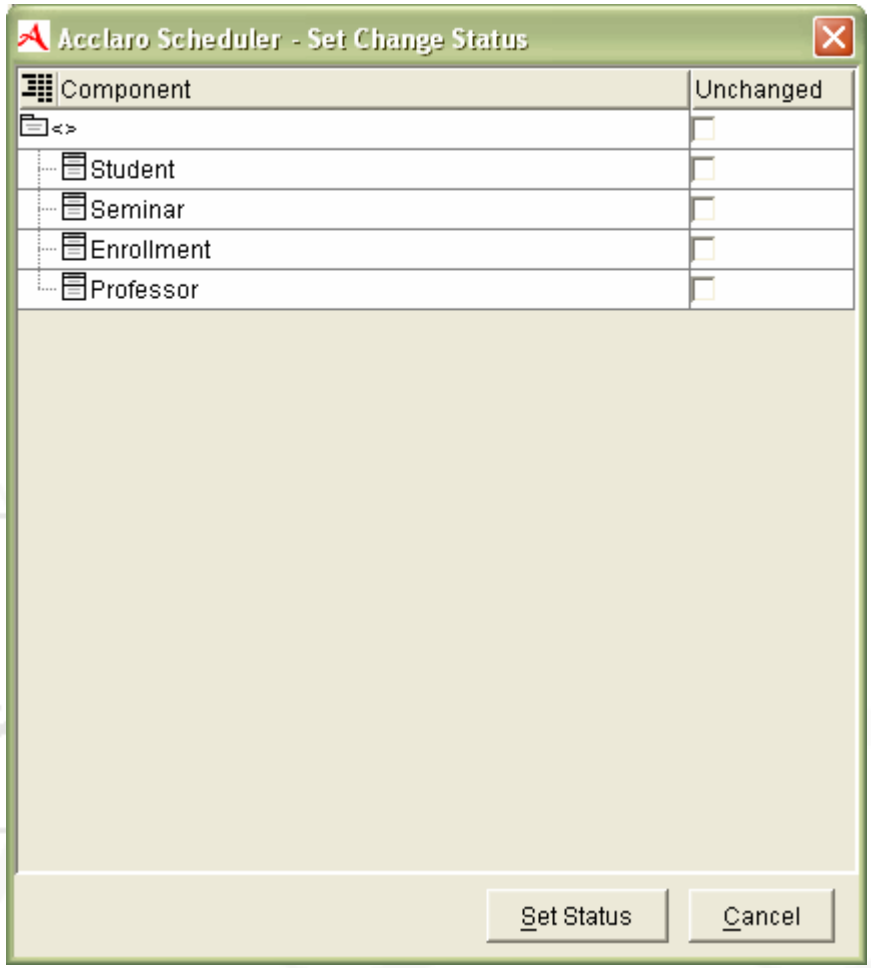
Class Diagram



Creating DSM

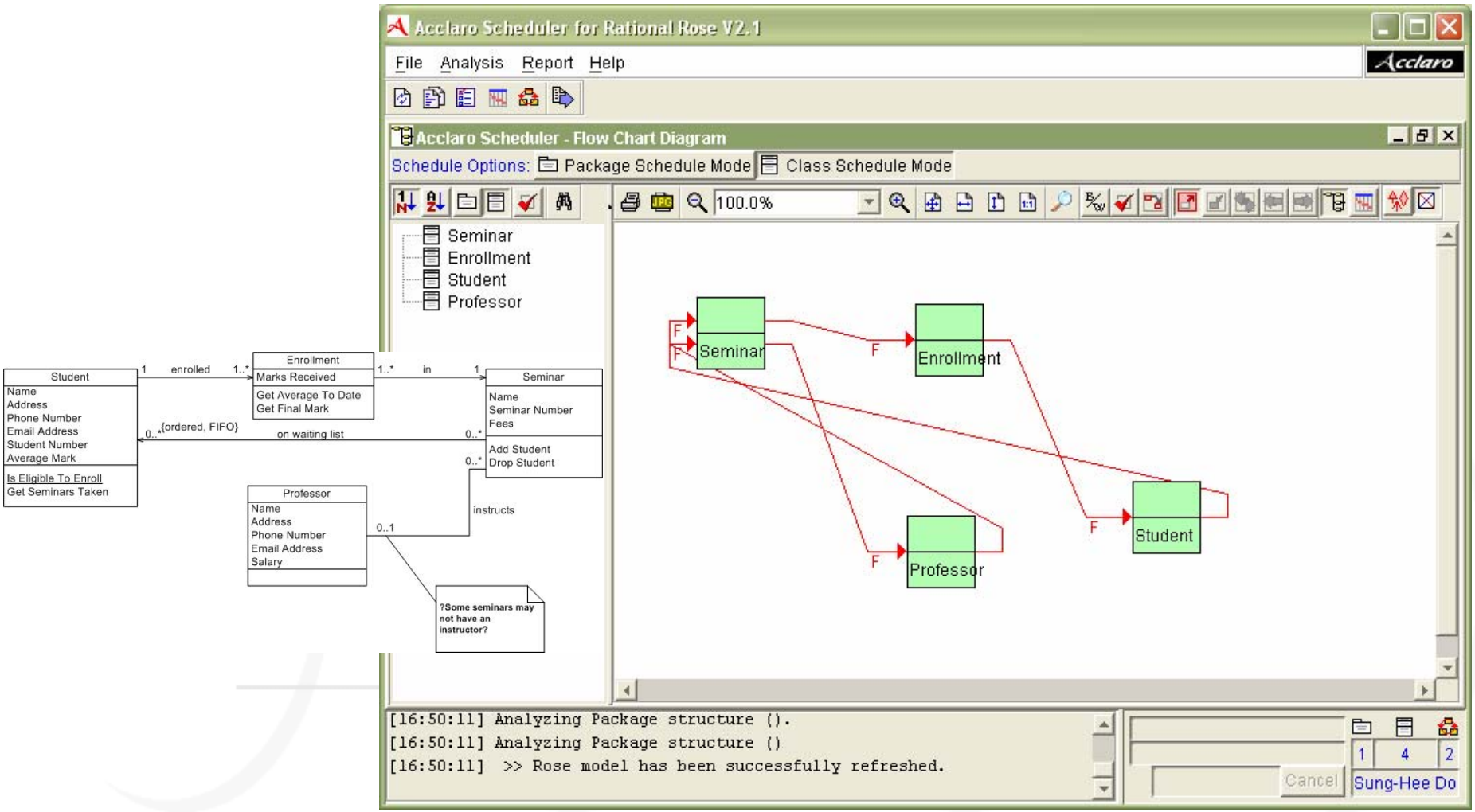
Step 1 – Identifying Classes (2/2)

- Student
- Enrollment
- Seminar
- Professor

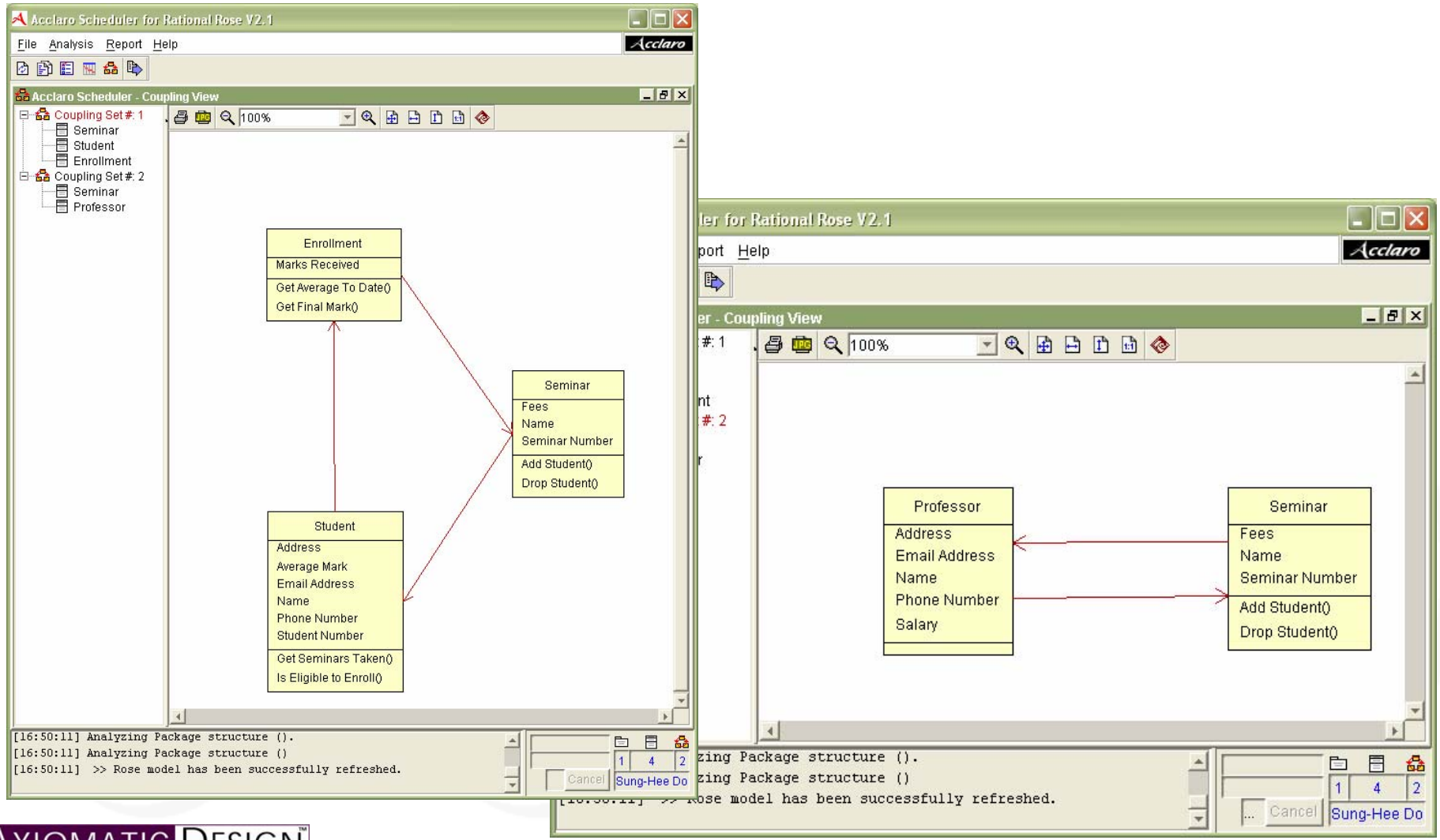


Creating DSM

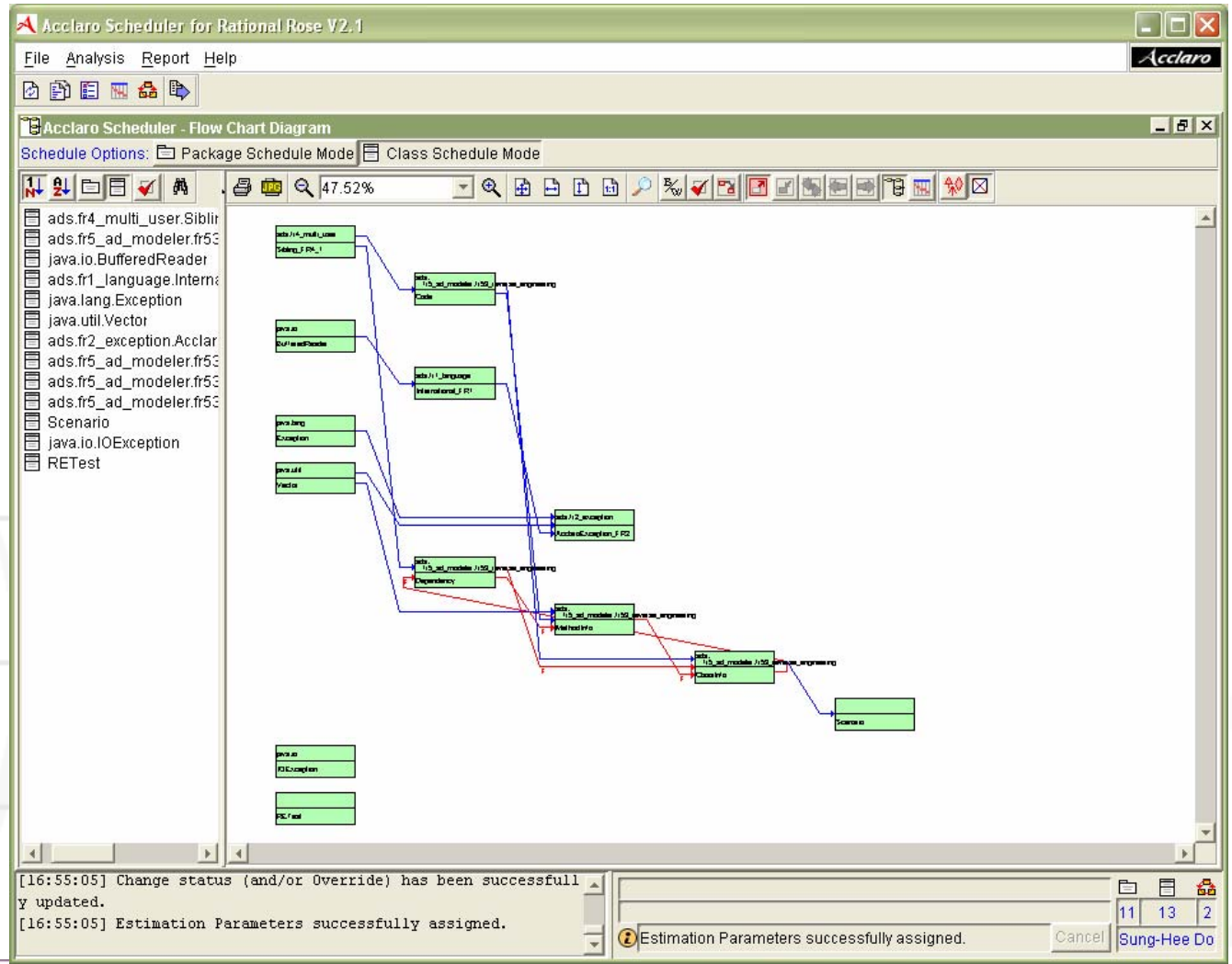
Step 2 – Identifying Relationships (2/2)



DSM analysis:
Clustering



DSM analysis:
Sequencing/Partitioning



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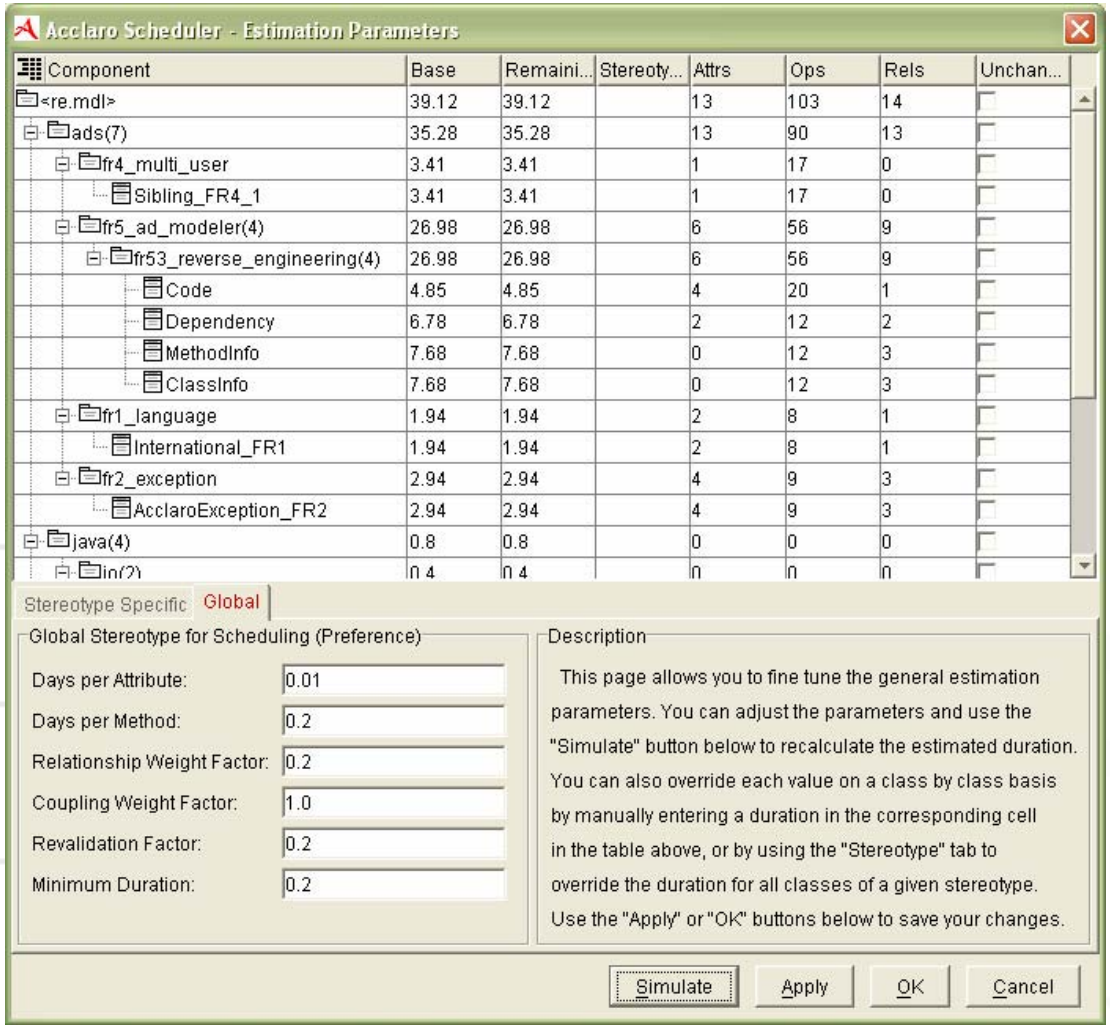
DSM analysis:
Estimation for project schedule



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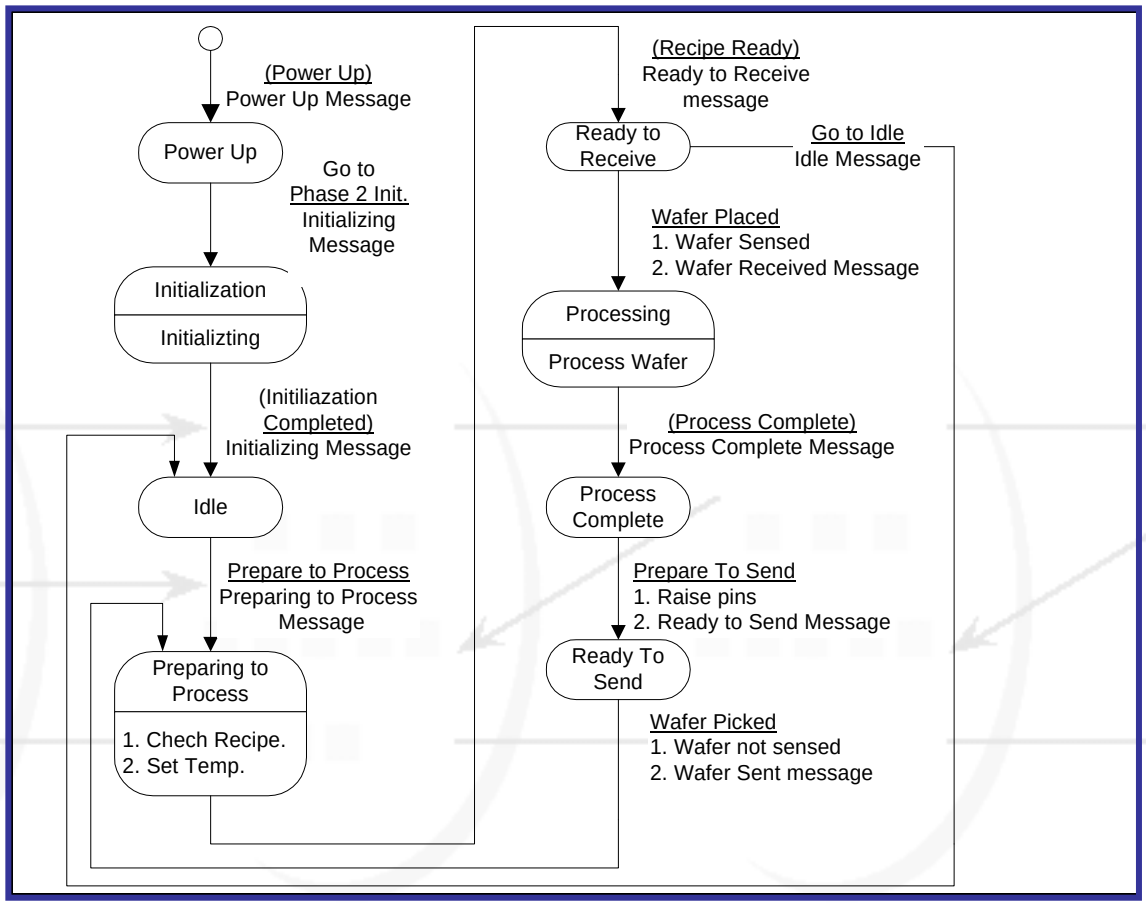
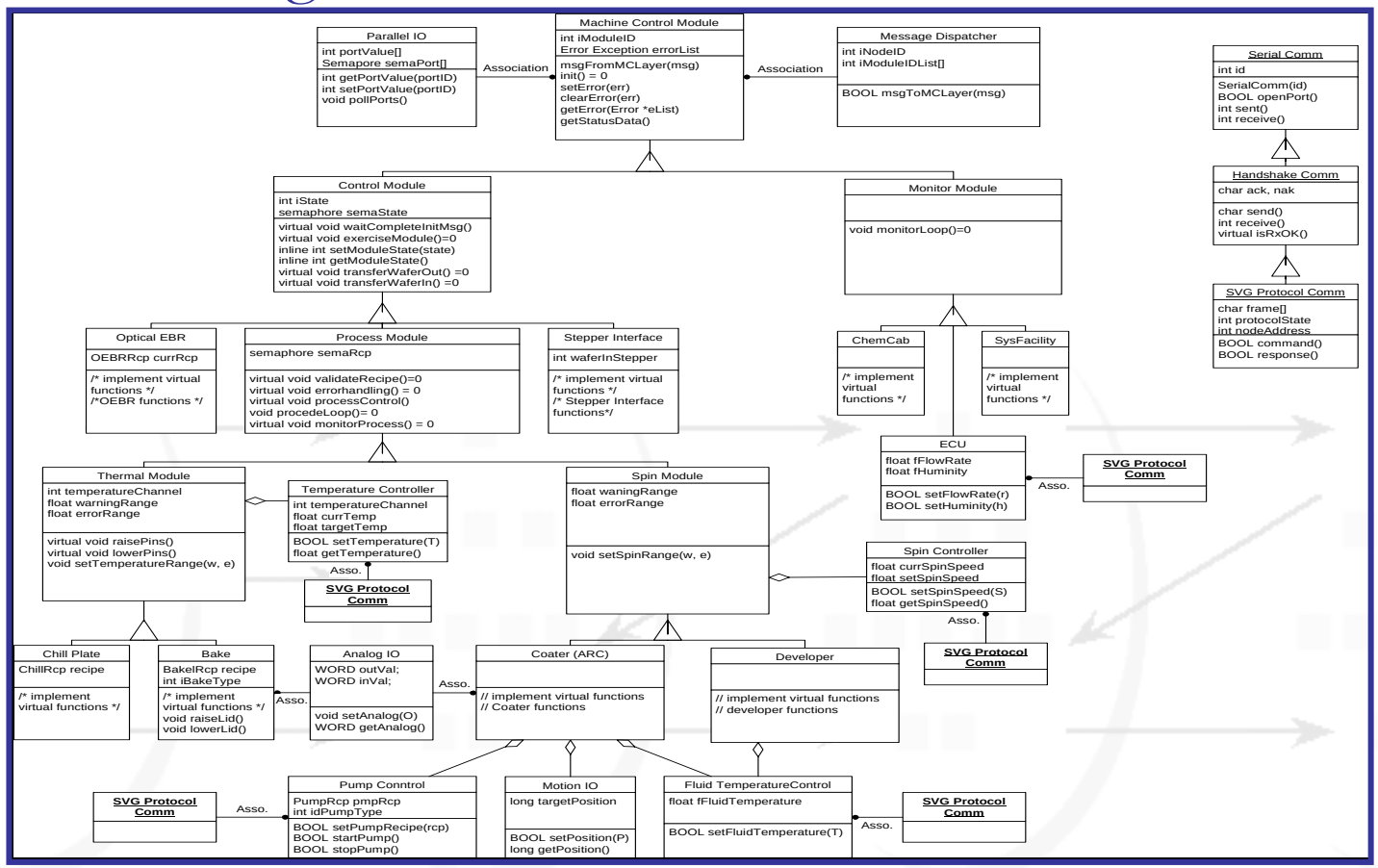
Case Study:
Chill plate control module (SVG Track)

- State Diagram



Case Study:
Chill plate control module (SVG Track)

- Class Diagram

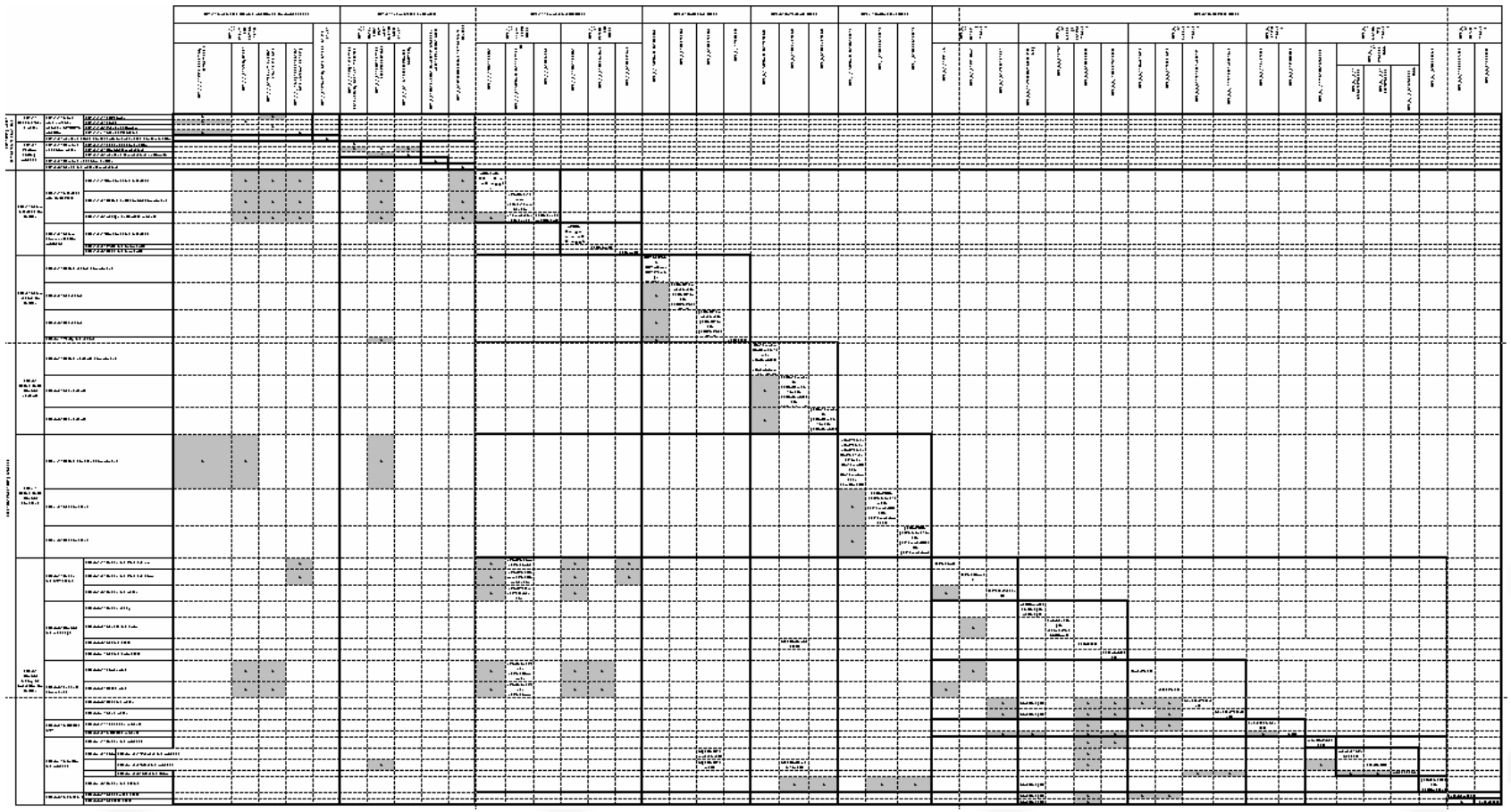


Case Study:
Chill plate control module (SVG Track)

- Translation process for reversing from OO to DSM
  - Scan the UML model to construct the diagonal term of the matrix
    - Classes, Packages
  - Scan the source code again to construct the off-diagonal term of design matrix
    - Find the operation call inside the method
    - Mark the operation call into the matrix

Case Study:
Chill plate control module (SVG Track)

- Design Structure Matrix



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Extending DSM to use cases

	U1	U2	U3	U4	U5	U6	U7
U1	*	X			X	X	
U2		*		X			X
U3		X	*	X			X
U4		X	X	*	X		X
U5				X	*	X	
U6	X				X	*	
U7		X	X	X			*

Requirement handling using clustering

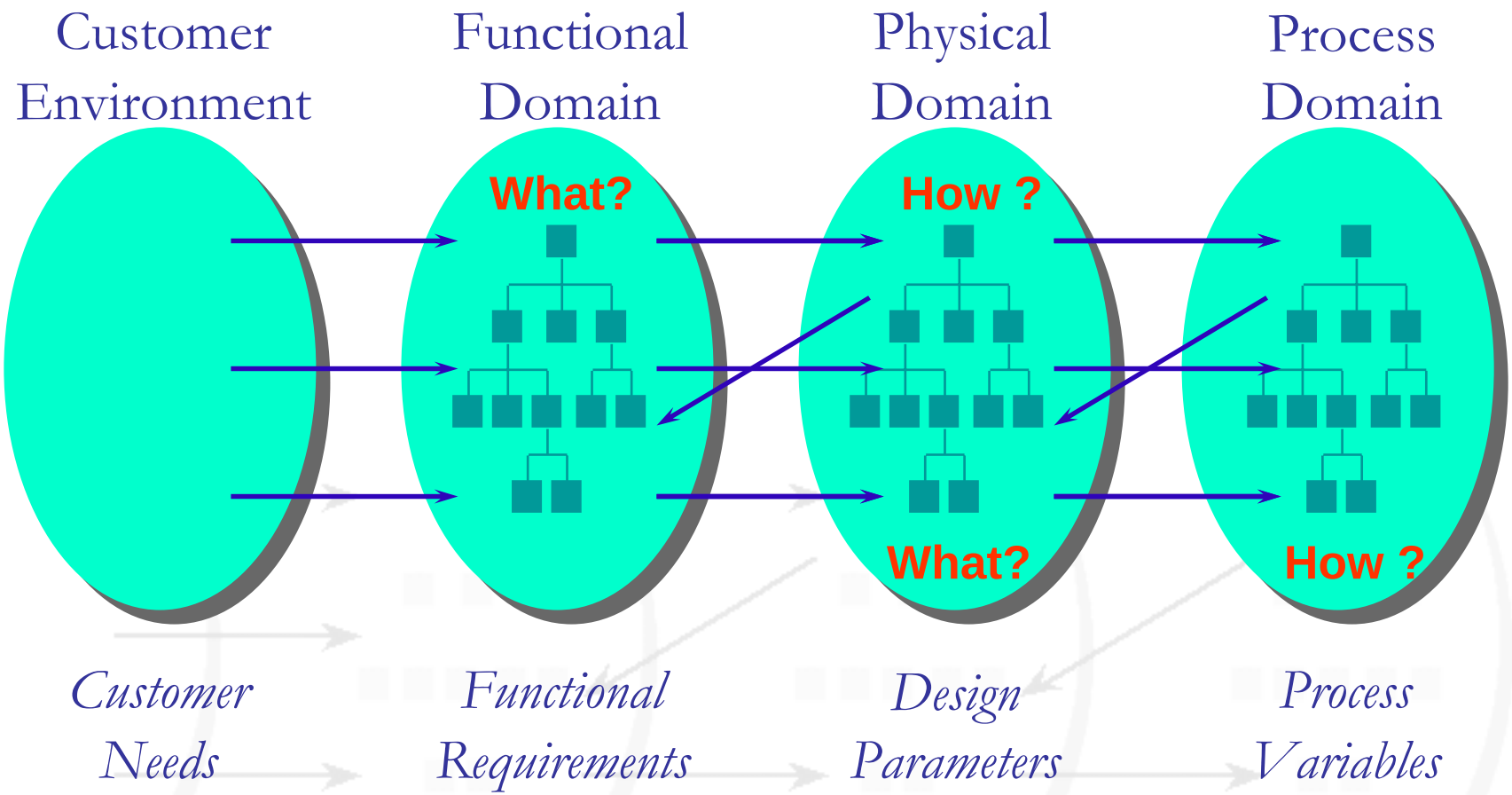
	U1	U6	U5	U4	U2	U3	U7
U1	*	X	X	X			
U6		*	X				
U5		X	*	X			
U4			X	C*	X	X	X
U2				X	*		X
U3				X	X	*	X
U7				X	X	X	*

A

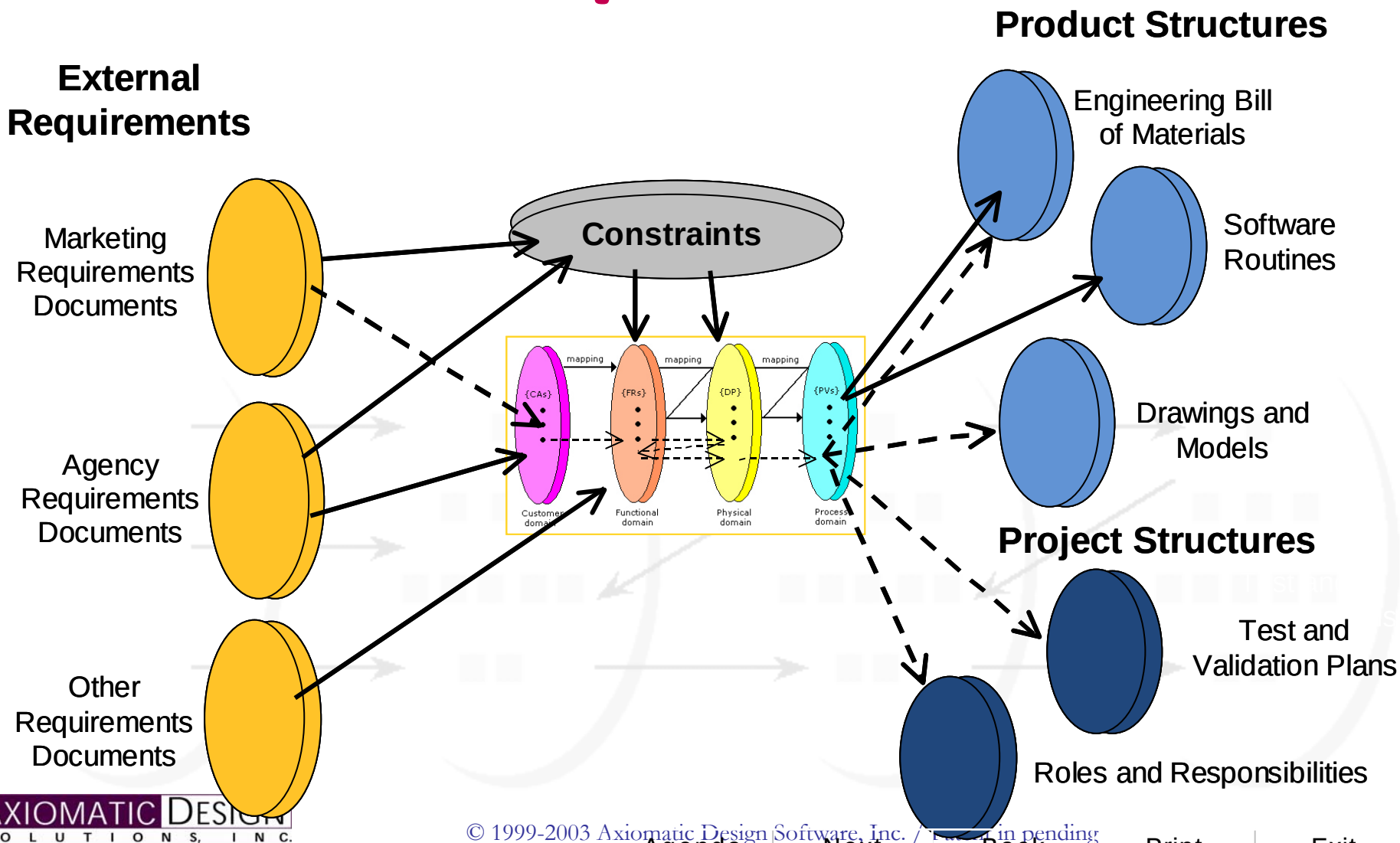
B

D

Axiomatic design:
Mapping, hierarchies, and zigzagging



End to End Requirements Traceability



Discussion

- An addin software for Rational Rose has been developed.
- DSM analysis for Software system gives benefits for work load grouping using clustering technique, scheduling and estimation using partitioning.
- The axiomatic process along with DSM concept defines a repeatable, yet flexible solution to many pitfalls in the area of software product lifecycle management.