

3rd International Workshop on a Research Agenda for
Maintenance and Evolution of Service-Oriented Systems

MESOA 2009

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Edmonton, Canada

ASMEM: A Method for Automating Model Evolution of Service-Oriented Systems

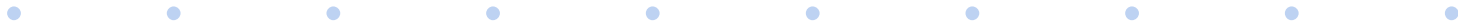
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R. Teimourzadegan, F. Shams



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Agenda

- Motivation
- Introduction (Basic Concepts)
- Approach Overview
- Change Scenarios and Instructions
- ASOMF Framework
- The Developed Tool
- Research Challenges
- Future Works



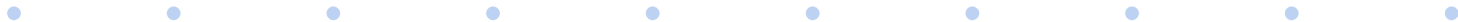
Motivation

- Evolution is labor-time-cost intensive
- Software solution is exposed to many change conditions emerging from business (environment, requirement, errors, future problem)
- Incorporation of *new user requirements* is the **core problem** for software evolution and maintenance (79% of all changes [Bennet])
- Dynamic adaptation to changes would minimize the cost of ownership
- SO Solutions have cohesive relation with business
- Accommodation of unanticipated changes in SO solutions in an agile way is key



Why Service-Oriented Modeling?

- The core artifact of service-based solutions
- As essential input to implementation and test activities
- It is more conceptual and abstract than design and implementation model so it is more likely to bring automation
- UML profile for software services (IBM) is accepted in OMG
- We had developed an automated framework for service-oriented modeling



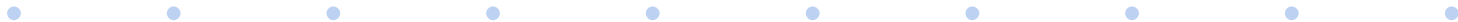
Why Automation?

- Productivity
- Agility
- Flexibility
- Reusability



Basic Concepts

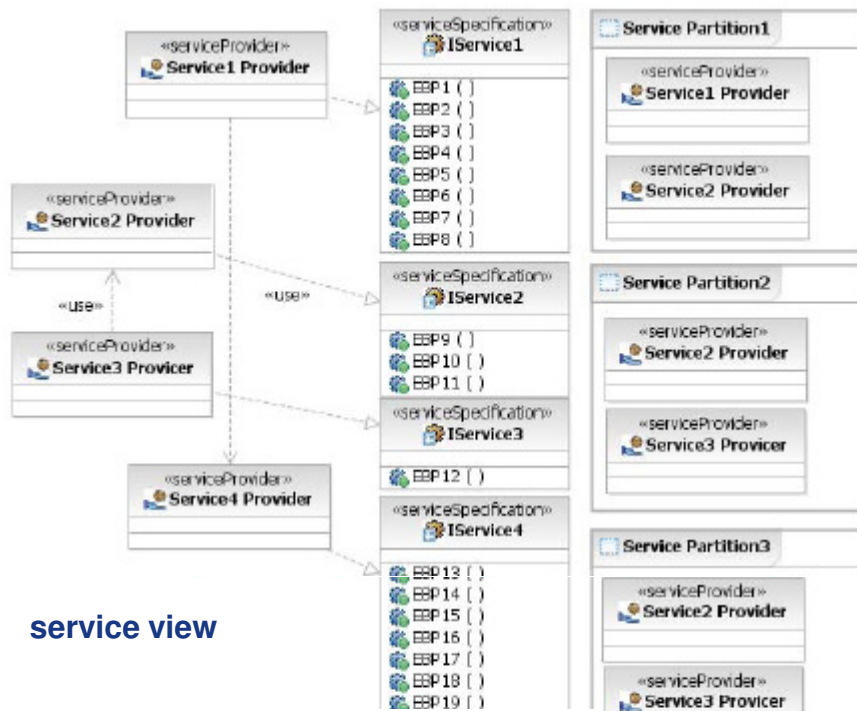
- Elementary Business Process (EBP)
- Business Entity (BE)
- CRUD matrix
- Software Service
- Enterprise Business Model
- Enterprise Service Model



A CRUD Matrix: Distribution Industry

BE EBP	Customer	Credit Account receivable note	Order	Discounts	Invoice	Shipping schedule	Draft	Inventory	Warehouse Voucher
Add a customer	C	C							
Add an account receivable note	R	U	C		R				
Check Credit	R	R	R						
Receive Order	R		C						
Calculate discounts			R	R					
Check Inventory			R					R	
Calculate Price			R	R					
Add discounts				C					
Issue Invoice	R	R	R		C				
Schedule Shipping					R	C			
Issue Draft					R	R	C		
Add an item								C	
Add a warehouse voucher	R				R			U	C

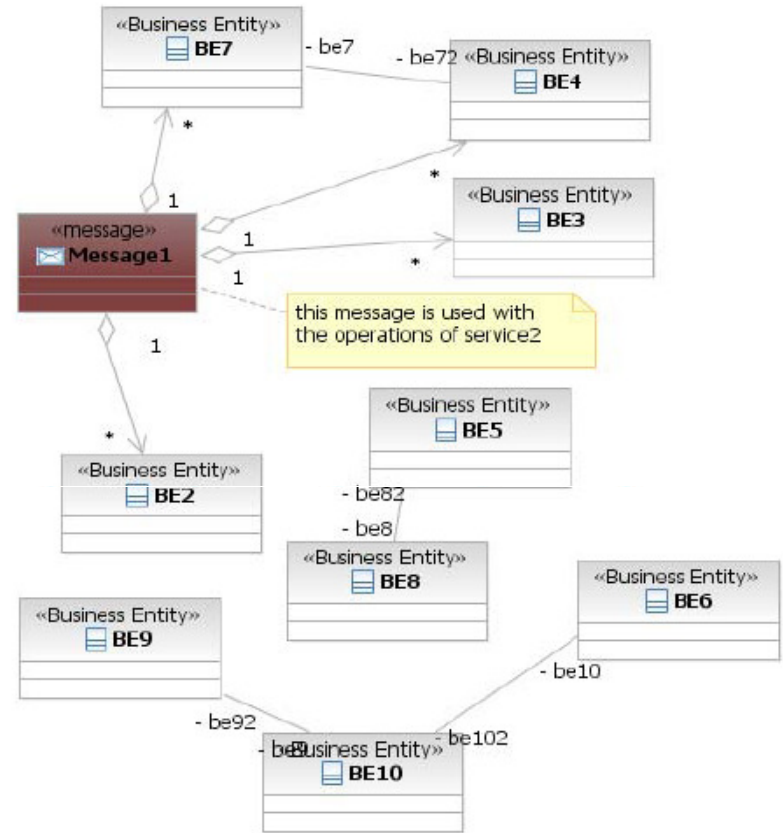
A Sample Service Model



service view



collaboration view

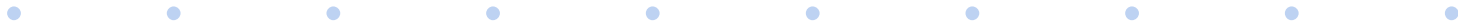


message view



Change Scenarios

- A. Adding a new EBP to the CRUD matrix
- B. Adding a new BE to the CRUD matrix
- C. Adding a new EBP and BE simultaneously to the CRUD matrix
- D. Omitting a BE from the CRUD matrix
- E. Omitting an EBP from the CRUD matrix
- F. Omitting a BE and an EBP from the CRUD matrix simultaneously



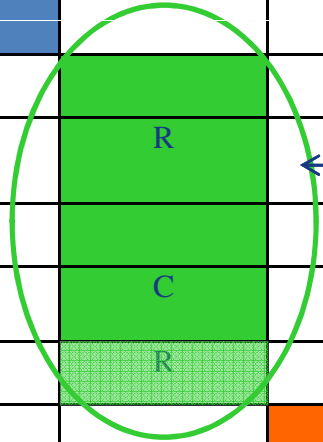
A. Adding a New EBP to the CRUD Matrix

	customer	Credit	Account receivable note	Discounts	Inventory	Warehouse Voucher
Add a customer	C	C				
Add an account receivable note	R	U	C			
Receive order	R	R				
Receive order	R					
Calculate discounts				R		
Check inventory					R	
Add discounts				C		
Add an item					C	C
Add a warehouse voucher		R			U	C



A. Continued ...

	customer	Credit	Account receivable note	Discounts	Inventory	Warehouse Voucher
Add a customer	C	C				
Add an account receivable note	R	U	C			
Receive order	R	R				
Receive order	R					
Calculate discounts				R		
Check inventory					R	
Add discounts				C		
Calculate Price				R		
Add an item					C	
Add a warehouse voucher		R			U	C



Service 2



B. Adding a New BE^{Here} to the CRUD Matrix

	customer	Credit	Account receivable note	Discounts	Inventory	Warehouse Voucher
Add a customer	C	C				
Add an account receivable note	R	U	C			
Receive order	R	R				
Receive order	R					
Calculate discounts				R		
Check inventory					R	
Add discounts				C		
Calculate Price				R		
Add an item					C	C
Add a warehouse voucher		R			U	C

B. Continued ...

	customer	Credit	Account receivable note	Order	Discounts	Inventory	Warehouse Voucher
Add a customer	C	C					
Add an account receivable note	R	U	C				
Receive order	R	R		R			
Receive order	R			C	R		
Calculate discounts				R	R		
Check inventory				R		R	
Add discounts					C		
Calculate Price				R	R		
Add an item						C	
Add a warehouse voucher		R				U	C

Service 2

C. Adding a New EBP and BE Simultaneously to the CRUD Matrix

Second

	customer	Credit	Account receivable note	Discounts	Inventory	Warehouse Voucher
Add a customer	C	C				
Add an account receivable note	R	U	C			
Receive order	R	R				
Receive order	R					
Calculate discounts				R		
Check inventory					R	
Add discounts				C		
Add an item					C	C
Add a warehouse voucher		R			U	C

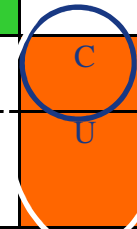
First

C. Continued ...

	customer	Credit	Account receivable note	Order	Discounts	Inventory	Warehouse Voucher
Add a customer	C	C					
Add an account receivable note	R	U	C				
Receive order	R	R		R			
Receive order	R			C			
Calculate discounts				R	R		
Check inventory				R		R	
Add discounts					C		
Calculate Price					R		
Add an item						C	
Add a warehouse voucher		R				U	C

D. Omitting a BE from the CRUD Matrix

	customer	Credit	Account receivable note	Order	Discounts	Inventory
Add a customer	C	C				
Add an account receivable note	R	U	C			
Receive order	R	R		R		
Receive order	R			C		
Calculate discounts				R	R	
Check inventory				R		R
Add discounts					C	
Calculate Price				R	R	
Add an item						C
Add a warehouse voucher		R				U



Service 3

E. Omitting an EBP from the CRUD Matrix

	customer	Credit	Account receivable note	Order	Discounts	Inventory
Add a customer	C	C				
Add an account receivable note	R	U	C			
Receive order	R	R		R		
Receive order	R			C		
Calculate discounts				R	R	
Check inventory				R		R
Add discounts					C	
Calculate Price				R	R	



Add a warehouse voucher		R				U
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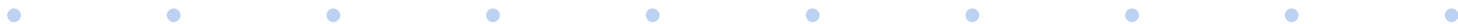


E. Continued ...

	customer	Credit	Account receivable note	Order	Discounts	Inventory
Add a customer	C	C				
Add an account receivable note	R	U	C			
Receive order	R	R		R		
Receive order	R			C		
Calculate discounts				R	R	
Check inventory				R		R
Add discounts					C	
Calculate Price				R	R	
Add a warehouse voucher		R				U

Service 2

No more "C" action



F. Omitting a BE and an EBP from the CRUD Matrix Simultaneously

First
↓

	customer	Credit	Account receivable note	Order	Discounts	Inventory
Add a customer	C	C				
Add an account receivable note	R	U	C			
Receive order	R	R		R		
Receive order	R			C		
Calculate discounts				R	R	
Check inventory				R		R
Add discounts					C	
Calculate Price				R	R	
Add a warehouse voucher		R				U

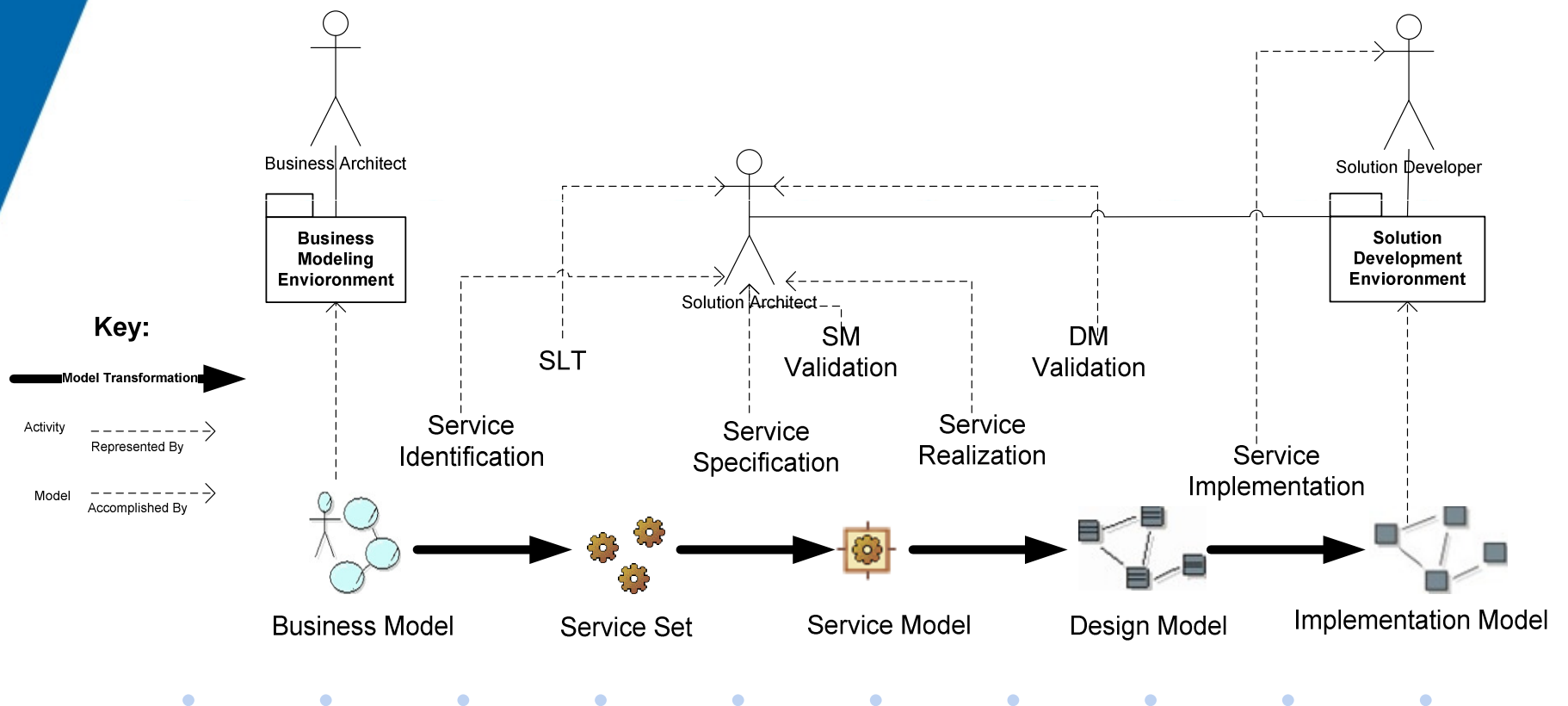
Second
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F. Continued ...

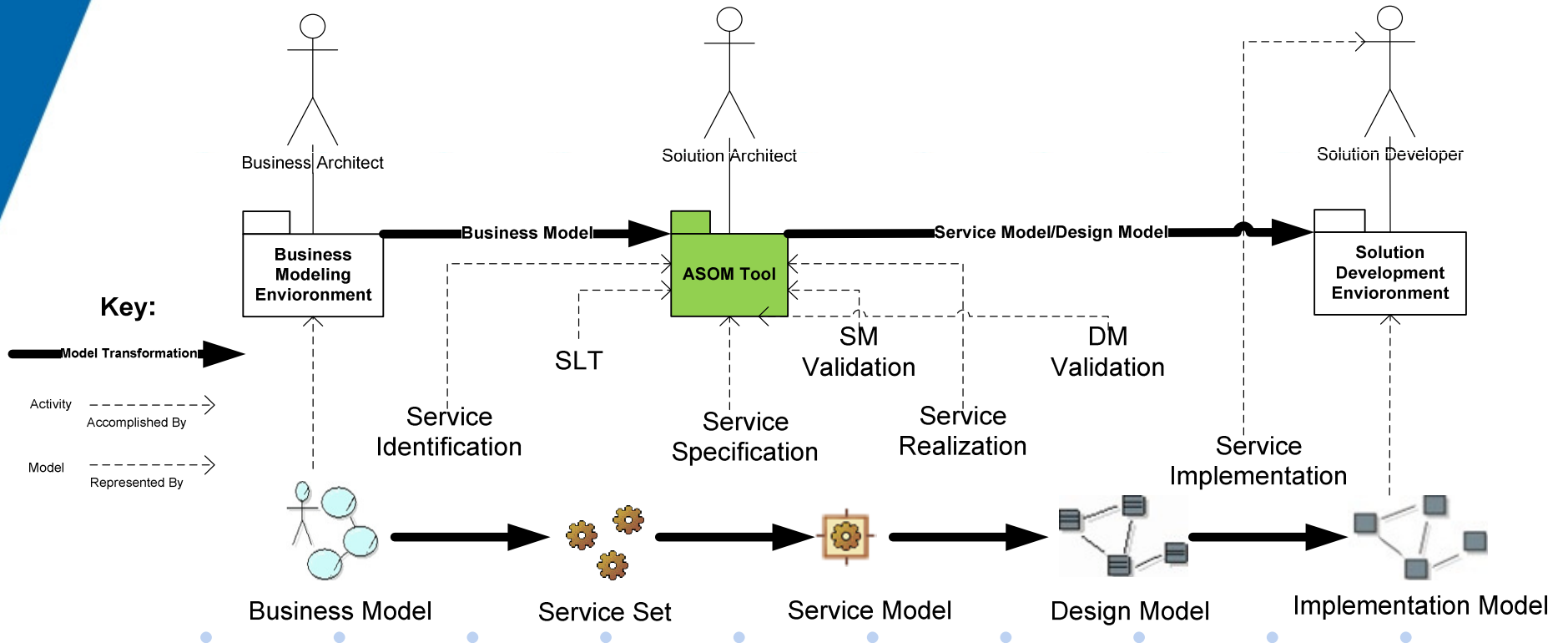
	customer	Credit	Account receivable note	Order	Discounts	Inventory
Add a customer	C	C				
Add an account receivable note	R	U	C			
Receive order	R	R		R		
Receive order	R			C		
Calculate discounts				R	R	
Check inventory				R		R
Add discounts					C	
Calculate Price				R	R	
Add a warehouse • voucher •		R				U

Service 2

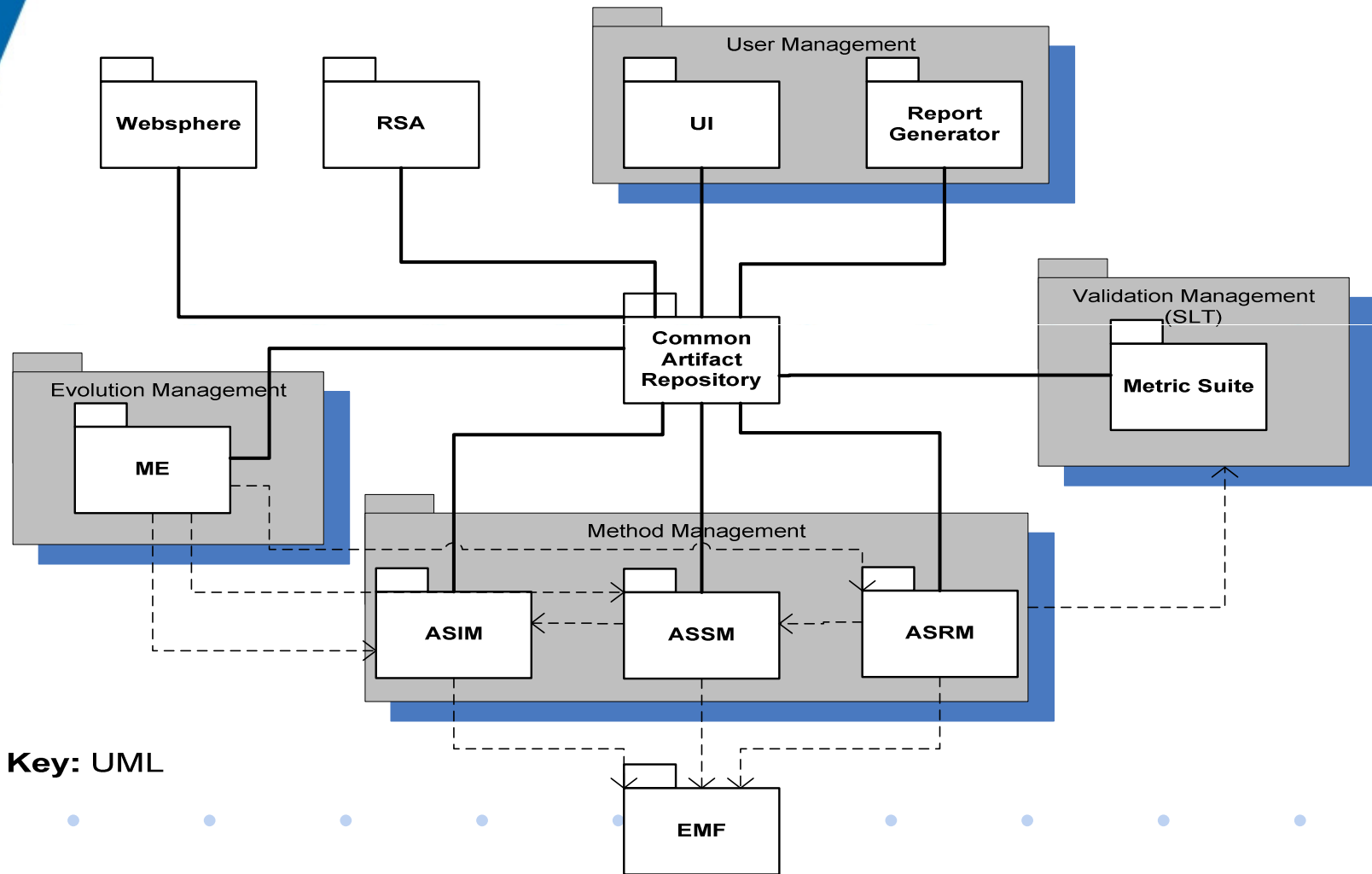
Service-Oriented Solution Lifecycle Before Using the ASOM-Tool



Service-Oriented Solution Lifecycle After Using the ASOM-Tool



ASOM-Tool Architecture



Discussion of Research Challenges

- Common software evolution platform
- Supporting model evolution
- Supporting co-evolution
- Need for improved predictive models

