



Software Measurement



SMEF 2004

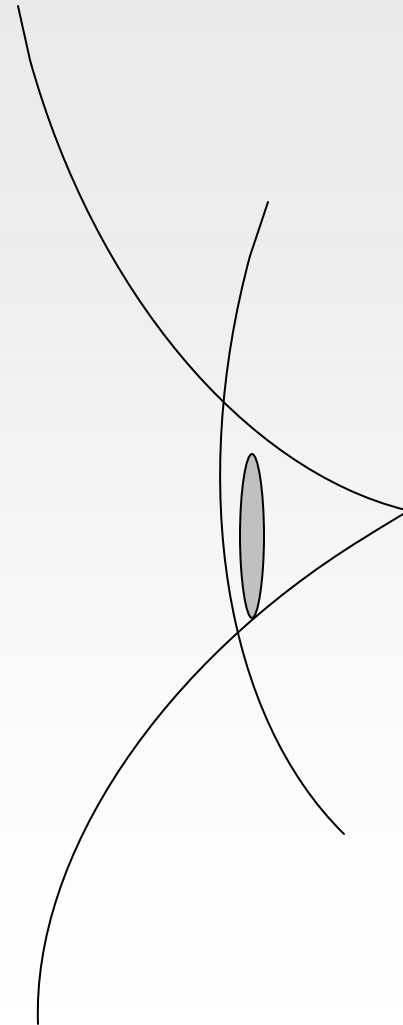
A Proposed Measurement Role in the Rational Unified Process and its Implementation with ISO 19761: COSMIC-FFP

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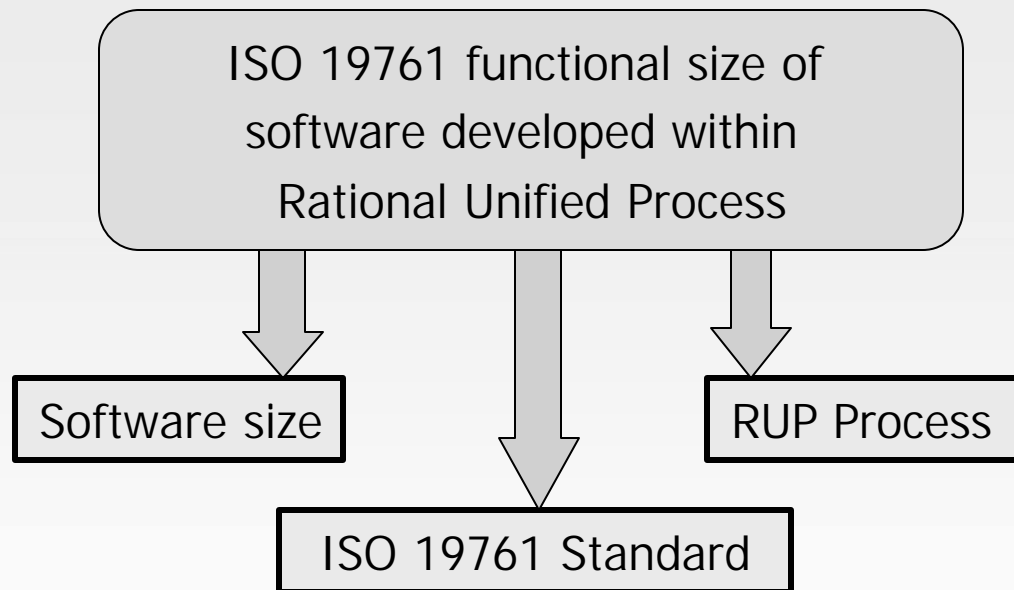
Summary

- ◎ Objective
- ◎ Software size
- ◎ Standard ISO 19761
- ◎ RUP new measurement activity
- ◎ Tool measurement basis
- ◎ Solution
- ◎ Results
- ◎ Conclusion



Functional Size Measurement

Objective



Predict – Measure software size at the first steps of development process



ISO 19761 Standard

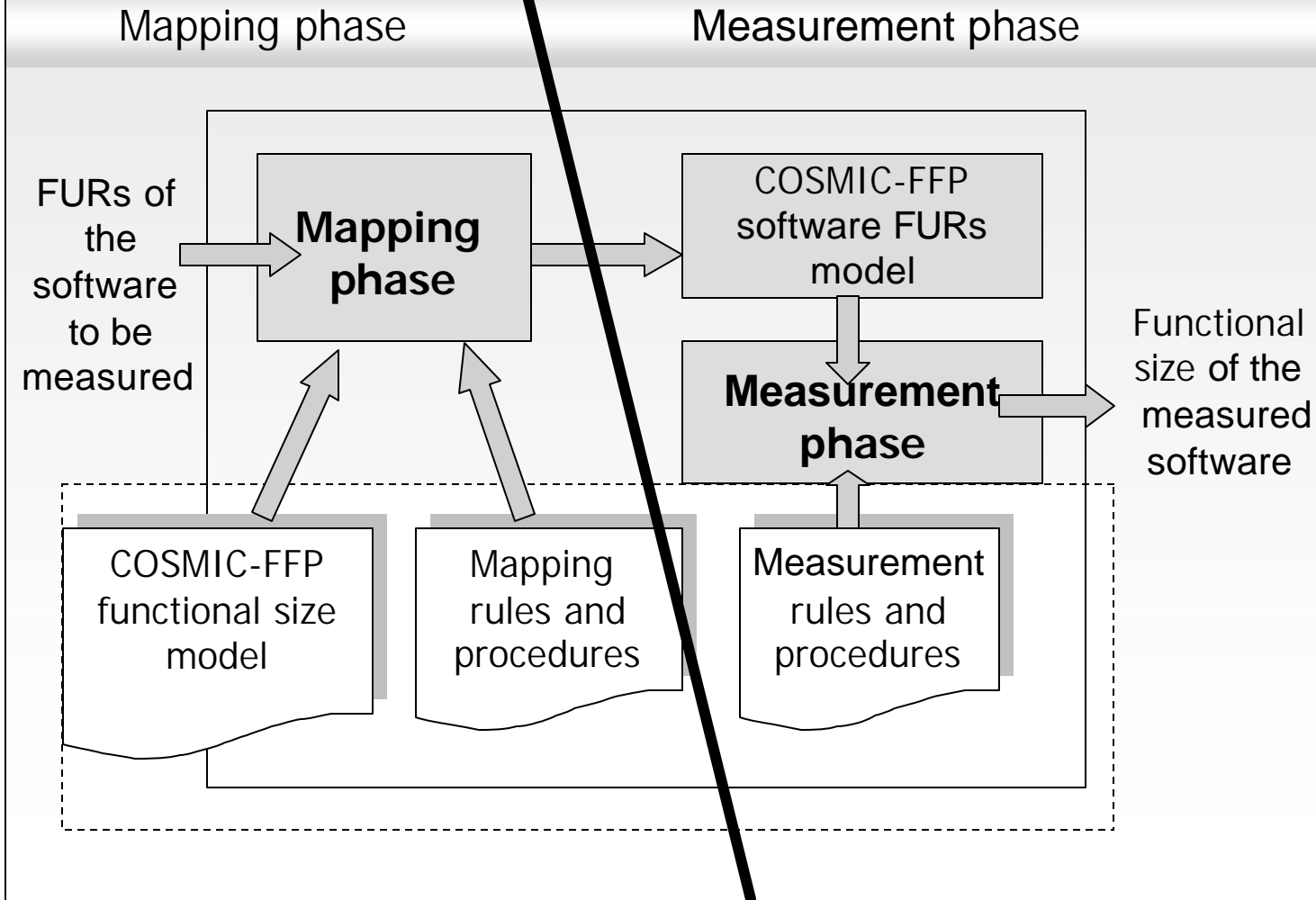


COSMIC-FFP

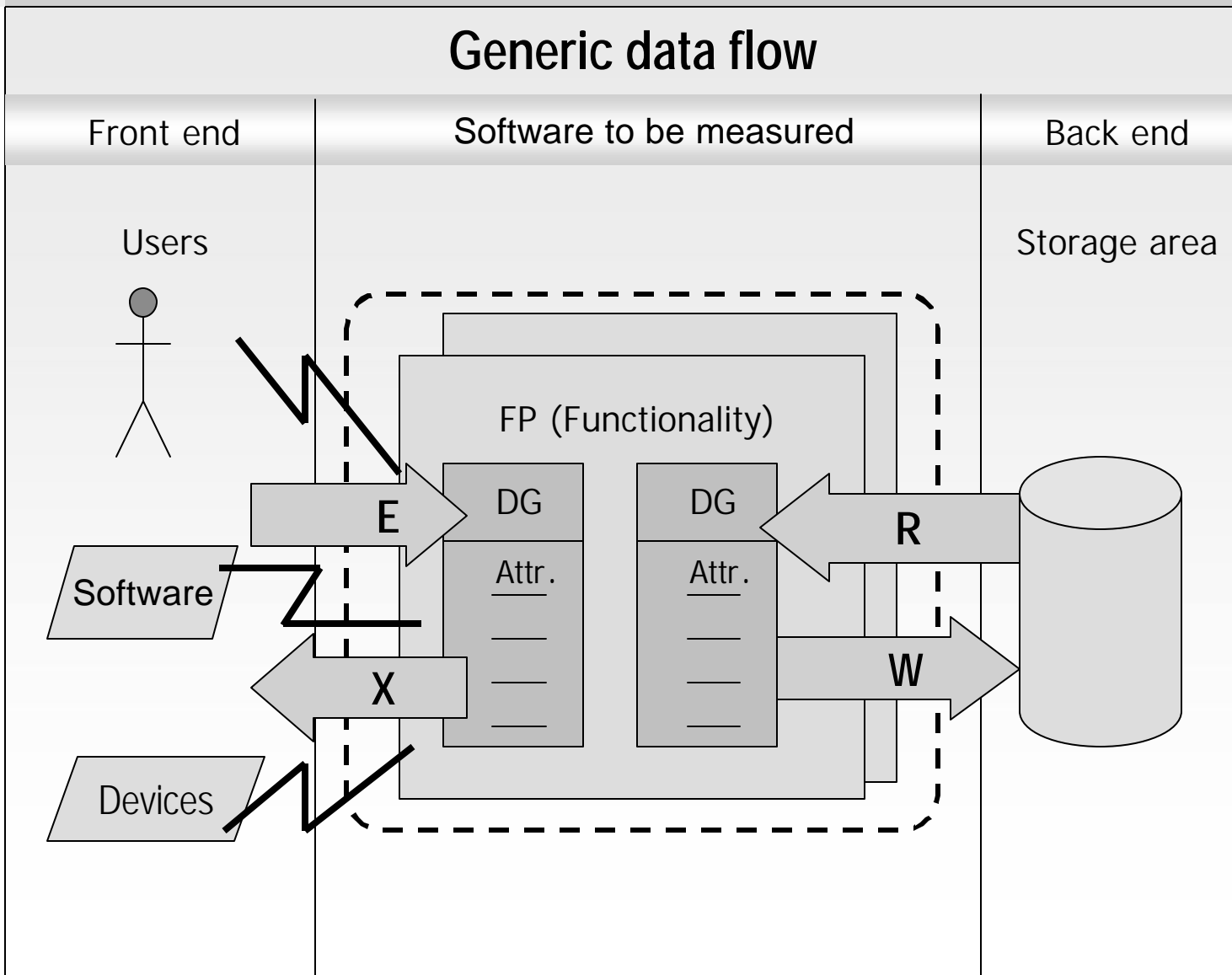
**Common Software Measurement International
Consortium - Full Function Point**

ISO 19761 Standard

COSMIC-FFP phases

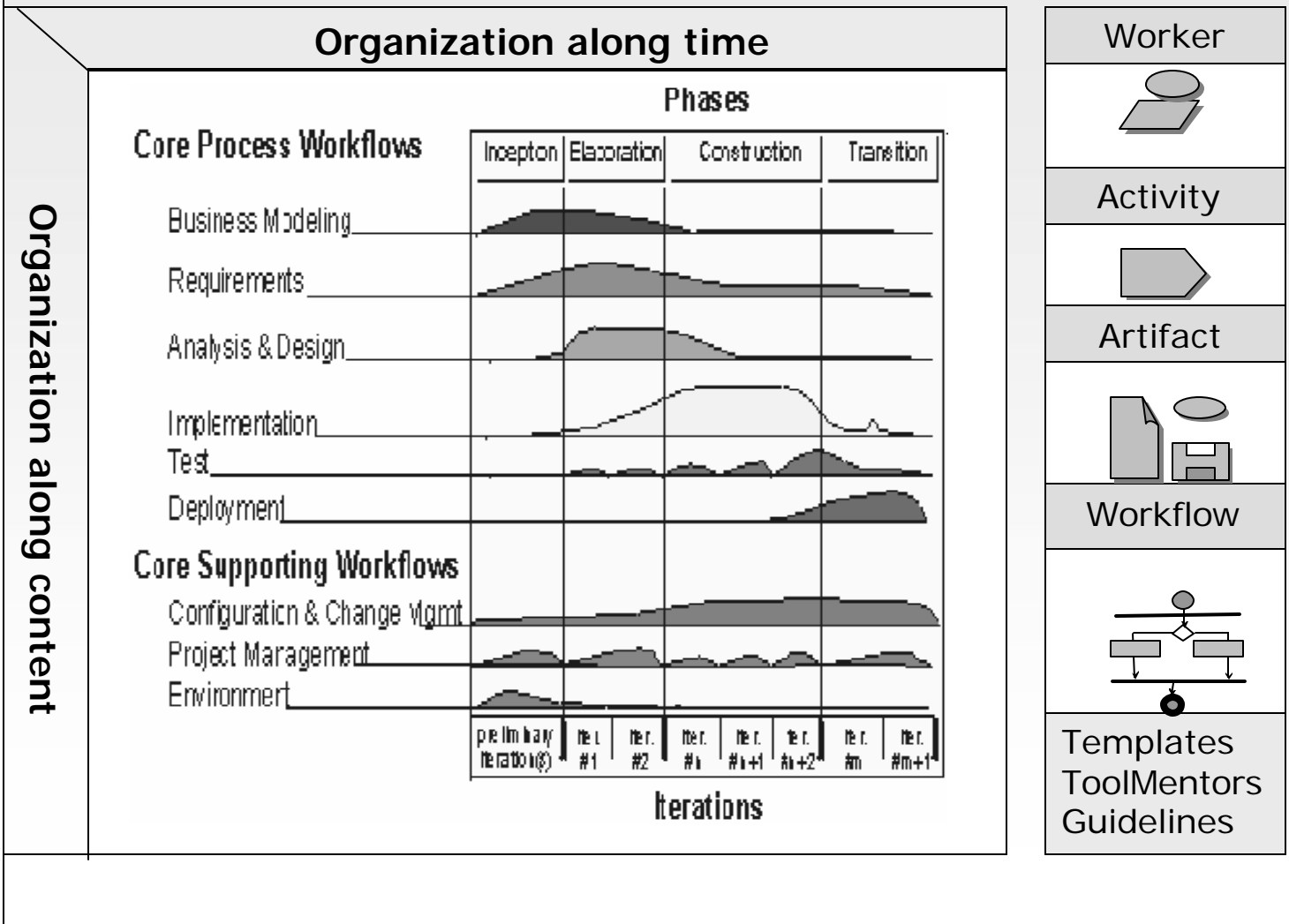


ISO 19761 Standard

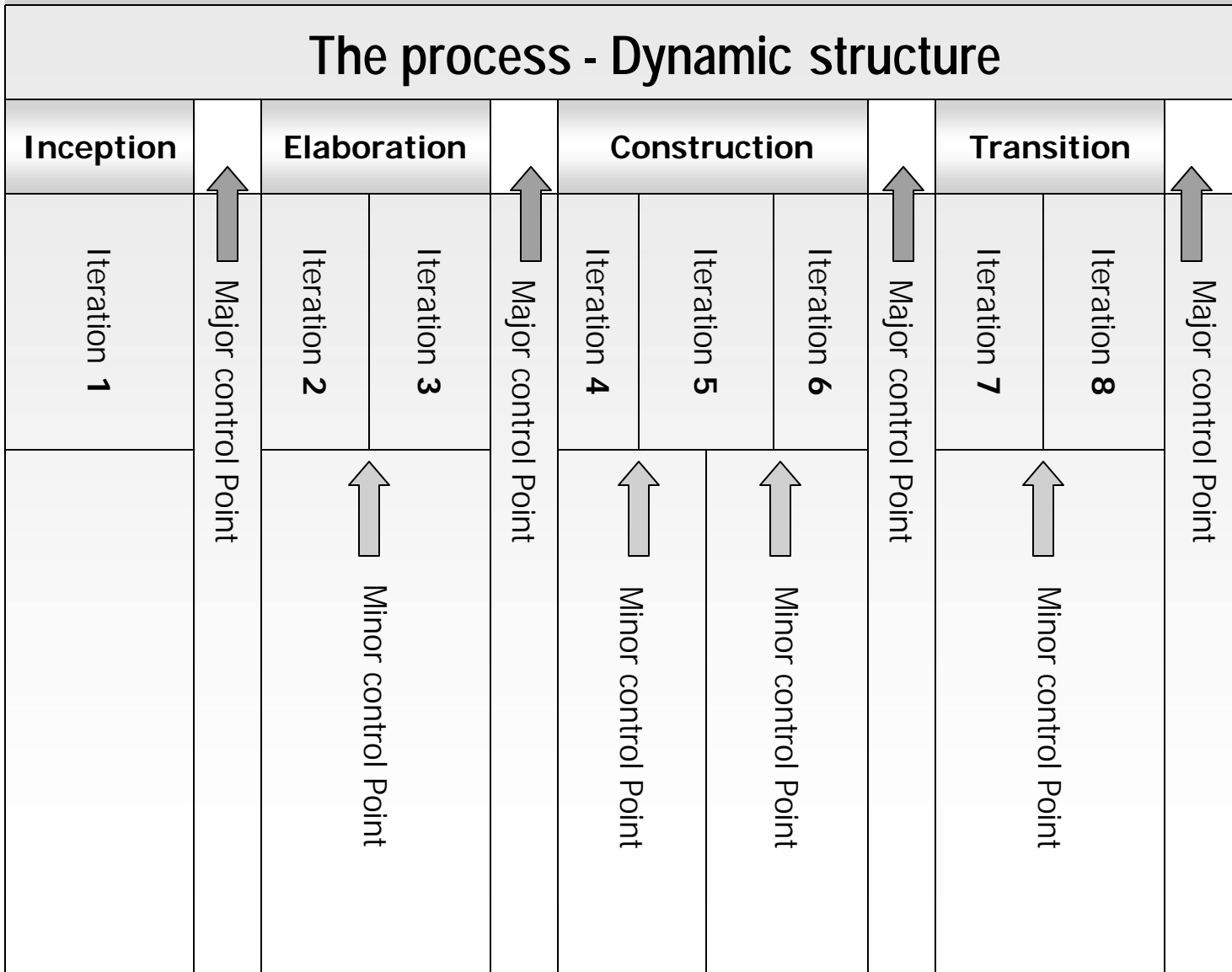


RUP and measurement activity

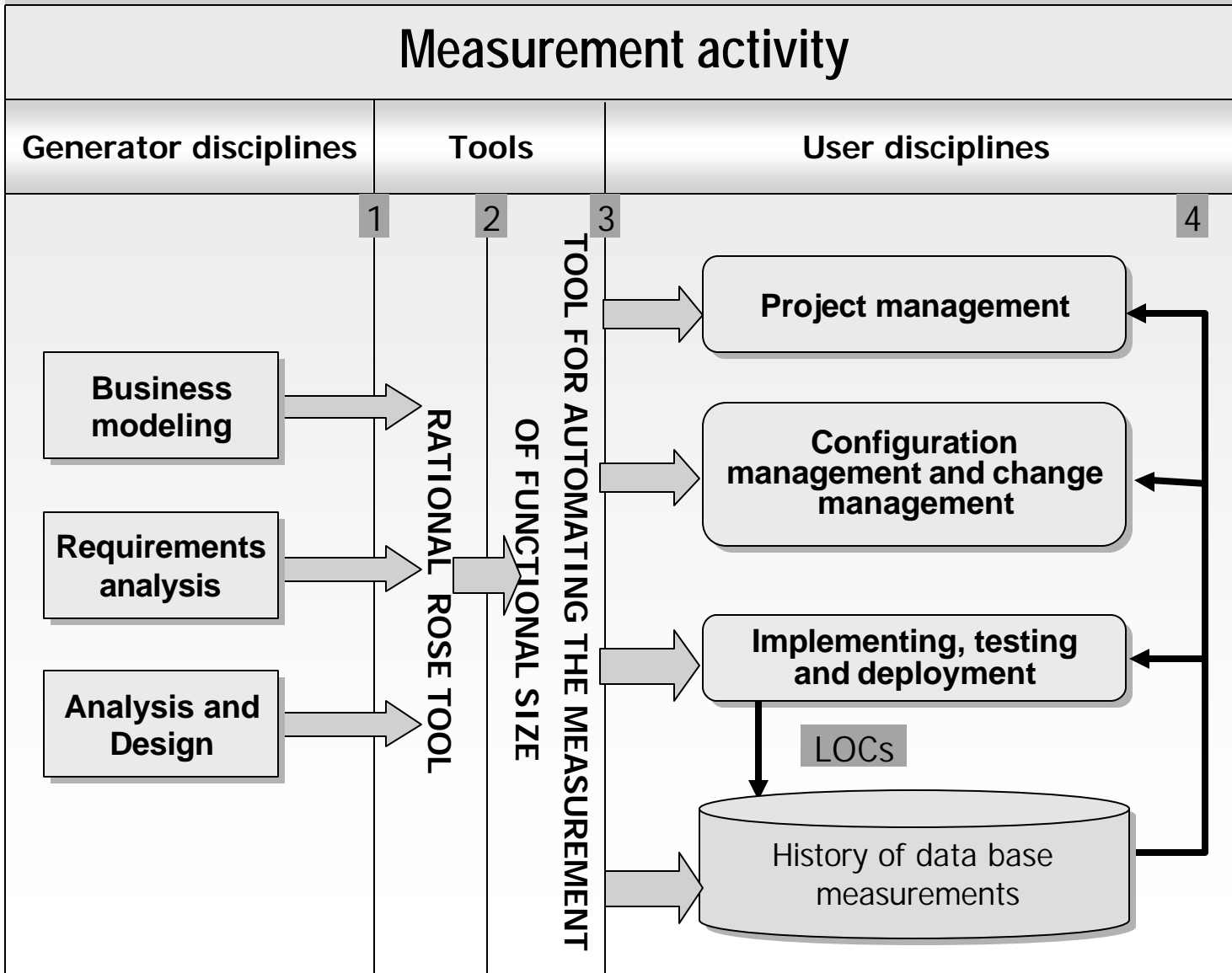
The process - Static structure



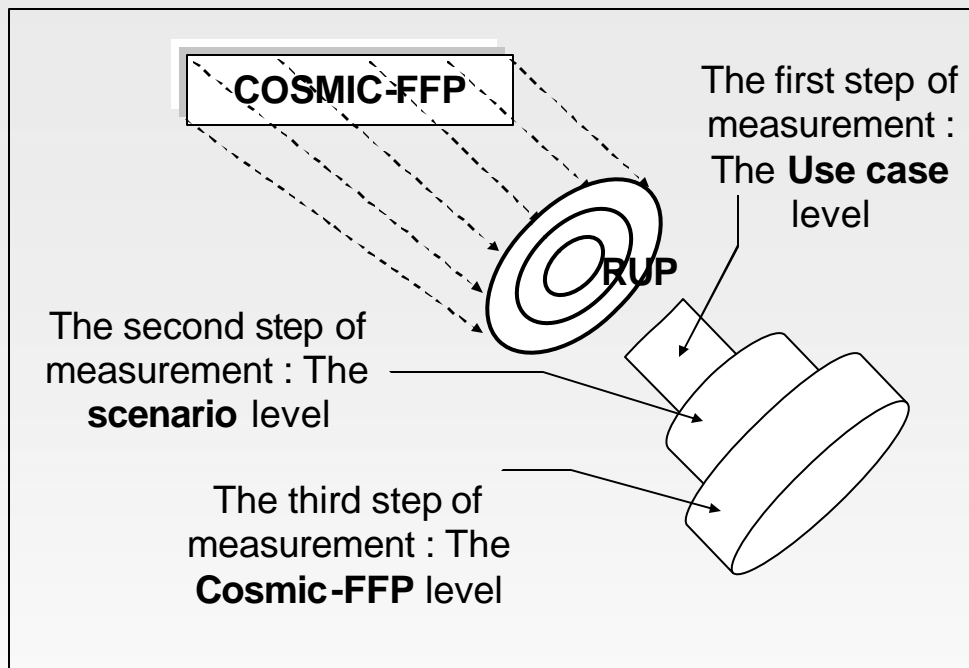
RUP and measurement activity



RUP and measurement activity



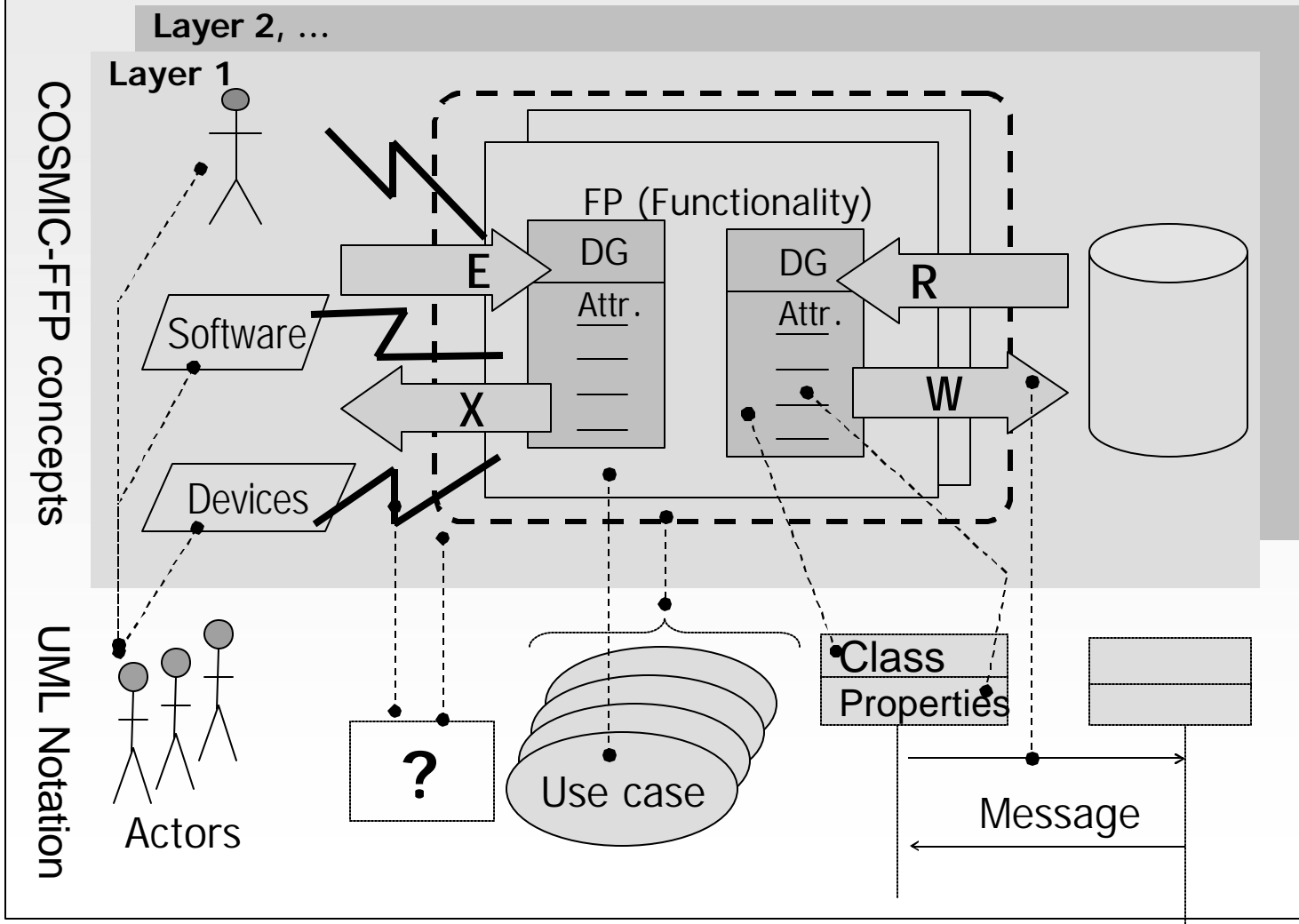
Automated measurement



***Automation is very useful
but needs oversight***


Automated measurement

Mapping of COSMIC-FFP concepts to UML



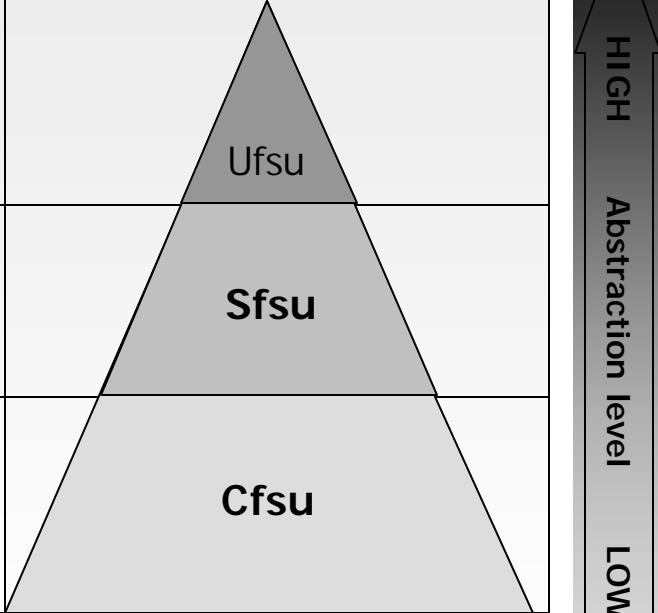
Automated measurement

Mapping of COSMIC-FFP concepts to UML

COSMIC-FFP Concept	UML equivalent	
Software boundary	Use case diagram ✓	
Software Layer	No UML equivalent (Has to be identified manually)	
COSMIC-FFP user	UML actor ✓	
Functional process	Use case ✓	
Data movement	Operation (message) ✓	
Triggering event	No UML equivalent (A new UML stereotype is created to distinguish a trigger event from a simple message in use-case diagrams)	
Data group	UML class ✓	
Data attribute	Class property ✓	

Automated measurement

Measurement levels

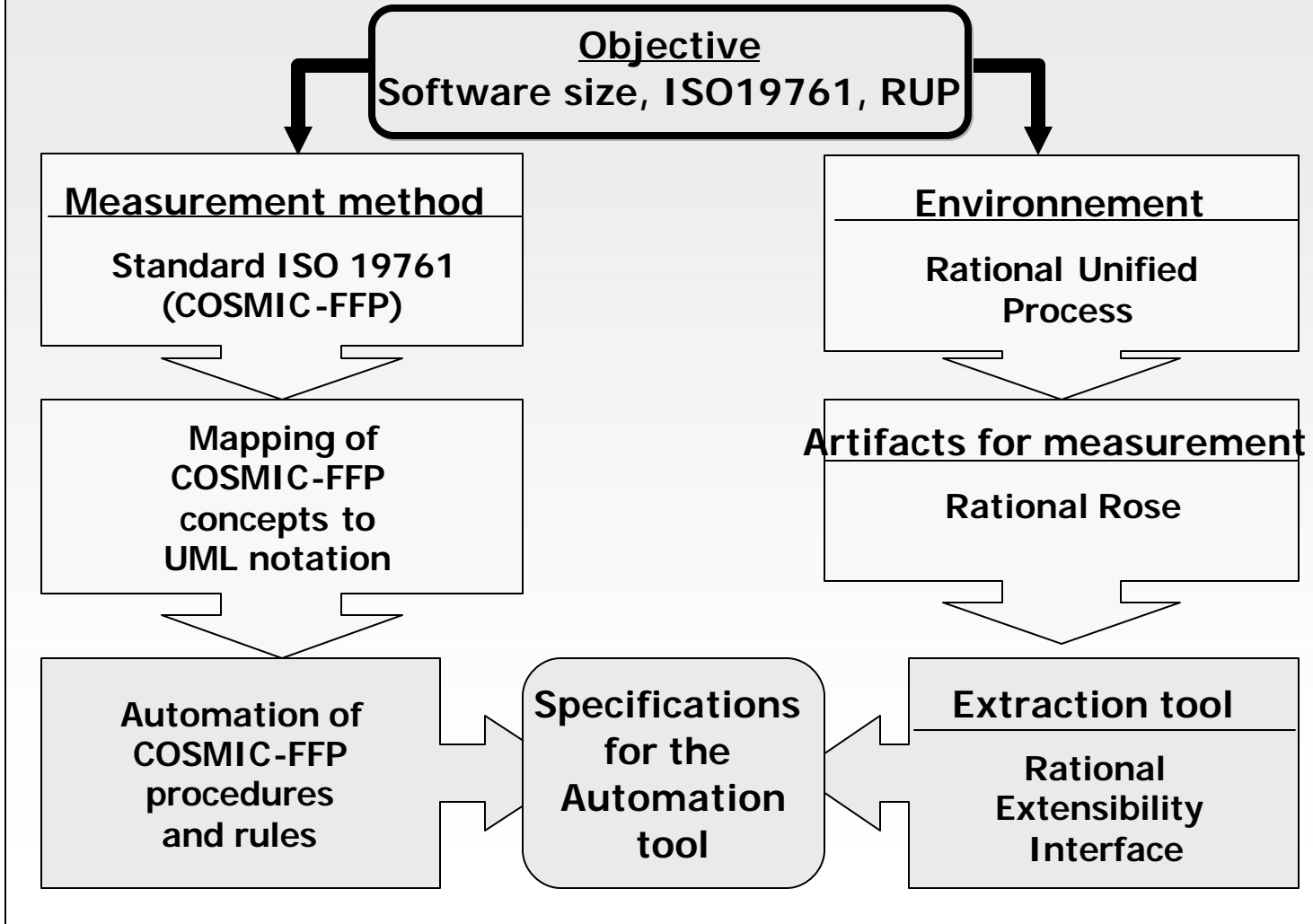
Development phase	RUP artifacts used	Precursor Indicators (numbers)	Unit convention
<ul style="list-style-type: none"> • Business modeling • Requirements analysis 	<ul style="list-style-type: none"> • Use-case diagrams 	<ul style="list-style-type: none"> • Use-cases • Actors • Interactions 	
<ul style="list-style-type: none"> • Analyse & Design 	<ul style="list-style-type: none"> • Scenario diagrams 	<ul style="list-style-type: none"> • Scenarios • Objets 	
<ul style="list-style-type: none"> • Analyse & Design 	<ul style="list-style-type: none"> • Detailed scenarios 	<ul style="list-style-type: none"> • Data movements • Type (E,X,R,W) 	

$$x \text{ Ufsu} = y \text{ Sfsu} = z \text{ Cfsu}$$

Tool basis :
*Mapping of COSMIC-FFP
concepts to UML notation*

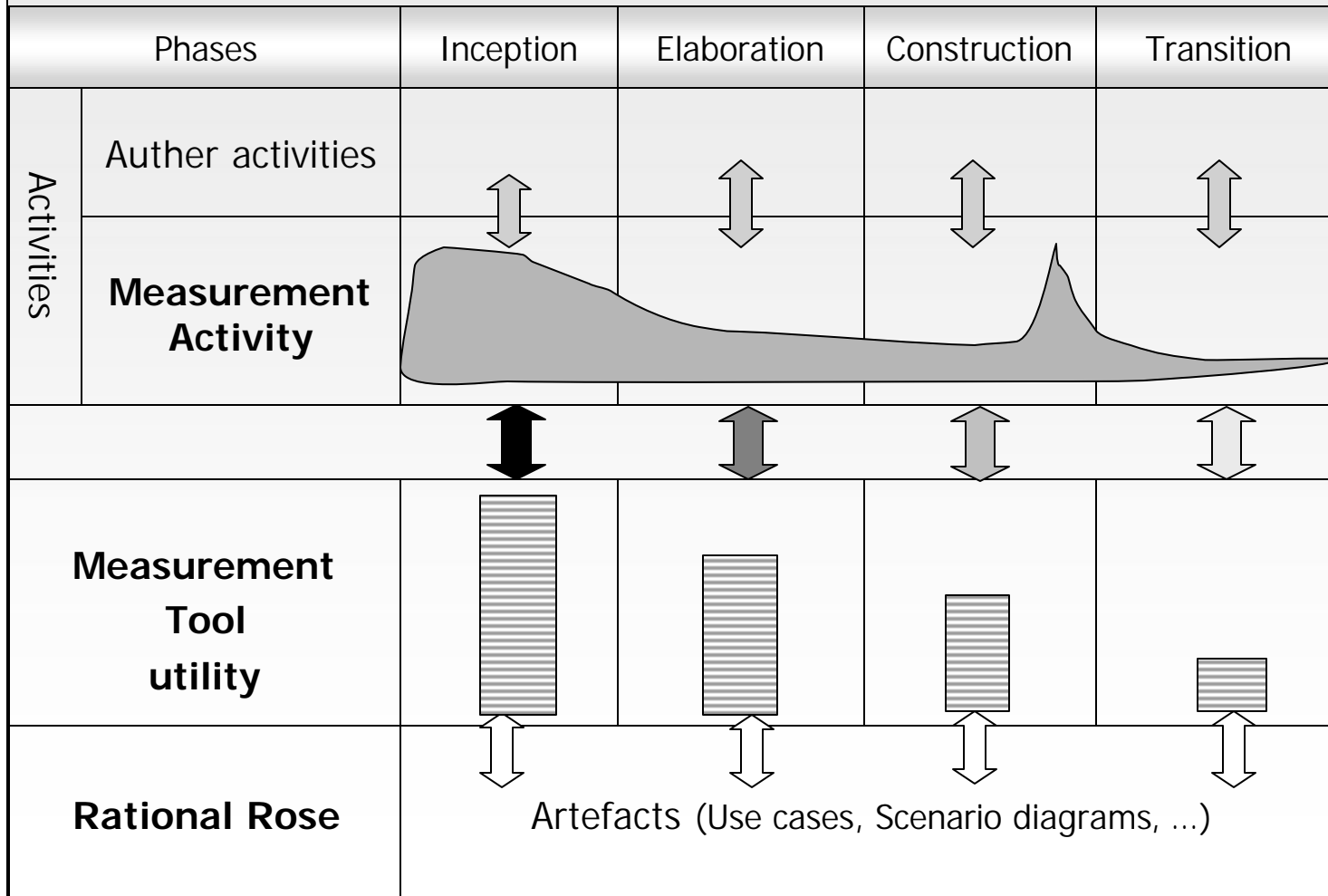
Solution Overview

Architecture of the solution



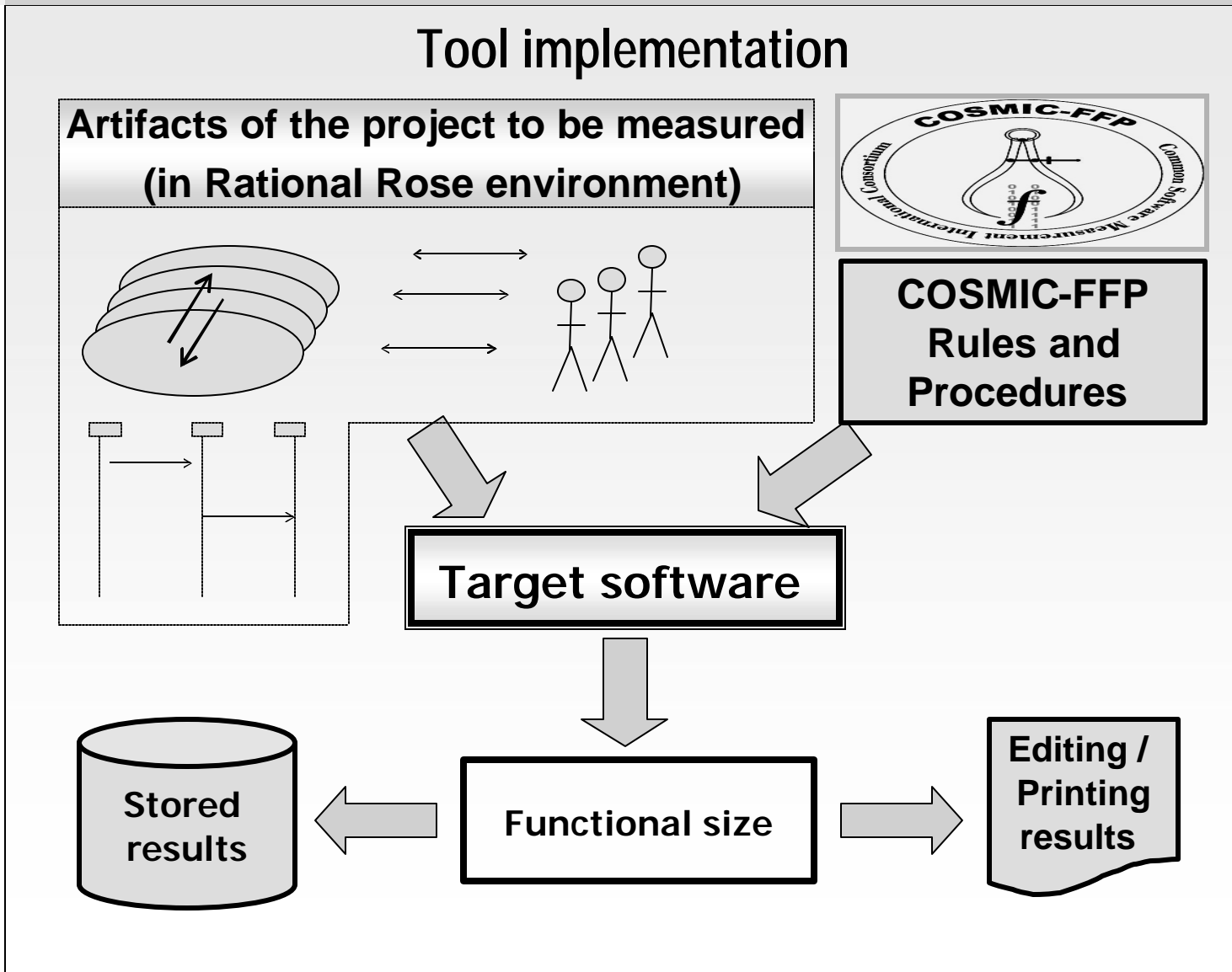
Solution Overview

Measurement activity



Solution Overview

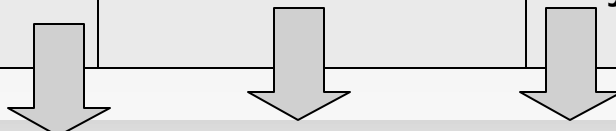
Tool implementation



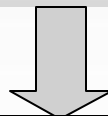
Solution Overview

The three measurement levels

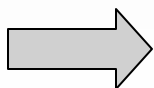
Stored results by software type (MIS, real time, embedded, etc.)		
Use case level (Ufsu)	Scenario level (Sfsu)	COSMIC-FFP level (Cfsu)
<ul style="list-style-type: none"> • Use Cases • Actors • Use case interactions 	<ul style="list-style-type: none"> • Scenarios • Objects 	<ul style="list-style-type: none"> • Data movements • Type (E,X,R,W, ?)



Analysis and synthesis



$$x \text{ Ufsu} = y \text{ Sfsu} = z \text{ Cfsu}$$

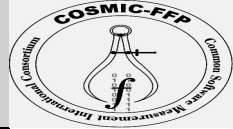


Estimations :

- Time,
- Effort,
- Costs, ...



Results



***Integrating the
measurement tool
as an Add-In to
Rational Rose***



Results

Results - Main screen

Rational Rose - Rice Cooker.mdl

File Edit View Browse Debugger Tools Add-Ins Window Help

Functional Size Count for 'Rice Cooker' project : General results

Functional Processes	Scenarios	Functional Sub-Process	Data Group
Control Heater	Control heater	(R) Receive actual temperature	Actual temperature
Select Cooking Mode		(?) Read target temperature	(Voir log erreur)
Set Target Temperature		(X) Set heater status	Heater status
Control Indicator Lamps			

Selected Process : **Control Heater** Trigger event : **5 s clock signal** Scenarios number : **1** Size (Cfsu) : **3**

Résumé des tailles

----- Ufsu -----		----- Sfsu -----		----- Cfsu -----	
Total Size	4 Ufsu(6,6)	Total Size	4 Sfsu(15)	Total Size (Cfsu).	11
Use Cases Number.	4	Scenarios Number.	4	Entries (E) number	3
Actors Number.	6	Objets Total Number	15	Exits (X) number	2
Interactions Number.	6			Reads (R) number.	3
				Writes (W) number	1
				Undetermined (E/X/R/W ?)	2

Language	Log Book Errors	Data Base	Results Type	Other
<input type="radio"/> Français	<input type="button" value="Consult Log"/>	<input type="button" value="Update"/>	<input type="button" value="Detailed results"/>	<input type="button" value="Print results"/>
<input checked="" type="radio"/> English	<input type="button" value="Print Log"/>	<input type="button" value="Consult"/>	<input type="button" value="Summary by FP"/>	<input type="button" value="Close"/>
			<input type="button" value="Summary by DM"/>	

For Help, press F1

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Results

Results - By Functional process

Rational Rose - Rice Cooker.mdl

File Edit View Browse Debugger Tools Add-Ins Window Help

Use Case View Logical View Component View

Calcul de la taille fonctionnelle pour le projet 'Rice Cooker' : Résultats détaillés

No	PID	Description du processus	Déclencheur	Description de Sous-processus	Groupe de données	S-P Type	FFP Total
1	1.1	Control Heater	5 s clock signal	Receive actual temperature	Actual Temperature	R	1
				Read target temperature	(Voir log erreurs)	?	1
				Set heater status	Heater Status	X	1
							3
2	1.2	Select Cooking Mode	Mode switch pressed	Receive Cooking Mode	Operator	E	1
				Write Cooking Mode	Cooking Mode	W	1
							2
3	1.3	Set Target Temperature	30 s clock signal	Receive elapsed time	Elapsed Time	E	1
				Read cooking time	Cooking Mode	R	1
				Write target temperature	(Voir log erreurs)	?	1
							3
Total d'unités COSMIC-FFP :							11

OK

Line: 1546 Col: 14 Modified

Log

For Help, press F1



Results

Results - by Data Movement types

Rational Rose - Rice Cooker.mdl

File Edit View Browse Debugger Tools Add-Ins Window Help

Use Case View Logical View Component View

Calcul de la taille fonctionnelle pour le projet 'Rice Cooker' : Résumé par type de mouvement de données

Sous-Processus COSMIC-FFP	Unités COSMIC-FFP (Cfsu)	Proportion (%)	(E)	(X)	(R)	(W)	(E/X/R/W ?)
Entrée (E)	3	27,27 %		100%			
Sortie (X)	2	18,18 %					
Lecture (R)	3	27,27 %					
Écriture (W)	1	09,09 %					
Imprécis (E/X/R/W ?)	2	18,18 %		27,27%	18,18%	27,27%	18,18%
Total:	11 CFSUs	100 %	0%			09.09%	

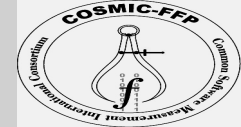
OK

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Log

For Help, press F1

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Results

Printed results

Calcul de la taille fonctionnelle pour le projet 'Rice Cooker' : Détail de la mesure - Classeur1

Fichier Edition Affichage Insertion Format Outils Données Fenêtre ?

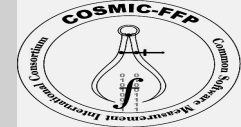
A1 = No

	A	B	C	D	E	F	G	H	I
1	No	PID	Description du processus	Déclencheur	Description de Sous-proces	Groupe de donné	Type de sou	Unités COSM	Total
2	1	1,1	Control Heater	5 s clock signal	Receive actual temperature	Actual Temperatu	Lecture (R)	1	
3					Read target temperature	Target Temperatu	Lecture (R)	1	
4					Set heater status	Heater Status	Sortie (X)	1	
5								Total Partiel	3
6									
7	2	1,2	Select Cooking Mode	Mode switch pressed	Receive Cooking Mode	Operator	Entrée (E)	1	
8					Write Cooking Mode	Cooking Mode	Écriture (W)	1	
9								Total Partiel	2
10									
11	3	1,3	Set Target Temperature	30 s clock signal	Receive elapsed time	Elapsed Time	Entrée (E)	1	
12					Read cooking time	Cooking Mode	Lecture (R)	1	
13					Write target temperature	Target Temperatu	Écriture (W)	1	
14								Total Partiel	3
15									
16	4	1,4	Control Indicator Lamps	30 s clock signal	Receive elapsed time	Elapsed Time	Entrée (E)	1	
17					read cooking mode	Cooking Mode	Lecture (R)	1	
18					Send Status to Lamps	Cooker Status	Sortie (X)	1	
19								Total Partiel	3
20									
21									
22								Total général	11
23									
24									
25									

Détail taille fonctionnelle / Feuil1 / Feuil2 / Feuil3

Prêt

Démarrer Rational Rose - Ri... Navigation en cou... Projet COSMIC-FF... Calcul de la ta... 11:19



Results

Measurement - Log

Rational Rose - Rice Cooker.mdl

File Edit View Browse Debugger Tools Add-Ins Window Help

Use Case View Logical View

Functional Size Count for 'Rice Cooker' project : History Measurements Consultation

Project Identification	Type	Ufsu			Sfsu		Cfsu					LOCs
		Use Case	Actors	Interac.	Scénarios	Objects	Entries(E)	Exits(O)	Reads(R)	Writes(W)	(E/D/R/W/?)	
Cosmic	2	5	2	9	4	0	7	7	0	0	4	0
Gestion	1	5	2	9	4	0	7	7	0	0	4	3
Gestions	4	5	2	9	4	0	7	7	0	0	4	0
Gestiongg	1	5	2	9	4	0	7	7	0	0	4	9
Gestion Glossaire1234	3	5	2	9	4	0	7	7	0	0	4	0
Rice Cooker	2	4	6	6	4	15	3	2	3	1	2	44
Valve Contrôle	4	1	5	1	1	9	4	1	13	3	0	6
1vcvf	1	0	0	0	0	0	0	0	0	0	0	0
2cvcv	2	0	0	0	0	0	0	0	0	0	0	0
3fvf	3	0	0	0	0	0	0	0	0	0	0	0
4vcvc	1	0	0	0	0	0	0	0	0	0	0	0
5vcv	1	0	0	0	0	0	0	0	0	0	0	0
6vcvcvc	1	0	0	0	0	0	0	0	0	0	0	0

Projets code type :
 1 - Management 2 - Real time
 3 - Embedded 4 - Other

OK

Log

Line: 2 Col: 2

For Help, press F1

Conclusion

Advantages:

- ⦿ Measurement results at 3 levels of abstraction
- ⦿ Good results with Rice Cooker & Valve Control case studies
 - ⇒ Delta = 1 cfsu between manual and automated measurements
- ⦿ Requires rigor in the specifications

Constraints:

- ⦿ Operates on one layer
- ⦿ Limited to Rational Rose tool

References

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- P. Kruchten, "The Rational Unified Process, an introduction," Addison Wesley, March 2000, p. 298.
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Questions



<http://www.internet.uqam.ca/web/t15040>