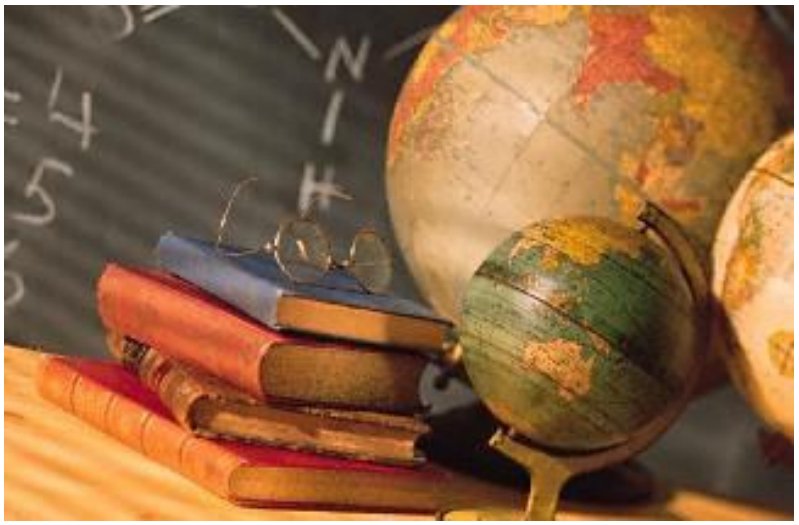
AS-TRM AND FUNCTIONAL SIZE WITH COSMIC-FFP



Manar Abu Talib Olga Ormandjieva Alain Abran

ISIE 2007 ~ Spain

Agenda

- ***Introduction***
- ***COSMIC-FFP Measurement Method***
- ***AS-TRM***
- ***Related Work***
- ***Analysis of Similarities across Models***
- ***Formalizing COSMIC-FFP in AS-TRM context***

Context

- **Software Engineering: A discipline for the systematic production and maintenance of large and complex software systems** **[Fenton & Pfleeger 1998]**

- **Software Measurement: is the mechanism to provide feedback on software quality** **[Fenton & Pfleeger 1998]**

- **Size: Systems built for a large number of interactions and with a large number of components** **[Fenton & Pfleeger 1998]**

- **Complexity: Overall Behavior can only be predicted with some degree of uncertainty** **[Fenton & Pfleeger 1998]**

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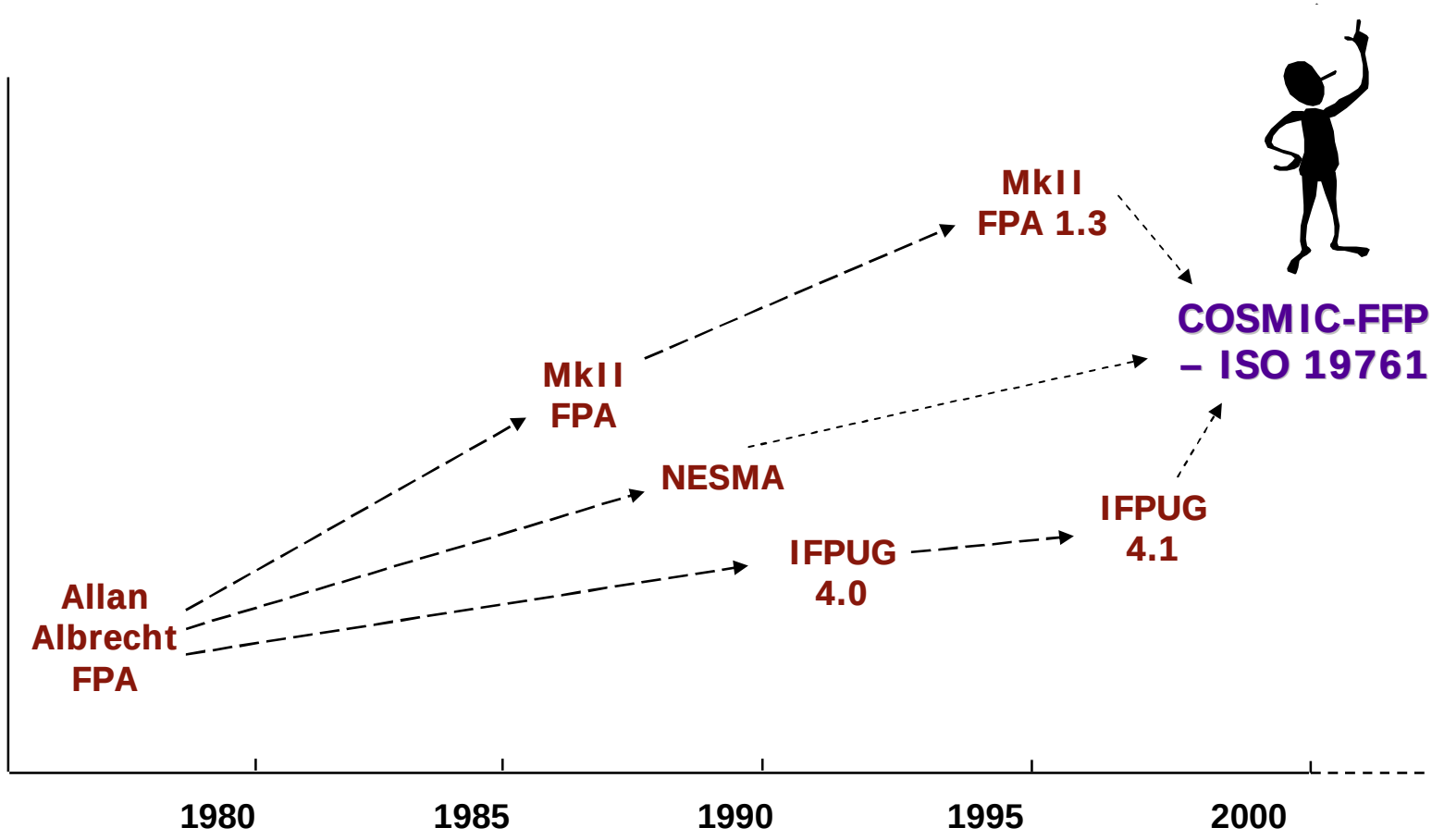
Functional Size

Functional Size:

A size of software derived by quantifying the functional user requirements

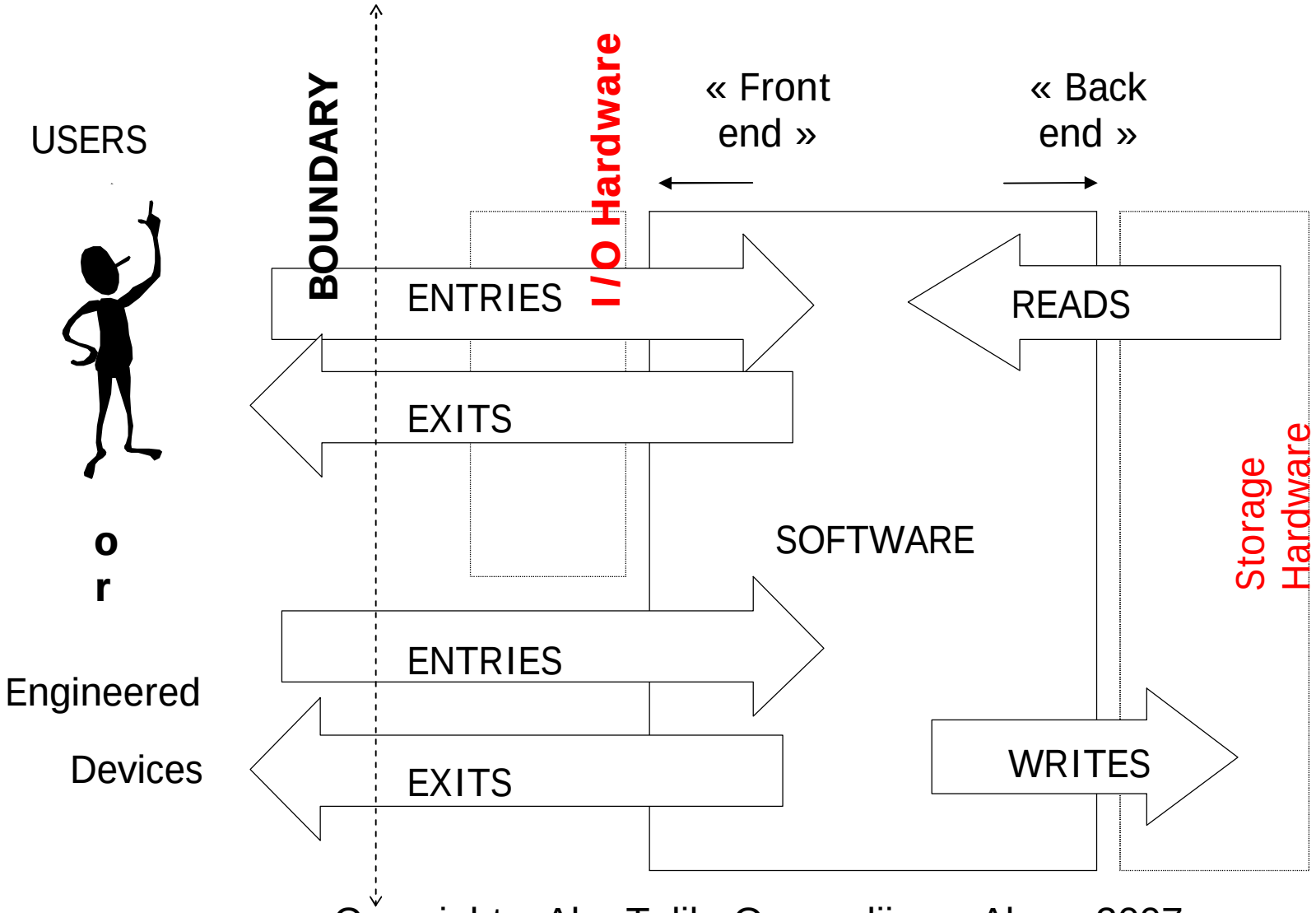
[ISO 14143-1 definition]

"So you want to measure Software Functional Size?"



COSMIC-FFP Measurement Method

[COSMIC-FFP Manual 2.2]



COSMIC-FFP Measurement Method

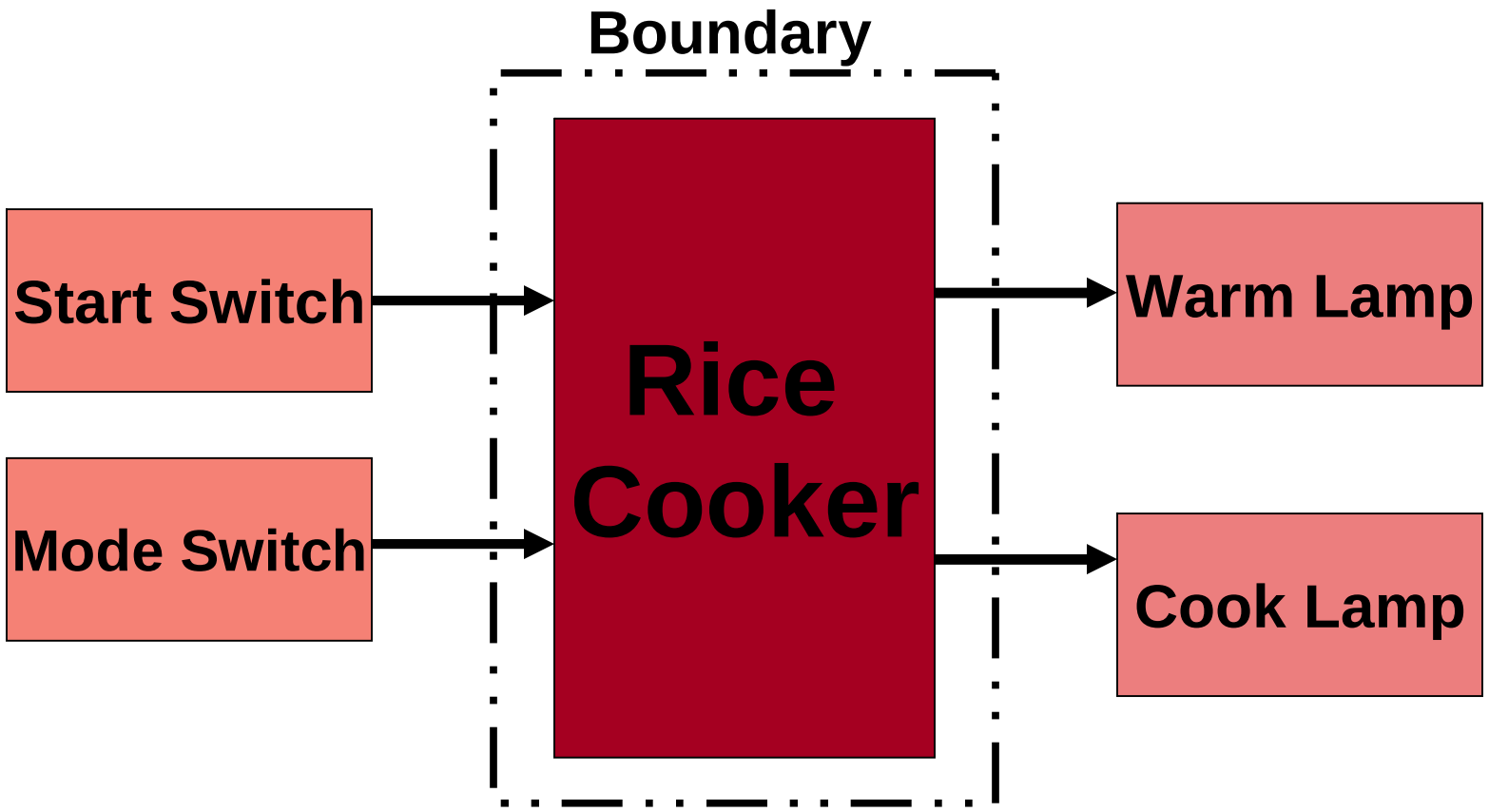
[COSMIC-FFP Manual 2.2]

- ***COSMIC-FFP focuses on the user view*** *(that is to the 'user requirements' from a functional perspective, see ISO 14143-1)*

- ***This view is relevant throughout all the software development phases***

Example: COSMIC-FFP Software Functional User Requirement boundary for Rice Cooker application

[Rice Cooker Case Study]



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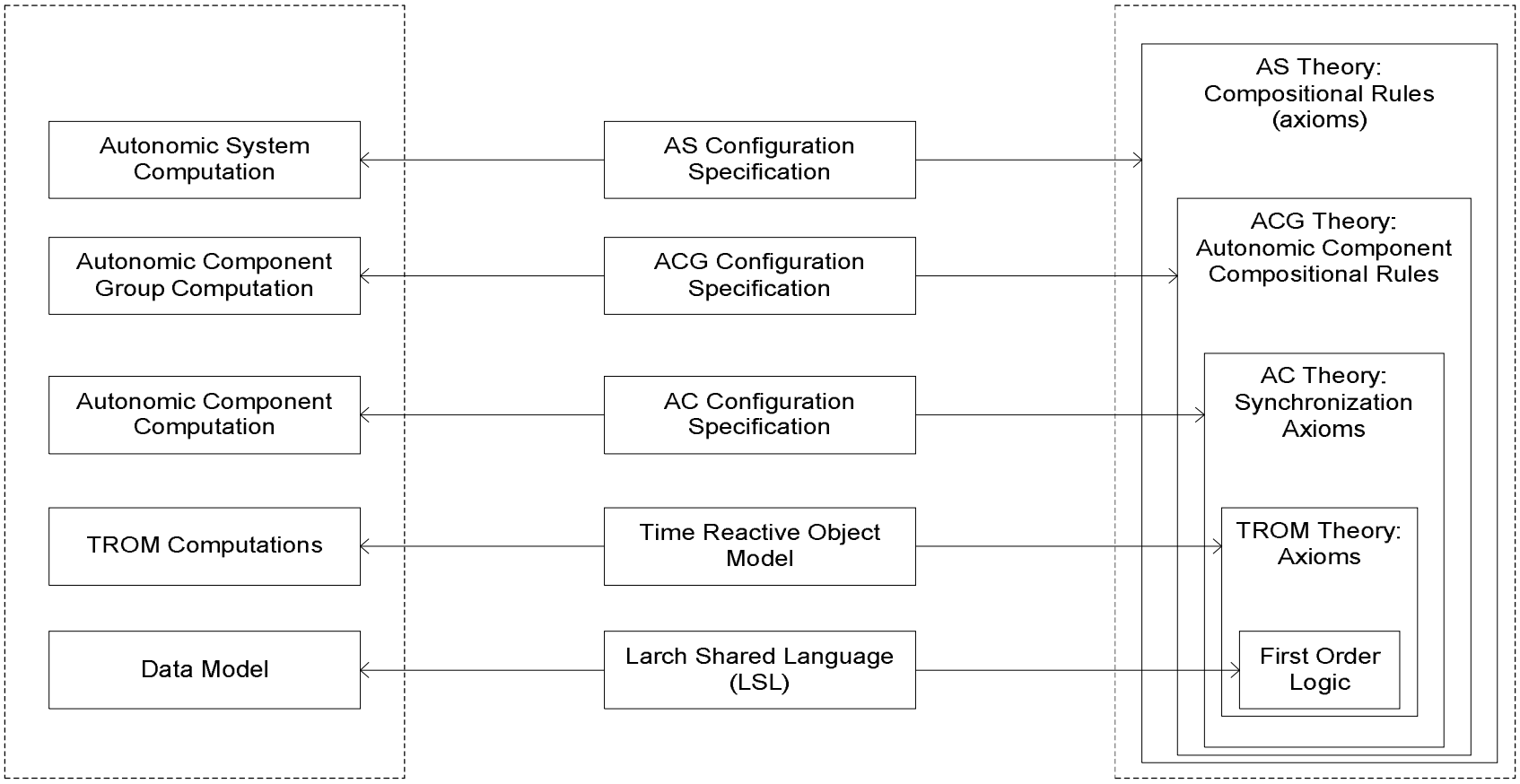
AS-TRM

- ***For modeling reactive autonomic distributed systems***

- ***The AS-TRM architecture builds on the TROM formalism for modeling reactive systems by adding more tiers and including the following specifications:***
  - ***Data modeling***
  - ***Timed Reactive Object Model (TROM)***
  - ***Timed reactive autonomic component (AC);***
  - ***Group of synchronously interacting ACs (ACG);***
  - ***Autonomic system (AS), consisting of asynchronously communicating ACGs.***

AS-TRM Formal Model

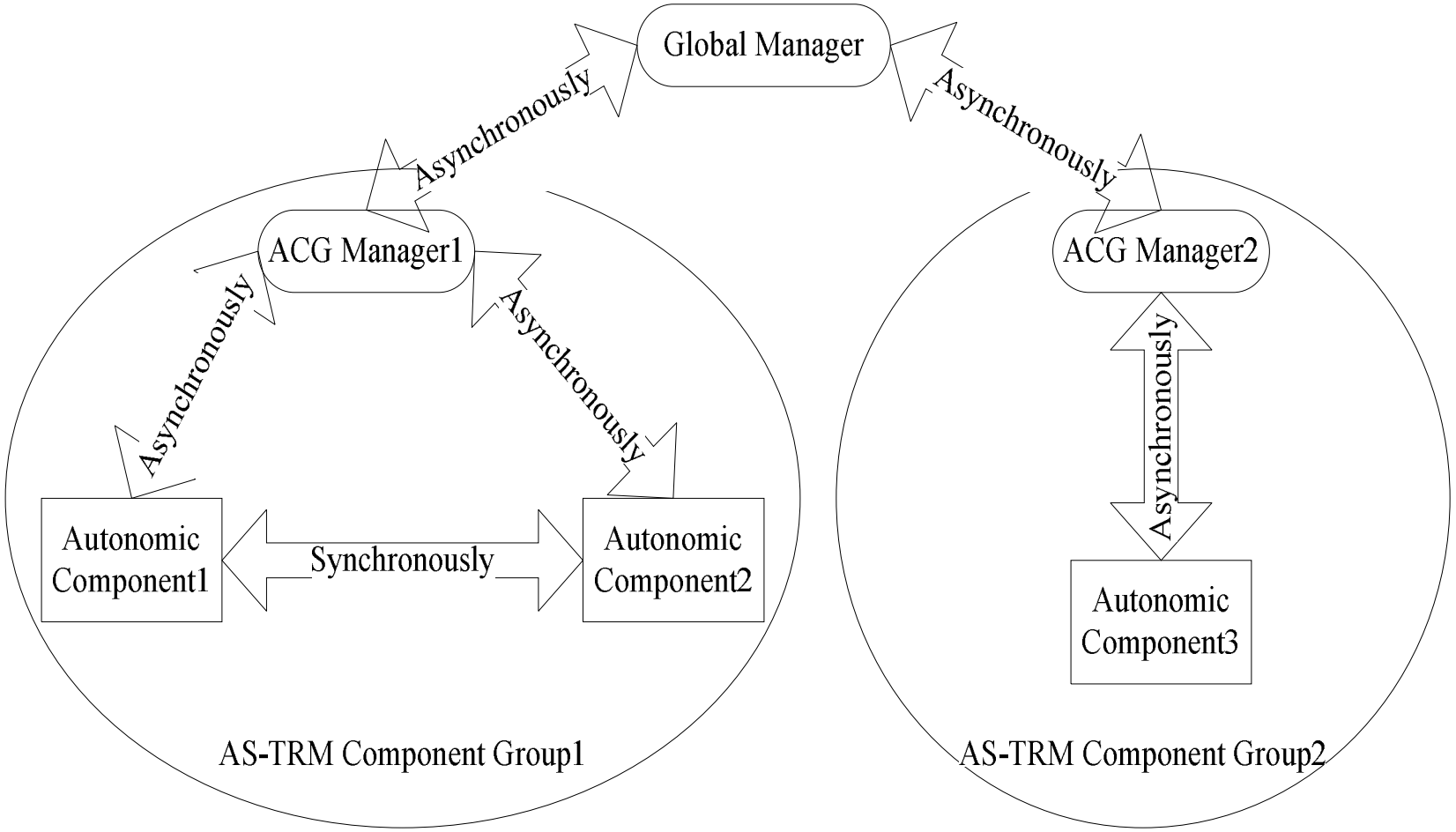


5-Tiered Design Specification

AS-TRM Formal Model (Script)

- *AC Tier: This newly added tier encapsulates the TROM objects into the AS-TRM autonomic components. An AC is responsible for undertaking a complete or partial real-time reactive task as a worker within the system.*
- *ACG Tier: each ACG can accomplish a complete real-time reactive task independently. The self-monitoring behaviour at the ACG tier as well as the asynchronous interaction between ACG and its ACs is implemented by an ACG Manager (AGM).*
- *AS Tier: the self-managing behaviour as well as the asynchronous interaction between the AS and the ACGs is implemented by the Global Manager (GM).*

Hierarchical view of the AS-TRM



Hierarchical view of the AS-TRM (Script)

- *At the peer group level, which is also the AS-TRM Component Group (ACG) level, every AGM interacts and shares knowledge as well as information with its ACs; it receives information (policies) from its superior (Global Manager) and implements them with its own resources. The autonomic behavior at this level is a result of peer knowledge-sharing, getting local agreement, and acting locally on that knowledge.*

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Related Work: Formalizing COSMIC-FFP

[Diab, Frappier & St-Denis 2001]

- *Formalization of (COSMIC-FFP) measure for the Real-time Object Oriented Modelling (ROOM) language.*

- *ROOM is now widely used for constructing real-time systems.*

  - *eliminates measurement variance*
  - *automation of COSMIC-FFP measurement for ROOM specifications*

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Analysis of Similarities across Models

COSMIC-FFP concepts	*AS-TRM formalism notations*
Boundary	Reactive Component interface
Layer	Tier in the formal model
Functional process	Reactive task or self-management task
Triggering event	Shared input event
Data group	LSL trait
Data Movement	Internal & External event (input & output)
Data Attribute	Operation in the LSL trait

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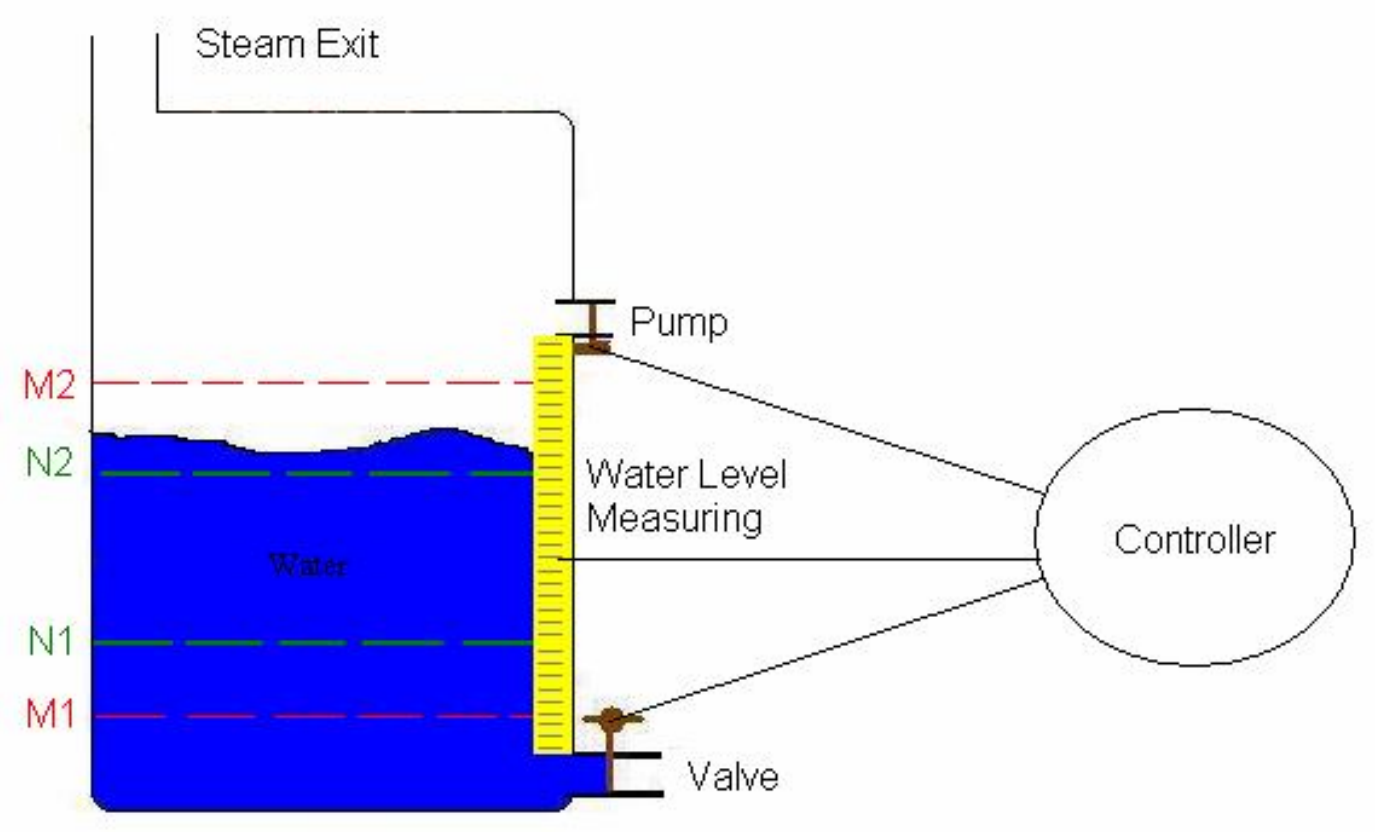
Results of Proposed Comparison

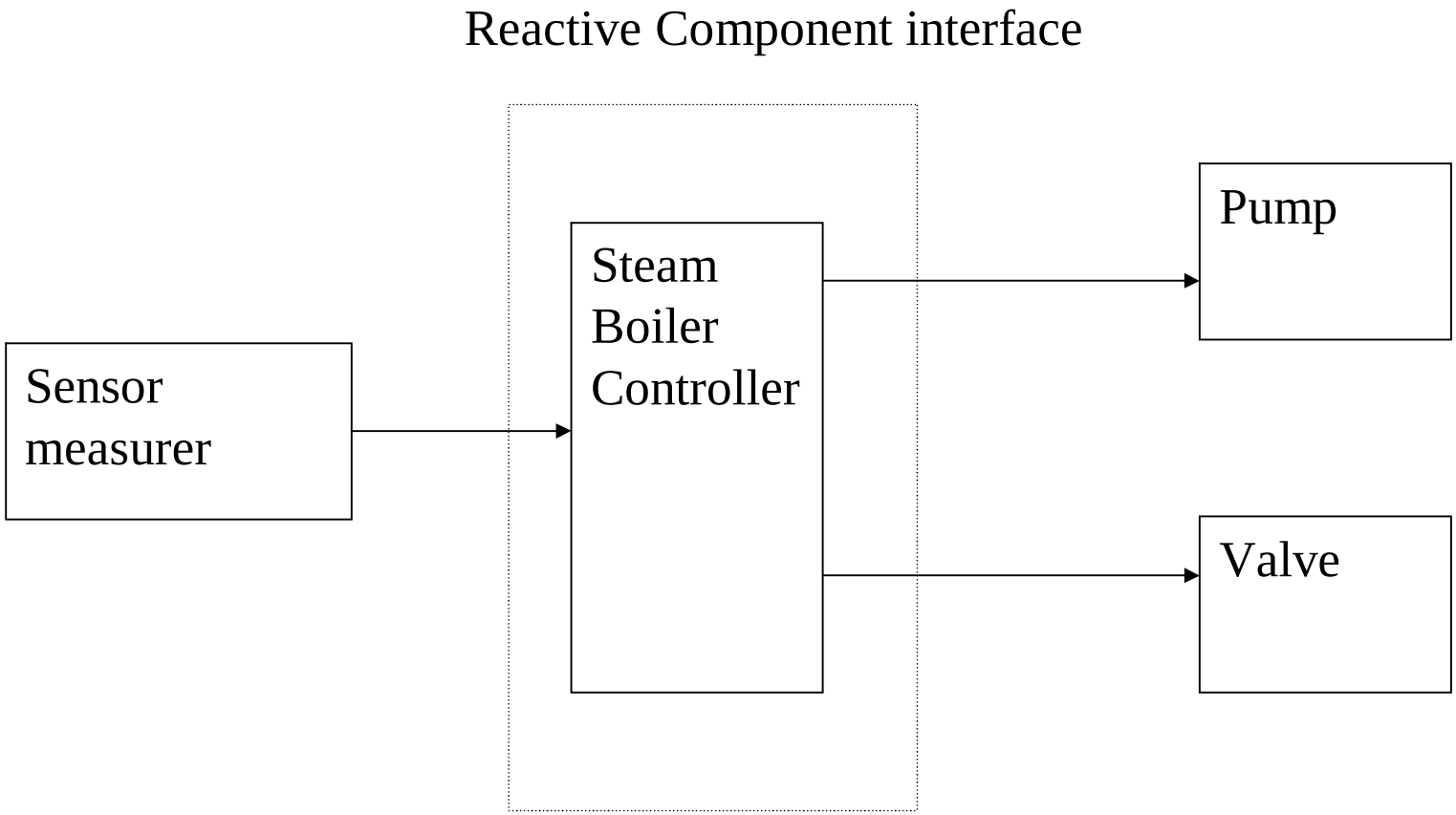
- The COSMIC-FFP method would complement the complexity management in AS-TRM allowing for early complexity assessment from the formal specification.

- Proof of concept through Steam Boiler Case Study.

Steam Boiler Case Study *[Steam Boiler Case Study]*



Steam Boiler Controller



Total Software Functional Size for Steam Boiler using AS-TRM terms

Tier i	Reactive task	Sequence of events	Type of event	Corresponding functional size
AC	Maintain Water Level	1. Obtain the water level measurement (value = below normal, normal or above normal)	Shared input event	1
		2. (Logic) Check if any action is needed; if not, terminate the cycle		
		3. Send message to Pump (value = open or close)	External output event	1
		4. Send message to Valve (value = open or close)	External output event	1
Total Functional size of Steam Boiler Controller software				3 Cfsu

Thank You !

Questions?

Manar Abu Talib: manar.talib@zu.ac.ae
Olga Ormandjieva: ormandj@cs.concordia.ca
Alain Abran: alain.abran@etsmtl.ca

www.gelog.etsmtl.ca

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