



Context-based Parametric Relationship Model (CPRM) to Measure the Security and QoS tradeoff in Configurable Environments

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Introduction

- ❖ Security and QoS Tradeoffs
- ❖ Approaches for Security and QoS T.
- ❖ Our approach

Parametric Relationship
Model (PRM)

- ❖ Concept (Overview)

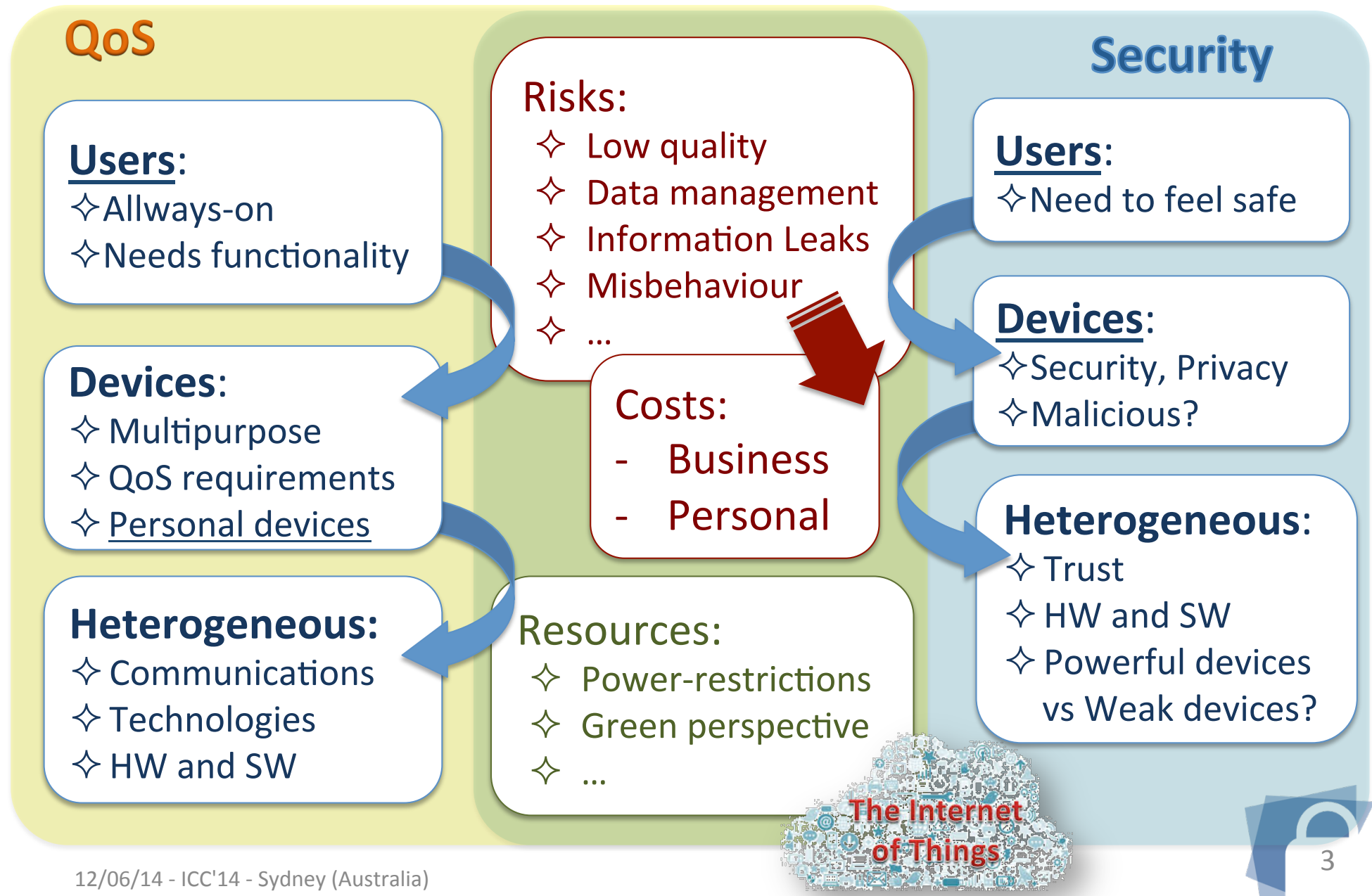
Context-based PRM (CPRM)

- ❖ Components
- ❖ Composition

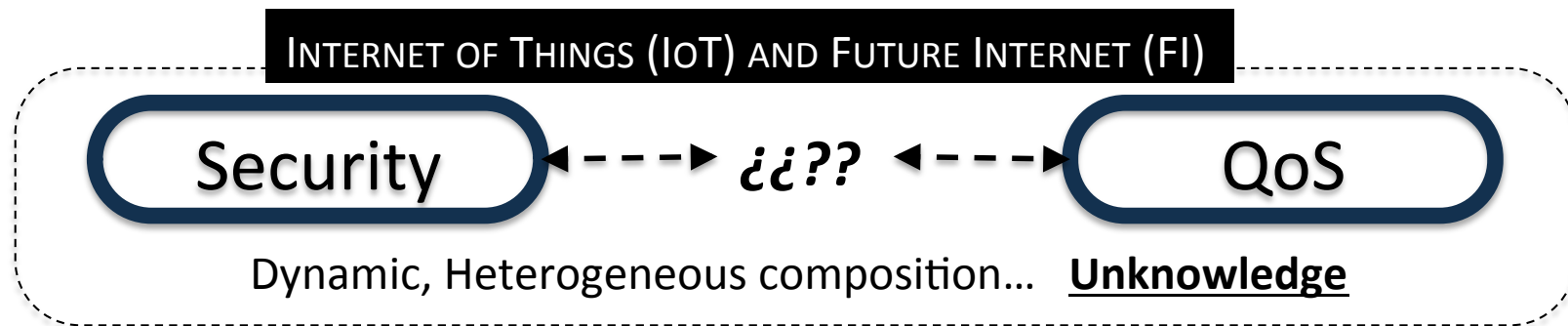
Prototype -- Tool (Video)



INTERNET OF THINGS AND FUTURE INTERNET



SECURITY AND QoS TRADEOFF APPROACHES



- Security as QoS parameter (e.g. Priority queues | | target in packet)
- QoS for enhancing Security (e.g. Ensure availability using QoS to avoid DoS)
- **Typical tradeoff** approaches (some examples):
 - Cost of secure routing (eg. Location privacy).
 - Cost of encryption mechanisms (eg. Packet size, computation time).
 - Cost of secure communication (eg. Energy).
 - Cost of authentication time (eg. User experience).
- **Context**
 - User, physical, software, etc. → Security, requirements, services
 - Location: home, work, etc. → Security, requirements, services
 - **Composition of Services (Web)**

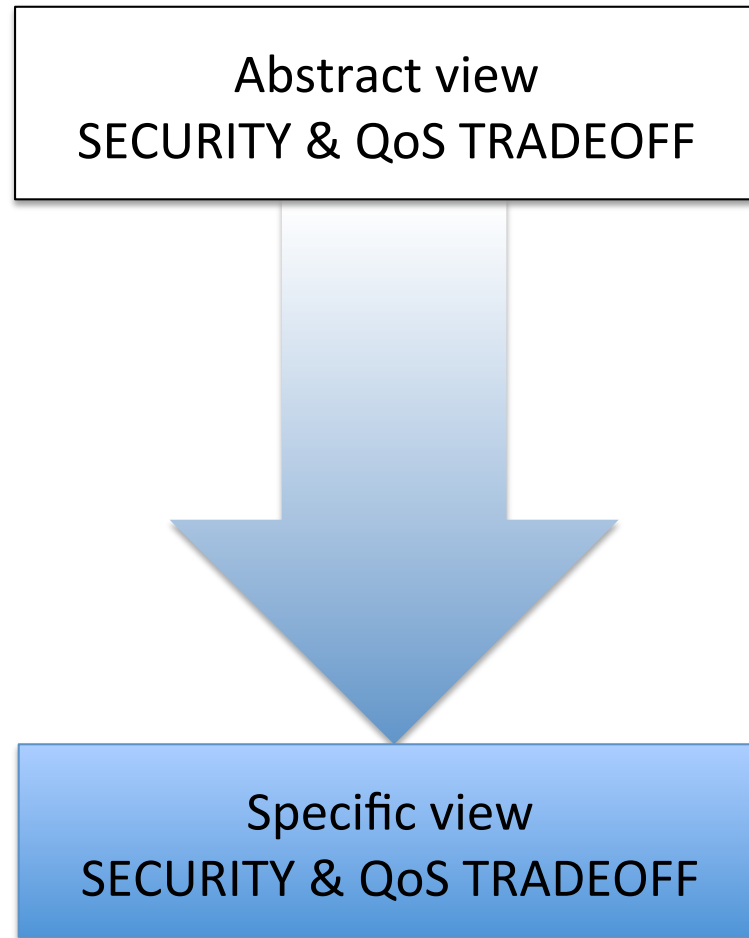
SPECIFIC

STATIC

KNOWN

OUR APPROACH

THE HETEROGENEITY REQUIRES DYNAMIC LEARNING



- General descriptions (common to a basic set of architectures)
- Basic set of parameters and relationships

Parameters

- Know platforms
- Network characteristics
- Specific environments

PARAMETRIC RELATIONSHIP MODEL (PRM)

✧ Defined in a previous work.

✧ Components:

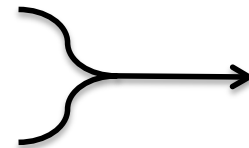
✓ Parameters

✓ Types

✓ Layers

✓ Operations (op)

✓ Relationships: Parameter-op-Parameter



*Properties for
a Parameter*

Ex. →

Anti-tampering is a
parameter of **type**
Security, and is defined at
Local Properties Layer

✓ Allow:

✓ Definition of parameters, based on type (e.g. QoS, Security, Performance, Characteristic, Consequence, etc.).

✓ Classification based on abstract layers (e.g. High-level requirements, local properties).

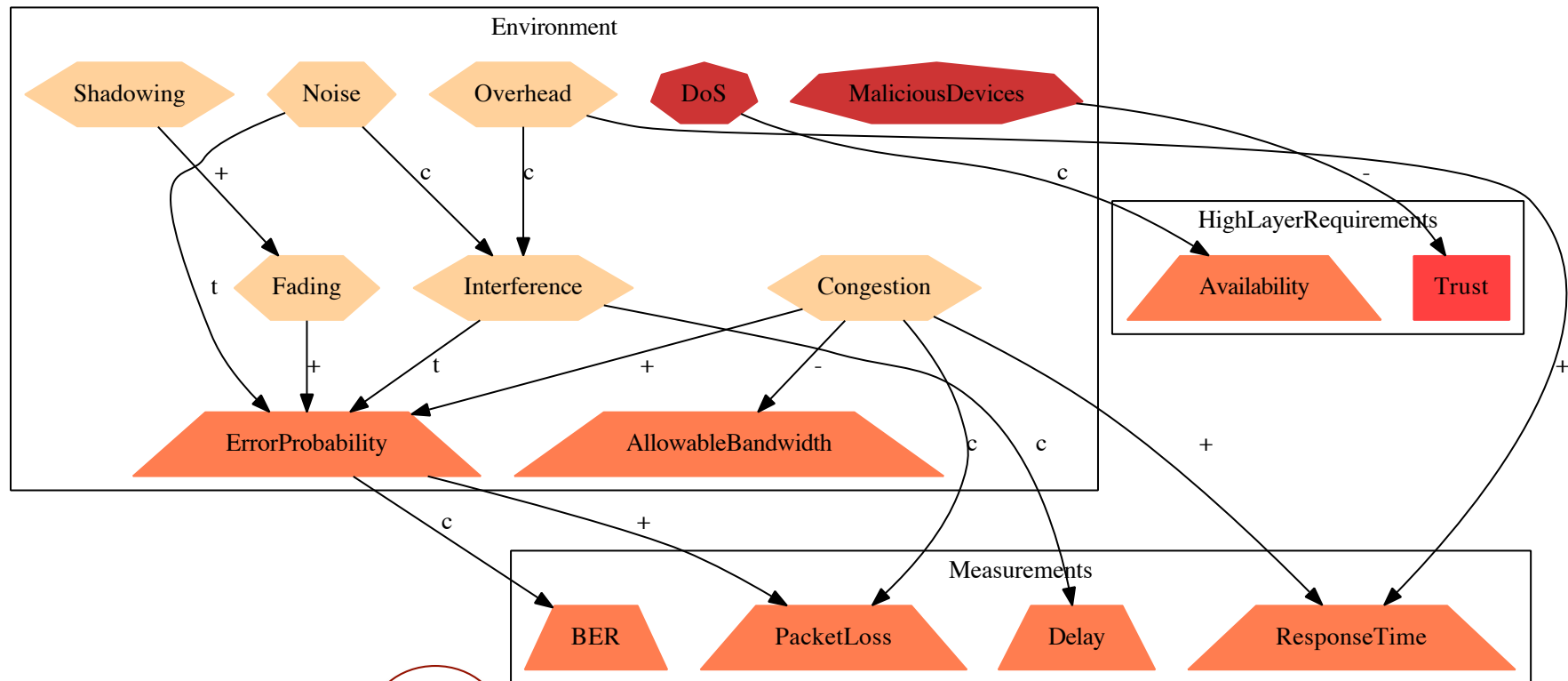
✓ **Results**

✓ **Dependence**, **influence** and **impact** between parameters.

✓ Recursive operations on matrixs and graphs

PARAMETRIC RELATIONSHIP MODEL (PRM)

EXAMPLE: A SECTION OF A PRM



PROBLEMS:

- ✧ STATIC BEHAVIOUR:
 - ✧ THE CONTEXT NEVER CHANGES
- ✧ DIFFICULT ADAPTATION
- ✧ LIMITED



1. Definition of **Context-based Parametric Relationship Model (CPRM)**

- **Based on PRM**
- **Components-based model**
 - Dynamic adaptation
 - Dynamic extraction of information
- **Contexts based on Weights**
 - Subjective and non-subjective values

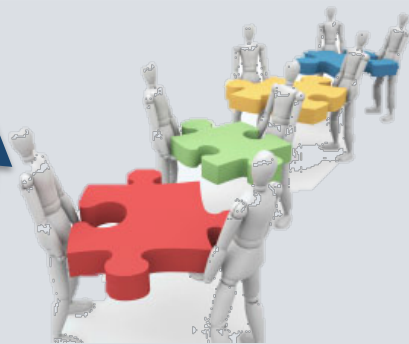


2. Implementation of a prototype in **Matlab**

- **CPRM-based systems Manager**

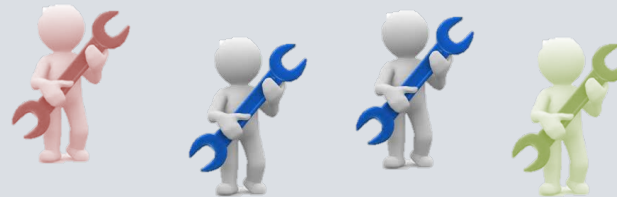
GENERAL OVERVIEW & COMPONENTS

Components

CPRMi**+PC****CPRM****+GC****PRM**

- Instance
- Inheritance
- Integration Rules

- Specialization, known of the final environment and mechanisms involved.



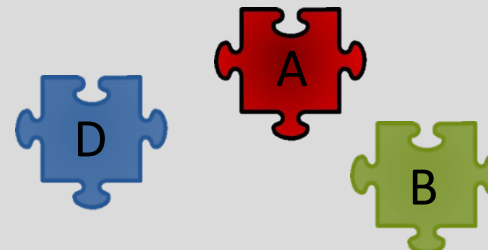
- Subjective & non-subjective values given as weights

- Objectives, priorities recognition and estimation of values
- Relevance of parameters



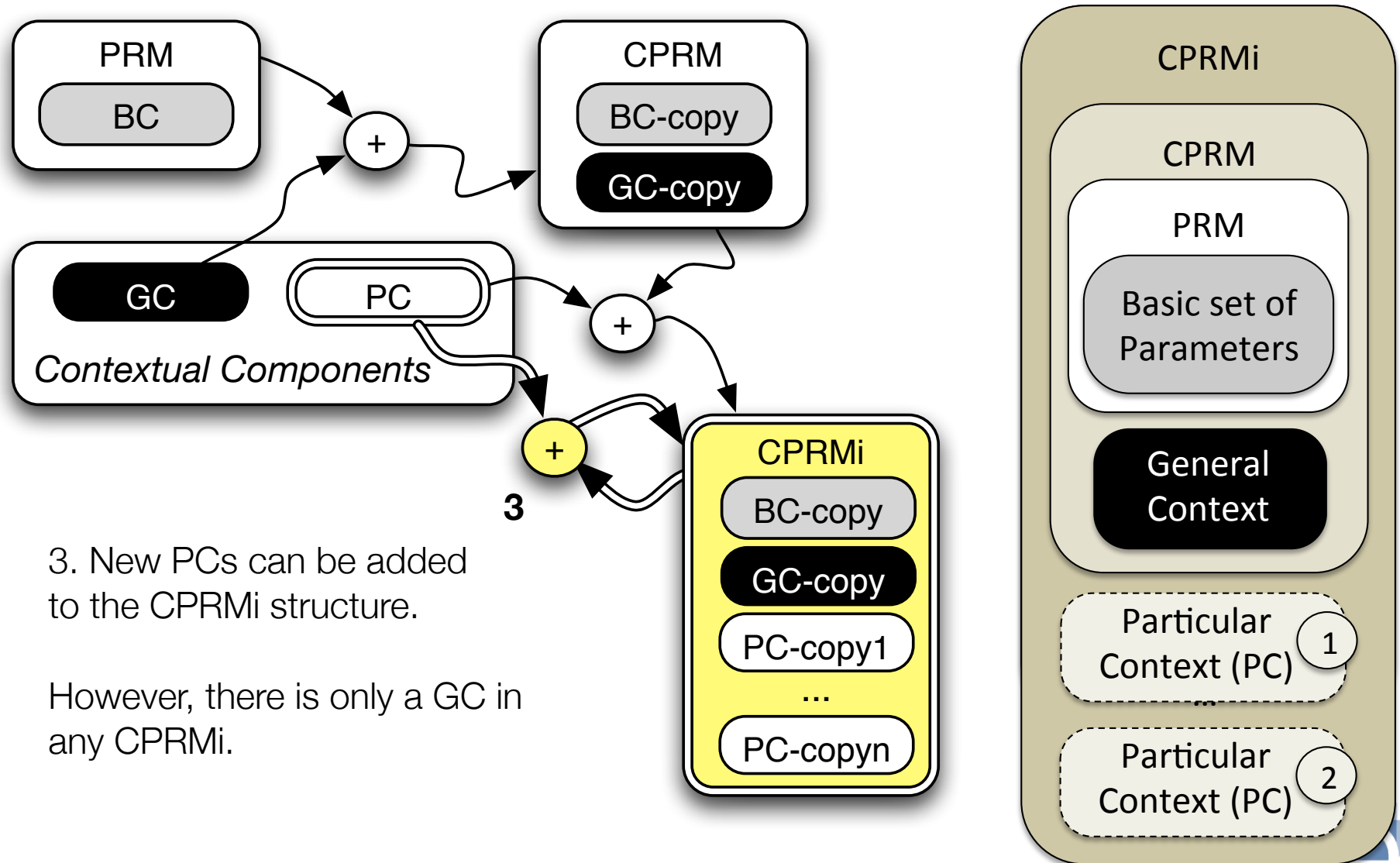
- Parameters
- Types
- Layers
- Operations
- Relationships

- State of the Art, Background, known of the problem.

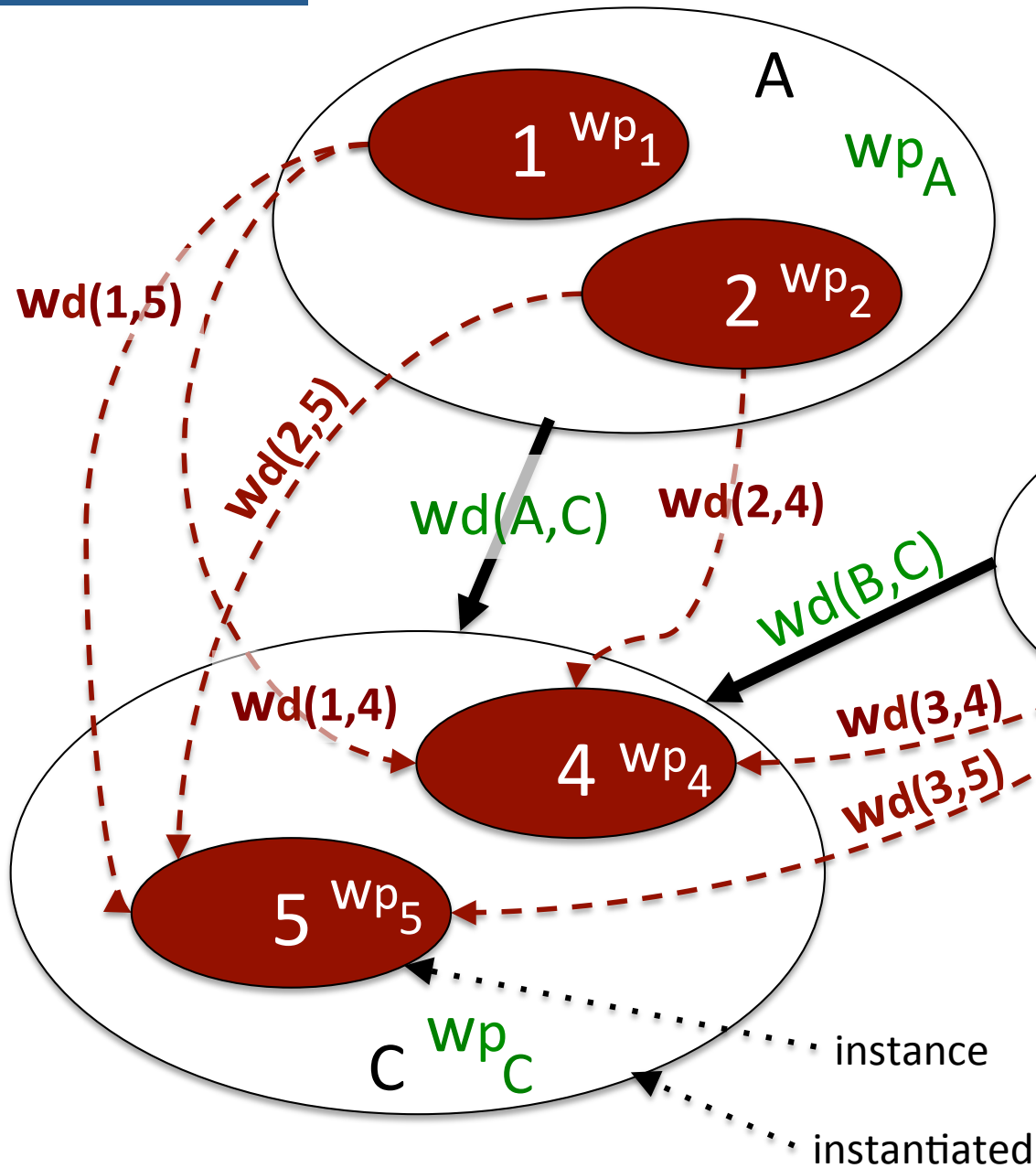


Context-based Parametric Relationship Model - CPRM

COMPOSITION OF MODELS (COMPONENTS)



EXAMPLE



PRM

CPRM

CPRMi

A	B	C	$\triangle A$	∇A
1	3	5	v1	v5
1	3	4	v2	v6
2	3	5	v3	v7
2	3	4	v4	v8

■ Rules

- Define the desired behaviour of the model.
- Focus:
 - Definition of Basic set of parameters (R1)
 - Inheritance P. Instantiated – P. Instance. (R3-R4)
 - Inheritance P. Instance – P. Instantiated. (R2)

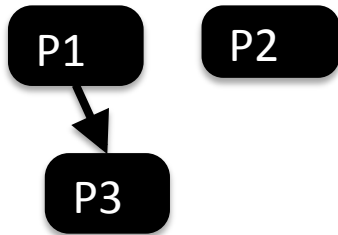
■ Action Rules (AR)

- Defined to maintain the coherence of the definition of the model, through the process of instantiation of the CPRM based on the PC.

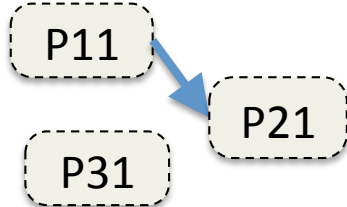
Context-based Parametric Relationship Model - CPRM

RULES AND ACTION RULES: EXAMPLE

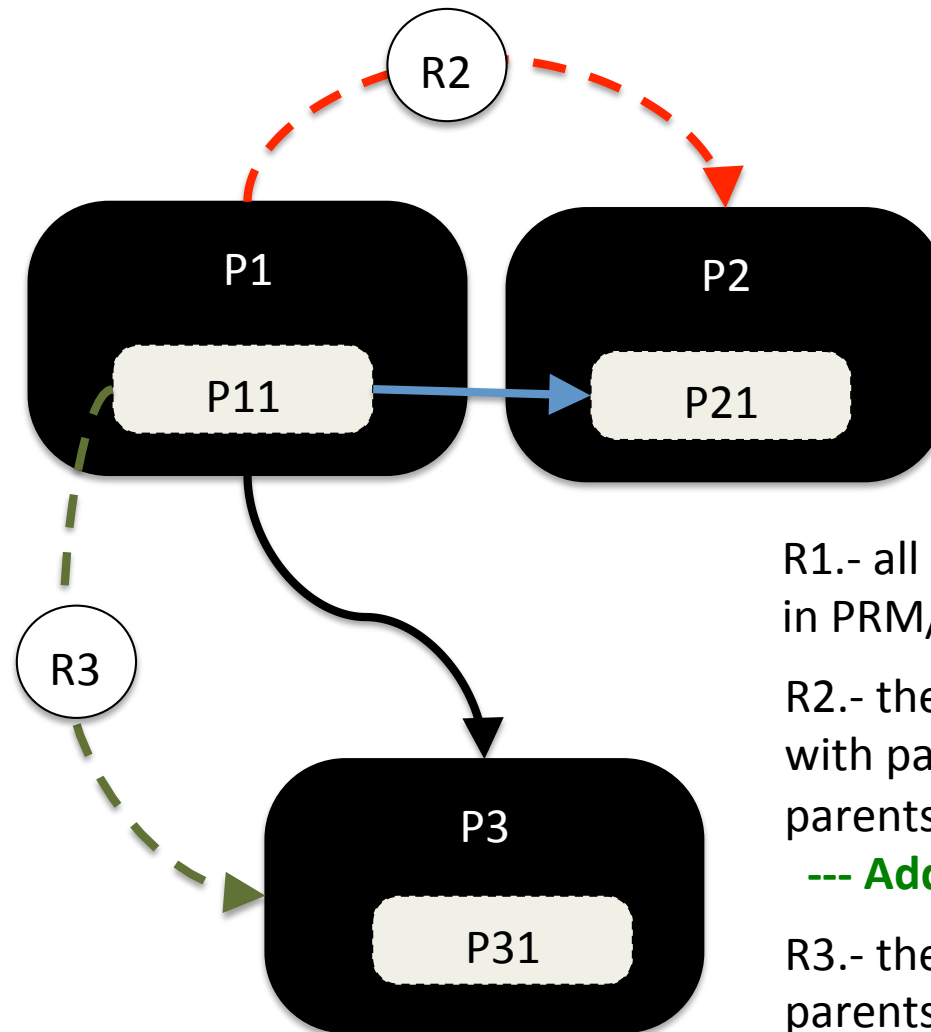
Defined in PRM/
CPRM:



Defined in PC/
CPRMi



P11, parents: P1
P21, parents: P2
P31, parents: P3



Defined by A2, to
satisfy R2:



Defined by A3, to
satisfy R3:



R1.- all the relevant parameters
in PRM/CPMR --- **OK**

R2.- the instances are related
with parameters known by their
parents. --- **WRONG**

--- **Add** $P1 \rightarrow P2$, $w(P1, P2)=0$

R3.- the instances inherit their
parents relationships
(applied during the calculations)

--- **Calculate:**

$P11 \rightarrow P31$

CPRM-based systems Manager

STEPS IN THE VIDEO

1. Load PRM
 1. Parameters and Relationships for Security and QoS tradeoff
2. Generate default GC based on PRM
3. Set GC in PRM (new CPRM)
4. Load Particular Context (PC):
 1. CAS and DAS (Authentication Mechanisms)
5. Set PC in CPRM (new CPRMi)
6. **Results**
 1. Check parametric tree CAS & DAS
 2. Check impact CAS & DAS



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