UNIVERSIDADE DO MINHO

NEWCASTLE UNIVERSITY

PhD

Modelling and simulating virtual environments

Literature review

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Summary

- Introduction and Objectives
- Modelling Literature
  - Context Approach Integration
- Simulation Literature
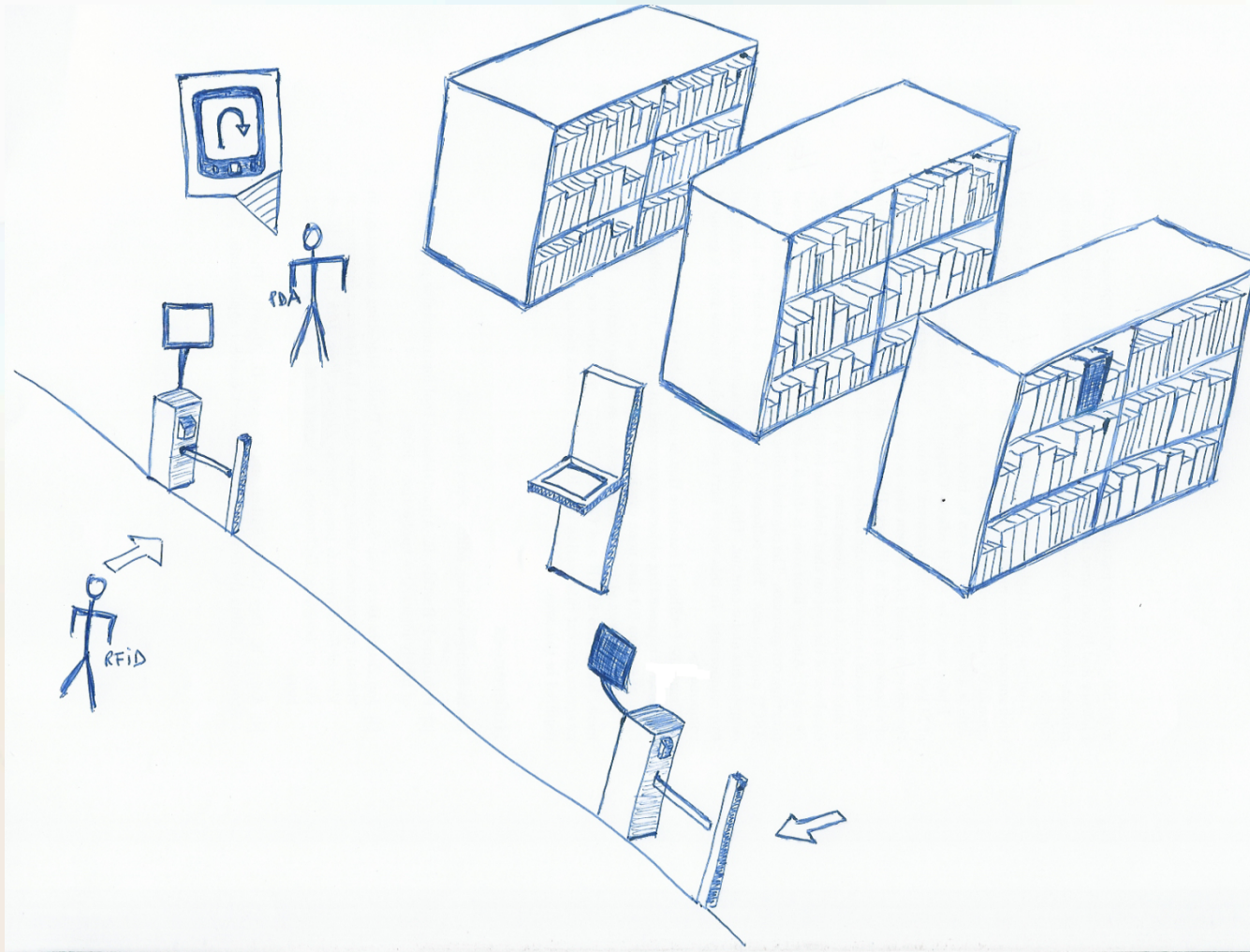- Discussion
- Direction for future work

Introduction and Objectives

- Context-aware applications
  - Personalized services to users through the integration of context
  - New challenges (distributed nature and use of sensors)
- Virtual environments
  - Modelling
  - Simulating

- Objectives
  - Study and compare existing relevant approaches
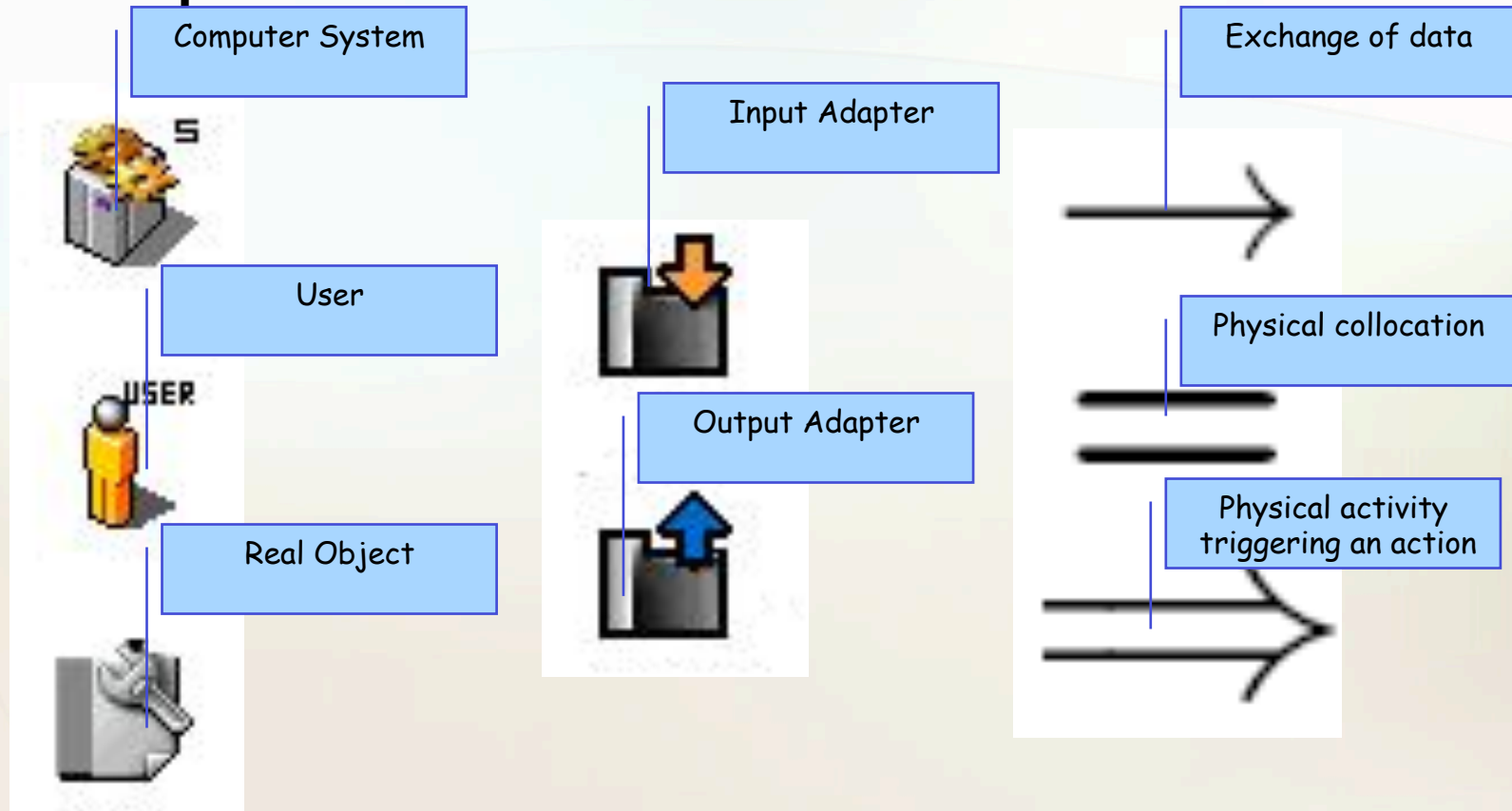 - Context integration

Modelling

➢ Modelling
  - ➢ is used to describe, analyse and reason about systems before implementation
  - ➢ Enables a more efficient construction
➢ Relevant approaches found
  - ➢ Hynets (Hybrid high-level Nets)
  - ➢ Flownets
  - ➢ ASUR++
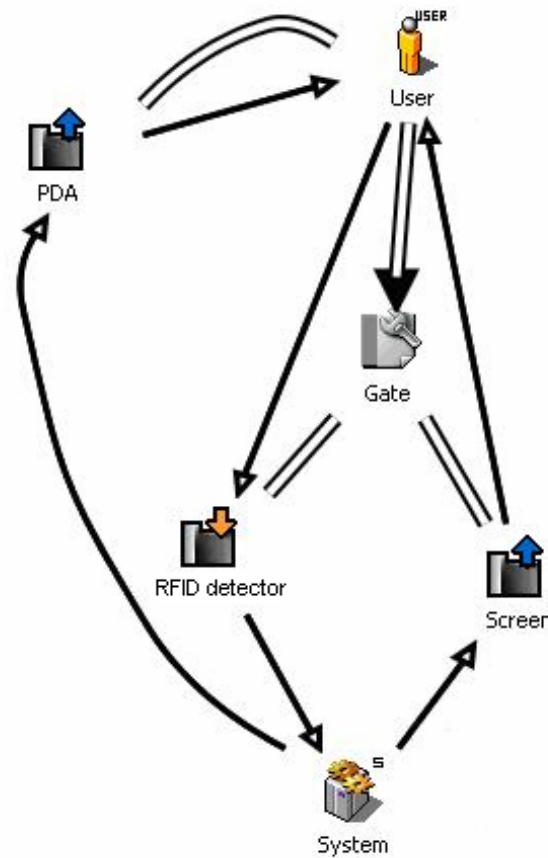 - ➢ ICO (Interactive Cooperative Object formalism)

Case Study

ASUR++

➢ ## Components

| Computer System | Input Adapter | Exchange of data |

| User | Output Adapter | Physical collocation |

| Real Object | | Physical activity triggering an action |

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Case Study using ASUR++
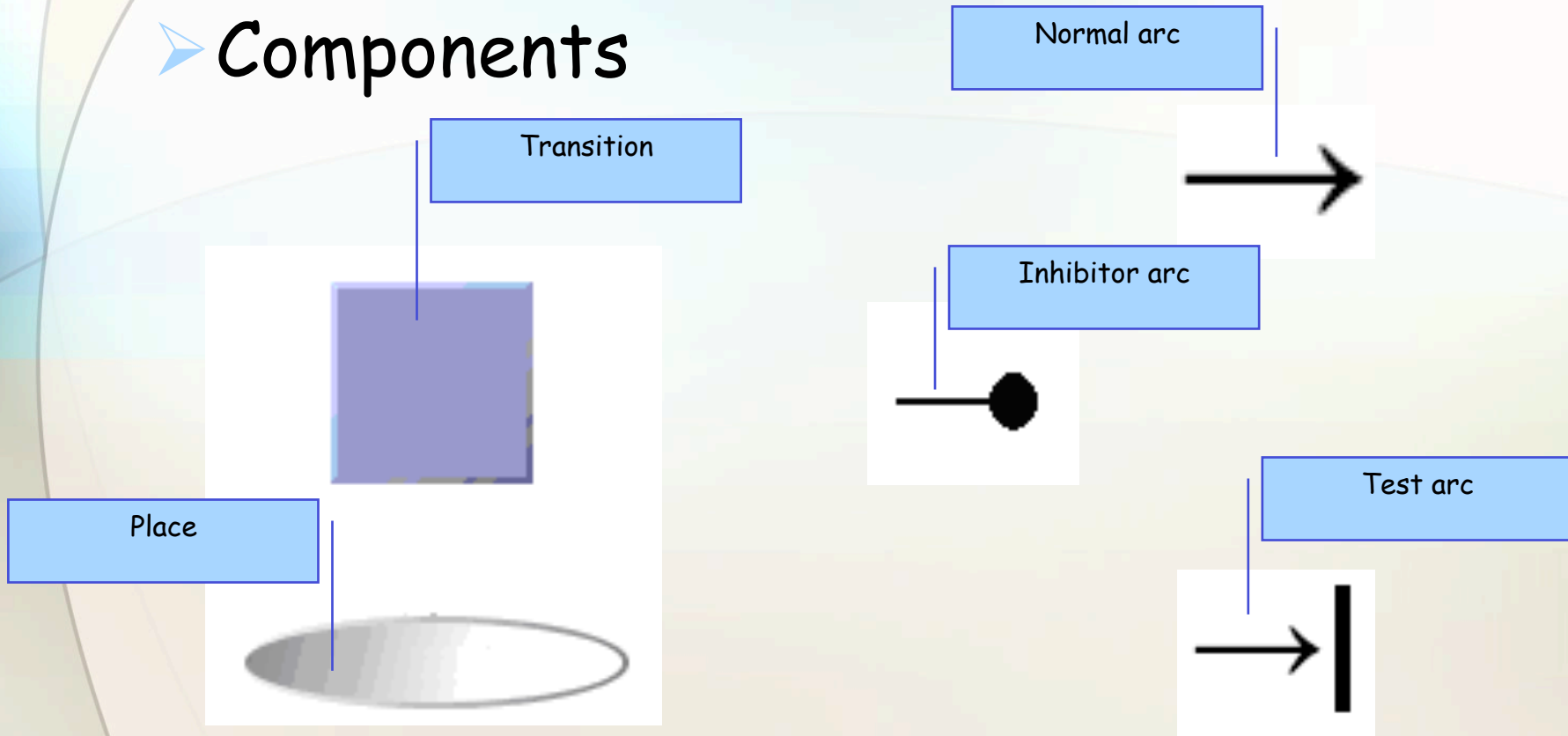
User arrives at entry gate

ASUR++ (analyse)

➢ Advantages

   ➢Provides a good architectural view

   ➢Think about design issues

   ➢Study the entities involved and the relations

   ➢Think about the transfer of information
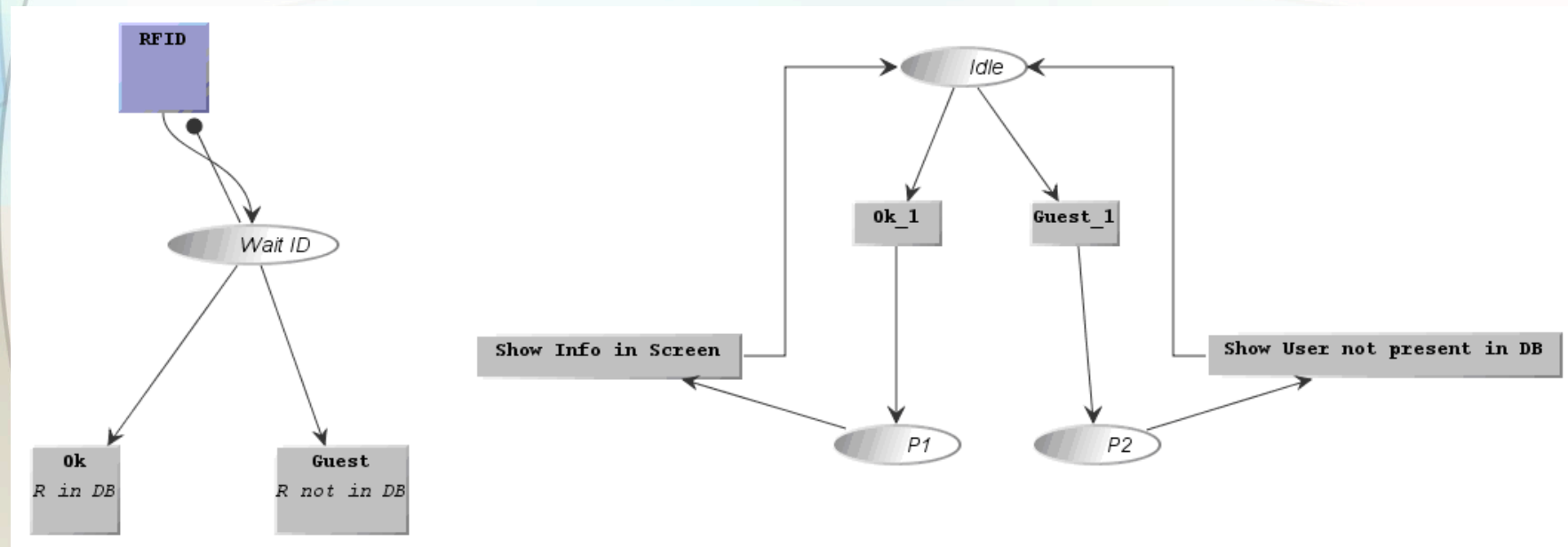
➢ Disadvantage

   ➢Don't model the behaviour of objects

ICO

➢ Components

Normal arc

Transition

Inhibitor arc

Place

Test arc

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Case Study using ICO

➢ User arrives at entry gate

ICO (analyse)

➢ **Advantages**

  ➢ Reason in a behaviour and structural level

    ➢ Animate models

    ➢ Check paths

  ➢ Describe the possible interactions

➢ **Disadvantages**

  ➢ Only models discrete part

  ➢ More appropriate to modelling interaction techniques

Flownets

➤ Components

Name	Symbol
State	
Transition	
Control arc	
Inhibitor arc	
Flow control	

Name	Symbol
Continuous flow	
Sensor	
Store	
Transformer	
External plug	

Case Study using Flownets

➢ User arrives at entry gate
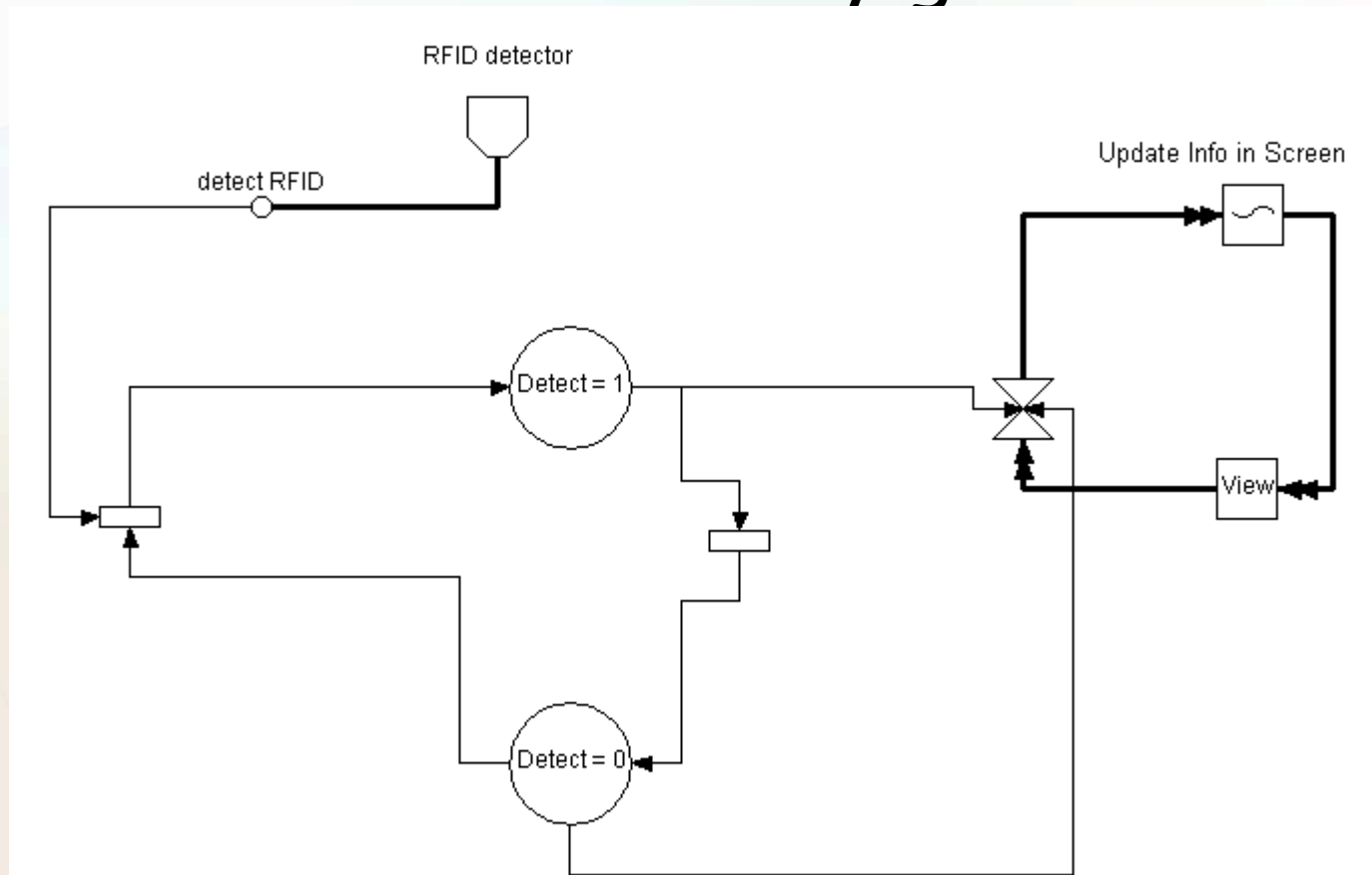
Flownets (analyse)

➢ Advantages

   ➢ Define the behaviour of system

   ➢ Add the capacity to represent the continuous part

   ➢ Using MAVERIK toolkit we also can animate the model

➢ Disadvantage

   ➢ "Complex"

Hynets

➤ **Components**

Place

Continuous arc

Discrete Transition

Inhibitor arc

Continuous Transition

Enabling arc

Standard arc
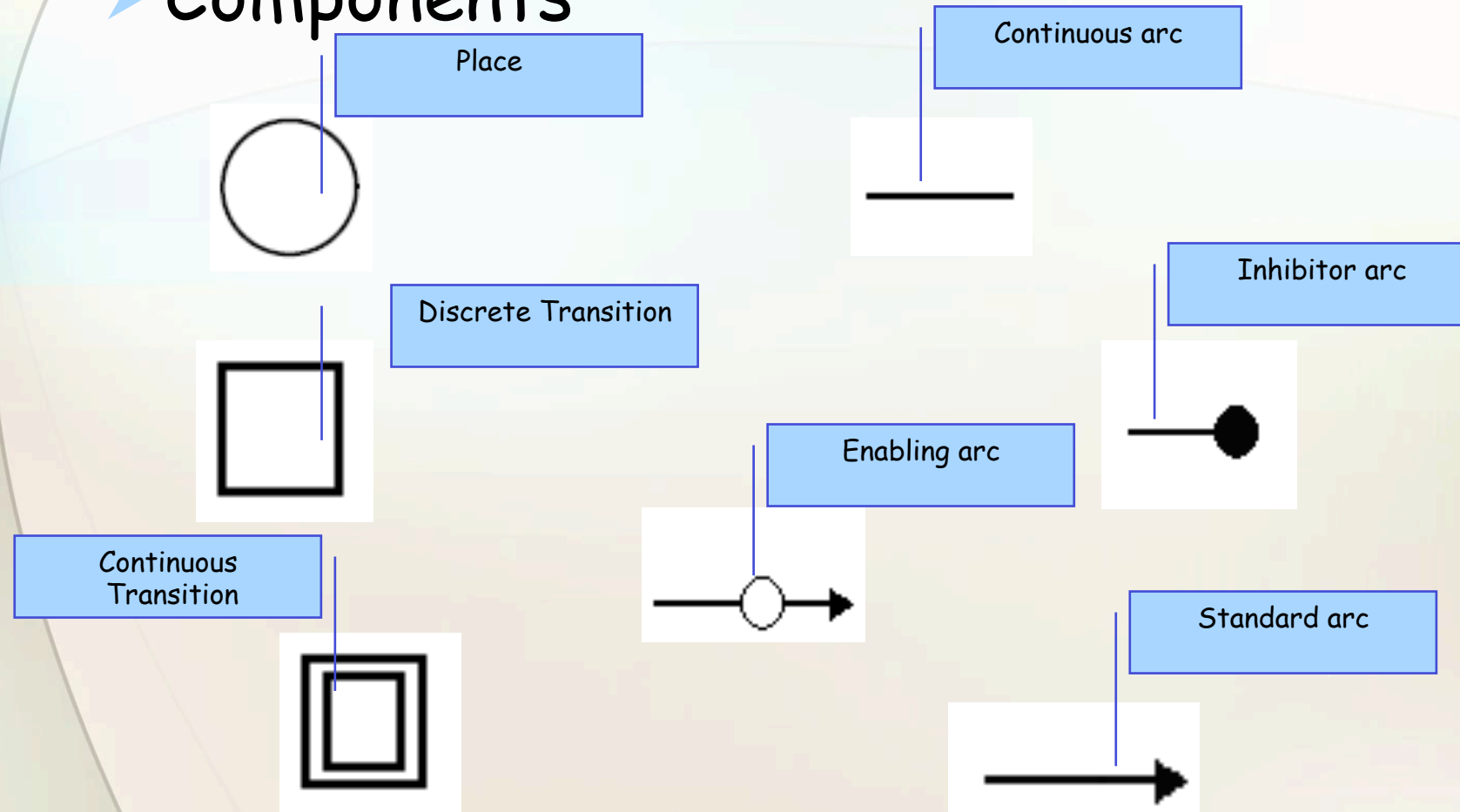
Case Study using Hynets

➢ User arrives at entry gate
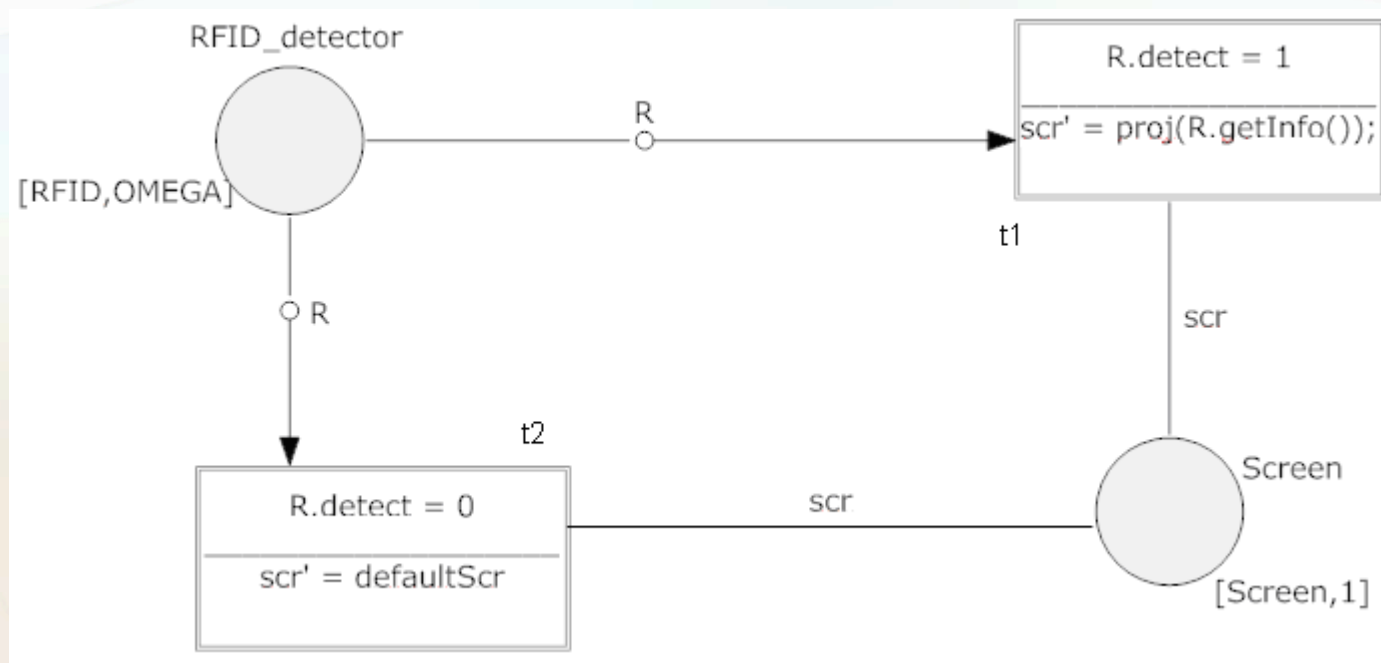
Hynets (analyse)

➢ Advantages
  ➢ Such as Flownets we can also deal with the discrete and continuous parts.
  ➢ Object oriented concept and hierarchical description
  ➢ Can deal with the time
  ➢ Can define the capacity of places
➢ Disadvantages
  ➢ Doesn't have editor
  ➢ Doesn't have tool that allow for the automatic verification of properties
  ➢ More complex

Representing the context

- ## 5W1H
  - ### Elements
    - Who, Where, When, What, How and Why
  - ### Categories
    - preliminary, integrated, final and conditional
- ## Context Toolkit
  - ### Context Widgets
    - Link the environment and the application

Modelling context in ICO
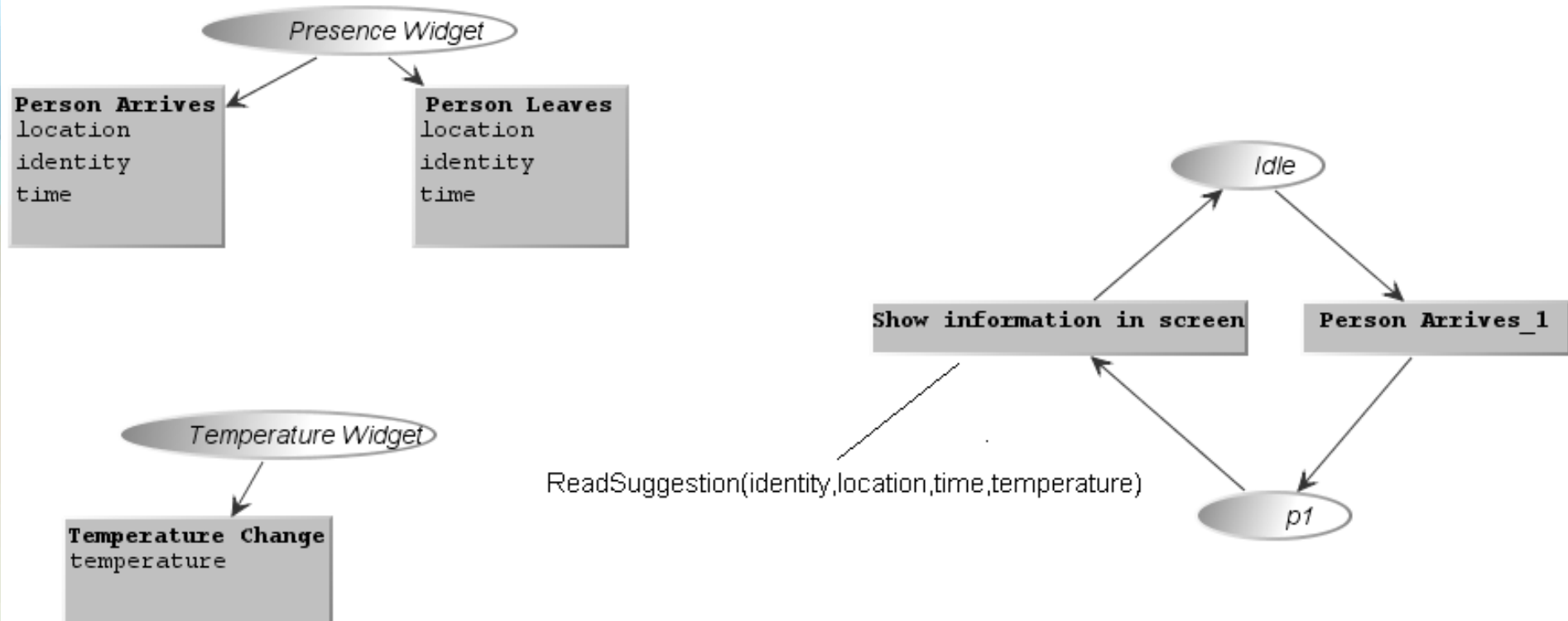
Modelling context in Flownets

Simulation

- Rapid user centred evaluation for context-aware systems
  - Platform using 3D virtual reality simulation
  - Used to test and evaluate usability and increase productivity in the development of context-aware services.
  - Reduce the risk involved in full scale deployment
- UbiWise
  - Used to develop and test hardware and low-level software for ubiquitous computing devices
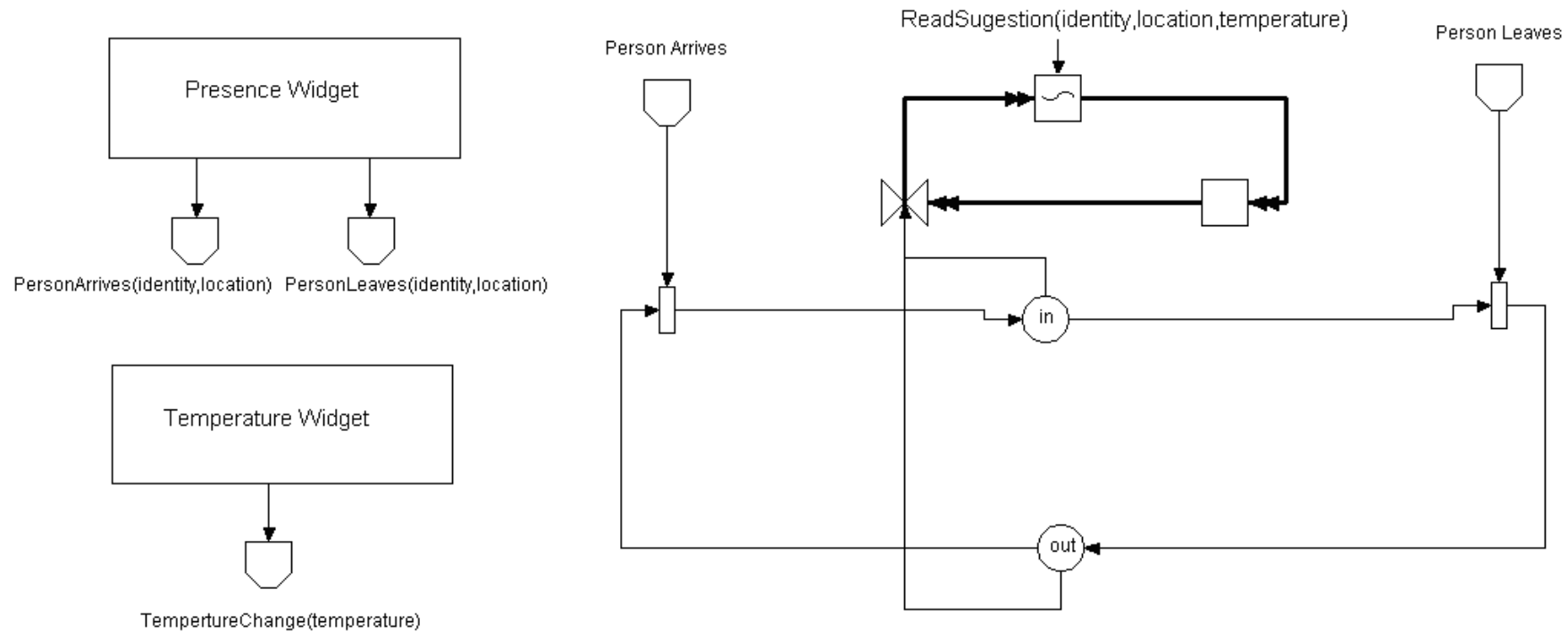 - Simulate the existence of devices in order to develop the systems that would run on them
- TATUS
  - Can simulate a ubiquitous application in a 3D virtual space
  - Allow the connection of software under test to the simulator
- UbiREAL
  - Can simulate Smartspace
  - Generate various contexts
  - Enable to confirm that a given ubiquitous application program runs as expected for all possible context patterns
- MAVERIK toolkit
  - Enables rapid production of complex virtual environments
  - Provides many functions valuable to developing applications with 3D graphics or using 3D peripherals

Discussion

➢ **Comparation of approaches**

    ➢ Architectural

        ➢ ASUR++   movement, relation and transfer

        ➢ Flownets abstract overview: but only input/output

        ➢ Hynets   abstract overview: relation between objects

        ➢ ICO   no architectural view

    ➢ Behavioural

        ➢ ASUR++   not described

        ➢ ICO   not separation of parts

        ➢ Flownets/Hynets

    ➢ Context

	ASUR ++	Flownets	ICO	Hynets
Formalism	-	Petri Nets	Petri Nets	Petri Nets
•Editor	GUIDE-ME	Marigold	PetShop	-
Dynamic models	No	No	Yes	No
Level of abstraction	Very High	Medium	Medium	Low
Hierarchical description	No	Yes	No	Yes
Interaction group	Yes	No	No	No
•Tool that allow for the automatic verification of properties	No	Yes	Yes	No
Level of Complexity	Low	Medium	Medium	High
Physical/input device interaction modelling	Yes	Yes	Yes	Yes
Logical interaction modelling	No	Yes	Yes	Yes
Dialogue Modelling	No	Yes	Yes	Yes
Rendering Modelling	No		Yes	Yes
•Separation of continuous and discrete parts	No	Yes	No	Yes
Modelling perception of information by user	Yes	No	No	No
•Description of internal behaviour	No	Yes	Yes	Yes
•More appropriate to modelling	Relation of physical objects	Continuous systems and Interaction techniques	Interaction techniques	Continuous systems and Interaction techniques

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Directions for future work

- Work in simulation approaches
- ASUR++ and Flownets/ICO combination
- More work in Context integration of modelling approaches

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Thank you!

Questions

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