IST BASIC RESEARCH PROJECT
SHARED COST RTD PROJECT
THEME: FET DISAPPEARING COMPUTER
COMMISSION OF THE EUROPEAN COMMUNITIES
DIRECTORATE GENERAL INFSO
PROJECT OFFICER: JAKUB WEJCHERT

Global Smart Spaces

Training Course: Global Smart Spaces

D 21

15/01/2002 VERSION 1

ALL PARTNER SITES

IST Project Number	IST-2000-26070	**Acronym**	GLOSS
Full title	Global Smart Spaces		
EU Project officer	Jakub Wejchert		

Deliverable	**Number**	D	**Name**	Training Course: Global Smart Spaces (Version 1)		
Task	**Number**	T	**Name**	(n/a)		
Work Package	**Number**	WP 3	**Name**	Interaction Archetypes		
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Abstract (for dissemination)	Document present version 1 of the training course on global smart spaces. The course as presented in the attached powerpoint slides describes the basic tools used in GLOSS to build smart spaces. The revised version to be presented in PM 22 will introduce design guidelines for both the physical spaces and software architecture.					
Keywords	Training Course					

Preface

The course attached here represents a description of the **tools** developed in GLOSS to investigate and build Global Smart Spaces. The course outlines the Trails, Radar and Hearsay model and describes the context structure we are using.

Due to the withdrawal of STARLABS and the subsequent delay in the work packages this course is presented here as version 1 in the form of a 2 hour tutorial. Following the successful completion of a number of delayed work-packages we will be extending the material to include physical space guidelines and software guidelines. We will also be including an overview of the archetypes model proposed in GLOSS. We expect this to be finalized in project month 22.

[Course on Separate file- SmartCourseVersion1.pdf]

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The consortium

The University of Strathclyde	Event systems, code mobility, and policy driven adaptation
Trinity College Dublin	Programming languages construction
STARLABS	ICT information technology in architecture/physical environments
The University of St Andrews	Distributed, mobile and persistent computing
Université Joseph Fourier	Plasticity of user interfaces

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The concept

"*To exploit the convergence of distributed systems technology, networking technology, and user interfaces to realise the reactive,* ***global smart environment****."*

But what does this actually mean …

… we want to build middleware

… that supports context based adaptation

… across arbitrary boundaries

… that takes account of physical environment

… with an underpinning theory of context, mobility and interaction

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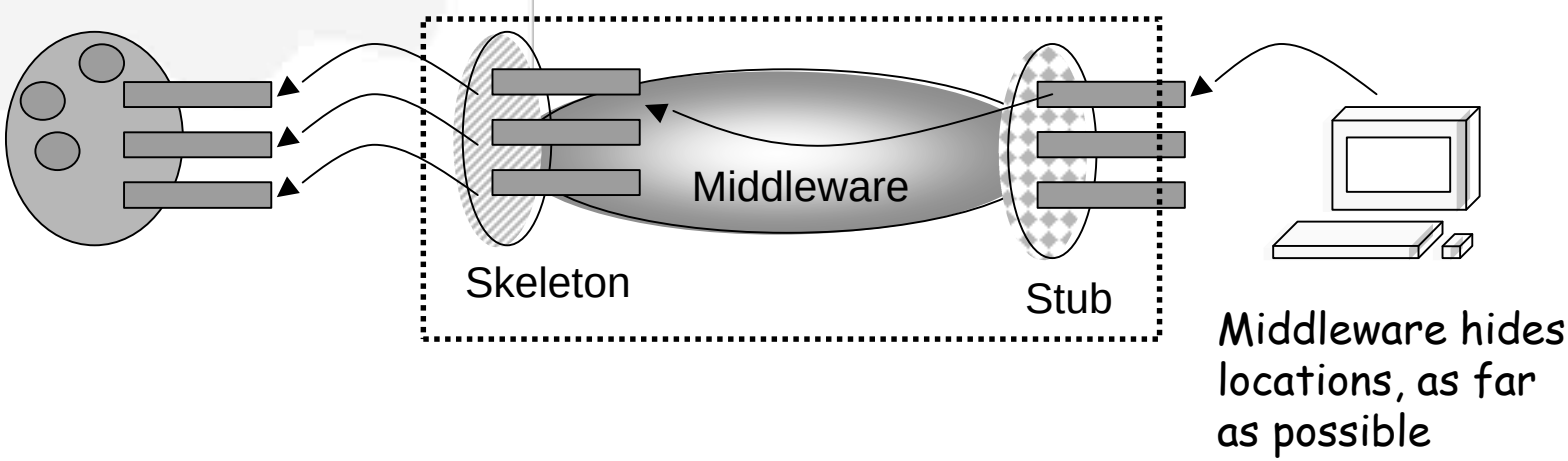
Distributed systems



The goal of location transparency has been assiduously pursued

- The web, CORBA, e-mail, …
- Remove significance of – and usually any knowledge of – the (absolute or relative) locations of agents in a system
- Allow arbitrary interactions

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Smart what?

Bringing computing into real space

- Infrastructure – wireless networks, sensors, locators, actuators, …
- Appliances – cellphones, palmtops, enabled artefacts, …
- Applications – user-, context- and location-sensitivity

“Space is the computer”

- In the sense that actions in space cause information to be processed with no explicit interaction with the underlying IT
- The applications should “just happen”, supporting the normal run of activities within the space

Much inspired by the work of Bill Hillier and his group on the analytic architectural theory (Hillier, “Space is the machine”, CUP, 1996)

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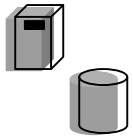
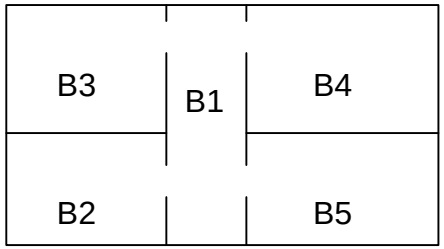
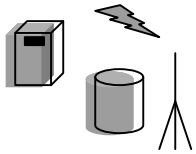
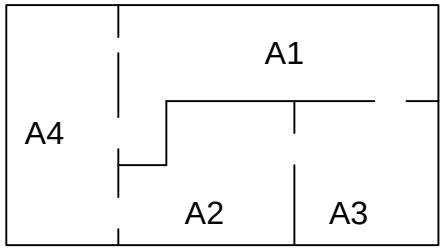
Dimensions of a system

Physical



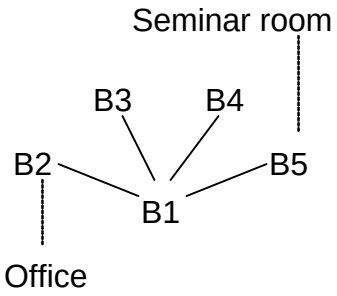


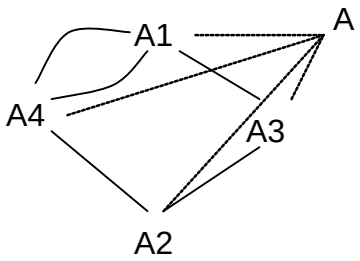




Devices

Topology

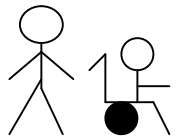




Organisation

Industrial Acme Inc
- Acme Widgets
- Acme Floobits

Nocturnal Aviation Ltd
- Information gathering
- Personal smearing
- Money laundering



Personal

Intranet

External web

Information

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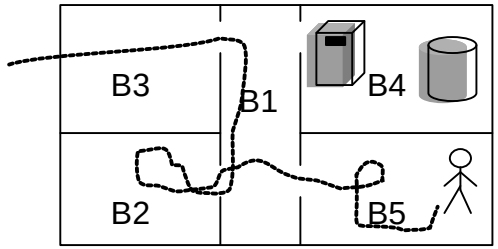
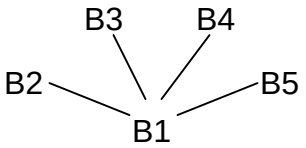
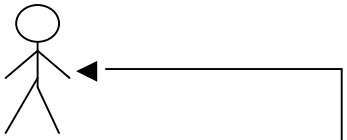
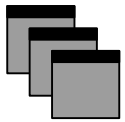
Relationships



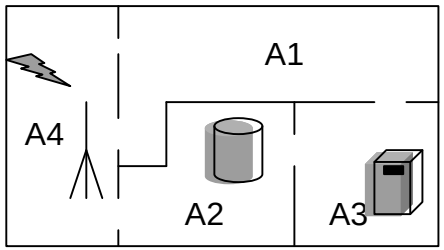


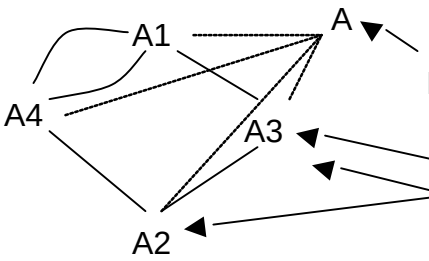




Intranet

External web





Nocturnal Aviation Ltd
Information gathering
Personal smearing
Money laundering

Policy

"Only a person working for Nocturnal Aviation can see the intranet"

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Synthesis

Each dimension of the system defines a particular part of its behaviour, with the dimensions inter-related

- A person's location affects the tasks they may (preferentially) perform
- A person belongs to an organisation, and that affects the information they should be able to access

Many current systems hard-wire some of these dimensions together, weakening their capabilities

- If you're off-site, you're an enemy; if you acquire this information, you can keep it; if you're in here, you belong

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The approach

(1) the precise understanding of how services are used and how users interleave various contexts during usage;
(2) the natural representations of these usage patterns and contexts via narratives;
(3) the development of a novel programming and the supporting systems infrastructure for narrative representations and execution;
(4) evaluation of interactions realised with the new infrastructure across three geographical distributed spaces.

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First deliverable

Interaction archetypes [STARLABS] –

"This work package will study how people interact with physical environments, how they utilise space and flow for communication and collaboration and to derive archetypes of interaction that can be used in the design of devices."

- We are interested in movement between/within three domains: private, public, and semi-public spaces.
- We want to support interleaving in time of private, public, and semi-public interactions within the three types of space.
- To develop an understanding we have developed three modelling tools and some supporting technologies …

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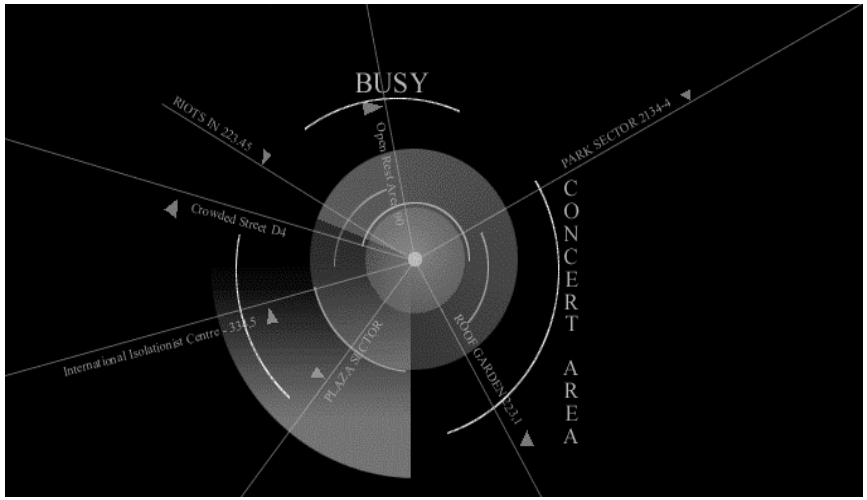
The tools - Radar

Radar: This is a tool that will give you an overview beyond the immediate environment. With this tool you will be able to locate low and high densities, crowds and groups in a larger area.

Ambience viewer:

- Location/map driven access to sensor information [Grenoble/TCD]
- Swiping device gives profiled information [Grenoble/TCD]



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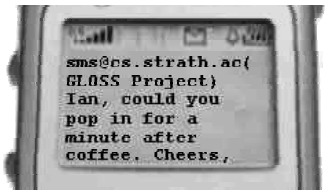
The tools - Hearsay

Hearsay: Hearsay is an intimate, sensitive tool that will be there to allow the user to pick up small notes in the environment left for them, provided that the context is right.

Hearsay application allows text messages to be received by individuals when in suitable location [Strathclyde].



Sample message (simulated screen image).

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The tools - Trails

Trails: We propose a Trail that is plastic, a trail that changes, grows and evolves with you. A morphic Trail that guides you in your daily life. This is also a tool to be shared with other people. Trails could be borrowed, given, bought or swapped.

•Trails gathering support tools.

- GPS/Handheld data collections tool [St.Andrews]
- Trail matching [Strathclyde]

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The tools - Trails

Three distinct varieties of trails were identified:

- **Observational trail**
  - An observational trail is an *ordered sequence* of observations of a person or artefact, each recording a time, a place and optionally some additional information.
- **Archetypal trail**
  - An archetypal trail can be visualised as a *directed graph* of places, together with some associated information and a recommended order for visiting them. The archetypal trail is a *directed graph* rather than a *sequence* to cater for alternative sub-routes depending on user preferences.
- **Intentional trail**
  - The intentional trail is an *unordered set* of places with associated information linked by theme. (e.g. A Scotch Whiskey Trail)

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The next steps

Key observation: Normal activity in every day interactions are a mixture of **task driven** and **activity driven.**

These two models are considered to be incompatible.

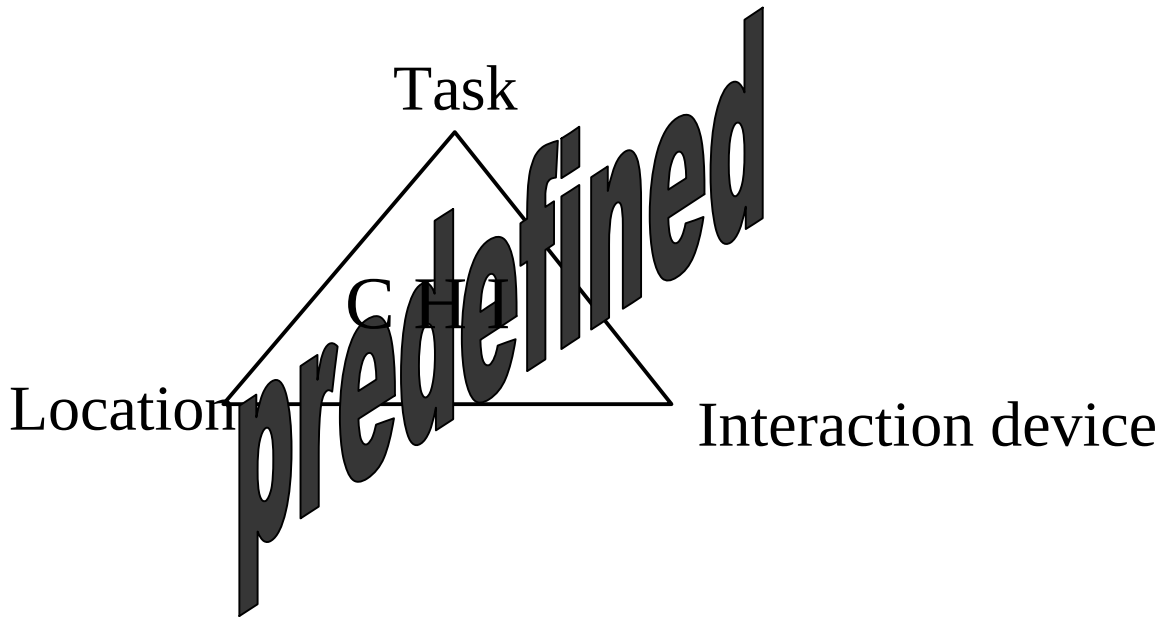
To achieve consistency of experience in GLOSS we need to **bridge** these two models.

Modelling of context

•So we have constructed a set of “archetypes” of interaction and developed a scenario.

• Next we have constructed a preliminary computational model of context.

Problem



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Problem

Context

- Profusion of interpretations
- Lack of models
-
  - Upstream design
  - Software design
  - Technical Implementation

Context :

User U, Task T, Time t,

Context(U,T,t) = ? (Situation(U,T,t_0) … Situation (U,T,t))

t_0 = time of reference

Situation (U,T,t) = Set of the states of peripheral variables and relation between those variables.

Peripheral variables = Entity n*ot central* to the task T at time t **but** likely to influence.

Granularity of time and task is free

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Peripheral variables : typology

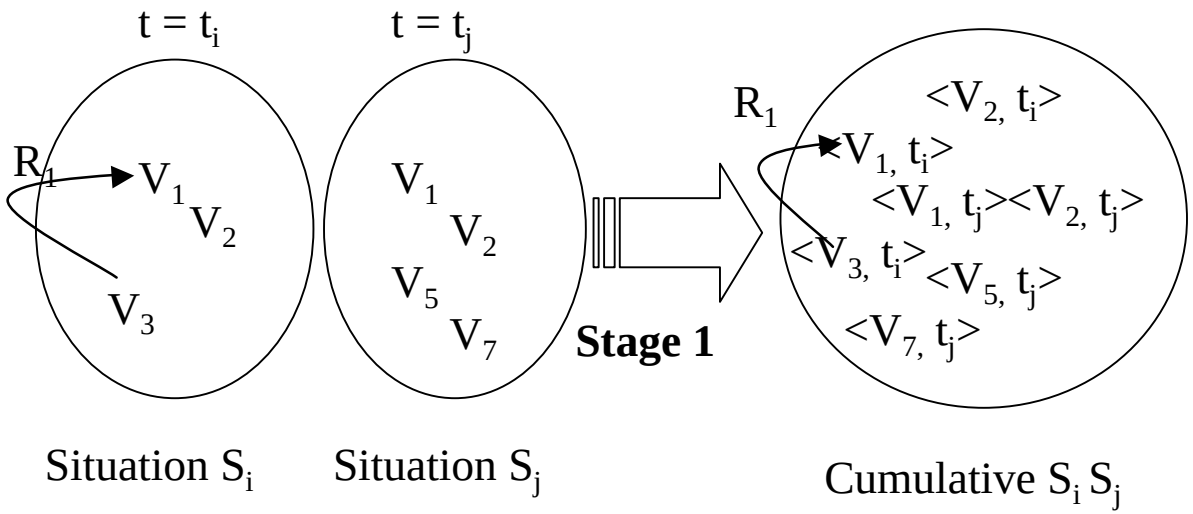
4 dimensions

- Physical
- Social
- System
- User

Context : Cumulative function

Context (U,T,t) = *Cumul*(Situation(U,T,t_0) … Situation (U,T,t))

Cumulative = (labelling+ union) + …



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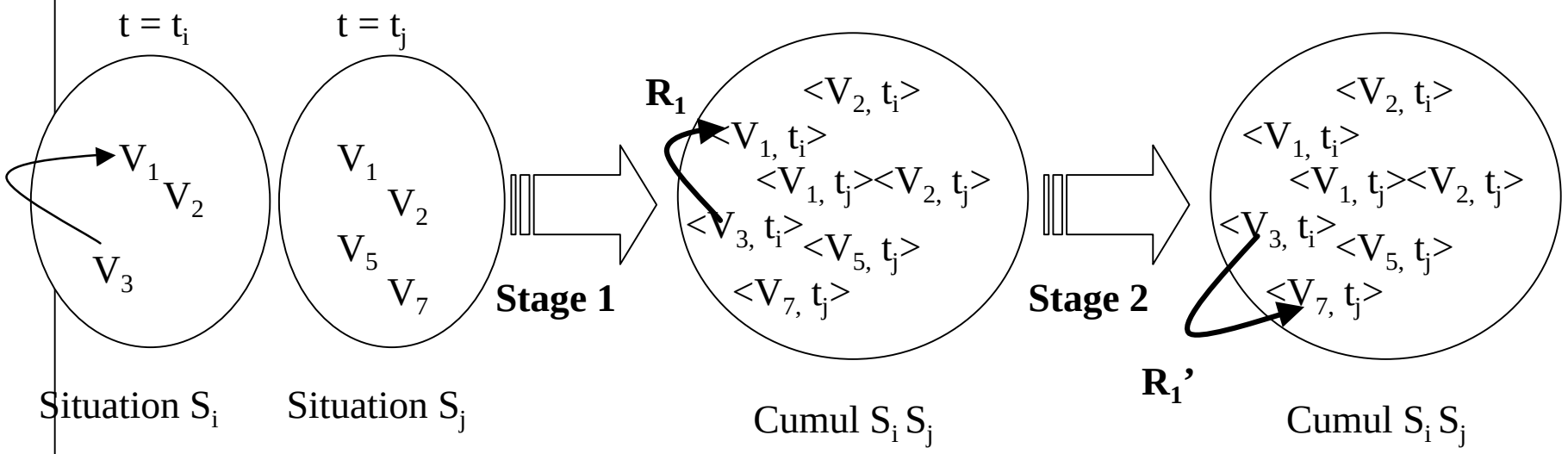
Context : Cumulative function

Context (U,T,t) = *Cumul*(Situation(U,T,t_0) … Situation (U,T,t))

Cumulative = (labelling + union) + rehandling



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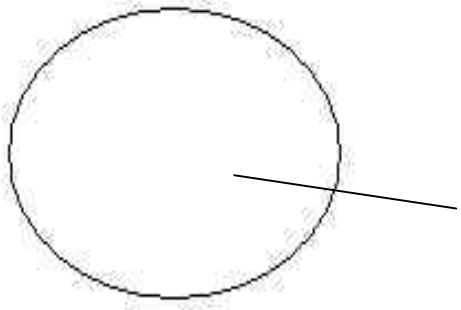
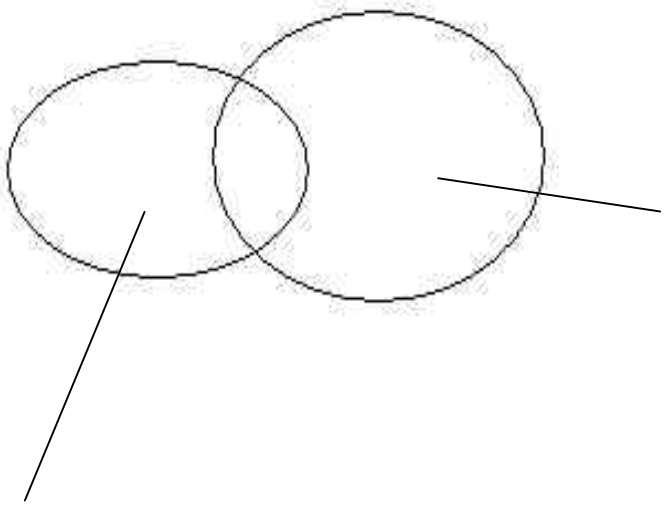
Context : point of view



User Context

http://www.gloss.cs.strath.ac.uk/

Context : point of view



User Context

System Context

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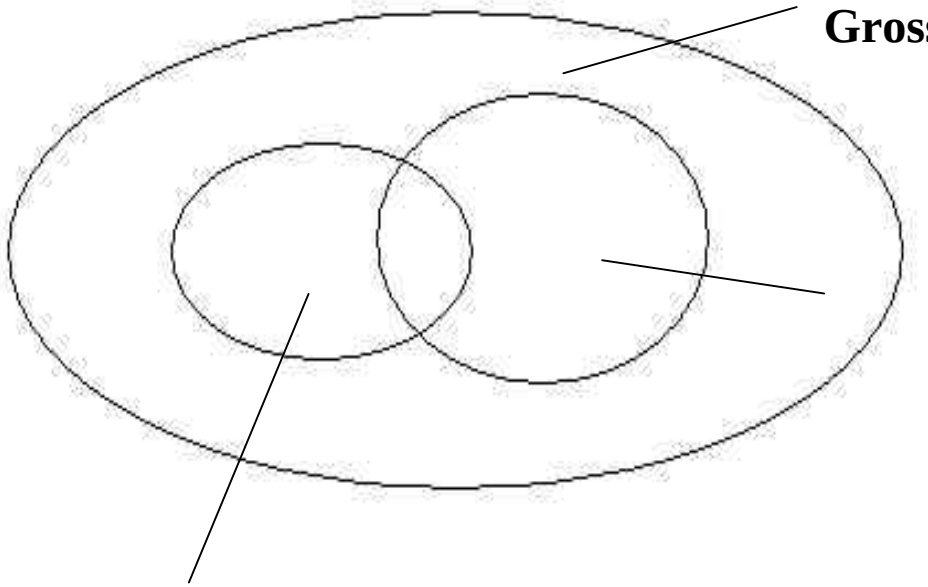
Context : point of view



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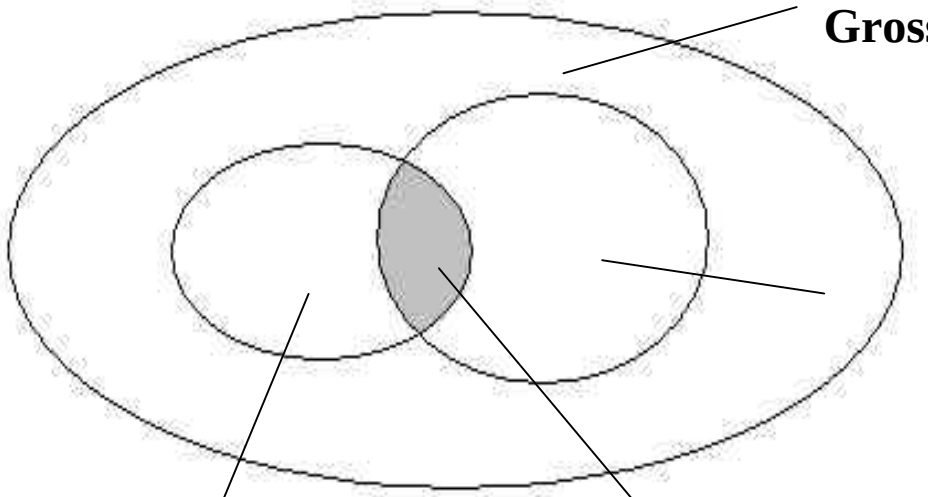
Context : point of view



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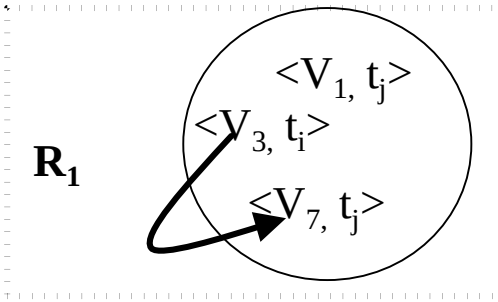
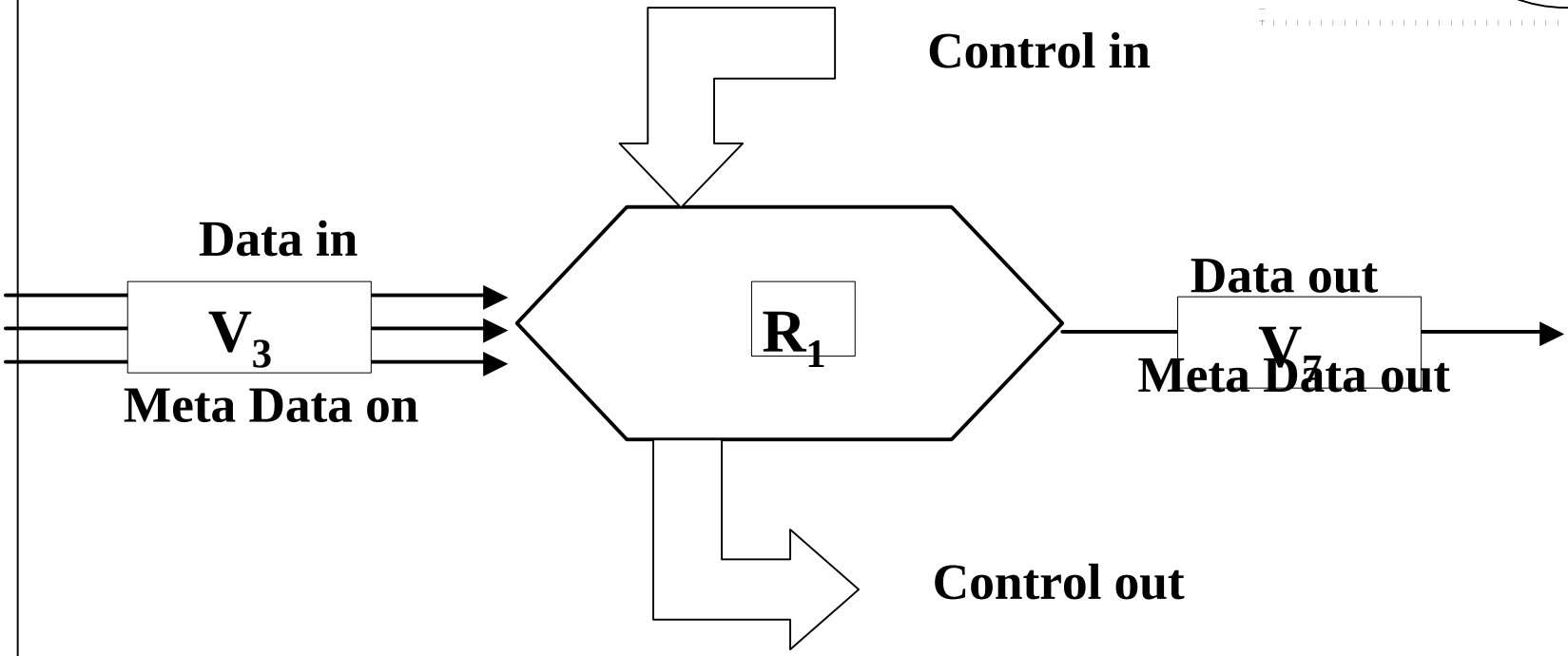
Contexteur : definition

Software abstraction





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Contexteur : properties

Reflexivity

Dynamic modification of the behaviour (flow of controls)

Remanence (loading & dynamics stopping)

Multiple instantiation

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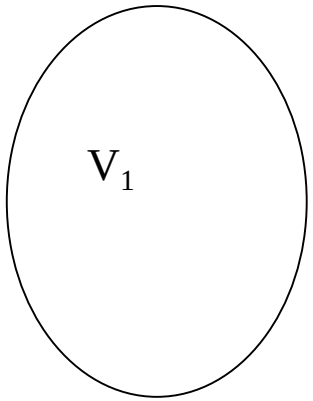
Contexteur : typology

Type of contexteur	Direct connection with a sensor	Number of input	Number of output	Type of data in	Type of data out
Elementary	Yes	0	1	-	X
Memory	No				
Threshold	No				
Translation	No				
Fusion	No				
Extension	No				

- Encapsulate a sensor
- Equivalent with the context-widget model
- Represent a variable



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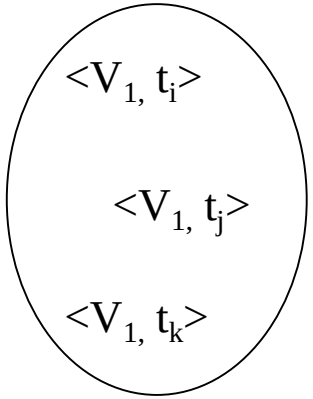
Elementary	Yes	0	1	-	X
Memory	No	1	1	X	{X}
Threshold	No				
Translation	No				
Fusion	No				
Extension	No				

- Represent labelling



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Elementary	Yes	0	1	-	X
Memory	No	1	1	X	{X}
Threshold	No	1	1	X	Boolean
Translation	No				
Fusion	No				
Extension	No				

- Evaluate a test of threshold

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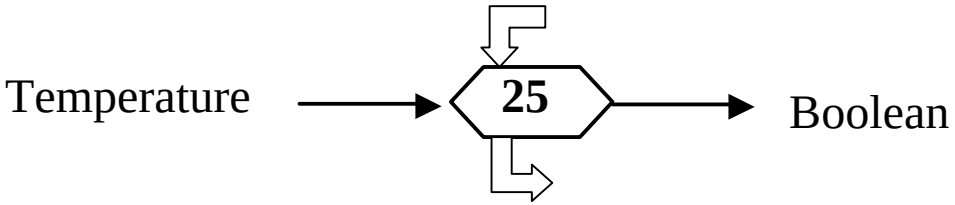

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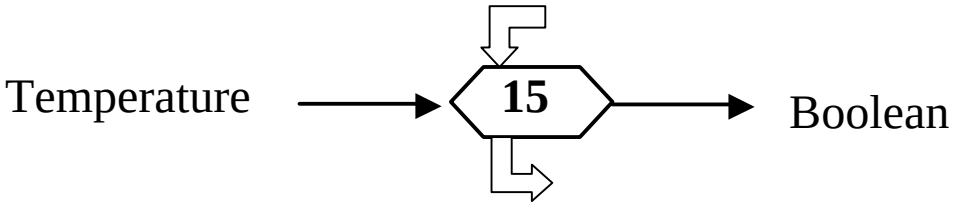

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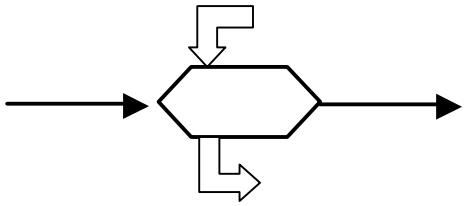
Contexteur : typology

Type of contexteur	Direct connection with a sensor	Number of input	Number of output	Type of data in	Type of data out
Elementary	Yes				
Memory	No				
Threshold	No				
Translation	No	1	1	X	X
Fusion	No	2 ou +	1	X,X	X
Extension	No	1 ou +	1	X,Y	Z

- Change unit of the data

Temperature in degrees Celsius



Temperature in degrees Fahrenheit

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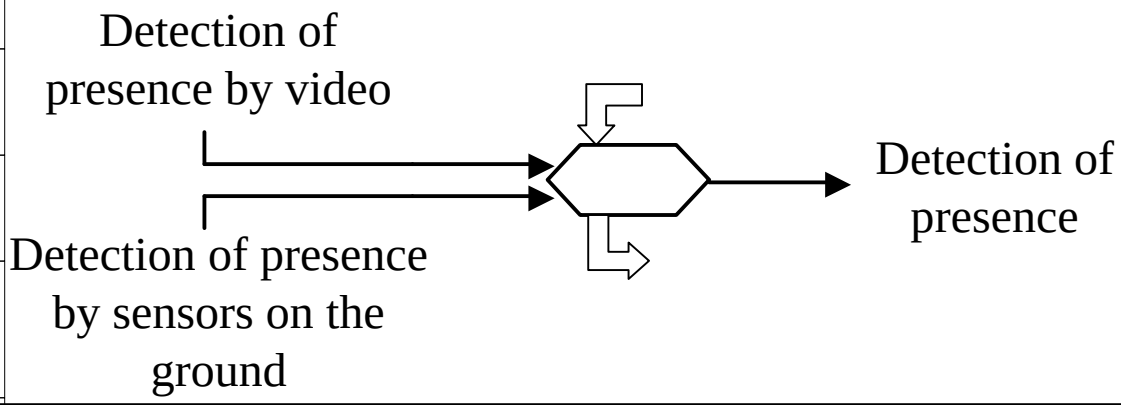
Contexteur : typology

Type of contexteur	Direct connection with a sensor	Number of input	Number of output	Type of data in	Type of data out
Elementary	Yes				
Memory	No				
Threshold	No				
Translation	No				
Fusion	No	2 ou +	1	X,X	X
Extension	No	1 ou +	1	X,Y	Z

- Improve Meta data



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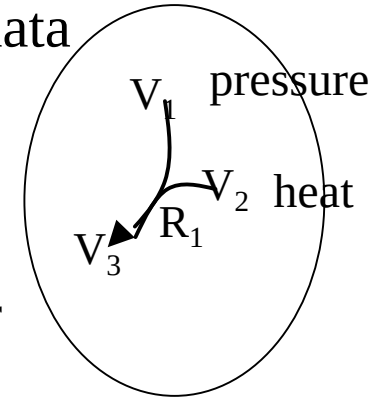
Contexteur : typology

Type of contexteur	Direct connection with a sensor	Number of input	Number of output	Type of data in	Type of data out
Elementary	Yes				
Memory	No				
Threshold	No				
Translation	No				
Fusion	No	2 ou +	1	X,X	X
Extension	No	1 ou +	1	X,Y	Z

- Different composition of the data
- Create new informations



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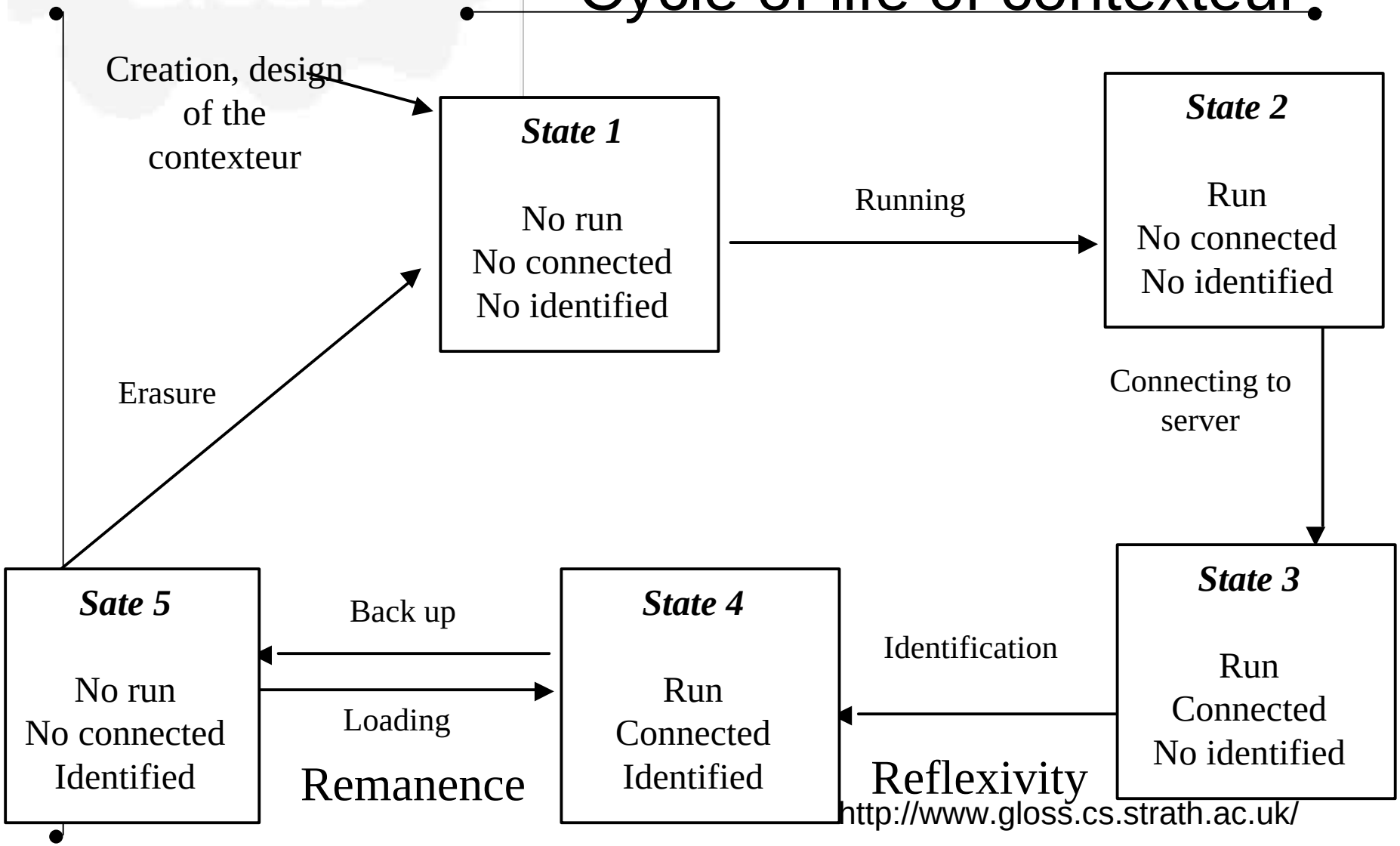
Server of contexteurs

Cycle of life of contexteur



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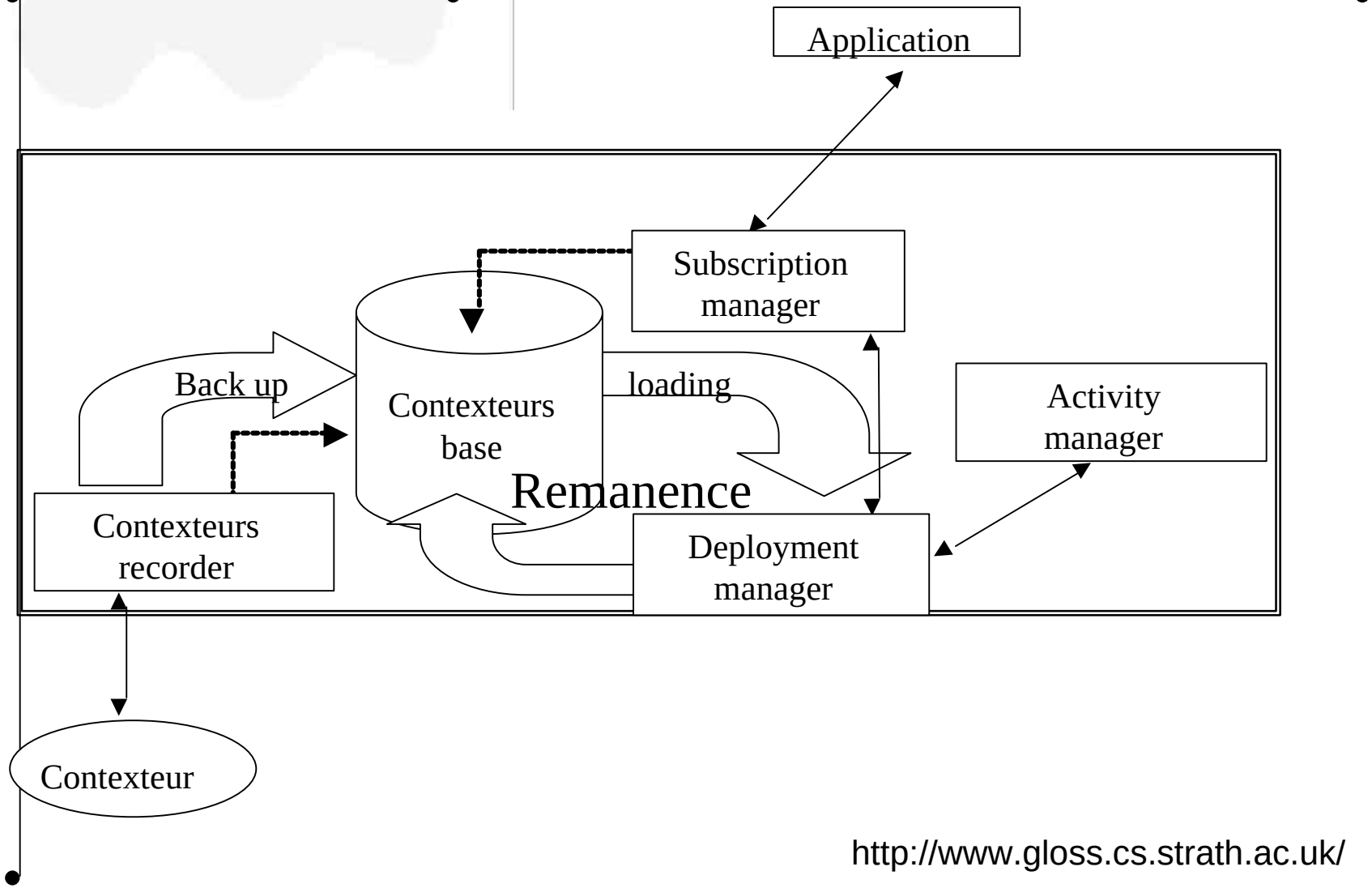
Server of contexteurs



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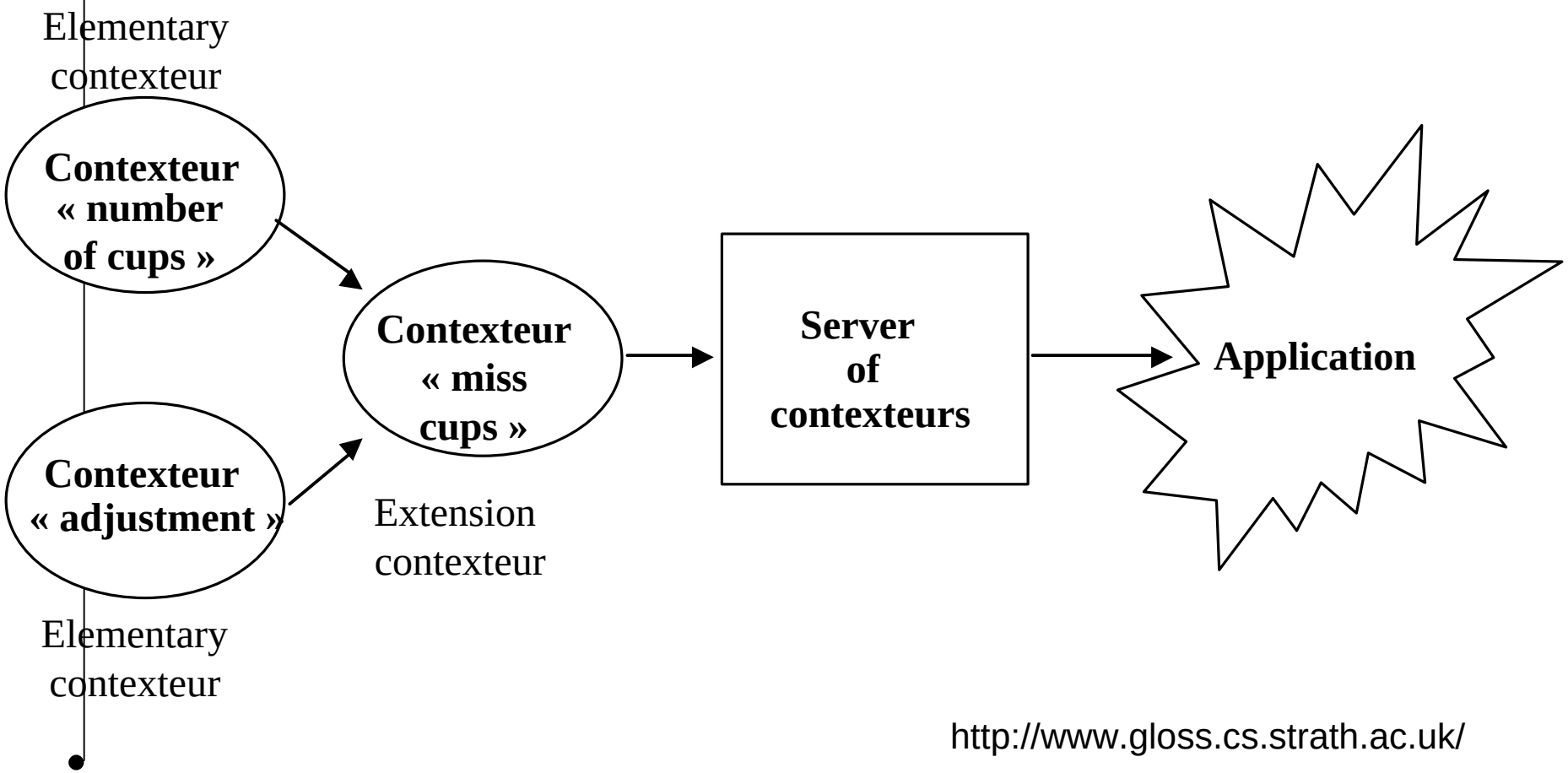
Example of application

Automatic recall of cups in the cafeteria



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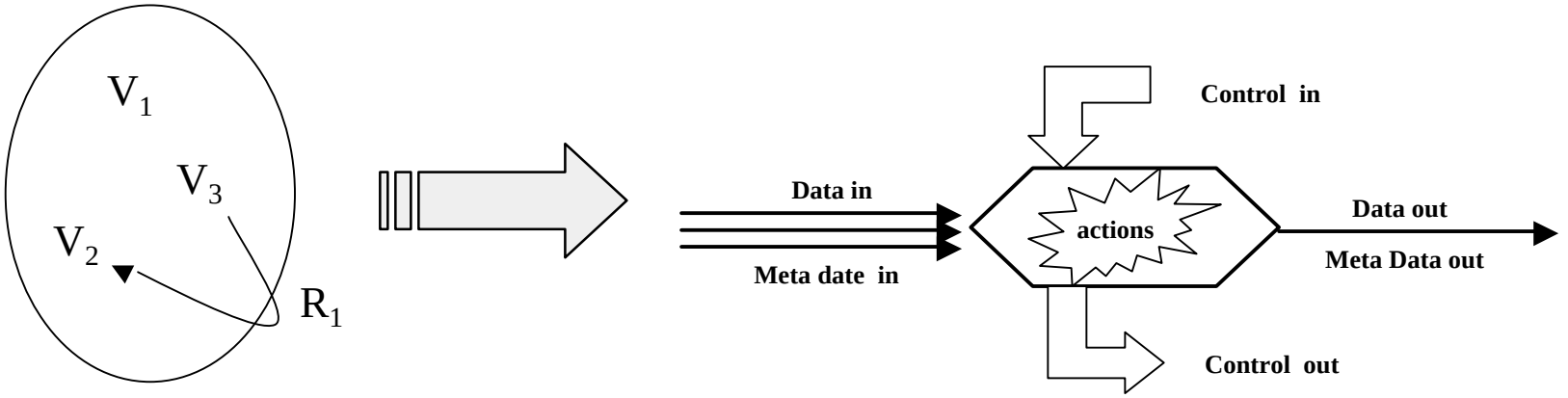
Synthesis of contexteur contribution

- Definition
- Model conceptual



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Conclusions

Where are we now:

- Have a set of archetypes and scenarios which highlight importance of activity theory.
- Developed a set of tools to assess archetypes.
- Have computational and implementation model for contextor that is task based.
- Working towards “trajectories” model to bind task based and activity models within a programming framework.

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