ACE
Autonomic Software Engineering for online Cultural Experiences

Carles Sierra

IIIA-CSIC
## Partners

<table>
<thead>
<tr>
<th>Partner</th>
<th>City</th>
<th>PI</th>
</tr>
</thead>
<tbody>
<tr>
<td>IIIA-CSIC</td>
<td>Barcelona</td>
<td>Carles Sierra</td>
</tr>
<tr>
<td>Goldsmiths, U. London</td>
<td>London</td>
<td>Mard d’Inverno</td>
</tr>
<tr>
<td>IRIT, CNRS</td>
<td>Toulouse</td>
<td>Leila Amgoud</td>
</tr>
</tbody>
</table>

Other Researchers: Nardine Osman, Henri Prade, Matthew Yee-King, Dave de Jonge, Roberto Confalonieri, Katina Hazelden
Project Objectives

- To develop autonomic BDI architectures for personal assistants of human agents engaging in online activities
- To develop a peer to peer autonomic electronic institution infrastructure to support the autonomous interaction or human and autonomic agents
- To embed the P2P infrastructure into mobile appliances to allow for a mobile social distributed consumption of cultural artefacts
- To develop a series of case studies with cultural institutions and build a full specification of a selected case study that we will develop into a working prototype
This talk’s menu

- P2P Electronic Institutions
- Autonomic agents
- Cultural experiences
- Demo
- Shared Experiences
This talk’s menu

- P2P Electronic Institutions
- Autonomic agents
- Cultural experiences
- Demo
- Shared Experiences
Need for Institutions

Reaching agreements among individuals require that individuals interact in ways that involve:

- commitment,
- delegation,
- repetition,
- liability, and
- risk.

Moreover, in open systems negotiators are: Autonomos, heterogeneous, independent, not-benevolent, not-reliable, liable.
Need for Institutions

Institutions’ aim is to make those interactions effective by:

- establishing and enforcing conventions (and norms),
- standardize interactions (fixing semantics),
- allocate risks,
- establish safeguards, and
- guarantee that certain intended actions actually take place and unwanted situations are prevented.

These functions have been the basis for the development of many traditional institutions.
Electronic Institutions may help in setting the rules for agreement making. Electronic institutions development can be divided into two basic steps:

- Formal specification of institutional rules: constraints, semantics, workflow, role flow policy, etc.
- Execution via an infrastructure that mediates agent interactions while enforcing the institutional rules.

The formal specification focuses on **macro-level** (rules) aspects of agents, not in their micro-level (players) aspects.
elnstitutions toolbox (http://e-institutions.iiia.csic.es)
Roles (internal and external) as patterns of behaviours. Agents can play multiple roles at the same time. Agents can change their roles.

Strong dialogical stance

Scenes as persistent interaction spaces with a FSM for interaction with constraints and procedures. Similar to an ambient.

Agents flow (synchronise, split, choose) between scenes according to specified paths.

Declarative norms establish obligations. Good/bad behaviour is regimented, reaction to inaction is programable.
3D Electronic Institutions

- Combination of regulated environments (eInstitutions) and un-regulated environments (Virtual Worlds)
P2P infrastructure

- avoid centralised monitoring and validation
- facilitate sharing knowledge units,
- search for components, and
- support the enactment of eInstitution executions transparently to a human/agent user.
P2P eInstitutions

- Repository of eInstitution specification components: Ontologies, norms, scenes, ...
- Repository of institutional agents
- Repository of agents
- Search utility
- Execution support to enact institutions
- research questions on: time-outs, synchronisation
P2P Architecture
This talk’s menu

- P2P Electronic Institutions
- **Autonomic agents**
- Cultural experiences
- Demo
- Shared Experiences
Objectives

- Argumentation-based agent architecture
- BDI mental model
- Argumentation-based negotiation
Autonomic Agents

- An **autonomic agent** is a computer system that is capable of autonomous and intelligent action. It has a model of itself and of others and shows self-* properties.

- An agent should have some **reasoning** capabilities
  - Reasoning about its **beliefs, desires, intentions** and **experiences**
  - Analyzing the **opinion** of a group of agents

- An agent should be able to **interact** with other agents
  - **Negotiating** with other agents
  - **Arguing** in order to make other agents revise their beliefs/desires
Internal reasoning

- An agent has **beliefs, desires, experiences** and **intentions**

- **Questions:**
  - How to represent each notion?
  - What are the interactions between them?
  - How to reason about them?

- **Some solutions:** XBDI logics, Argumentation logics
Opinion analysis

- Agents express **opinions** about an **object** by assigning **values** to some **features**

  - **Example:** This digital camera is acceptable since it has good resolution, good battery life, but is not easy to use
    - Object: digital camera
    - (Feature, Value): (Resolution, Good), (Battery life, Good), (Use, Bad)

- Each pair (Feature, Value) is an **argument** PRO or CON the object

- How to aggregate the opinions of the agents?
  - **Example:** to reject anything that is rejected by at least one agent and to take the union of what is favored by the agents (if compatible with what is rejected)
Interactions of an agent

- **Negotiation** is a process in which agents having different interests try to find a compromise on an object.

- \( O \) = the set of all possible values of the negotiation object. The compromise is an element of \( O \).

- Each agent has a **preference** relation \( \geq \) on \( O \).
  - (Beliefs, Desires, Experiences) \( \Longrightarrow \geq \subseteq O \times O \)

- **Questions:**
  - How to reach the best compromise?
  - How to exchange arguments in order to influence the preference relation of others?

- **Solution:** Argumentation-based negotiation models
This talk’s menu

- P2P Electronic Institutions
- Autonomic agents
- Cultural experiences
- Demo
- Shared Experiences
Objectives

- Case study selection and specification
- Cultural experience prototype
- Validation of the prototype
### WP3: Cultural exp.

**Table:** visitor numbers of Government funded institutions in London.

<table>
<thead>
<tr>
<th>Institution</th>
<th>Visitors in July 2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>BRITISH MUSEUM</td>
<td>663,409</td>
</tr>
<tr>
<td>TATE LONDON (Britain and Modern)</td>
<td>630,110</td>
</tr>
<tr>
<td>NATIONAL GALLERY</td>
<td>542,000</td>
</tr>
<tr>
<td>NATIONAL MUSEUM OF SCIENCE AND INDUSTRY (NMSI)</td>
<td>477,280</td>
</tr>
<tr>
<td>NATURAL HISTORY MUSEUM (NHM)</td>
<td>467,542</td>
</tr>
<tr>
<td>VICTORIA AND ALBERT (V&amp;A)</td>
<td>341,051</td>
</tr>
<tr>
<td>NATIONAL MARITIME MUSEUM</td>
<td>216,323</td>
</tr>
<tr>
<td>NATIONAL PORTRAIT GALLERY</td>
<td>213,201</td>
</tr>
<tr>
<td>IMPERIAL WAR MUSEUM LONDON</td>
<td>103,052</td>
</tr>
<tr>
<td>HORNIMAN MUSEUM</td>
<td>48,131</td>
</tr>
</tbody>
</table>
NATURAL HISTORY MUSEUM (NHM)

- 467,542 visitors in July 2011
- 50,000 image archive
- Excellent picture search, with related words
- http://piclib.nhm.ac.uk/
NHM: picture search

Search box:

Search results:

Detail page:

Related keywords:
HORNIMAN MUSEUM

- 48,131 visitors in July 2011
- large image archive
- Excellent picture search, with related words
- User tagging, tag clouds
- http://www.horniman.ac.uk/collections/search-for-objects
HORNIMAN: picture search

Search box:

Detail page:

User tag cloud search
# Evaluation of institutional image archives

**Table:** The scores achieved by the institutions according to the metric of footfall and various features of their public, online archives.

<table>
<thead>
<tr>
<th>Name</th>
<th>visitors Jul. 2011</th>
<th>footfall</th>
<th>new ideas</th>
<th>tags</th>
<th>search</th>
<th>variety</th>
<th>score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tate London (Britain and Modern)</td>
<td>630,110</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>14</td>
</tr>
<tr>
<td>Horniman Museum</td>
<td>48,131</td>
<td>1</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>13</td>
</tr>
<tr>
<td>British Museum</td>
<td>663,409</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>13</td>
</tr>
<tr>
<td>Natural History Museum</td>
<td>467,542</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>13</td>
</tr>
<tr>
<td>Victoria and Albert Museum</td>
<td>341,051</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>13</td>
</tr>
<tr>
<td>National Museum of Science and Industry</td>
<td>477,280</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>11</td>
</tr>
<tr>
<td>National Maritime Museum</td>
<td>216,323</td>
<td>1</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>10</td>
</tr>
<tr>
<td>National Gallery</td>
<td>542,000</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>10</td>
</tr>
<tr>
<td>National Portrait Gallery</td>
<td>213,201</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>9</td>
</tr>
<tr>
<td>Imperial War Museum</td>
<td>103,052</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>7</td>
</tr>
</tbody>
</table>

- **footfall:** number of visitors to the institution (= potential impact).
- **interest:** apparent interest of the institution in invigorating their archive, e.g. are they actively developing new methods of presenting and exploiting their digital archives.
- **tags:** tags (or short descriptors) on images. Do the items in the archive have a range of different tags associated with them and how complete does the coverage of the archive appear to be?
- **search:** ability to search by tag. Is there an obvious means to search for items with a specific tag associated with them.
- **variety:** image variety. A somewhat subjective measure of the variety of images in the archive.
Representatives from London Museums in the January 2012 meeting

- Natural History Museum: Sheila Sang and Ludvig Lohse
- Horniman Museum: Adrian Murphy
- John Soane Museum: Beth Walker
- Geffrye Museum: Eleanor John
This talk’s menu

- P2P Electronic Institutions
- Autonomic agents
- Cultural experiences
- **Demo**
- Shared Experiences
Social Browsing over iPads
Not yet *very* autonomic
Version 2 newlook
Version 2 newlook
Version 2 newlook

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua.
Version 2 newlook
This talk’s menu

- P2P Electronic Institutions
- Autonomic agents
- Cultural experiences
- Demo
- Shared Experiences
Shared Experiences
Community Browsing Requirements

- To manage charters
- To regulate membership
- To model interactions
- To interact with humans
- To take decisions
Some management so far

- Consortium Agreement being signed right now
- Four general meetings
- 3 architects week-long meetings
- First prototype running
- Papers under review: 2 AAAI, 2 (short) ECAI, 1 PAIS
- 1 paper for COMMA 2012 under preparation
- 1 Journal paper under preparation
- 1 spin-off company planned (negotiation of touristic packages)
- 2 STREP proposals based on ideas generated in ACE
- Very active team
What’s next

- Finalize the platform
- Implement Version 2
- Develop the concept of Shared Experience
- Select a Museum
- Develop a prototype for the museum