

Organizing the multimedia content of an m-learning service through Fedora Digital Objects

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Outline

- The CHAT Research Project
- *Explore!*
- Architecture
- Fedora multimedia content repository
- Digital Objects in Explore!
- Conclusion



2



The CHAT Research Project



Explore!

- CHAT (Cultural Heritage fruition & e-learning applications of new Advanced (multimodal) Technologies) Project 2006-2008
 - Funded by the Italian Research Ministry
- **Goal**
 - Developing a general purpose software infrastructure to provide context-sensitive services accessible through thin clients such as cellular phones or PDAs
 - The multimedia contents of the services provided by the CHAT infrastructure are organized in Digital Objects (DOs) managed by Fedora content management software
- Tested in two application domains
 - e-Learning
 - Cultural heritage fruition



[VIDEO]

3

- Explore! is an m-learning service developed to support and enhance middle school students' experience during a visit to an archaeological park
 - A learning technique called excursion-game, whose aim is to help students to acquire historical notions while playing a game on a cell phone was adopted
 - Groups of 3/5 students, carrying a cell phone and a map, freely explore a park and discover its hidden secrets
 - If students have difficulties, they can ask the "Oracle" for help
 - Players provide their answer to a mission by typing in the place code on the cell phone
 - The group receives "God's gift": they are given the opportunity to view the 3D reconstruction of the identified places on the phone and visually compare how the places probably once looked with the existing remains

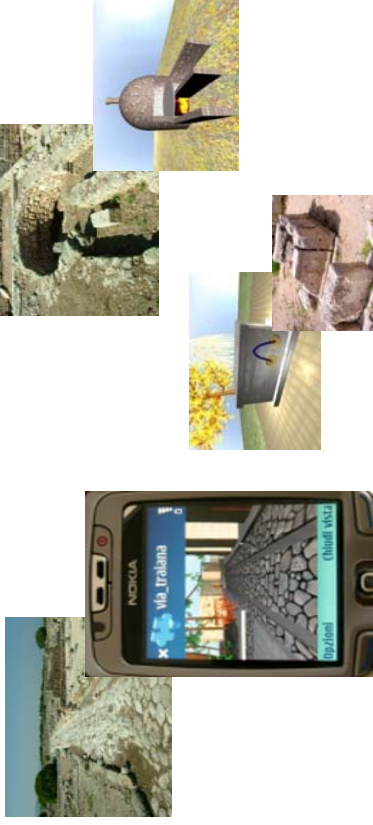
4



Game phase



- The group receives "Gods'gifts"
 - the cell phone visualizes the 3D models of the place identified



5

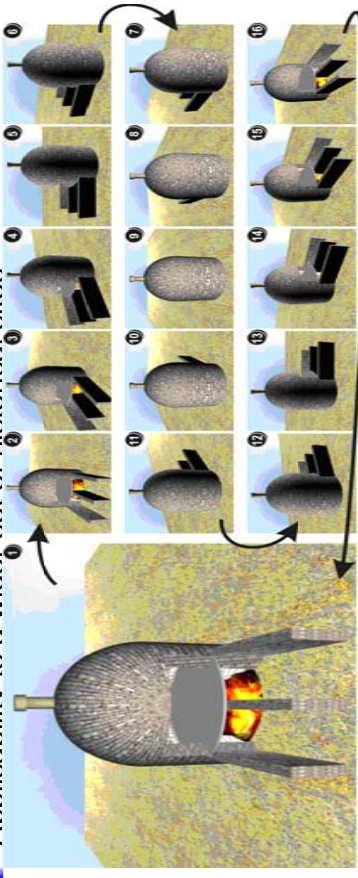


3D Simulator



- M3G files contain the 3D models (JSR184 is required)
- even in cell phones with limited RAM memory
 - 8 snapshots taken with 45 degrees between the snapshots at two different distances from the monument (zoom-in / zoom-out effect)
 - a version with 16 snapshots taken with 22.5 degrees was also evaluated

Applicability to a wider set of historical sites



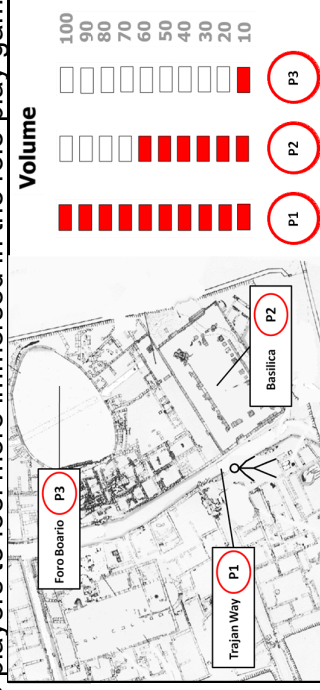
6



Contextual Sounds



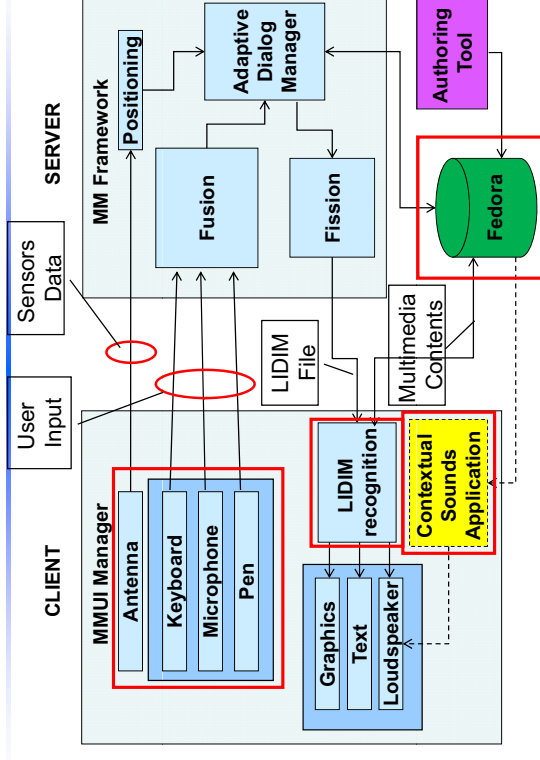
- Virtual sound sources at various locations at the site
 - carts running on the Trajan Way
 - noise of people in the Basilica
 - cows lawing in the Foro Boario
- Increase the number of cues available for problem solving
- Help players to feel more immersed in the role-play game



7



Architecture



8



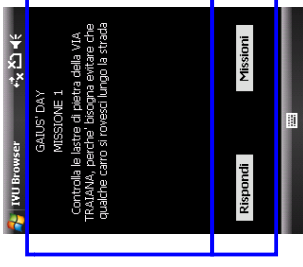
LIDIM (LInguaggio di Definizione Interfaccia Multimodale)

- Linguaggio XML-based per la descrizione di un'interfaccia multimodale
 - Realizzato specificamente per il progetto CHAT
- Permette di specificare
 - Quali sono gli elementi che compongono l'interfaccia
 - Quali operazioni sono consentite su ogni elemento
 - Dove sono memorizzati (in una cartella locale o in un database Fedora)

9



Interfaccia e LIDIM

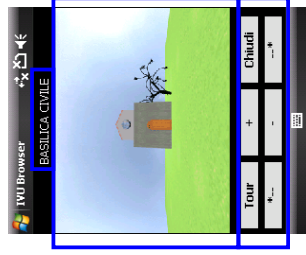


```
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<graphics>
  <main_objects>
    <object id="0">
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        point="off"/>
      </output_media>
    </object>
  </main_objects>
  <other_objects>
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      <output_media>
        <btn testo="Rispondi"/>
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    </object>
  </other_objects>
  <object id="1">
    <output_media>
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</graphics>
</LIDIM>
```

10



Interfaccia con 3D

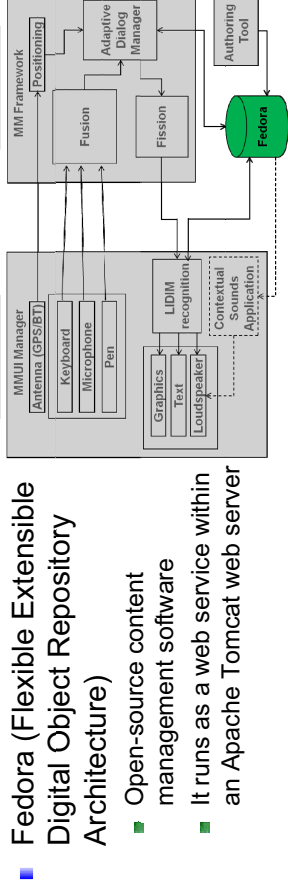


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  ...
  </other_objects>
</LIDIM>
```

11



Fedora multimedia content repository



- Fedora (Flexible Extensible Digital Object Repository Architecture)
 - Open-source content management software
 - It runs as a web service within an Apache Tomcat web server
- Fedora provides tools and interfaces for creation, ingest, management, and dissemination of content stored within a repository, MySQL in the proposed architecture
- In CHAT Fedora is motivated by the complex nature of the service contents, which can be text, images, audio, videos, etc. distributed in Internet

12



Authoring Tool



- It allows people, to define information needed by Explore!
 - The character to be impersonated (Gaius in the case of Egnathia), the game challenge, the missions, the hints, the 3D reconstructions, the GPS coordinates of the places, the contextual sounds
- Users with no computer programming expertise, e.g. history experts, can easily adapt the Explore! service to different archaeological parks
- Information provided by users is automatically stored in Fedora through five DOs
- To improve service performance, each DO is described by an XML file used by the other modules to access the DO

13



Fedora Digital Objects in Explore!



- Five Digital Objects (DOs)
 - Three DOs for providing information about the park
 - "SITE": Information describing the park
 - "PLACES": Places of interest
 - "CONTEXT": Contextual information (contextual sounds in the specific case presented)
 - Three DOs for defining the game
 - "SCHEMA": Game storyboard
 - "INTERFACE": User interface elements
- In order to adapt the service to new archaeological parks, the history expert must change contents (SITE, PLACES, CONTEXT, SCHEMA) and user interface elements (INTERFACE)

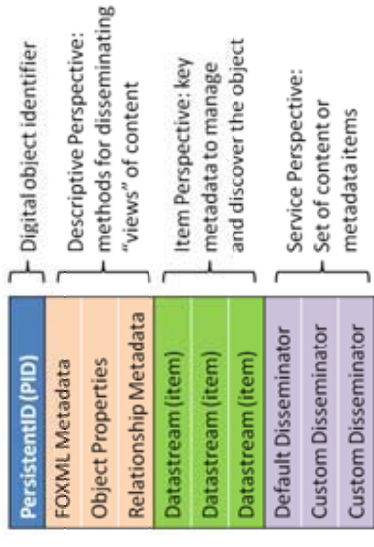
15



Fedora Digital Objects (DOs)



- A Digital Object (DO) describes content (data and metadata) and a set of associated behaviours or services that can be applied to that content
- A DO consists of four parts



14



Authoring the DO "PLACES" (1/5)



- PLACES contains the information about places of interest (monuments, roads, market squares, etc) in the park
- The multimedia content consists of a text and audio description, photos, GPS position, a map, 3D reconstruction images

16

Authoring the DO “PLACES” (3/5)

- Entering another place

17

Authoring the DO “PLACES” (3/5)

- Entering another place

18

Authoring the DO “PLACES” (5/5)

- ```

..
<place="furnace">
- <description>
- <text>
- <audio>
http://...:808
http://...:808
</description>
- <photo>
http://...:808
- <map>
http://...:808
- <gps>
http://...:808
..
<place=« Tempio">
- <description>
- <text>...
..

```

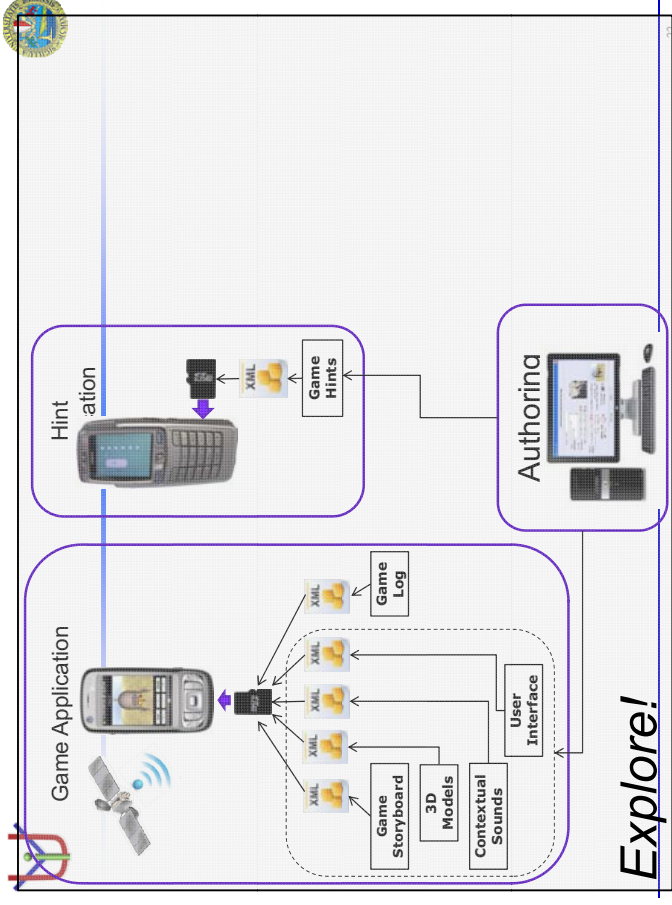
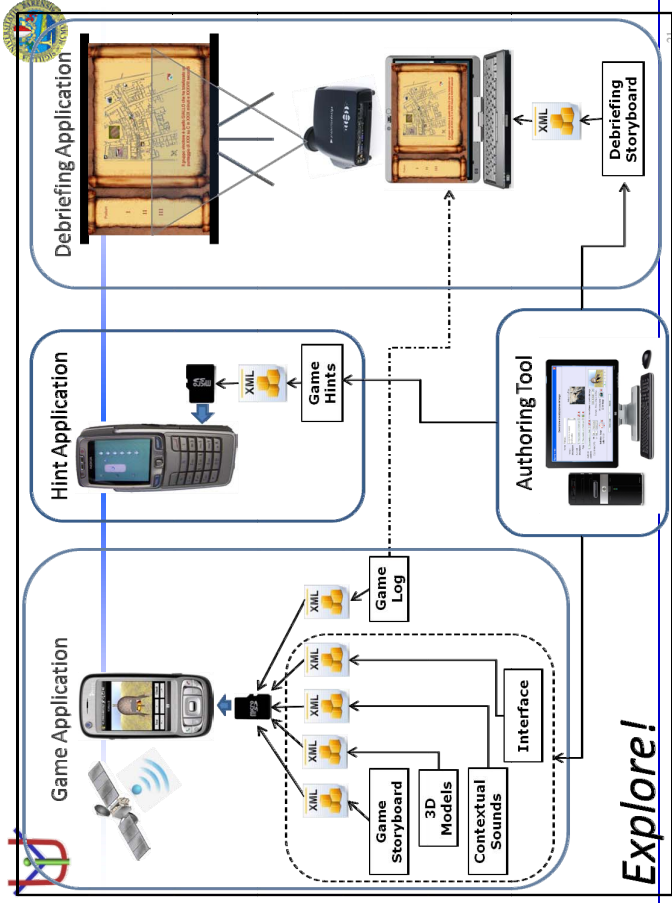
19

## Authoring the DO “PLACES” (5/5)

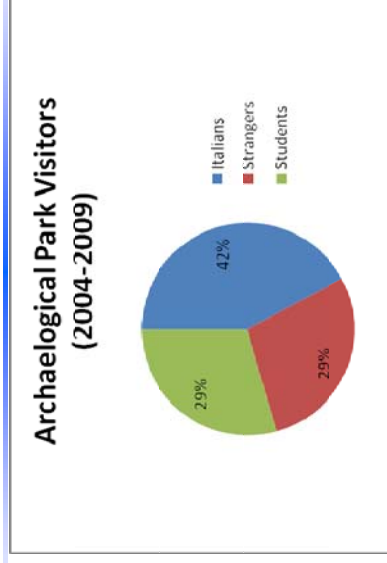
- ```

...
<place="furnace">
- <description>
- <text>
- <audio>
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    http://...:8080/fedora/get/place:furnace/audioFurnace</audio>
</description>
- <photo>
    http://...:8080/fedora/get/place:furnace/photoFurnace</photo>
- <map>
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- <gps>
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...
<place=« Tempio">
- <description>
- <text>...

```



An electronic guide for all the visitors

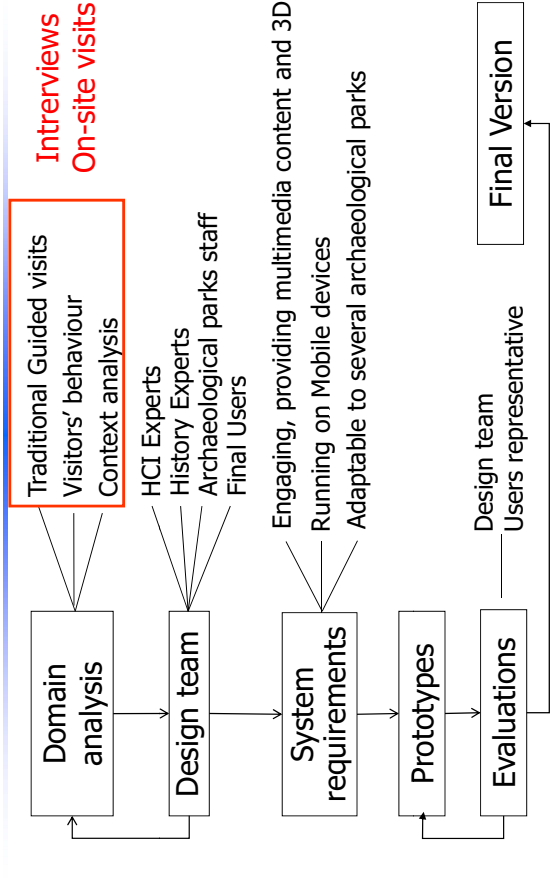


Goal

- An electronic guide on mobile devices for visitors of archaeological parks
 - Simple, cheap and ecologic



Design Phases





Requirements



- Multi-language support
 - Italian, English, German
- Alternative styles of visit
 - Standard
 - Thematic (by civilization, defunct veneration, daily activities,...)
- Multimedia content
 - Audios, videos, photos, 3D models, contextual sounds
 - Gallery of discoveries
- Map of the park
 - User position
 - Places to visit

25



Simple, cheap and ecologic digital gaming infrastructure

- Cellular phones, complemented with compatible memory cards containing the game software
- Visitors can use their own device
 - The users easily interact with a device that know well
 - The park institution does not buy and maintain devices
 - The park does not provide wireless network or further hardware infrastructure



26



XML files to model information



- Park information (**Information.xml**)
 - Park name, history, ...
- Style of visit (**Visits.xml**)
 - Standard, Thematic
- Points of interest (**Places.xml**)
 - Basilica, Furnace, ...
- Discoveries (**Discoveries.xml**)
 - Pots, coins, ...
- Contextual sounds (**AudioContext.xml**)
 - Carts, animals, people...

27



XML file example: Discoveries.XML

```
<Site>
<discovery id="1" trunk="0">
  <name name_discovery="Mosaico delle tre Grazie" />
  <description info="Al margine nord orientale....." />
  <photo path=".../discovery1.jpg" />
  <photo_zoom path=".../discovery1I.jpg" />
  <snd path=".../discovery1.amr" />
</discovery>
<discovery id="2" trunk="0">
  <name name_discovery="Ciotola carenata" />
  <description info="Orlo arrotondato, labbro svasato,....." />
  <photo path=".../discovery2.jpg" />
  <photo_zoom path=".../discovery2I.jpg" />
  <snd path=".../discovery2.amr" />
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```

28

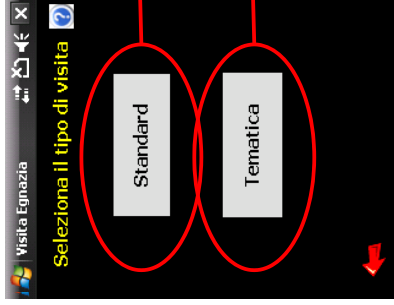


Preferences



- Visitors can choose between

- Standard Visit
- Thematic Visit



29



Position and Path



- The GPS antenna determines the visitor position
 - A flag indicates the next place to be visited



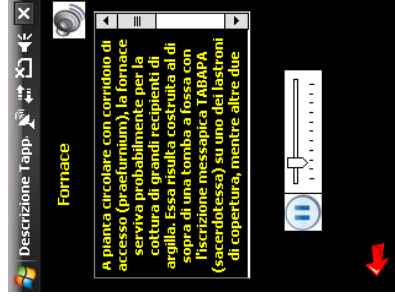
30



Place Information



- The GPS position determines which place the visitor is approaching
 - Text, audio and video related to the places are displayed



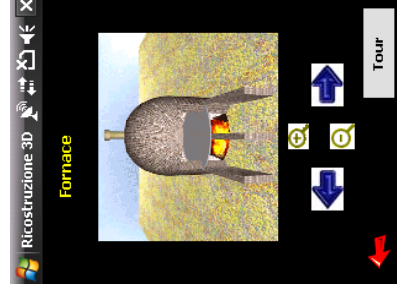
31



3D Reconstruction



- Augmented reality approach
 - The visitor can compare the original aspect with the actual ruins



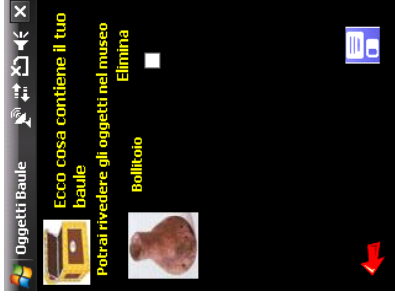
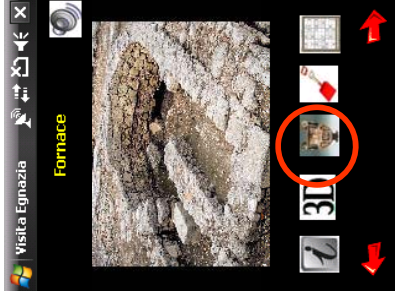
32



Discoveries



- Discoveries found in a specific place are shown
 - Discoveries are exposed in the museum
 - Visitor can put them in the "trunk", generating a list of objects to view during the successive tour in the museum



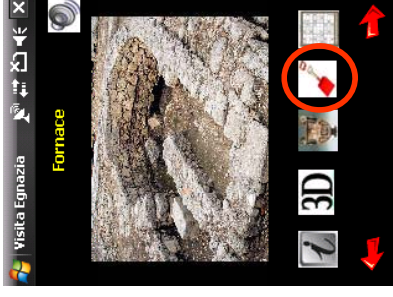
33



Excavations



- Multimedia information about the excavation of a specific place is provided



34



Conclusion



- A software infrastructure aiming at providing general services accessible through thin clients has been presented
 - Services multimedia contents are stored in Digital Objects managed by Fedora web server
- Fedora (Flexible Extensible Digital Object Repository Architecture)
 - Open-source content management software that provides tools and interfaces for creation, ingest, management, and dissemination of (multimedia) content
 - Fedora permits to manage complex contents (text, images, audio, videos, etc.) distributed in Internet
- An Authoring Tool has been integrated in the framework
 - End users not expert in computer programming can define new games to visit archaeological parks
 - XML files describing the Digital Objects to speed up the overall interaction with the service provided are automatically created

35