3D models and Emulation

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Overview

- Context
- Emulation, virtualization, containerization
- 3D models and emulation
- Challenges of emulation
- Benefits of Emulation and EaaSI
- Getting started with Emulation
Emulation, Virtualization and Containerization

**Emulation** = “an emulator is hardware or software that enables one computer system (called the *host*) to behave like another computer system (called the *guest*). An emulator typically enables the host system to run software or use peripheral devices designed for the guest system.”

**Virtualization** = emulation but with compatible hardware

(some of the host machine’s hardware is used directly by the “virtualized” computer)

Virtualization bridges the gap between departure of recently obsolete hardware and the arrival of hardware powerful enough to emulate it

**Containerization** = virtualization at the Operating system level – some parts of the OS are replicated for use by each “container”
Emulation is a natural fit for 3D models
Properties of 3D models

- Digital objects that lend themselves to interaction (e.g. rotation, zooming, etc)
- Digital objects that are complex often dependent on with highly proprietary software that has a continually and rapidly evolving feature-set
- Digital objects that may have multiple dependencies including on disparate data sources and other proprietary applications, add-ons and systems
Emulation for 3D models
Yale University Library Manuscripts and Archives


Files are made accessible using an emulated Pentium 2 PC environment running Windows 98 with AutoCAD 2002 installed.

Balmori Associates
Abandoibarra Master plan 1993-2012
Yale University Library Manuscripts and Archives

AutoCAD files created by Balmori Associates who developed the award-winning regeneration Master Plan for Abandoibarra that was implemented over the 1993-2012 period.

MusicLibrary (D:)

Select an item to view its description.
Yale University Library Manuscripts and Archives

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AbandoibarraM (D:)

Select an item to view its description.
Citation and usability with “snapshots”
## Environments

### Virtual machines

**Number of Environments:** 2

<table>
<thead>
<tr>
<th>Name</th>
<th>ID</th>
<th>Owner</th>
<th>ObjectId</th>
<th>Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zoomed DWG Snapshot</td>
<td>7ce085...</td>
<td>shared</td>
<td>68348093-2817-4a6...</td>
<td>Choose action</td>
</tr>
</tbody>
</table>

Preserving complex, networked systems
Universal

- it is intended to be able to be "universal" and (theoretically) work with any files/digital objects.

Virtual

- A homage to the Universal Virtual Computer (UVC) concept developed by IBM and the Koninklijke Bibliotheek, KB

Interactor

- Rendering and viewing are primarily passive activities but digital object experiences are not passive, they’re interactive
Emulation Challenges

- Emulators are difficult to install, configure and scale up access to.
- Legacy software can be hard to find, install and configure.
- Old software can be challenging for modern users to understand.
- Intellectual property concerns can deter decision-makers.
Program Goal

To scale up access to emulation and software preservation infrastructure
Building on bwFLA Emulation as a Service (EaaS)
What is Emulation-as-a-Service?
Simplifies access to various emulators
Enables management of persistent, citable emulation environments
Derivatives enable storage savings

"Base" Environment
(e.g. Windows XP)
5 GB (Compressed)

Derivative x1
(e.g. Windows XP + SPSS 13)
150 MB

Derivative x1.1
(e.g. Windows XP + SPSS 13 + SPSS code)
1 MB

Derivative x2
(e.g. Windows XP + STATA 8.2)
250 MB

Derivative x3
(e.g. Windows XP + STATA 8.2 + STATA code)
1 MB

Derivative x3
(e.g. Windows XP + R 2.0.0)
50 MB
Distributed Mgmt

- A network of distributed nodes, each contributing to the EaaSI service and the software development roadmap.
Simplifies access to preserved software

- In-network sharing of software images and configured environments.
- Yale University Library is configuring and sharing at least 3000 pre-configured software applications running in configured environments.
(2D) CAD software already in the EaaSI network
Documentation/Discovery

- Incorporating services developed by Wikidata for Digital Preservation
- Comprehensive, open, machine-readable documentation
- Defining profile for description of software and computer environments
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Access

- Emulated CD-ROM environment sharing service
- Virtual Reading Rooms Service
- Scientific Software Portal
- API to enable automatic interaction with objects in original software via emulation
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UVI Overview

1. Click on a digital object in a catalogue or finding aid

2. Object opens automatically in the original software in browser for user-interaction

- Optional printing to PDFs
- Optional saving changes
- Optional exporting data with/without confidentiality review
UVI Overview

- Upload file
- Identify age and format family
- Extract any useful metadata
- Match to environments and rank “best match” or a hex editor
- Autostart rendering object
EaaSI - Updated UI Wireframe
Future developments

- Improve automation
- Enable networked environments to be preserved
- Automated package reproduction
- "Headless"/GUI-less interaction with preserved software environments (input commands, receive and save outputs e.g. data)
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Emulation & 3D models: Benefits

- Enables replication and researcher interrogation of all functionality of the development and interaction software and its impact on 3D models
- Increasingly EaaS to use
- Enables new forms of citation
- Can handle simple digital objects and their contexts and complex multi-system dependent objects and datasets
Getting Involved

1. Download and try an (any) emulator
4. Join the Software Preservation Network www.softwarepreservationnetwork.org
5. Contribute software metadata to https://wikidata.org
6. Advocate for software preservation locally
7. Work to establish a legal basis for reuse of legacy proprietary software for preservation and access to digital heritage
8. Connect with the EaaSI team at eaasi@yale.edu
Our Team

- **Euan Cochrane** Principal Investigator
- **Seth Anderson** Program Manager
- **Ethan Gates** Software Preservation Analyst
- **Klaus Rechert & Oleg Stobbe (OpenSLX)** Technical Architecture and Development
- **PortalMedia** UX/UI Development
- **Jessica Meyerson (Educopia/SPN)** Communications/Outreach
- **Kat Thornton (Data Current/WikiDP)** Semantic Architect
A Very Special Thanks to the EaaSI Funders...
Thank you

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https://www.softwarepreservationnetwork.org/eaasi/

Install #EaaSI for yourself using Docker (~6GB download):