

The logo for EaaS (Emulation-as-a-Service) is located in the top-left corner. It consists of the text "EaaS" in a white, sans-serif font, with a blue exclamation point as the letter "i". The logo is enclosed within a dark blue circle, which is itself surrounded by a larger, lighter blue circular glow.

EaaS

The Emulation-as-a-Service Stack

EaaS Training Module #3

A series of five concentric white circles are positioned in the bottom-right area of the slide. They are partially overlapping the large white circle that serves as the background for the main text.

During This Module

- What are the essential components of the Emulation-as-a-Service (EaaS) stack?
- How does the EaaSI platform build on EaaS?
- Where are EaaSI resources (Environments, Software, Content) stored relative to EaaS?



Google Workspace



But first...do you use any SaaS (Software as a Service) products in your day-to-day work or life?

Software as a Service

- Rather than installing on your computer, the application runs on a server
- You access, interact and save work over the internet, via a web browser
- Most major examples are “cloud-based” - hosted in a vendor’s data center(s) and accessible via subscription fee



Emulation-as-a-Service

- Takes the SaaS model, applies it to emulation
- Emulators run on a server - you access, interact and save your resources (Environments, Software, Content) over the internet, via a web browser
- EaaS is both a conceptual model and a specific stack originally developed by the bwFLA program, now maintained by OpenSLX
- Open source - join a collaborative effort like EaaSI or roll your own



Emulation-as-a-Service



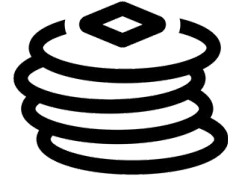
Advantages

- Run one stack instead of installing many individual emulators separately
- Save and configure many Environments in a central location
- Share Environments via web browser, over the internet

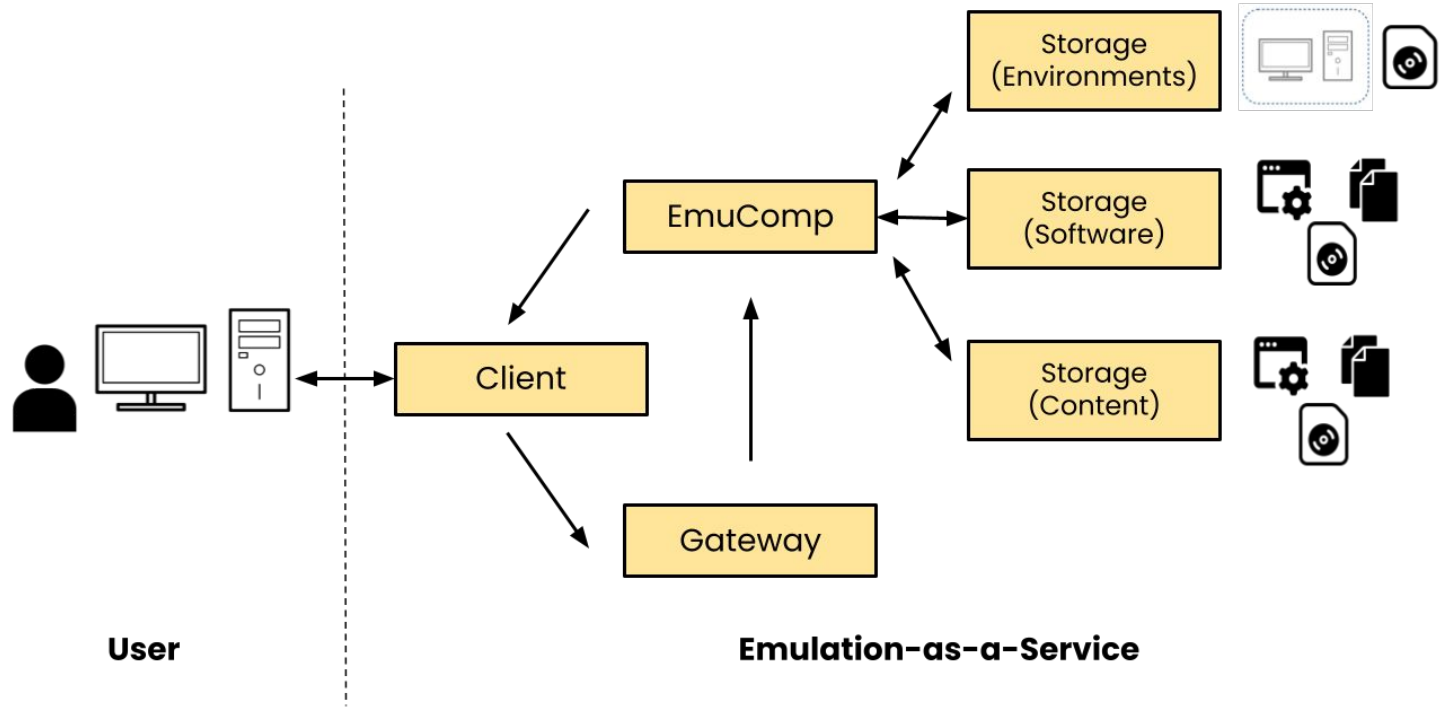
Limitations

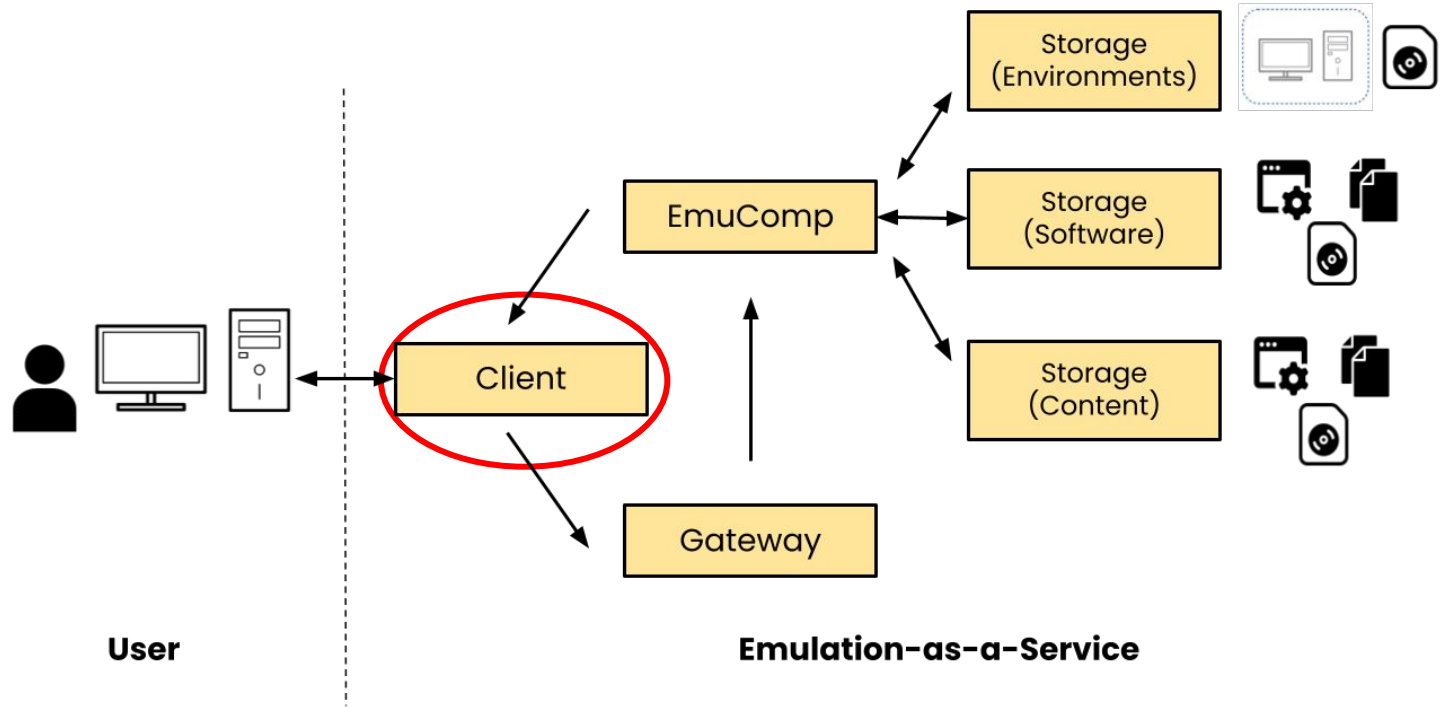
- Some features may not be available for all Environments due to capabilities of underlying emulators
- More simultaneous users requires more computing resources, higher costs

Emulation-as-a-Stack

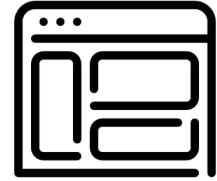








- EaaS is a software *stack*
- Composed of several modules, each with a specific purpose
- EaaSI program of work has sponsored development on several new or improved modules



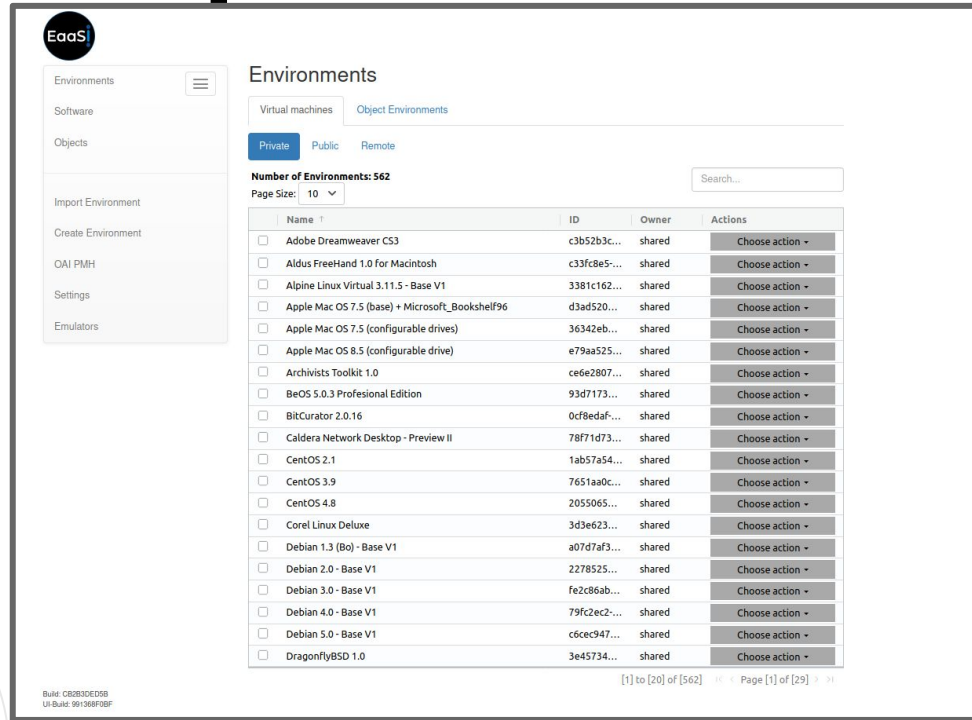


EaaS Components: Client



- The web interface that users interact with (“front-end”)
- Use to perform actions with resources (Environments, Software, Content):
 - Manage 
 - Create 
 - View 
 - Request 
 - Share 
 - Describe 
- Somewhat independent from rest of the stack (the “back-end”) - multiple clients can be built and interact with the same resources

EaaS Components: Client

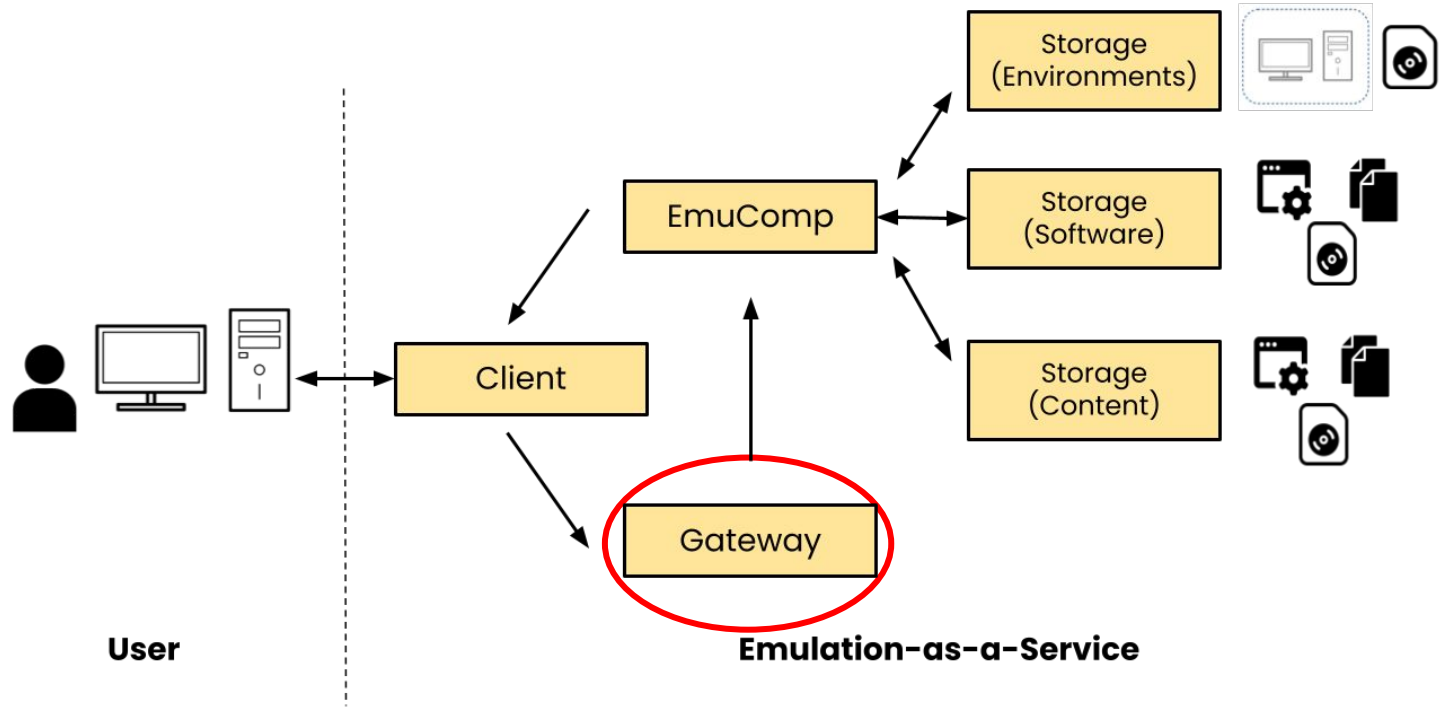


The screenshot displays the EaaS Client interface. On the left is a navigation sidebar with options: Environments, Software, Objects, Import Environment, Create Environment, OAI PMH, Settings, and Emulators. The main content area is titled 'Environments' and shows a list of virtual machines under the 'Object Environments' tab. The list is filtered to 'Private' environments and shows 562 total environments. The table columns are Name, ID, Owner, and Actions. Each row includes a checkbox and a 'Choose action' button.

Name	ID	Owner	Actions
<input type="checkbox"/> Adobe Dreamweaver CS3	c3b52b3c...	shared	Choose action
<input type="checkbox"/> Aldus FreeHand 1.0 for Macintosh	c33fc8e5...	shared	Choose action
<input type="checkbox"/> Alpine Linux Virtual 3.11.5 - Base V1	3381c162...	shared	Choose action
<input type="checkbox"/> Apple Mac OS 7.5 (base) + Microsoft_Bookshelf96	d3ad520...	shared	Choose action
<input type="checkbox"/> Apple Mac OS 7.5 (configurable drives)	36342eb...	shared	Choose action
<input type="checkbox"/> Apple Mac OS 8.5 (configurable drive)	e79aa525...	shared	Choose action
<input type="checkbox"/> Archivists Toolkit 1.0	ce6e2807...	shared	Choose action
<input type="checkbox"/> BeOS 5.0.3 Professional Edition	93d7173...	shared	Choose action
<input type="checkbox"/> BitCurator 2.0.16	0c8bedaf...	shared	Choose action
<input type="checkbox"/> Caldera Network Desktop - Preview II	78f71d73...	shared	Choose action
<input type="checkbox"/> CentOS 2.1	1ab57a54...	shared	Choose action
<input type="checkbox"/> CentOS 3.9	7651aa0c...	shared	Choose action
<input type="checkbox"/> CentOS 4.8	2055065...	shared	Choose action
<input type="checkbox"/> Core Linux Deluxe	3d3e623...	shared	Choose action
<input type="checkbox"/> Debian 1.3 (Bo) - Base V1	a07d7af3...	shared	Choose action
<input type="checkbox"/> Debian 2.0 - Base V1	2278525...	shared	Choose action
<input type="checkbox"/> Debian 3.0 - Base V1	fe2c86ab...	shared	Choose action
<input type="checkbox"/> Debian 4.0 - Base V1	79fc2ec2...	shared	Choose action
<input type="checkbox"/> Debian 5.0 - Base V1	c6cec947...	shared	Choose action
<input type="checkbox"/> DragonflyBSD 1.0	3e45734...	shared	Choose action

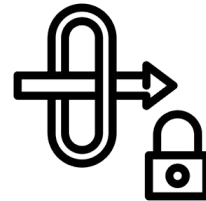
Build: CB2835CE09
UI-Build: 99136F09F

Demo EaaS Client - used by bwFLA/OpenSLX to develop and show off new features

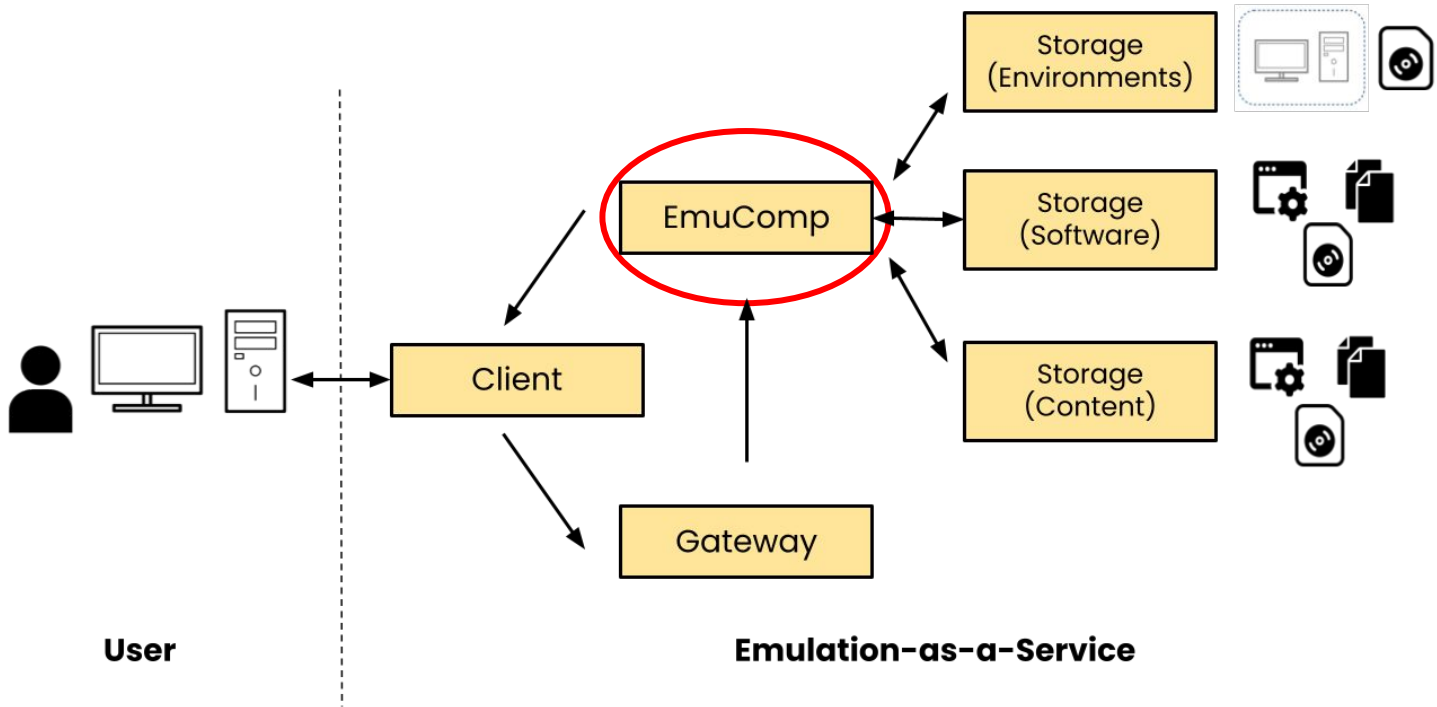


Emulation-as-a-Service

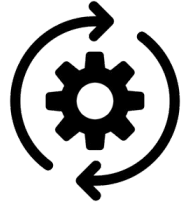
EaaS Components: Gateway



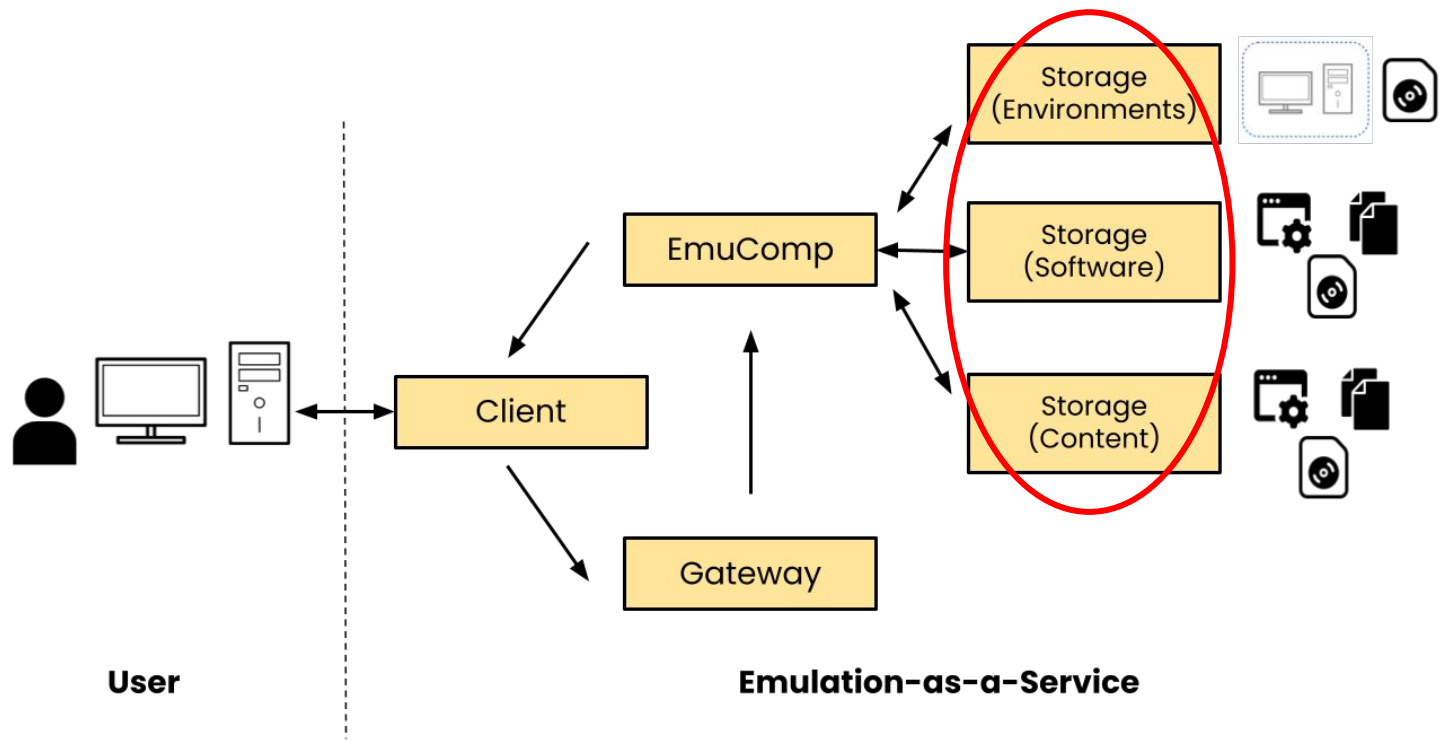
- Takes requests from the user/client
- Assembles the necessary metadata to fulfill user's requests
- Directs EmuComp to start emulation sessions
- Points the EmuComp to the Environments, Software and Content it needs
- Enforces permissions



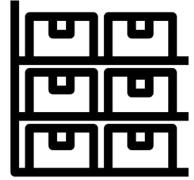
EaaS Components: EmuComp



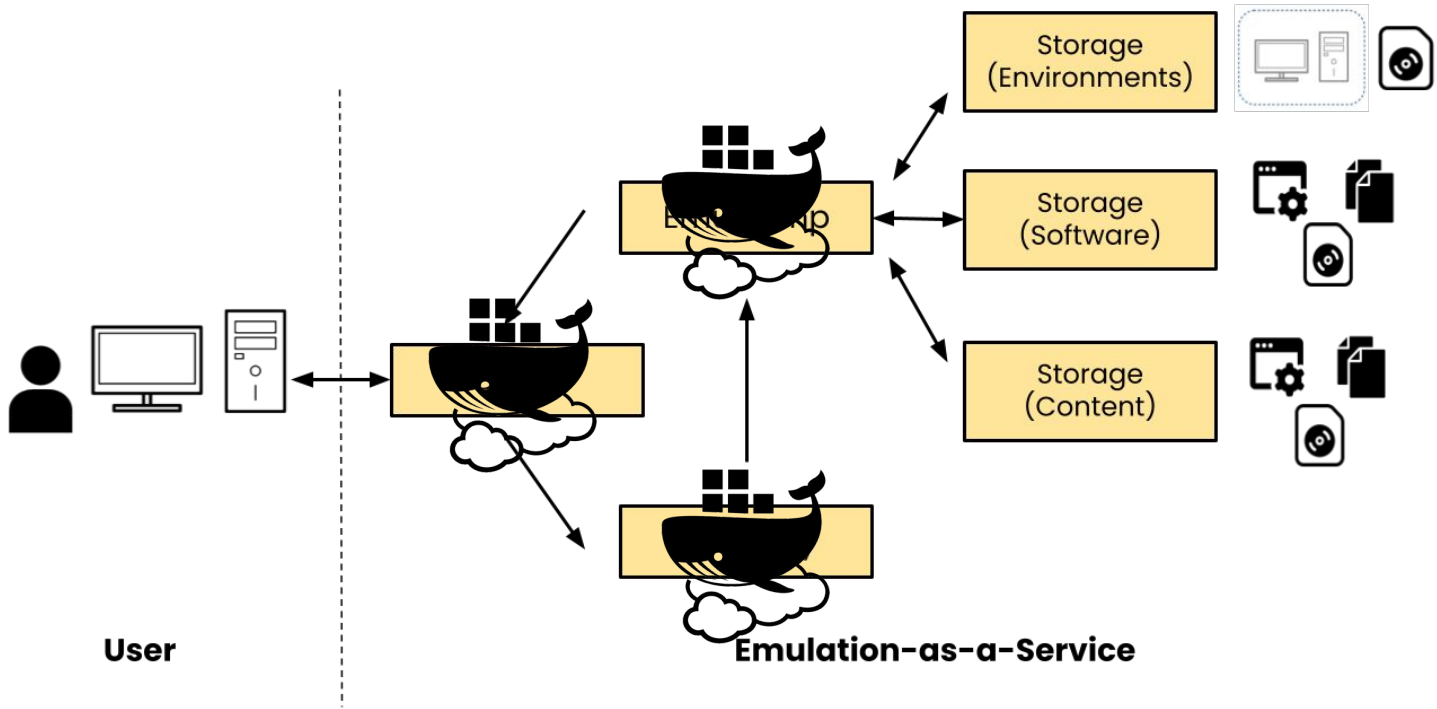
- **Emulation Component**
- Underlying emulator applications are stored and run here
- Requires the most computing power, to handle e.g. running multiple simultaneous emulation sessions
- Sends emulator output (audio and video) back to the client for the user to interact with



EaaS Components: Storage



- Store the disk images and file sets that make up Environment, Software and Content resources
- Resources are cached from storage to the EmuComp at the start of an emulation session



Just Dock It

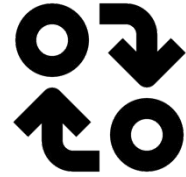


- Many pieces of the EaaS stack are containerized
- Allows for modularity – slot in new and updated emulators or components in the future as necessary
- Will require upkeep with Docker, but widespread adoption ensures some measure of continued commercial and/or community support

The graphic features a large black circle with a white border. Inside this circle, there is a smaller white circle. The background between these circles is dark blue and filled with numerous small, out-of-focus blue circles of varying sizes, creating a bokeh effect. The text 'EaaS' is written in a white, sans-serif font, with the second 'a' being lowercase. The vertical bar of the 'S' is a solid, bright blue. Below 'EaaS', the word 'Additions' is written in a smaller, white, sans-serif font.

EaaS
Additions

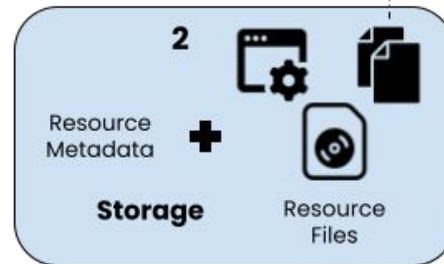
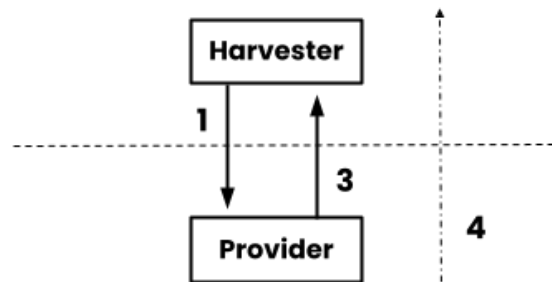
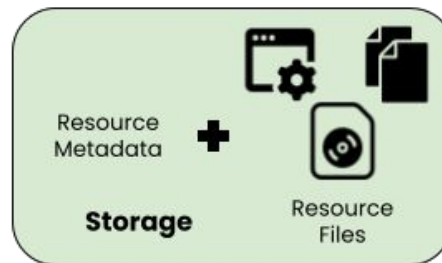
EaaS Additions: OAI-PMH



- **O**pen **A**rchives **I**nitiative **P**rotocol for **M**etadata **H**arvesting
- Specifies a metadata *Harvester* and *Provider* for each installation of the EaaS stack
- Allows EaaS installations to synchronize and exchange resources with each other

1. Yale Harvester requests metadata from Notre Dame's Provider
2. Notre Dame's Provider queries ND storage
3. ND's Provider reports available resources back to Yale Harvester
4. Yale user can save ND resources to Yale storage (if desired)

Local EaaS Node (e.g. Yale)



Remote EaaS Node (e.g. Notre Dame)



Environments



Software

Objects

Import Environment

Create Environment

OAI PMH

Settings

Emulators

Metadata Harvesting

Configured Endpoints

Add OAI-PMH Endpoint

UVA

Synchronize Incremental

Synchronize Full

Remove Endpoint

Notre Dame

Synchronize Incremental

Synchronize Full

Remove Endpoint

CMU

Synchronize Incremental

Synchronize Full

Remove Endpoint

Build: CB2B3DED58
UI-Build: 991368F0BF



EaaS Additions: EaaS Client



- New design for User Interface/User Experience (UI/UX)
- Intended particularly for workflows identified in the EaaS program of work
- Functionality (search and discovery, user management, Environment features) may diverge from the Demo Client

EaaS

➤

MY DASHBOARD

EXPLORE RESOURCES

MY RESOURCES

EMULATION PROJECT

IMPORT RESOURCE

MANAGE NODE

Refine Your Results

RESOURCE TYPES

Environment (123)

Software (619)

Content (12)

NETWORK STATUS

Emulators (1)

Default (7)

Public (41)

Remote (74)

ENVIRONMENT TYPE

Base (120)

Object (3)

SOURCE ORGANIZATION

Shared (123)

SOURCE LOCATION

Remote Objects (602)

Zero Conf (29)

Environment Results

Ready-to-emulate results that include an operating system and hardware settings.

10 of 123 results See all Environment Results >

contralto

DRIVES: 1 INTERNET ENABLED: false
PRINTING ENABLED: false
DESCRIPTION: imported base environment
INSTALLED SOFTWARE: 0 ARCHIVE: emulators
EMULATOR: Contralto

OWNER: shared

Environment Base

Arbeiter database (Microsoft Access database) [Restricted Access]

DRIVES: 3 INTERNET ENABLED: false
PRINTING ENABLED: false
DESCRIPTION: Double-click shortcut on desktop to open "Unlocked_Arbeiter.mdb" in Microsoft Access (read-only).
INSTALLED SOFTWARE: 2 ARCHIVE: default
EMULATOR: Qemu

OWNER: shared

Environment Object Private

Historical documentation database (Filemaker Pro database) [Restricted Access]

DRIVES: 3 INTERNET ENABLED: false
PRINTING ENABLED: false
DESCRIPTION: Double-click "HDfinalwokeys Copy 2.fp3" file on the desktop to open automatically in FileMaker Pro 3 (read-only).
INSTALLED SOFTWARE: 1 ARCHIVE: default

Software Results

Results for software install media that can be attached to environments so you can install the software.

10 of 619 results See all Software Results >

OmniPagePro_9

ID: dd737f87-fa33-4fca-bafc-760cd10a3c60
IS OPERATING SYSTEM: false

Software

HiJaak_Pro_2.0

ID: 2ab14707-d4f0-4bfc-a23a-c04ca8d7684f
IS OPERATING SYSTEM: false

Software

Micro CFMS Profit Planning System 9.0

ID: e60cadea-bd07-4813-ac12-c380fce1caee
IS OPERATING SYSTEM: false

Software

ClarisWorks_for_Mac_1.0v2

ID: 5ba7a271-24bf-4678-81cb-12ddc92ea6a1
IS OPERATING SYSTEM: false

Software

Corel_Paradox_8

ID: Corel_Paradox_8 IS OPERATING SYSTEM: false

Software

DeLorme_Street_Atlas_5.0

EaaS Client view of a Yale EaaS Installation

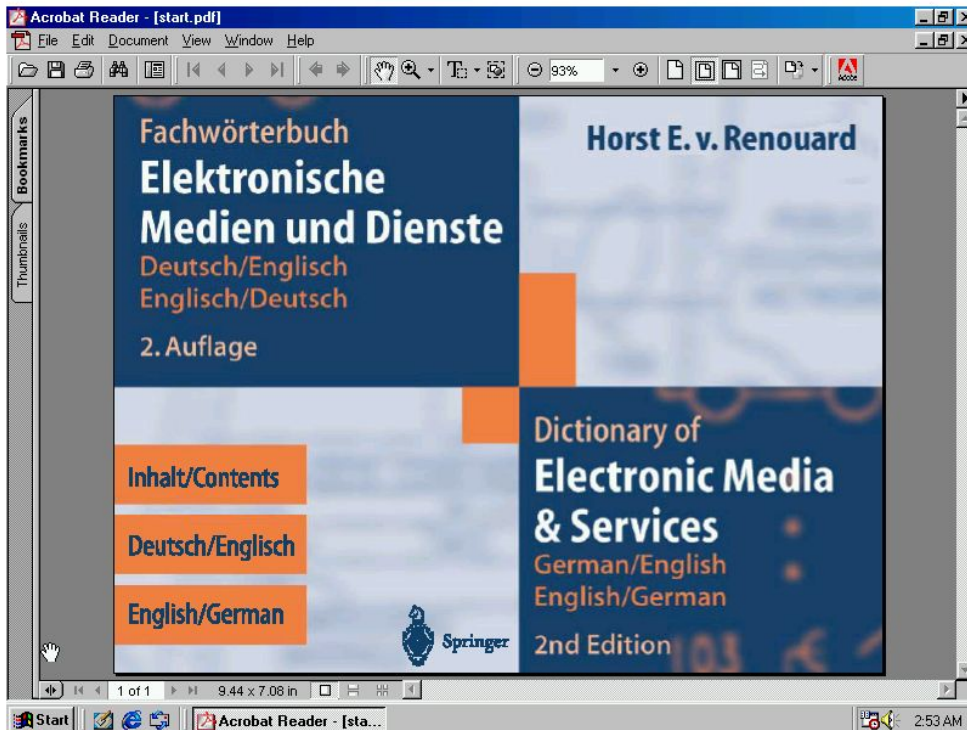


EaaS Additions: More Clients



- Designs and prototypes for additional access services
- Build off Environments created in the EaaS Client
- Further integration into existing sites and systems: catalogs, repositories, digital preservation suites, etc.
 - “Virtual Reading Room”
 - Access service for born-digital, media-bound publications (e.g. published CD-ROMs)
 - Universal Virtual Interactor*

*The Universal Virtual Interactor will be the subject of its own future Training Module



Example: Yale Library “Emulation Viewer” Client, for integration with library catalog

Credits

- Training Module written and designed by Ethan Gates, Software Preservation Analyst, Yale University Library
- All photos, screenshots, and videos recorded by Ethan Gates
- Emulation-as-a-Service module diagrams based on designs by Klaus Rechert
- Icons sourced from [The Noun Project](#)
- EaaSI program of work sponsored by the Alfred P. Sloan Foundation and the Andrew W. Mellon Foundation, hosted by Yale University Library



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