Challenges and Solutions of Developing and Implementing a Novel Desktop-as-a-Service

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NUROMEDIA

FRANKFURT UNIVERSITY OF APPLIED SCIENCES

Bundesministerium für Wirtschaft und Klimaschutz

ZIM Zentrales Innovationsprogramm Mittelstand

Tough decisions. Everybody faces them from time to time!

A solution that offers everything would be really helpful. . .

Motivation for the Project

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Deciding which deployment strategy is best, today often feels like having to choose between. . .

⟹ **Locally deployed applications**

(„native Linux/Windows applications“)

or. . .

+

⟹ **Software-as-a-Service – SaaS**

(„web applications“)

Benefits and Drawbacks of Traditional IT vs. SaaS

Locally deployed applications

(„native Linux/Windows applications“)

- 🙂 Privacy + Security
- 🙂 Legacy applications supported
- 🙂 No vendor lock-in possible

- ☹ Client requires specific operating system
- ☹ Client must be trustworthy
- ☹ Administration effort
- ☹ Remote access to applications is difficult
- ☹ No automatic synchronisation
- ☹ No automatic backup

Software-as-a-Service – SaaS

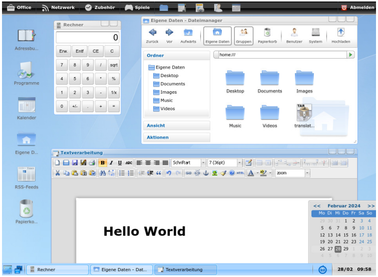
(„web applications“)

- 🙂 Any client with a browser can be used
- 🙂 Simple data synchronisation and backup
- 🙂 No deployment effort (if public cloud)

- ☹ Much deployment effort (if private cloud)
- ☹ Provider must be trustworthy
- ☹ Fear for a vendor lock-in
- ☹ Potential privacy and security issues
- ☹ Network connection required
- ☹ Cannot replace all applications (e.g., legacy applications)

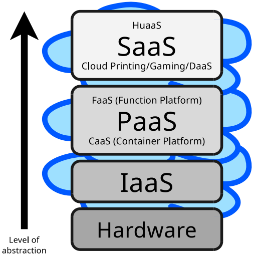
Even modern VDI solutions (Virtual Desktop Infrastructure) such as Azure Virtual Desktop or Windows 365 have drawbacks. They increase complexity (additional desktop), require a lot of configuration and are typically not free software.

Inspiration: Web-Desktops ≈ Desktop-as-a-Service



- Web desktops implement a sort of Desktop-as-a-Service (DaaS)
  - Example: **eyeOS** (2005-2014)

Last free revision (AGPL license): v2.5 (2011)
`https://github.com/nawawi/eyeOS`
`https://github.com/jonrandoem/eyeos`
Acquired by Telefónica in 2014 ⟹ † 2017
Follow-up project **oneye** ⟹ † 2023
`https://github.com/oneye/oneye`



HuaaS
SaaS
Cloud Printing/Gaming/DaaS

FaaS (Function Platform)
PaaS
CaaS (Container Platform)

IaaS

Hardware

Level of abstraction

- The eyeOS approach: A desktop is recreated or „emulated“using PHP and (static) HTML
  - Internet technologies from 20 years ago
  - **Failed concept**
    - No Linux/Windows applications
  - However, it is an inspiring solution:
    - Users only need a browser
    - Runs in public clouds and on-premises
    - Free software & no vendor lock-in

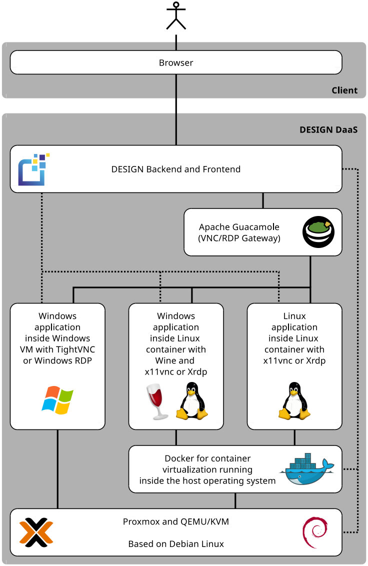
Motivation for the development of a novel DaaS

Is it possible to develop a system or service that has all mentioned benefits and avoids the drawbacks? ⟹ **We try hard with DESIGN**

The characteristics we aim for set the demands for the components chose

- Integration of unmodified **Linux/Windows applications**
  - ⟹ Containers and virtual machines are essential and improve security through isolated operation
- **Remote control** of the Linux/Windows applications
  - ⟹ Containers/VMs must include a VNC or RDP service
- **Focus is applications and not full desktops**.
  - ⟹ Export individual applications
  - ⟹ Few VNC and RDP services implement this feature e.g. TightVNC, Xrdp, RDP in Windows, x11vnc (by using the window manager qtile)
- **All interaction** is done **via the browser**
  - ⟹ A Gateway translates the GUI into a web stream (Apache Guacamole)
- **On-premises deployment and renting as a service possible**
  - ⟹ Precondition: Stable and popular open solutions (including the Proxmox server virtualization platform)
  - ⟹ Ideal for achieving a high level of security and privacy, and avoiding the risk of a vendor lock-in

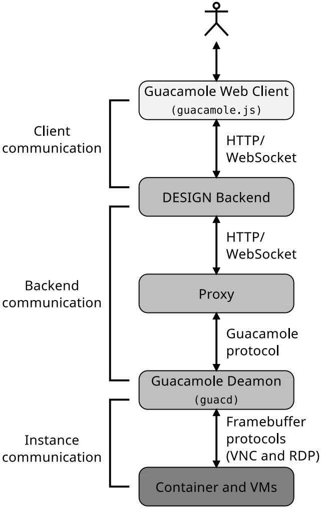
Architecture


Browser
Client
DESIGN DaaS
DESIGN Backend and Frontend
Apache Guacamole (VNC/RDP Gateway)
Windows application inside Windows VM with TightVNC or Windows RDP
Windows application inside Linux container with Wine and x11vnc or Xrdp
Linux application inside Linux container with x11vnc or Xrdp
Docker for container virtualization running inside the host operating system
Proxmox and QEMU/KVM
Based on Debian Linux

- Apache Guacamole as VNC/RDP Gateway
- **3 deployment ways for applications:**
  1. Linux applications running inside Linux containers
  2. Windows applications running inside Linux containers with Wine (if it works)
  3. Windows applications running inside Windows VMs (if Wine does not work)
- The Proxmox server virtualization platform offers i.a., VMs (KVM), containers (LXC), storage, networks, multi-node deployment,. . .
- Docker offers an API and range of features that are superior compared to LXC and runs well inside a Linux VM

All components (except the Windows operating system inside the Windows VMs are free software (open source)

Some Challenges we faced (1/3)



- Do users accept the **time required to deploy and start applications**?
  - Docker Linux
    $\Longrightarrow$ Start application: $\approx$ 5-10 sec.
    $\Longrightarrow$ Deploy (clone = copy) application: $\approx$ 5-30 sec.
    $\Longrightarrow$ Deploy (create) application: $\approx$ 8-10 min.
  - Windows VM
    $\Longrightarrow$ Start application: $\approx$ 10-20 sec.
    $\Longrightarrow$ Deploy (clone = copy) application: $\approx$ 4-5 min.
    $\Longrightarrow$ Deploy (create) application: $\approx$ 30-60 min.

Connecting

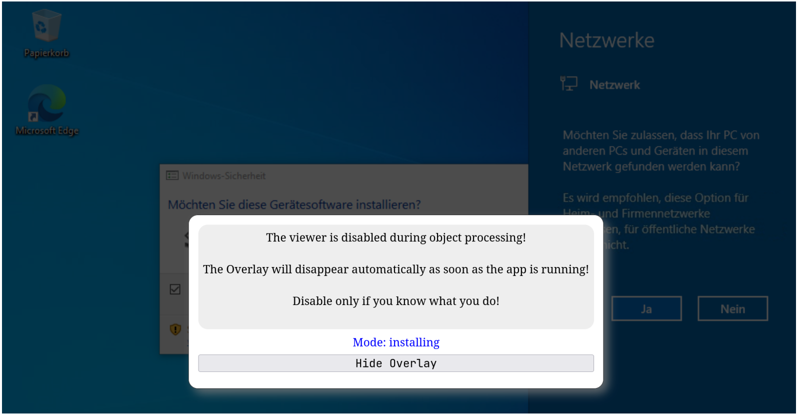
Connecting websocket

wait for boot

Some Challenges we faced (2/3)

- Windows applications usually demand user interaction during installation

  $\Longrightarrow$ Their deployment is often hard to automate



Netzwerke

Netzwerk

Möchten Sie zulassen, dass Ihr PC von anderen PCs und Geräten in diesem Netzwerk gefunden werden kann?

Es wird empfohlen, diese Option für Heim- und Firmennetzwerke

en, für öffentliche Netzwerke

icht.

Windows-Sicherheit

Möchten Sie diese Gerätesoftware installieren?

The viewer is disabled during object processing!

The Overlay will disappear automatically as soon as the app is running!

Disable only if you know what you do!

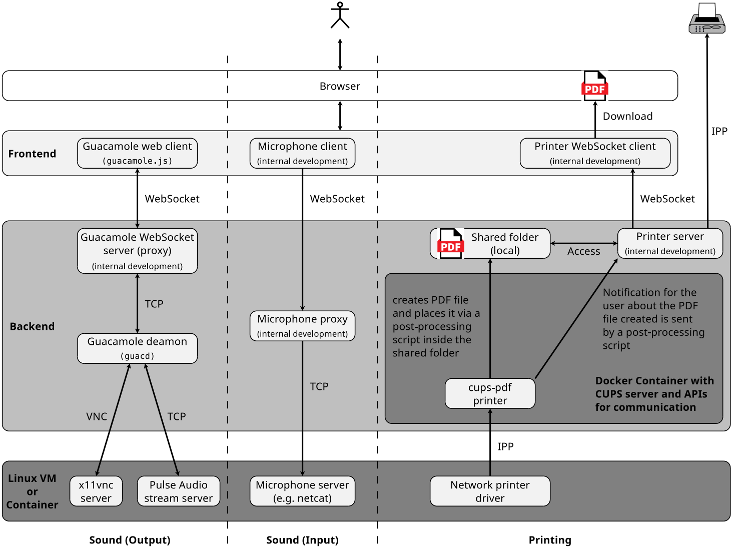
Mode: installing

- Essential features like **printing**, **sound**, and **microphone** are not supported by RDP and VNC in the same way (see next slide)

Printing, Sound, and Microphone – RDP vs. VNC

RDP (and Guacamole) support Sound (Output), microphone and printing out of the box

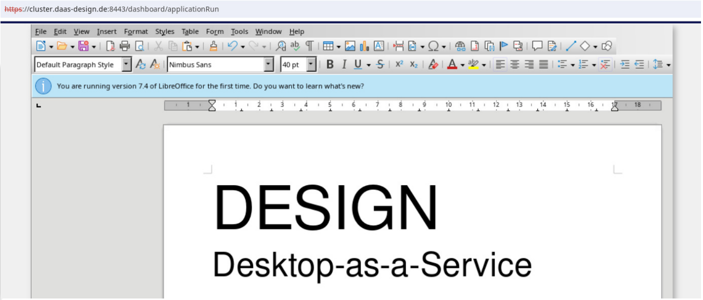
The picture shows the required components in DESIGN to support these features via VNC (and Guacamole) too



Some screenshots

Top image: LibreOffice Writer inside a Debian Linux Container

Bottom image: Firefox web browser inside a Windows 11 virtual machine

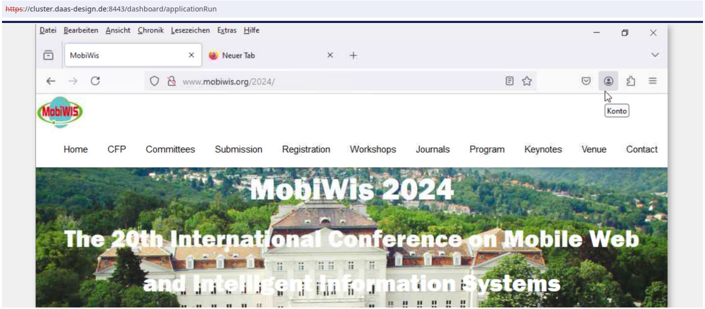


https://cluster.daas-design.de:8443/dashboard/applicationRun

You are running version 7.4 of LibreOffice for the first time. Do you want to learn what's new?

DESIGN

Desktop-as-a-Service



https://cluster.daas-design.de:8443/dashboard/applicationRun

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Thank you for your attention! Questions?

Soon you will find here information about DESIGN, a novel Desktop-as-a-Service solution with unique features that adapts to your needs.

- DaaS-DESIGN is a joint development of Nuromedia and Frankfurt University of Applied Sciences, funded by the Federal Ministry for Economic Affairs and Climate Action
- The service is planned to be ready in autumn/winter 2024
- An URL worth remembering: `https://www.daas-design.de`
- Preview: `https://youtu.be/oYv7wnMJ1YM`

More information about the architecture and components

Christian Baun, Johannes Bouché.
Closing the Gap between Web Applications and Desktop Applications by designing a novel Desktop-as-a-Service (DaaS) with seamless support for Desktop Applications.
Open Journal of Cloud Computing (OJCC), 8(1):1–19, 2023

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