

Open source Virtual Desktop Infrastructure solution for remote visualization and training in the NFDI

Authors:

Armin Saur^{1*}, Michael Scherle², Dirk von Suchodoletz²,
Rafael Gieschke², Yi Sun³, Jean-Karim Hériché³

*Lead presenter

¹armin.saur@rz.uni-freiburg.de, Albert Ludwigs University of Freiburg

²Albert Ludwigs University of Freiburg

³European Molecular Biology Laboratory, Heidelberg

Abstract:

The evolving landscape of IT services is witnessing a significant shift from traditional desktop computer software environments to centralized, cloud-like infrastructures. This transition offers a compelling alternative to the labor-intensive administration associated with distributed machines deployment and updating. Accompanying advantages encompass:

- highly flexible provisioning of diverse software environments, hardware components, or networks,
- scalability for large amounts of data,
- streamlined administration and sharing of work environments,
- support for environmentally sustainable practices, aligning with green IT initiatives, and
- enhanced access and security measures allowing the division of software, data visualization, and (sensitive) data.

Termed as Virtual Desktop Infrastructure (VDI), this approach to machine operation is gaining widespread acceptance. Within the realm of VDI, various use cases emerge, including:

- Scalable desktop infrastructures for education and training of (junior) researchers in various fields on their data management workflows, accessible across a broad spectrum of end-user systems.
- Remote visualization capabilities integrated on top of different High-Performance Computing setups or imaging analysis workstations, with efficient WAN remote access to resources. This reduces the need for data replication to achieve their visualization.
- Secure remote access solutions for sensitive data.
- Establishment of custom (permanent) desktops as alternatives to local desktop installations or terminal servers.

To address these use cases, BAND [1], a first generation OpenStack-based VDI was developed during the EOSC-Life project [2] with a focus on bioimage analysis and as bwLehrpool Remote for general desktops [3]. Both are publicly accessible. To construct a further developed generation, five core areas necessitate implementation, leveraging existing open-source components:

1. Development of an access gateway facilitating unified access to all VDI resources in the cloud. End-users without technical background but advanced research requirements are enabled, by this web page, to use VMs customized for their needs.
2. Construction of a service which allows service steward or administrators the creation, upload and sharing of new VM templates, customized for their unique workflow.
3. Implementation of efficient VM framebuffer grabbing mechanisms, running on the host, and hardware-accelerated video encoding for the remote access protocol SPICE. SPICE enables features like bidirectional audio, printer sharing and USB forwarding.

4. Integration of hardware-accelerated rendering, encompassing 3D-graphics and video processing capabilities within VMs, using passedthrough GPU partitions. Hardware with good open-source drivers is favored over proprietary drivers.
5. Establishment of long-term resource scheduling within the OpenStack framework, catering to the substantial demands of large-scale remote desktop sessions.

As this project is continuing, the first milestones for an open source VDI have been completed [4]. Our research indicated that the Bumblebee project is not modular enough, and a new frontend is developed following previous experience and feedback from [5]. Using a modified QEMU/SPICE server, the VM's frame buffer is accessible and encoded into a video stream, using GPU features. With a latency of less than 100 ms, a first large improvement is done. Using the VDI, the end-user's browser, instructed by the access gateway, opens a SPICE-Client, to establish a connection to the VM.

[1] BAND <https://band.embl.de>

[2] EOSC-Life project <https://www.eosc-life.eu>

[3] bwLehrpool Remote <https://bwlehrpool.ruf.uni-freiburg.de>

[4] Open-source VDI <https://github.com/OpenSourceVDIhttps://github.com/OpenSourceVDI>

[5] bwLehrpool <https://www.bwlehrpool.de/en>

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