

Virtual Expansion of a Departmental Cluster Two MetaCentrum Use Cases

Jiří Sitera, Miroslav Ruda, Petr Holub, David Antoš, Luděk Matyska

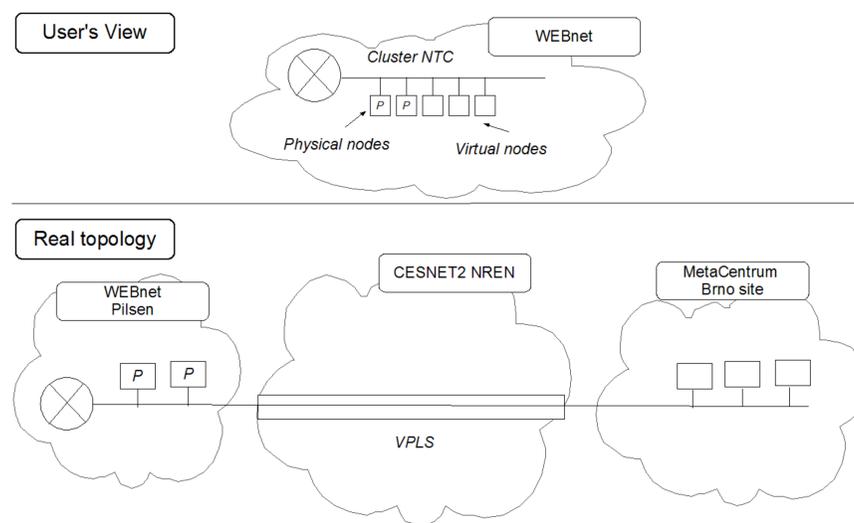
CESNET, a. i. e., Prague, Czech Republic

Motivation

Significant portion of MetaCentrum users have their own resources to run computations, taking the form of workstations or small clusters. They only use MetaCentrum services for projects demanding exceptional resources. The fact that **the use of their own resources differs from the use of the MetaCentrum infrastructure is very inconvenient** and often becomes the reason why even resource-demanding projects are solved using local services.

Departmental Cluster

- New Technology Center (NTC) of University of West Bohemia
- local cluster, customised setup, specific application portfolio
- local NFS setup, non-scalable security and system configuration
- image provided by application group, only minor modifications
- connected to the dedicated IP segment behind a firewall



Prototype setup: user's and real view of networking part

New virtual nodes of the cluster were provided as virtual machines running in MetaCentrum. From the user perspective they are exactly the same as the physical ones. In reality, a virtual cluster running a custom image has been created and connected directly to the NTC VLAN. Virtual clusters are built using standard MetaCentrum batch system – on request by local group administrators and within the **common resource management domain shared with standard MetaCentrum job-based services.**

The networking part:

- relying on advanced services of the CESNET2 network (end-to-end services based on VPLS and Cisco DWDM Xponders)
- virtual network management system SBF [1]
- a dedicated VLAN (virtual network) created for each virtual cluster
- transparent connection to the real cluster – the virtual cluster's VLAN connects to a particular VLAN in WEBnet, the UWB network

Results and Features Achieved

Users can focus on the scientific side of their problem.

- job management through user's original batch system
- local conventions and configuration (authentication, data storage, software installations and exact versions) stay untouched
- local security and network policy is fully followed
- technologies otherwise unsuitable for MetaCentrum due to scalability or security reasons (ID based NFS authentication) can be used
- no additional user training or support. Only local administrators interact with MetaCentrum services and support unit

Adding Grid Resources to the Local Cluster

To bridge the gap many users see in existing differences between the familiar home environment and general-purpose MetaCentrum services, we have prototyped and tested a solution designed to transparently extend local clusters with virtual machines running on MetaCentrum resources. We believe that this new service will be a significant step ahead in the effort to provide MetaCentrum resources as a comfortably and widely usable science infrastructure.

Video Processing

- collaboration with a non-academic subject (KitD)
- virtual cluster network tunneled outside of academic network
- we achieved reasonable (more than one Gbps) speed using GRE tunnelling
- worker node runs MS Windows
- a new feature of SBF client port – a demarcation point between MetaCentrum controlled network and a user network

MetaCentrum resources can be transparently available as virtual nodes or clusters regardless of location and node OS.

From PBSPro to Torque

In recent years, MetaCentrum has been using Xen-based virtualization to achieve more flexibility and efficiency. Relying on the Magrathea virtualization manager and local batch system extensions, jobs can be submitted to virtual machines built according to specific job requirements. Virtual clusters consisting of virtual machines are managed by a common job management system and are scheduled together with standard computing jobs.

Central batch system of MetaCentrum recently converted from PBSPro to Torque and **all virtualization-related functionality developed by MetaCentrum has been ported to Torque.**



<http://meta.cesnet.cz>

MetaCentrum is responsible for building the Czech National Grid and its integration to related international activities, especially in the European Union. It is actively involved in many international grid projects such as EMI, EGI InSpire, CHAIN, EPIKH.

References

- [1] David Antoš et al. *VirtCloud: Virtualising Network for Grid Environments – First Experiences*, AINA 2009.
- [2] Jiří Sitera et al. *MetaCentrum Virtualization – Use Cases*, CESNET technical report 30/2010.