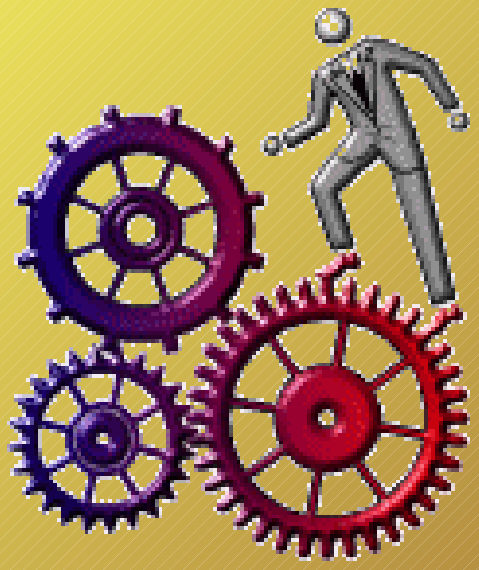
openQRM, pluggable virtualization for modern data-centers



Fosdem 2008

A presentation by Matt Rechenburg

Agenda

- OpenQRM in short
- Pluggable architecture
- Virtualization layer in openQRM
- Details about the openQRM Virtualization-plugins
- Developing a Virtualization-plugin
- Time for questions and discussion

Project History

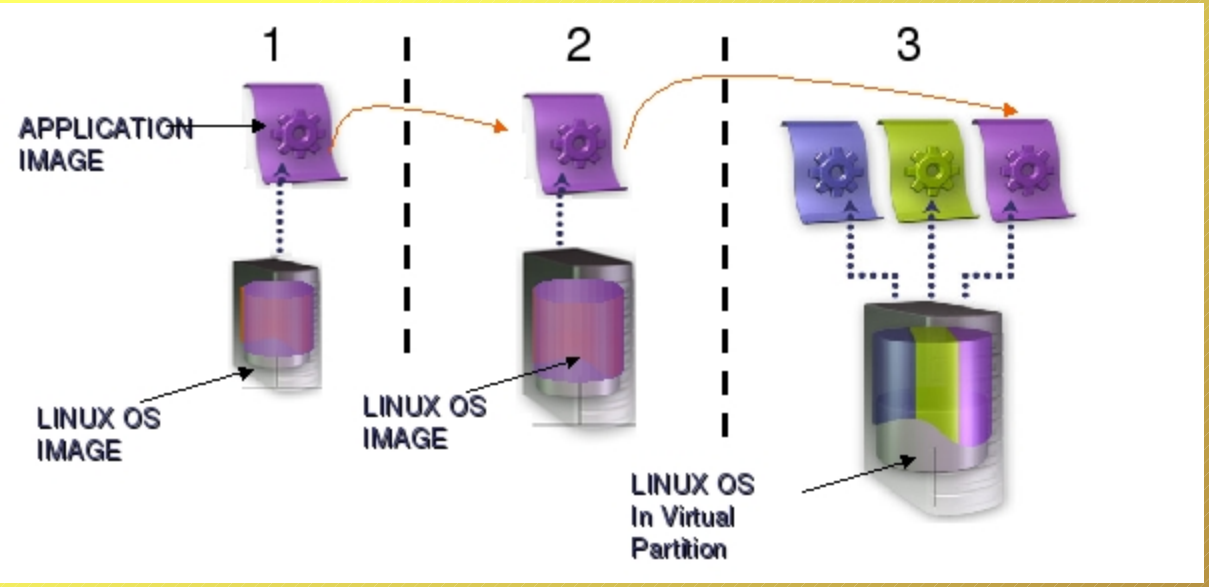
- Derived from a proven commercial product
- Open-source since beginning of 2006
- openQRM Project on Sourceforge.net
- Active development by the community

openQRM: Goals and Concepts

- Separation of different modules in the data-center
  - Servers -> physical hardware
  - Services -> Operation System + Applications
  - Storage- and Network-devices
- Abstraction of modules via Virtual-environments
- Plug-able architecture, huge selection of plugins
- Automated mechanisms for enhanced monitoring, system-management and rapid deployment
- Support for different operation systems and Virtualization types

Virtualization layer in openQRM

- Unifies the different Virtualization types
- Transparent support for migrating from physical resources to virtual partitions from different types
- Server-images does not require any changes



Virtualization Host-management

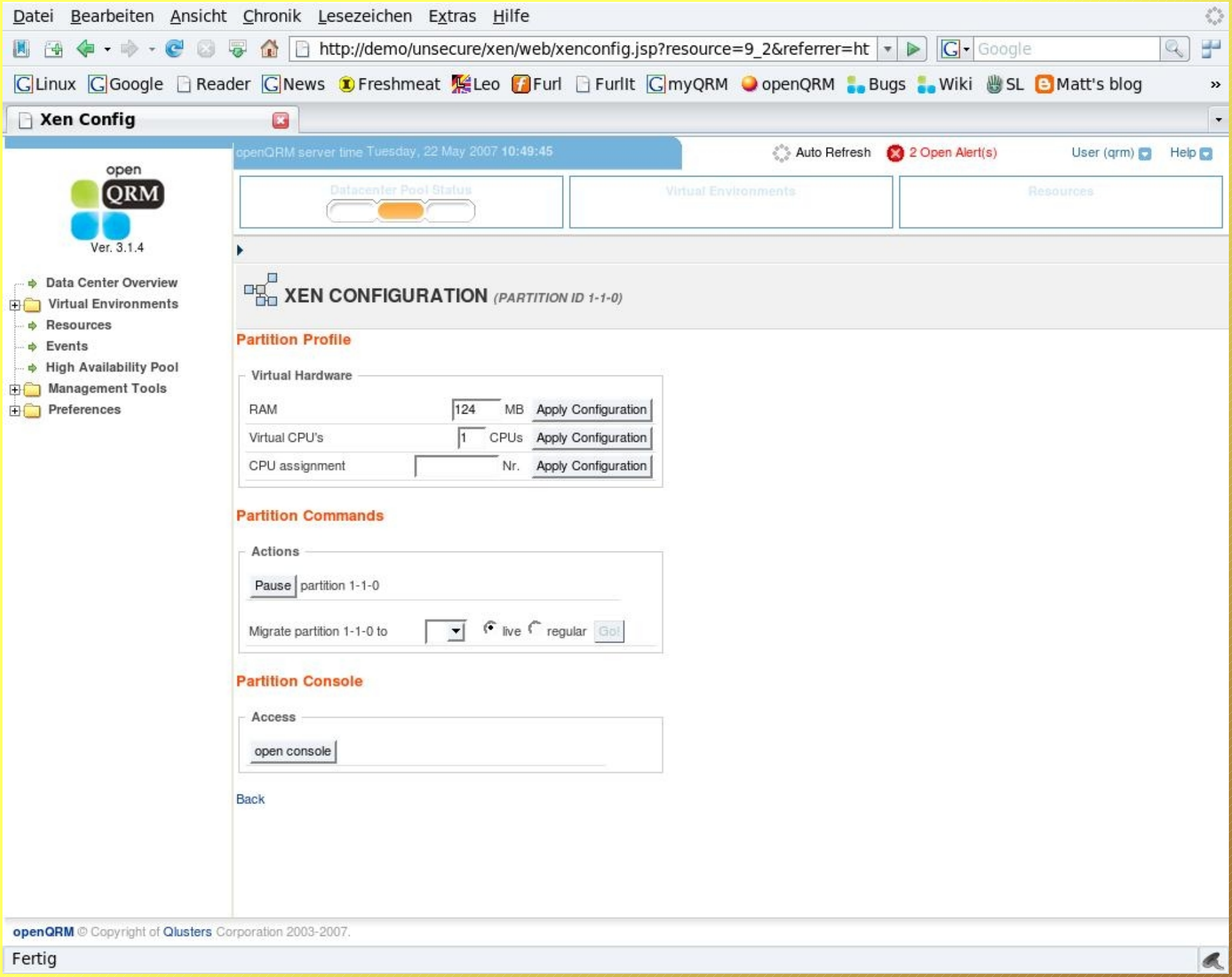
- Not only a GUI for a single Virtualization Host
- Automated Host deployment
- Automatic installation of the Virtualization components on the Host VE
- Cluster of shared Hosts (SSI)
- Load-balancing and scalability

Virtualization Partition-management

- Partitions created on behalf of Host-resource
- Partitions are just another type of resource
- openQRM maps partition commands to actions on the Virtualization Host
- Administration of vm's just like physical servers
- Partitions can move easily from one Virtualization Host to another
- Transparent resource management

The Xen plugin

- Automatic installation of the Xen VE via a resource boot-service
- Adding/removing/mapping of virtual network-interfaces
- Mapping of the virtual CPUs
- Increasing/decreasing memory consumption “on-the-fly”
- Pause/Unpause
- Handing over block-devices (FC/LVM)
- Live-migration
- Xen-console within the openQRM user-interface
- Supports NFS and Iscsi storage-servers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Xen Config
openQRM server time Tuesday, 22 May 2007 10:49:45
Auto Refresh
2 Open Alert(s)
User (qrm)
Help
open QRM
Ver. 3.1.4
Datacenter Pool Status
Virtual Environments
Resources
Data Center Overview
Virtual Environments
Resources
Events
High Availability Pool
Management Tools
Preferences
XEN CONFIGURATION (PARTITION ID 1-1-0)
Partition Profile
Virtual Hardware
RAM 124 MB Apply Configuration
Virtual CPU's 1 CPUs Apply Configuration
CPU assignment Nr. Apply Configuration
Partition Commands
Actions
Pause partition 1-1-0
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Partition Console
Access
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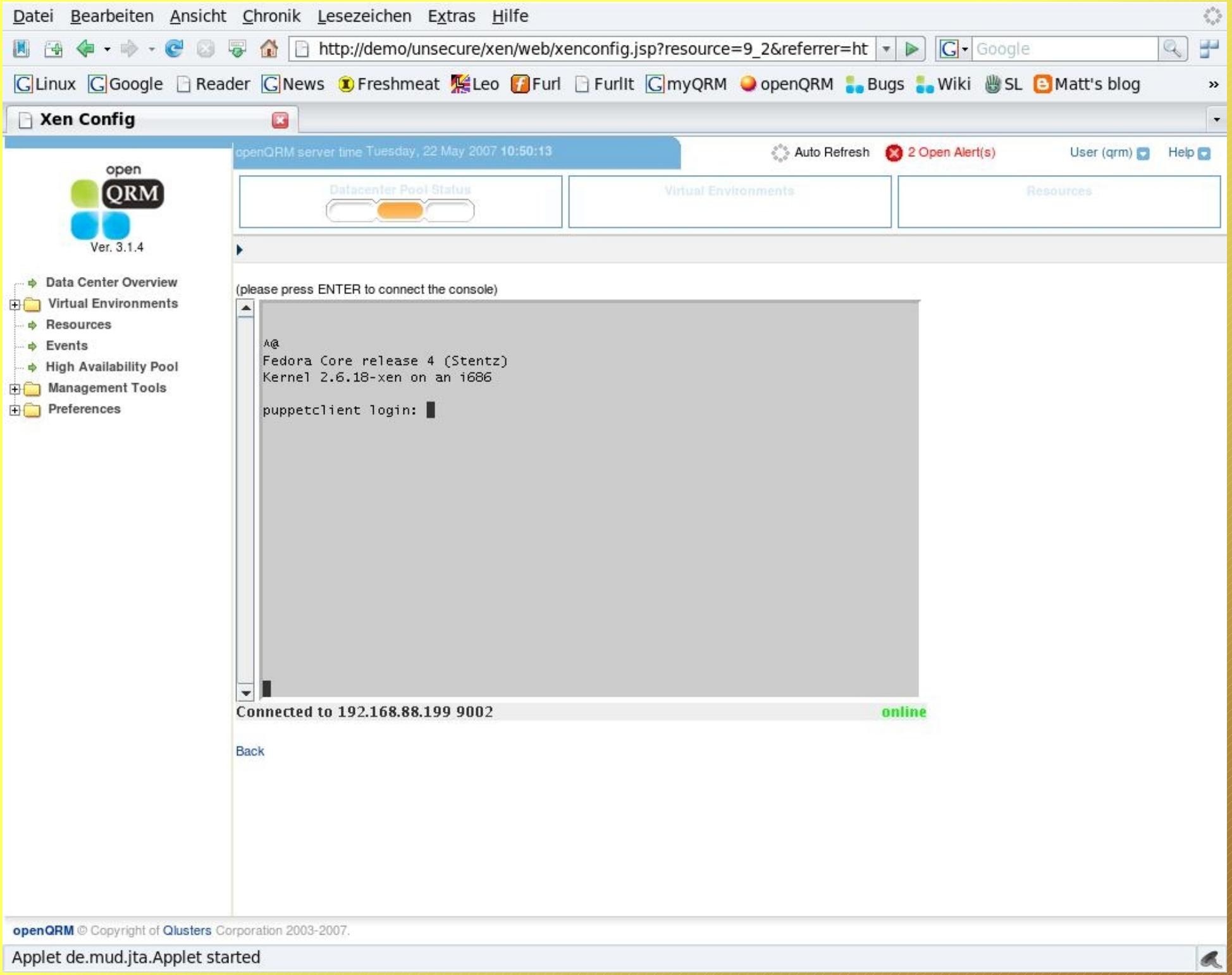
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Xen Config
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Auto Refresh
2 Open Alert(s)
User (qrm)
Help
Datacenter Pool Status
Virtual Environments
Resources
open QRM
Ver. 3.1.4
Data Center Overview
Virtual Environments
Resources
Events
High Availability Pool
Management Tools
Preferences
(please press ENTER to connect the console)
^@
Fedora Core release 4 (Stentz)
Kernel 2.6.18-xen on an i686
puppetclient login:
Connected to 192.168.88.199 9002
online
Back
openQRM © Copyright of Qlusters Corporation 2003-2007.
Applet de.mud.jta.Applet started

The Qemu plugin

- Automatic installation and pre-configuration of Qemu on the Host VE via a resource boot-service
- Support for kqemu and KVM
- Adding/removing/mapping of virtual network-interfaces
- Increasing/decreasing memory consumption
- Supports NFS and Iscsi storage-servers
- Does not require special boot-image

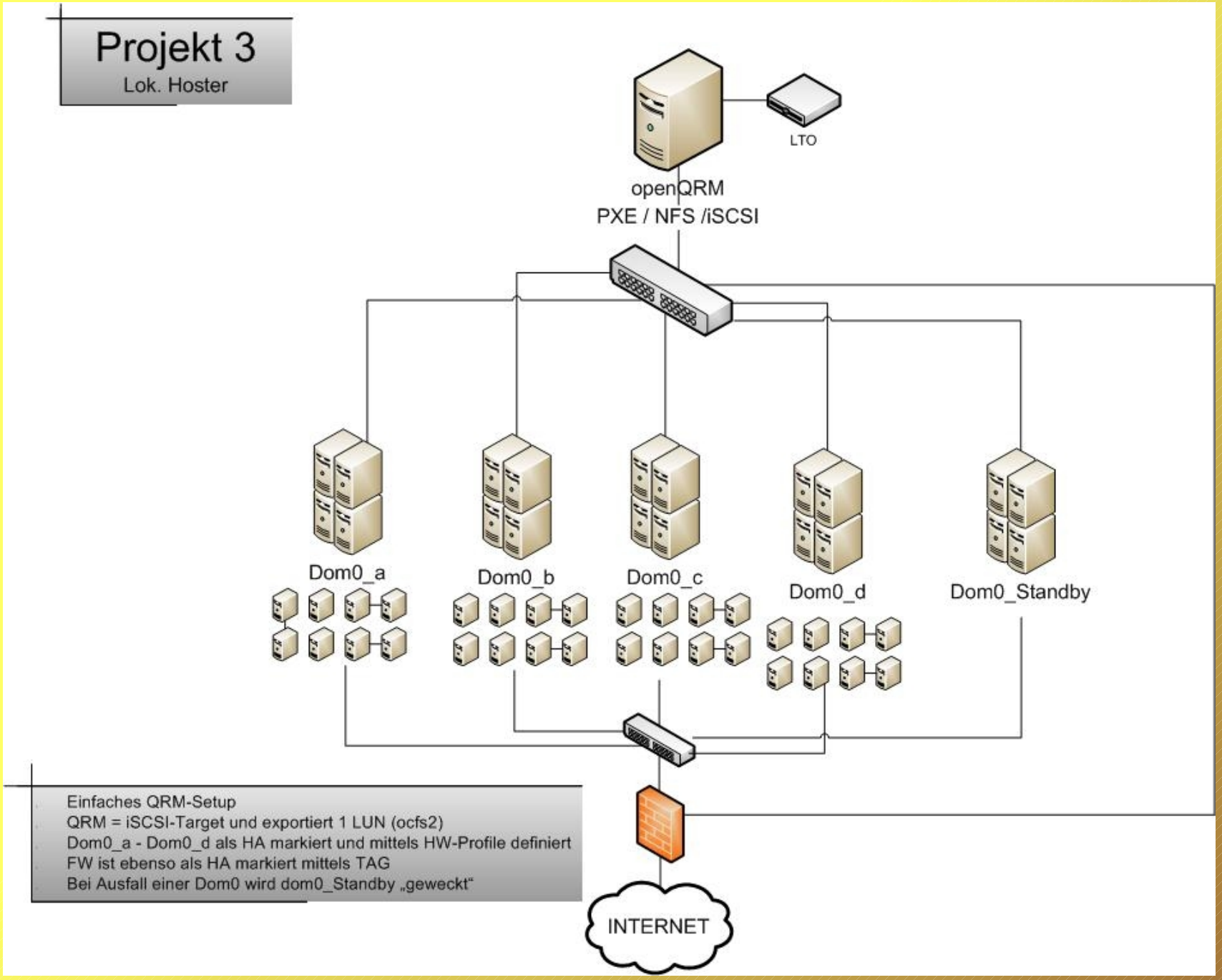
The Linux-VServer plugin

- Automatic installation and pre-configuration of the Linux-Vserver tools on the Host VE
- Adding/removing/mapping of virtual network-interfaces
- Increasing/decreasing memory consumption
- Supports NFS storage-servers
- Best for web-farms

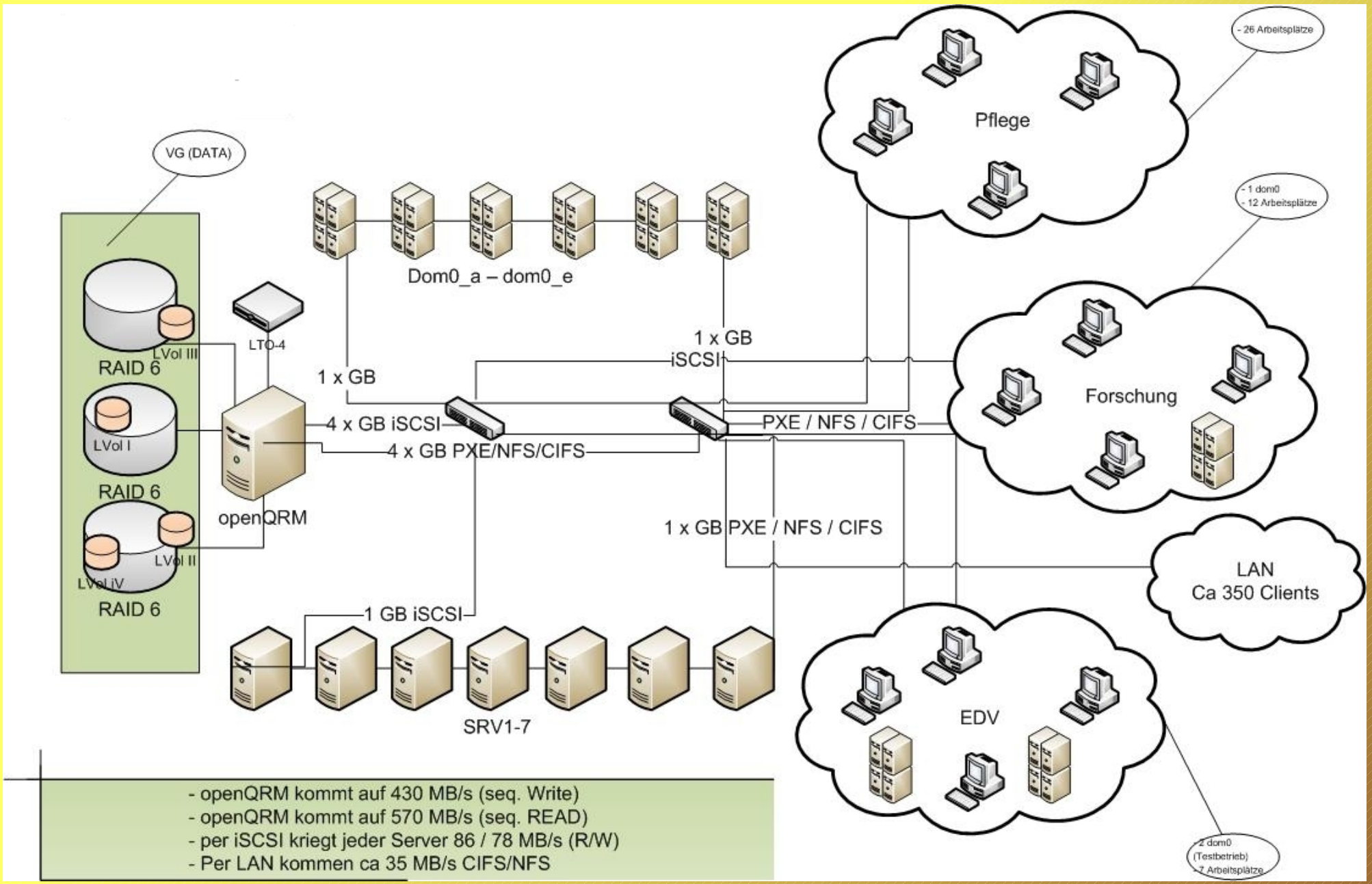
The VMware plugin

- Provided and maintained by Qlusters
- Manages existing VMware-server
- Support VMware GSX and ESX
- based on VMware API
- Supports NFS, Iscsi and local-deployment

A web-hosting setup



An advanced setup



2 classes to implement
... for example the Xen-plugin

Namespace
main/code/java/com/qlusters/qrm/plugins/partitioning/xen/

- XenPartitionBridge.java
  - Maps the vm-commands
  - Runs vm-commands on behalf of the Virtualization Host
- XenMacAddressProvider.java
  - Generates Mac-Addresses for partitions
  - Mac-address namespace per technology

The XenPartitionBridge implementation

```
public class XenPartitionBridge extends BaseParitioning {
    private static XenPartitionBridge instance = new XenPartitionBridge();

  public void startFromOff(ComputeResourceData resource) {
    ComputeResourceData node = Finder.getComputeResourcesFinder()
      .getReadOnlyHostingResourceByPartition(resource);

  StartPartitionCommand spc = new StartPartitionCommand(node, resource);
    CommandsExecutor.executeNow(spc);
  }

}
```

How the StartPartitionCommand works

```
public class StartPartitionCommand extends XenCommand {
   private static final String startPartition = Prefs.getPrefs()
            .getString(
               StartPartitionCommand.class,
               "startPartition", xenControlScript + "start -m ${" + MAC + "}");

   protected StartPartitionCommand(ComputeResourceData node,
         ComputeResourceData partition) {
      super(node, partition);
      createCommand(partition, startPartition);
   }
}
```

... and the implementation of the XenMacAddressProvider

```
public class XenMacAddressProvider implements MacAddressProvider {
...
   private long getAddress(int vmId, byte forthByte) {
   ...
      long result = 0x000000L;
      result += (forthByte & 0xff) << 16;
      result += vmId & 0xffff;
      result += MAC_TEMPLATE;
      try {
               result = getAddress(vmId, ++forthByte);
        } catch (IllegalArgumentException e) {
               System.out.println("We have reached max forth byte");
               Collections.sort(macs);
               Long lastMac = (Long) macs.get(macs.size() - 1);
               result = lastMac.longValue() + 1;
        }
        macs.add(new Long(result));
        return result;
     }
...
}
```

Summary and Conclusion

- Open architecture / fully plug-able
- Conforms different Virtualization technologies via partition-layer abstraction
- Transparent resource management
- Supports mainstream Virtualization vendors
- Plugin-development is made easy
-

Future Roadmap

- Focus on Virtualization
- Create plugins for
  - OpenVZ
  - Virtualbox
  - Virtuozzo
- Enhance Virtualization plugins actions
- **Port to PHP !**

  Your code and contribution is welcome !

openQRM on the internet

openQRM project

http://sourceforge.net/projects/openqrm

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Time for your questions

Many thanks and have a great time at Fosdem 2008!