CONTROL SYSTEM VIRTUALIZATION AT KARLSRUHE RESEARCH ACCELERATOR

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With the deployment of a Storage Spaces Direct hyper-converged cluster in 2018, the whole control system server and network infrastructure of the Karlsruhe Research Accelerator have been virtualized to improve the control system availability. We report on our experiences running EPICS IOCs and the industrial control system WinCC OA in this virtual environment.

6 Dell PowerEdge R740xd Servers

- 1,152 GB RAM
- 72 Cores 144 Threads
- 40 TB Hyper Converged Storage
- Bandwidth 20 GB/s
- 120 virtual machines

Hyper-V Storage Spaces Direct Cluster

All beamlines and storage ring have separated VLANs
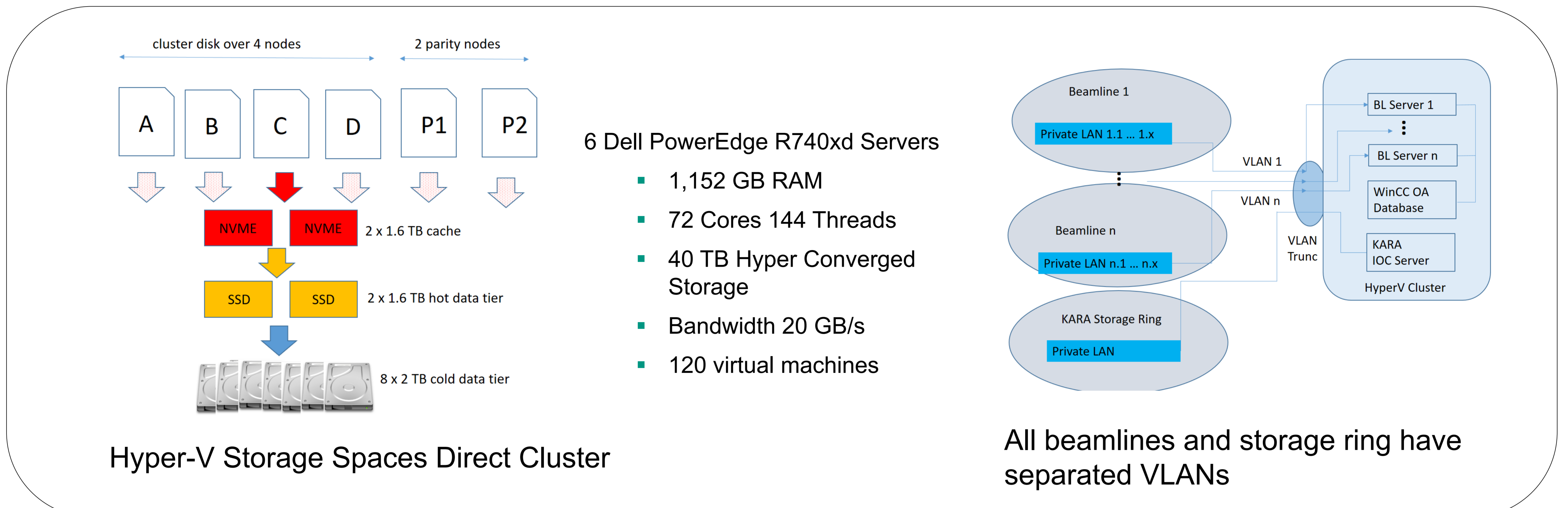
Why control virtualization?

- Higher control system availability
  => Zero downtime due to hardware failures
  => Life migration of VMs to another cluster host
- Automatic deployment of new servers
- Easy resource management
- Simple hypervisor based backup (VEEAM)
- Simple test of new control system functionality

Common pitfalls with virtualization

- Easy rollback to preliminary server versions
  => Careful server version management
- Live Migration is not high availability!
  => VM Host failure causes restart of VM
- VLAN management
  => Attaching new network by changing one number
- Cluster Network backbone stablity
- Over provisioning of cluster resources

KARA storage ring virtualization

- EPICS 7.0
- 22 Virtualized servers
- More than 100 IOCs with more than 70,000 PVs
- Automatic Server Deployment with VINEGAR
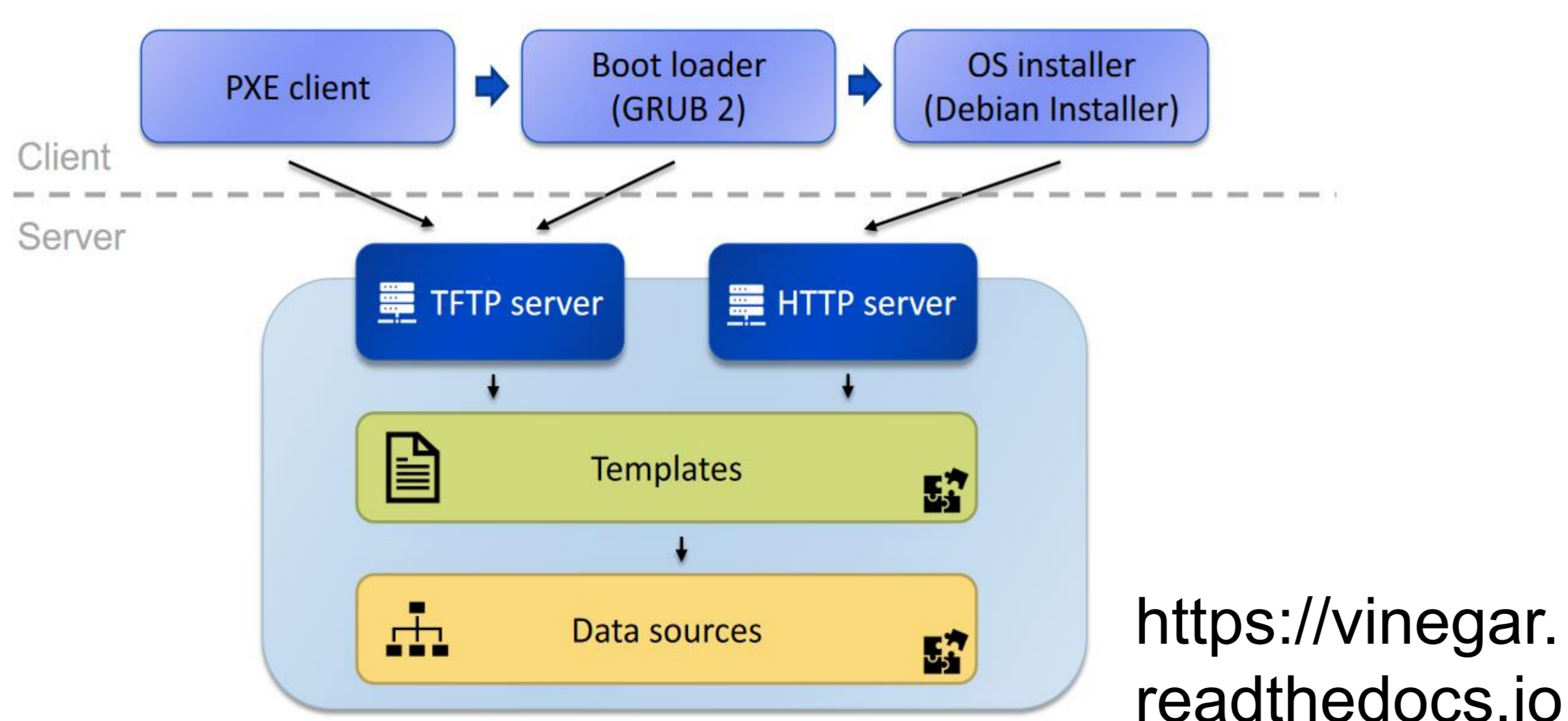- Automatic Server Configuration with SALTSTACK

KIT synchrotron beamline virtualization

- WinCC OA 3.15 as SCADA System
- Tango 8/spec for experiment control
- Virtualization of 15 servers in one week shutdown
- Introducing Dockerhosts with portainer as Management System

VINEGAR automatic server deployment

https://vinegar.readthedocs.io

Virtualized WinCC OA SCADA system for beamlines