

Accessing Network File System (NFS) from Linux* Laptop

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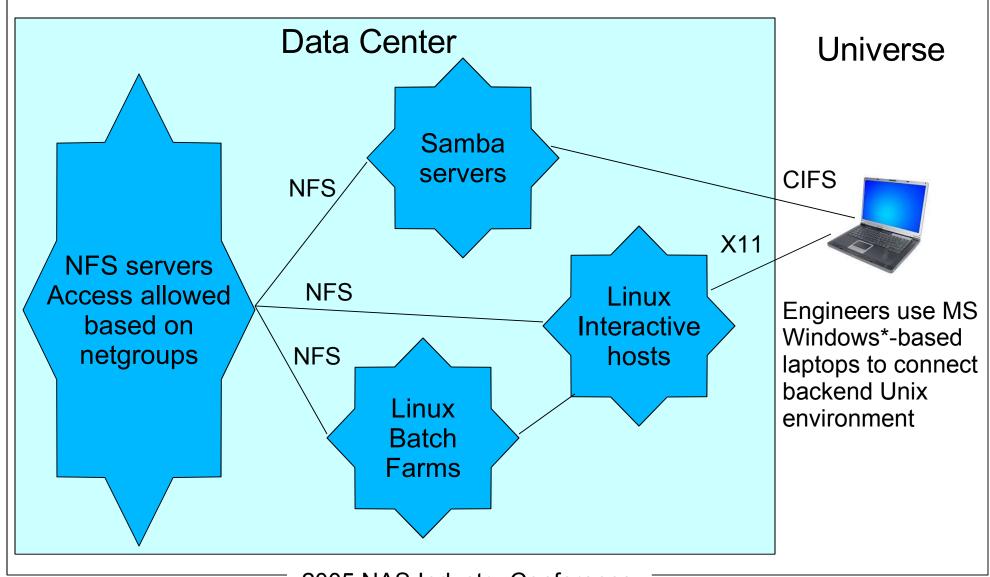


Intel's Engineering Environment

- Around 70 design centers worldwide
- Hardware/Software development, mostly Unix*-based
 - Large design projects span multiple sites
- Large farms of data-less Linux* compute servers used for batch and interactive jobs
- NFS is used for data sharing within data centers



Typical Intel Design Center Environment

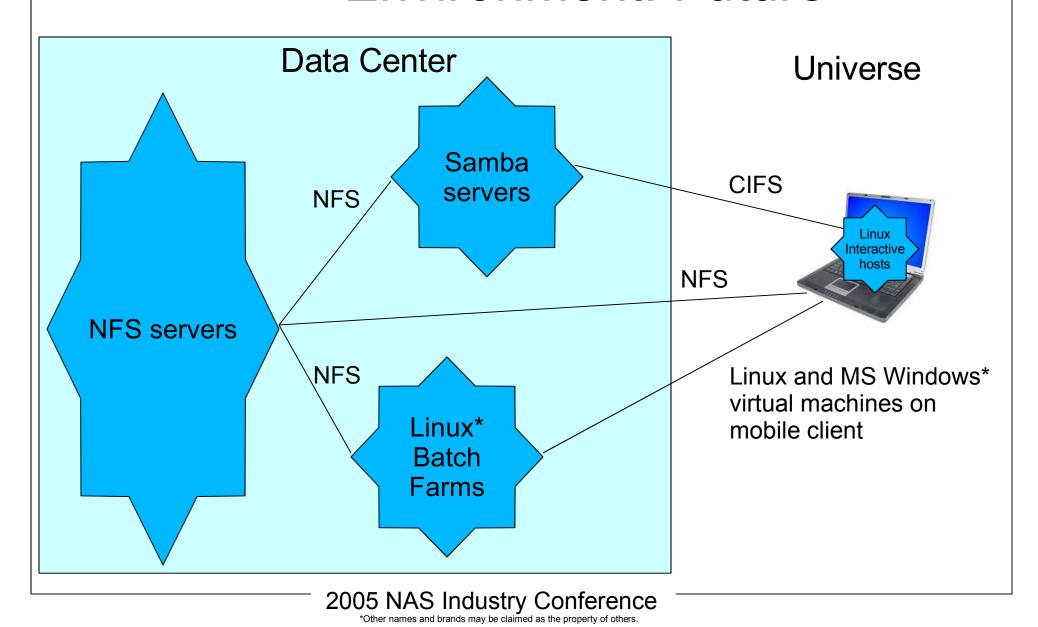


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Typical Intel Design Center Environment: Future





2007 Unified Client Environment

Service Partition Virtual Machine

Common system administration and management services

ex: security, backup, inventory, SW/OS provisioning, monitoring, etc.

Always "ON" and servicing all other system partitions

Office Partition Virtual Machine

Standard Intel IT Office client environment

ex: MS Office* Suite, IE*, IM, VoIP, Net Meeting*, WinZip*, Win DVD*, etc.

By default, can be turned off/on on-demand

Linux* CAD Design Virtual Machine

Linux-based CAD design tools and environment

ex: Interactive EDA CAD tools, X11 connectivity, batch, etc.

"On-demand" image instantiation

Linux SW Dev Virtual Machine

Linux-based SW development environment

ex: ClearCase* or other SCM tool, debugger, editor, compiler, etc.

"On-demand" image instantiation

Win CAD or SW Dev Virtual Machine

Windows CAD or SW development environment

ex: VSS, Visual.Net, Windows CAD tools, etc.

"On-demand" image instantiation

Micro-Hypervisor Virtual Machine Manager (VMM)

VT Enabled Hardware Platform

Host BIOS

CPU

GMCH

ICH

HDD

NIC

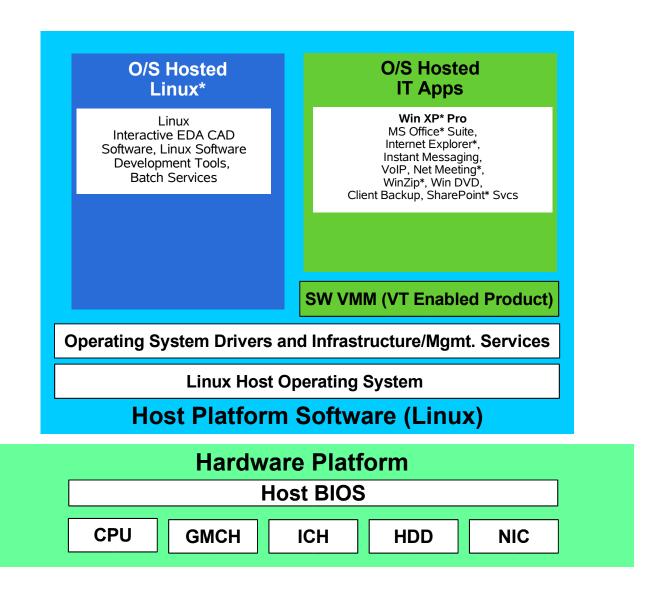
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2005 Unified Client Environment





Challenge: Secure NFS Access from Roaming Linux* Client

- Different types of connectivity:
 - Office LAN
 - Conference room WLAN
 - Home/public Internet via VPN
 - Remote site over WAN
 - Future: multiple Linux virtual machines from the same host with different security levels
- Can't rely on the existing NFSv3 security (IP-based netgroups)



Examined Options

Solution	Pros	Cons
NFSv4	 Kerberos support Access Control Lists (ACLs) Delegation and other WAN goodies 	 Might not be mature enough Lack of vendor support Some features are not supported yet
NFSv3 + Kerberos	· Re-use existing infrastructure	No support by all vendorsNo support for ACLs, WAN
NFSv3 + netgroups	• Use existing exports restriction model -add "mobile-client" netgroup	· DNS and netgroups caching on file servers

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Examined Options (Continued)

Solution	Pros	Cons
NFSv3 over SSH tunnel		PerformanceScalabilitySupport
NFSv3 over OpenVPN	 Transparent for roaming clients, tunnel survive client IP change Certificates for authentication 	PerformanceExtra IP addresseesVPN tunnel endpoint system
Smbmount through Samba		PerformanceLack of full Unix semantics

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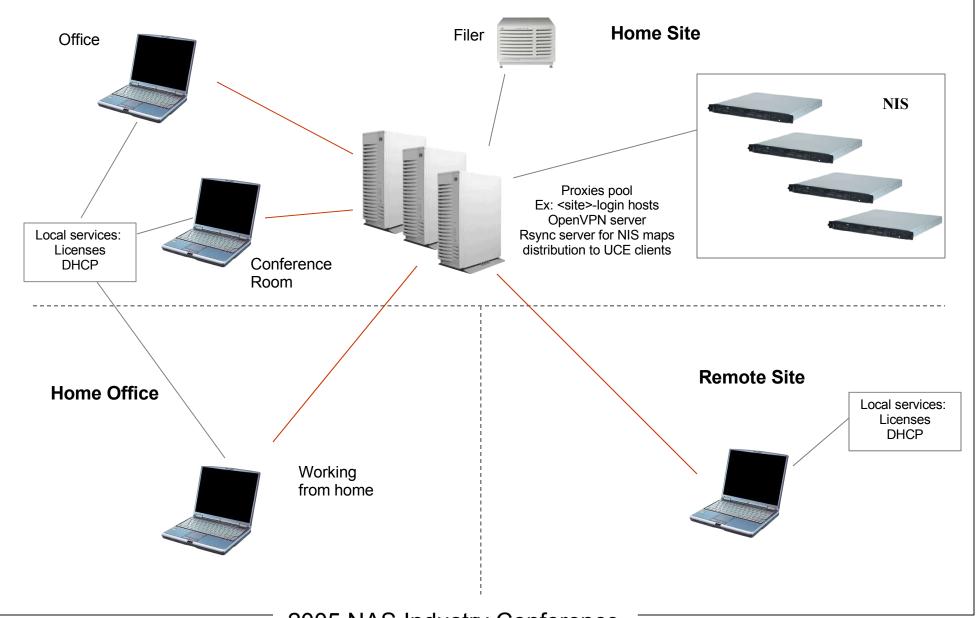


Chosen Directions

- Short term
 - NFSv3 over OpenVPN tunnel
- Long term
 - NFSv4
 - Lots of integration will be required
 - OS vendors support is crucial



NFS over OpenVPN architecture



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NFS over OpenVPN: Best Known Methods

- Automounter maps are cached on clients
 updated hourly via rsync from the proxy
- Routing table on clients updated every time new NFS server appears on automounter map
- Several OpenVPN processes run on the proxy for better performance
- Several OpenVPN servers share single DNS RR alias for load balancing and redundancy
- Certificates management/distribution mechanism should be defined



Next Steps

- Deploy certificates management solution for OpenSSL authentication
- Approach NFSv4 deployment towards multipartitioned systems
 - Identification, Authentication integration
 - Automounter support
 - Backward compatibility old NFS servers? Mixed security mode (v3/v4) for new servers
 - Vendors support
 - Performance
- Define secure file system sharing solution between different VMs within single client