

The Design and Implementation of Federated Cloud in WIDE Project

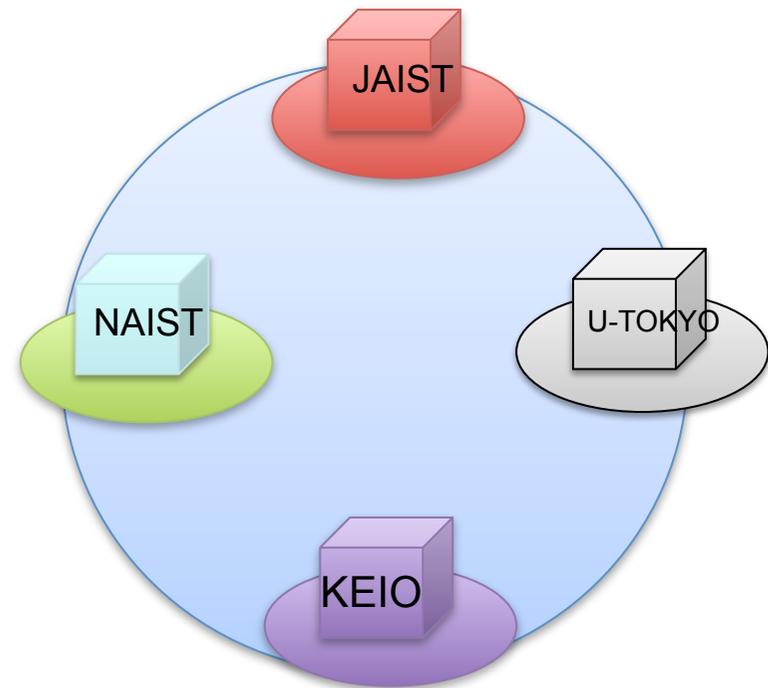
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Motivation

- We need “Cloud” for Researchers.
 - Why ?
 - Need servers for analysis and computation for measured data
 - Need storage for measured data
- Reducing daily **operational costs**
 - Hardware trouble, blackout for legal inspection
- Reducing **costs for building environment**
 - Prepare servers for computation, network experiments

Motivation

- A number of universities and research institutes are joined in WIDE Project
 - We build “Cloud” for Researchers
 - We can share resources.
 - Interconnection of clouds
=> Federated cloud

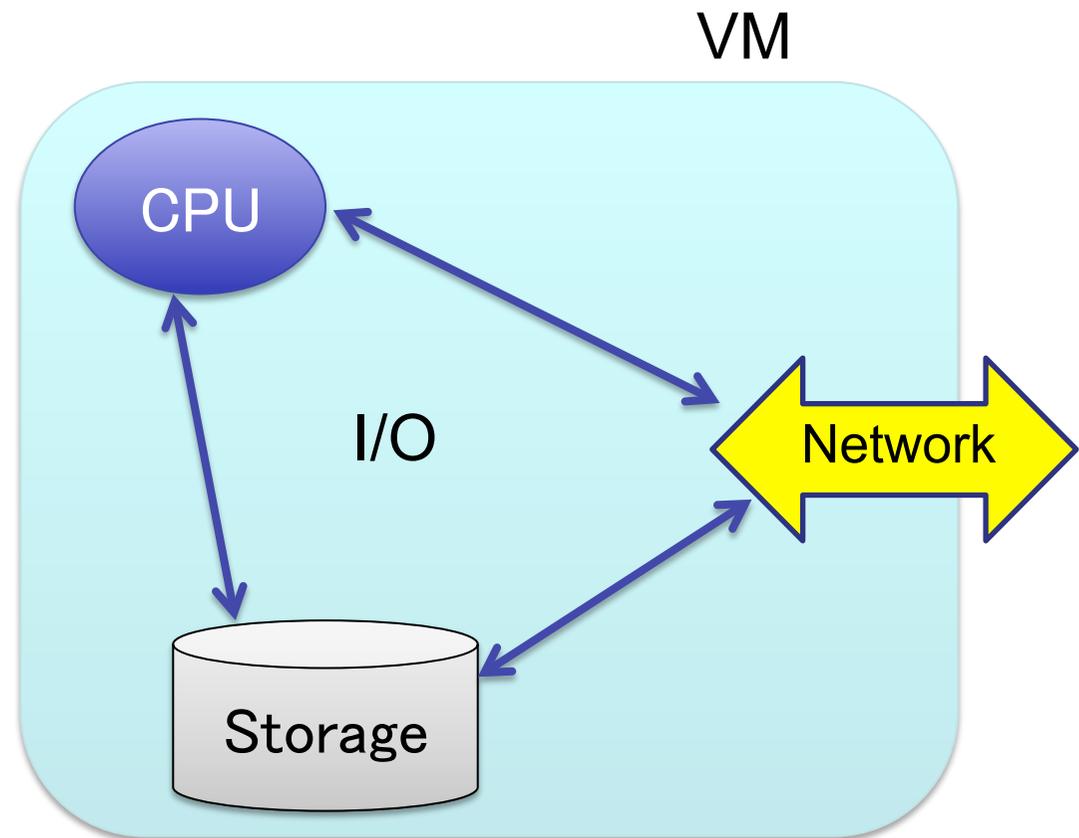


Challenges

- We evaluate possibility of Federated cloud **in actual environment**.
- Interconnecting clouds
 - Each Universities has **different policy, facilities and networks**.
- Providing flexible resource allocation
 - CPU is allocated from NAIST, Storage is allocated from JAIST, Network is allocated from KEIO.
- Migration of resources
 - **Avoiding interruption** due to blackout, network maintenance.

Design

- Four components for Virtualization
 - CPU
 - Storage
 - Network
 - I/O
- Each components should be migratable.



Implementation

- Hypervisor
 - kvm, xen
- Storage
 - iSCSI, NFS
 - Distributed filesystem, Cluster filesystem
- Network
 - NEMO, Stateless NAT
- I/O
 - Internet (not dedicated line)

Current Status

- Interconnecting clouds on each universities
 - Merging different technologies on each universities.
- Implemented Controller for Federated cloud
 - Controlling **different network, facilities**
- It works

The screenshot shows the WIDE Cloud Controller web interface. The browser address bar displays `http://wcc.wide.ad.jp/vms/list/1`. The page title is "WIDE Cloud Controller" and the subtitle is "Inter-University Virtual Machine Cloud Computing System". The user is logged in as "sekiya".

The main content area is titled "Listing sekiya's Virtual Machines" and displays a table of Virtual Machine Templates (Public VM). The table has the following columns: OS, Name, Status, CPU, Memory, Boot Device, CD-ROM, Hard Disk, Network, Created by, and GO. The data rows are as follows:

OS	Name	Status	CPU	Memory	Boot Device	CD-ROM	Hard Disk	Network	Created by	GO!
Debian 5.0.4 (amd64)	TEMPLATE	1	1024MB	hd	debian-504-amd64-netinst.iso	debian-504-amd64.img	NAT-1	sekiya	[Icons]	
Ubuntu 9.10 Desktop (32bit)	TEMPLATE	1	1024MB	hd	ubuntu-9.10-desktop-i386.iso	Ubuntu_Desktop_9.10_32bit.img	NAT-1	sekiya	[Icons]	
Ubuntu 9.10 Server (64bit)	TEMPLATE	1	1024MB	hd	ubuntu-9.10-server-amd64.iso	Ubuntu_Server_9.10_64bit.img	NAT-1	sekiya	[Icons]	
CentOS 5.4 (i386)	TEMPLATE	1	1024MB	hd	CentOS-5.4-i386-netinstall.iso	CentOS-5.4-i386.img	NAT-1	sekiya	[Icons]	
NetBSD 5.0.2 (i386)	TEMPLATE	1	1024MB	hd	i386cd-5.0.2.iso	NetBSD-5.0.2-i386.img	NAT-1	qoo	[Icons]	
FreeBSD 8.0 (i386)	TEMPLATE	1	1024MB	hd	8.0-RELEASE-i386-bootonly.iso	FreeBSD_8.0_32bit.img	NAT-1	sekiya	[Icons]	
Windows XP Professional	TEMPLATE	1	1024MB	hd	WindowsXP.iso	WindowsXP.img	NAT-1	sekiya	[Icons]	
FreeDOS (live CD)	TEMPLATE	1	1024MB	cdrom	fdfullcd.iso	empty-1G.img	NAT-1	sekiya	[Icons]	

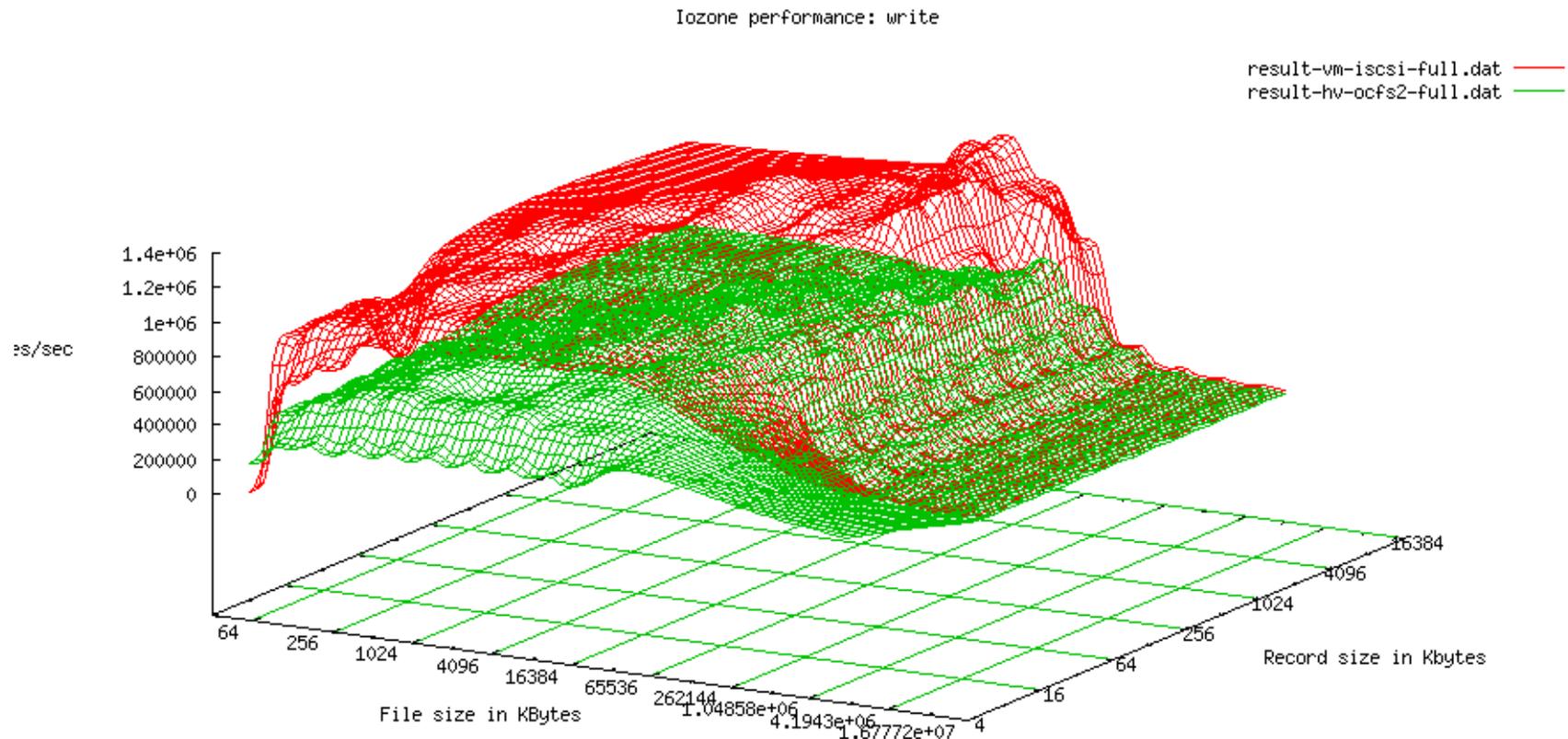
Below the table, there is a section for "Your Virtual Machines (Private VM)" with a similar table structure, but it is currently empty.

The footer of the page contains the text: "WIDE Cloud Working Group © 2010 Yuji Sekiya / WIDE Project All Rights Reserved".

Storage Performance measurement

- Measured I/O performance between CPU and Storage
- Preliminary result
 - iSCSI + Linux on kvm
 - Average of 20 times evaluation
 - 1G link, 1500byte MTU
 - Write
 - 64kbytes – 2Gbyte files
 - 4kbytes – 1024kbytes records

- Red lines : iSCSI storage mounted on each VM
- Green lines : iSCSI storage mounted on HyperVisor



Actual Application up to today

- GIT web server of research project.
 - USAGI Project
<http://www.linux-ipv6.org/gitweb/gitweb.cgi>
- WIDE web server for avoiding power outage
- Web and programming server for university lecture
- P2P broadcasting server for the 2nd budget screening meeting by government
(第2回事業仕分け)
- Please use for research purpose.

Future Works

- Distributed filesystem
 - Not replication, **shared filesystem** like a RAID5 using network.
- Flexible Network
 - **Network Mobility**
- High Availability
 - VM duplication and synchronization
 - **Automatic migration for avoiding troubles** – algorithms
- Security Management
 - Accommodate different policies for network
 - Encryption of storage and I/O