Using Virtual Servers for the CERN Windows infrastructure

Emmanuel Ormancey, Alberto Pace

CERN, Information Technology Department

A demo before we start

◆ **http://cern.ch/Winservices/Services/WoD**

Renaissance of dying technologies

The "virtual" Computer

- ◆ **An old dream, a long story**
  - ◆ make the software independent from the hardware
  - ◆ Follow hardware evolution without rewriting the software

- ◆ **Between 1977 and 1979, portability of Unix was being demonstrated with the C language**
  - ◆ "write it in C, it will run on any UNIX"

SECOND EDITION

THE

C ANSI C

PROGRAMMING LANGUAGE

BRIAN W. KERNIGHAN
DENNIS M. RITCHIE

PRENTICE HALL SOFTWARE SERIES
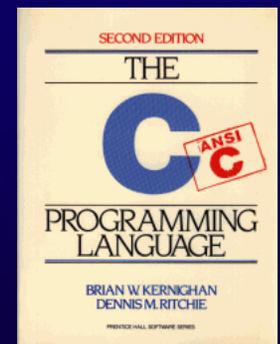
The "virtual" Computer (cont'ed)

◆ **In the '80s IBM's System/390 had specialized circuits in the CPU to allow it to virtualize itself**

   ◆ **VM – The virtual machine idea**
   ◆ **The VM operating system was literally giving each user its own virtual computer**

◆ **In 1995, the web required another virtual machine**

   ◆ **The Java Virtual machine**
   ◆ **New idea: independent from the underlying OS**
   ◆ **"write it in Java, it will run everywhere"**

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Vicious circle

**Need for better performances
(in terms of speed but also development times)**
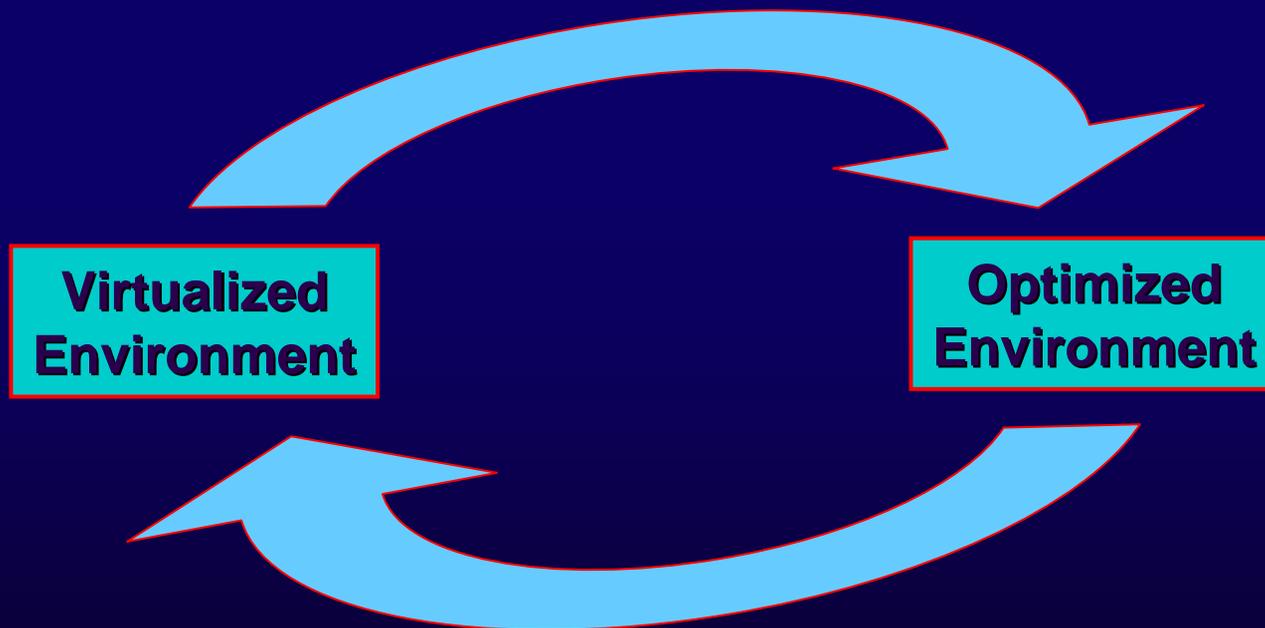
Need for portability, investment preservations

What's new today ?

◆ **The "Intel" PC is a consolidated standard.**

◆ **The Virtual Intel PC becomes now the new virtual machine**

   ◆ **It can run any flavors of Windows and Unix**

◆ **When running on Intel or AMD. On all processor families (Itanium, Pentium 4, Opteron)**

Why Virtual servers

◆ **More and more requests for dedicated servers in the CERN computer centre**

  ◆ **Excellent network connectivity, to the internet and to the CERN backbone (10 Gbit/s)**
  ◆ **Uninterruptible power supply**
  ◆ **24x365 monitoring with operator presence**
  ◆ **Daily backup with fast tape drives**
  ◆ **Hardware maintenance, transparent for the "customer"**
  ◆ **Operating system maintenance, patches, security scans**
  ◆ **"customer" focus only on "his application".**
  ◆ **Customer not willing to share his server with others, but ready to pay lot of $$, €€, CHF**

◆ **Frame for this server hosting service:**

  ◆ **http://cern.ch/Win/Help/?kbid=251010**

A real success

◆ **Several request per month received from LHC controls, Technical services, LHC experiments, …**

http://cern.ch/Win/Help/?kbid=251010

However, after an inside look …

◆ **Installing and maintaining custom servers is time consuming …**
- ◆ Lot of management overhead

◆ **Space in the computer centre is a scarce resource**

◆ **Several of these servers are underused**
- ◆ Hardly more than 2-3 % CPU usage

◆ **Excellent candidate for virtualization**

Goal of virtualization

- **Clear separation of hardware management from Server (Software) management**
    - **Could be even be made by independent teams**
- **Hardware management**
    - **Ensure enough server hardware is globally available to satisfy the global CPU + Storage demand**
    - **Manages a large pool of identical machines**
    - **Hardware maintenance**
- **Server (Software) management**
    - **Manages server configuration**
    - **Allocates server images to machines in the pool**
    - **Plenty of optimization possible**
        - Automatic reallocation to different HW according to past performances
- **Little overhead**
    - **Emulation of PC on real PC is very efficient**

Foreseen advantages

◆ **Simplified management**

  ◆ **"installing a server" becomes "loading an image"**

  ◆ **Unprecedented automation can be achieved**

◆ **"Server on Demand" Service**

Server on Demand

◆ **Chose from a set of "predefined" images**
  - ◆ Windows server 2003
  - ◆ Windows Server 2003 + IIS + Soap + Streaming
  - ◆ Windows Server 2003 + Terminal Server Services
  - ◆ …
  - ◆ Scientific Linux CERN 3 or 4
  - ◆ …

◆ **Takes resources from the pool of available HW**
  - ◆ Multiple, different, OS can be hosted in the same box

◆ **Available within 10 minutes**
  - ◆ Before: between one week and one months

◆ **Cost: much cheaper, especially manpower**

◆ **Performances: unnoticeable difference**

"VirtualMachine04" Remote Control   Remote Control ▼

```
Initializing random number generator:                      [  OK  ]
Starting pcmcia:                                           [  OK  ]
Starting up APM daemon:                                    [  OK  ]
Found system call table at 0xc0363bf0 (scan: close+chdir+write)
Starting AFS services.....
```

"VirtualMachine04" Configuration   ⊠

🖥 General properties	"VirtualMachine04"
When Virtual Server starts:	Never automatically turn on virtual machine
When Virtual Server stops:	Save state
🎭 Virtual Machine Additions	Virtual Machine Additions information not available
▥ Memory	256 MB
💾 Hard disks	1 virtual hard disk installed; Undo disks are disabled
Virtual hard disk 1	Attached to primary channel (0)
	Virtual hard disk file "VirtualHD-Dynamic-04.vhd"
	Maximum size is 40 GB; Currently expanded to 6.4 GB
💿 CD / DVD	1 virtual CD / DVD drive installed
Virtual CD / DVD drive 1	Attached to secondary channel (0)
	No media captured
📇 SCSI adapters	No virtual SCSI adapters installed
🖧 Network adapters	1 virtual network adapter installed
Virtual network adapter 1	Connected to "External Network (Intel(R) PRO_1000 MT Dual Port Network Connection)"
	Current Ethernet (MAC) address: 00-03-FF-36-69-06
📜 Scripts	Scripts disabled
💾 Floppy drive	No media captured
🖵 COM ports	2 COM ports installed
COM port 1	Attached to none
COM port 2	Attached to none
🖵 LPT ports	1 LPT port installed
LPT port 1	Attached to none

Microsoft
Virtua

Navigation
Master Stat
Virtual Serve

Virtual Mach
Create
Add
Configure

Virtual Disks
Create
Inspect

Virtual Netw
Create
Add
Configure

Virtual Serv

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What's next ?

- **We can expect request for more "Server types"**
  - **Various combinations of OS and applications**
- **We can expect request for custom server types**
  - **User creates and manages his server images**
- **Future server on demand**
  - **"I need 20 servers with this image for one month"**
  - **"I need an image for this server replicated 10 times"**
  - **"I need more CPU / Memory for my server"**
  - **"I do not need my server for 2 months, give me an image I can reuse later"**
  - **"I need a test environment, OS version n+1, to which I can migrate my current production services"**
  - **I need 10 Macintosh instances …**
  - **…**

Conclusion

◆ **Server virtualization a strategic direction for (windows) server management at CERN**

◆ **HW and SW management can be independent**

◆ **We can expect consequences also for traditional batch systems**

  ◆ **Instead of allocating CPU time for jobs submitted for a rigid OS configuration one could allocate bare "virtual PC time"**

  ◆ **User would submit "PC image hosting the job". Farm independent of OS, less security implication (for the farm management), unprecedented flexibility for users**

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