L7: Key Generation, Virtualization

Lecture
2011-03-31
Challenge

• No reply to any → no interest from students?
• Shall I cancel?
• Also regard alternative:
  – If you have an interesting sysadmin report, present some material to me and you can get a 10 minutes slot to present and if selected 3 bonus points
Certificates

- Exercise: research and post/present: How to create your own self-signed certificate 5 minutes.
Quick hint to self-signing

• Private key
  - openssl genrsa -des3 -out server.key 2048

• CSR (certificate signing request)
  - openssl req -new -key server.key -out server.csr

• Remove password (not always recommended)
  - cp server.key server.key.org
  - openssl rsa -in server.key.org -out server.key

• Self-Signed Certificate
  - openssl x509 -req -days 3660 -in server.csr \ 
    -signkey server.key -out server.crt

• Upload and install to server

http://www.akadia.com/services/ssh_test_certificate.html
Virtualization

• Abstraction of computer resources
• May, but does not have to change the interface
• End-user has limited or no knowledge about the real resources behind the virtualization layer
• Original / physical characteristics are hidden
Virtualization

join, aggregation, concatenation, array, $N \rightarrow 1$

ühendamine, agregeerimine, konkateneerimine, massiiv
Virtualization

partitioning, fragmenting, $1 \rightarrow N$

partitsioneerimine, fragmenteerimine
Virtualization

emulation, simulation, encapsulating, 1→1
emuleerimine, simuleerimine, kapseldamine
Virtualization

mixed
Why virtualize?

If...

• the characteristics of our existing resources are not quite what we need
  - replacing all the hardware is expensive
  - our demands change frequently
• we are unsure of our needs
  - sorting out our needs could prove costly when trying out different physical configurations

...then virtualization could be of help
Why virtualize?

• consolidation cuts the costs
• virtualization adds extra flexibility
  – answer to frequently changing needs
  – resource management is more granular
• possible security gains from isolating the application into virtual environment
• affordable testing platforms
• simplified end-user interfaces
Exercise (20min)

- Compile a list of virtualization concepts (IT related)
- Find at least 6.
- Pick two of them. Discuss them and write 3-4 sentences about them. Also find examples for them.
- Present!
(some) Virtualization Types

- Network (Desktop, Network)
- Software (Operating system-level, Application, Workspace)
- Hardware
  - Full
  - Partial
  - Para
- Memory (Physical, Virtual)
- Storage
- Data
Virtualization

the term “virtualization” is ~50 years old!

- platform virtualization
- resource virtualization
Platform Virtualization
Platform Virtualization

- server virtualization, virtual machines
- virtualized CPU, memory, I/O, devices
- *guest* virtual machines run on *host* hardware
CPU Virtualization

• Emulation
  - imitates the behaviour of one type of CPU with another CPU
  - usually implemented in software, performance issues

• QEmu
CPU Virtualization

• Full virtualization (täisvirtualiseerimine)
  - Virtual processor equal to underlying processor
  - Can run unmodified guest OS
  - Some instructions can be executed directly on physical hardware, some must be trapped/translated
  - VMWare Workstation/Server
  - VirtualBox
  - MS Virtual PC/Server
  - KVM
CPU Virtualization

- Full virtualization, hosted on OS
CPU Virtualization

- full virtualization with hypervisor (*hüperviisor*)
- hypervisor - layer between host hardware and guest OS
- VMM – Virtual Machine Monitor
CPU Virtualization

• paravirtualization (*paravirtualiseerimine*)
  - virtual CPU interface differs (in parts) from physical CPU interface
  - guest OS must be ported
  - can provide better performance in many scenarios
  - Xen, Citrix XenServer, VMWare ESX, MS Hyper-V
CPU Virtualization

- paravirtualization with hypervisor
CPU Virtualization

• hardware assist
  - trapping and emulating privileged/sensitive calls
  - AMD: AMD-V (Pacifica)
  - Intel: Intel VT (Vanderpool)
• VMWare, Xen/XenServer, VirtualBox, Hyper-V
Platform Virtualization

- containers, partitions
  - multiple userspaces on the same OS kernel
    - Solaris Containers
    - Linux Vserver
  - virtual directory trees
    - chroot,
    - BSD Jail
Resource Virtualization

- virtual memory, virtual machines(?!)
  - natural part of modern operating systems
Resource Virtualization

• Storage virtualization
  - RAID
  - Logical Volume Management, LVM
  - Network-Attached Storage
Resource Virtualization

- Network virtualization
  - Virtual Lan, VLAN
  - Virtual Private Network, VPN
  - link aggregation
  - Network Address Translation, NAT
Resource Virtualization

- Virtualizing the computing power
  - Clusters
  - GRID
  - Cloud Computing
  - ....
Exercise (20min)

- Form teams (3-5)
- Find two cases, where virtualization makes sense
- Find 4 pros and 4 cons for virtualization
- Select two most important pros and cons from these
Virtualization Upsides

• Better resource utilization
• Cost reduction
  – hardware, power, administration
• Recovery from single (virtual) machine disaster is easier
• Rolling out new systems is faster
• Extensive changes can be made without touching the physical layer
• Flexible resources matching the needs
Virtualization Downsides

• Additional virtualization layers add more complexity
• Recovery from large-scale disaster is complicated
• Security: virtualization layer must be carefully protected
• Resource overhead: additional layers consume resources
Other forms of virtualization
Exercise

● What about jvm, cli, llvm, wine, dosbox, dosemu?
● What is virtualized here?
● Classify!
● 10 minutes