

Cloud Environments



Introducing Cloud-based virtualised environments and their use in supporting learning and teaching

Prof Bill Buchanan

Cloud Environments



- Introduction to the Cloud.
- Community Clouds.
- Sharing Materials and Support Teaching.
- Virtualised Desktops.

Cloud Environments



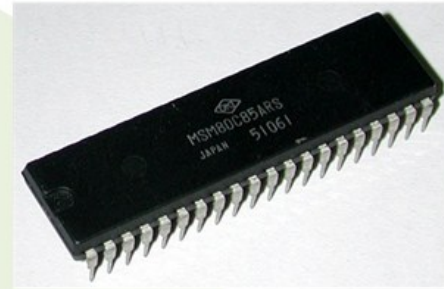
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Transistor



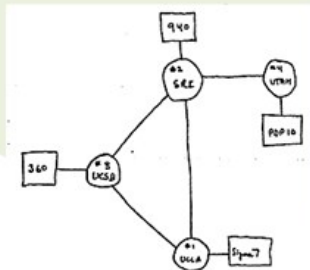
Microchip



Microprocessor



The Cloud



THE ARPA NETWORK

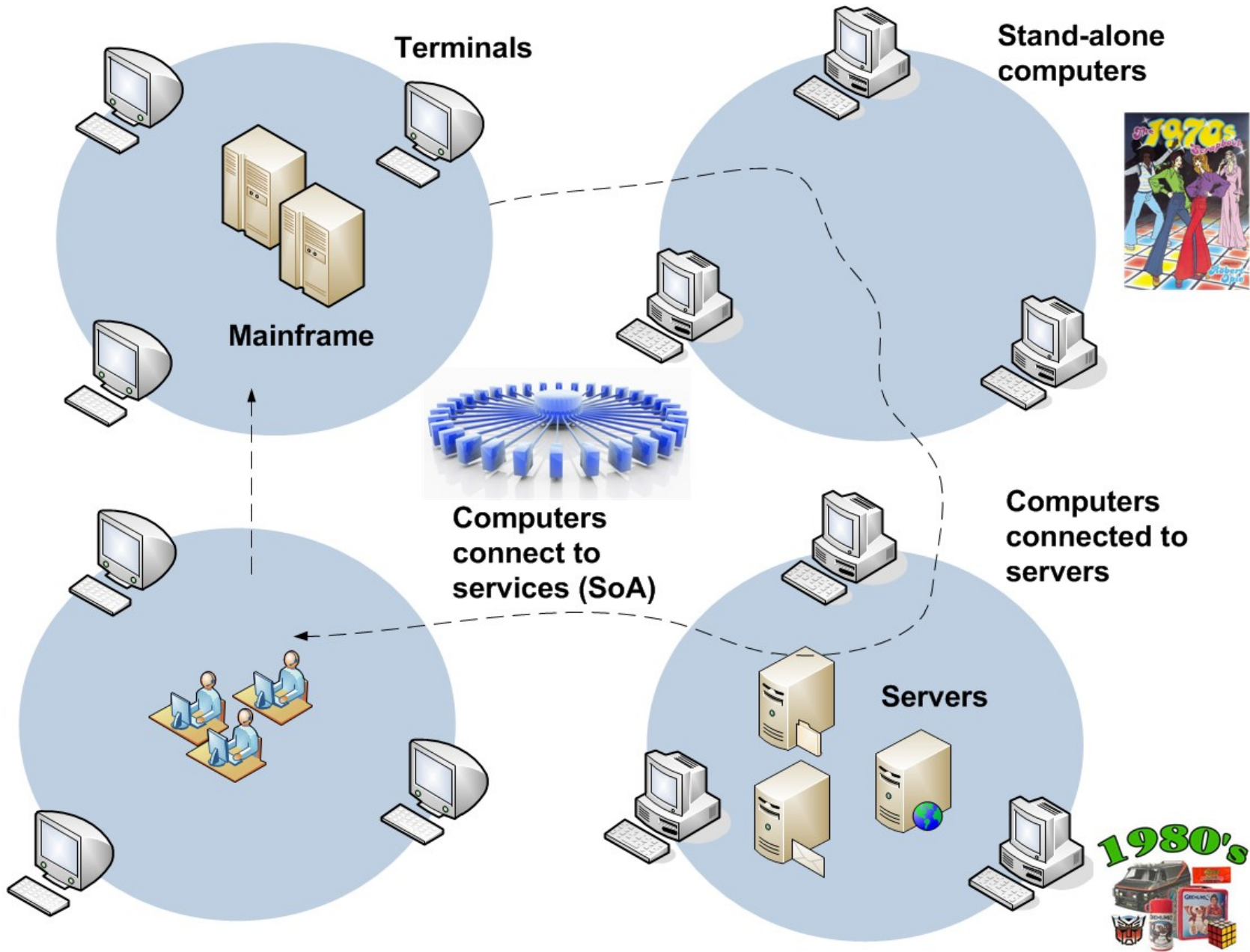
DEC 1969

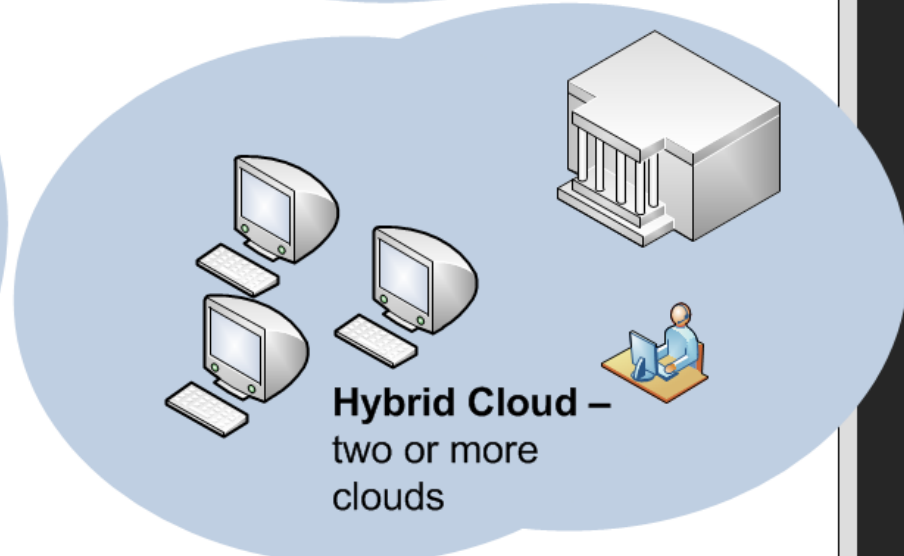
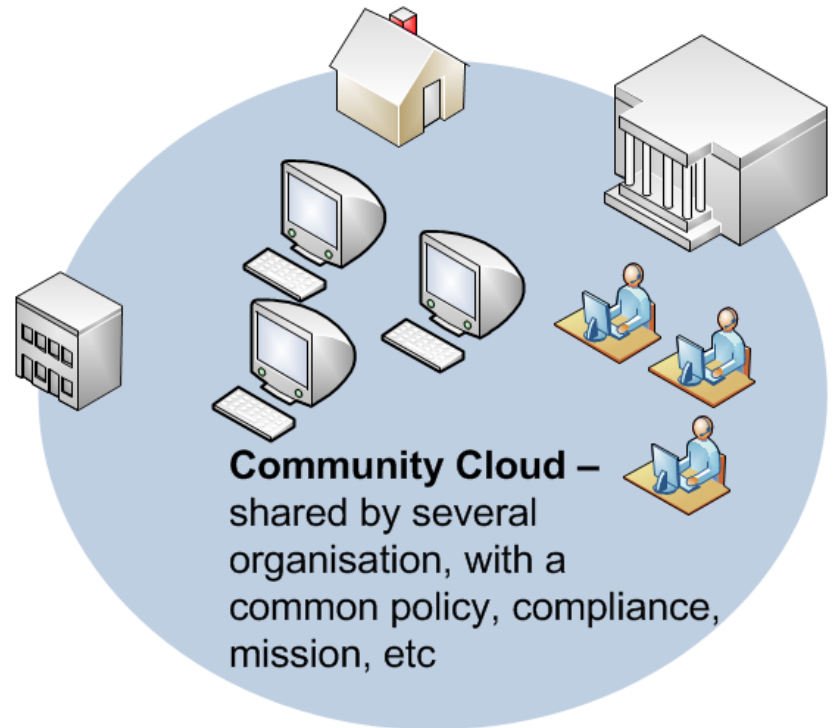
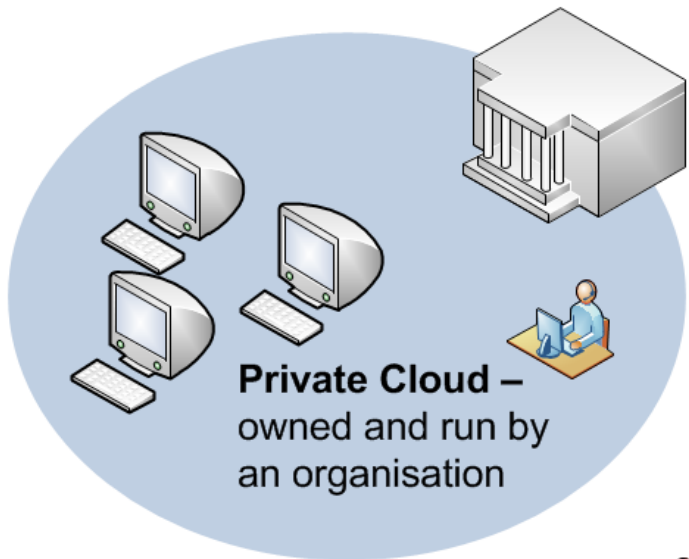
4 nodes

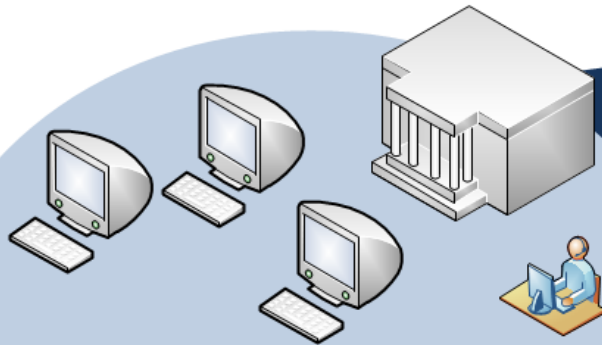
The Internet



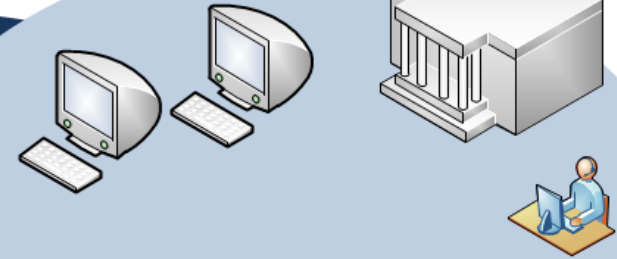
The Personal Computer





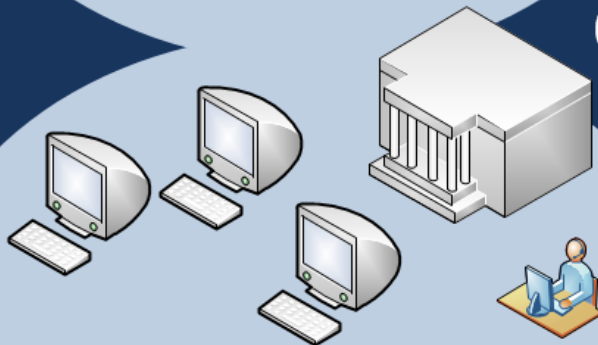


On-demand self-service. Consumers get server CPU, memory, bandwidth and storage resources whenever required.

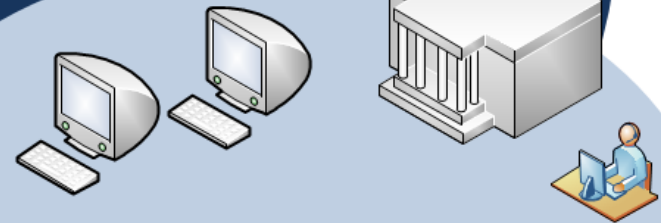


Location independent resource pooling. Multiple customers use shared resources within the provider, without actually knowing where the exact location of these are.

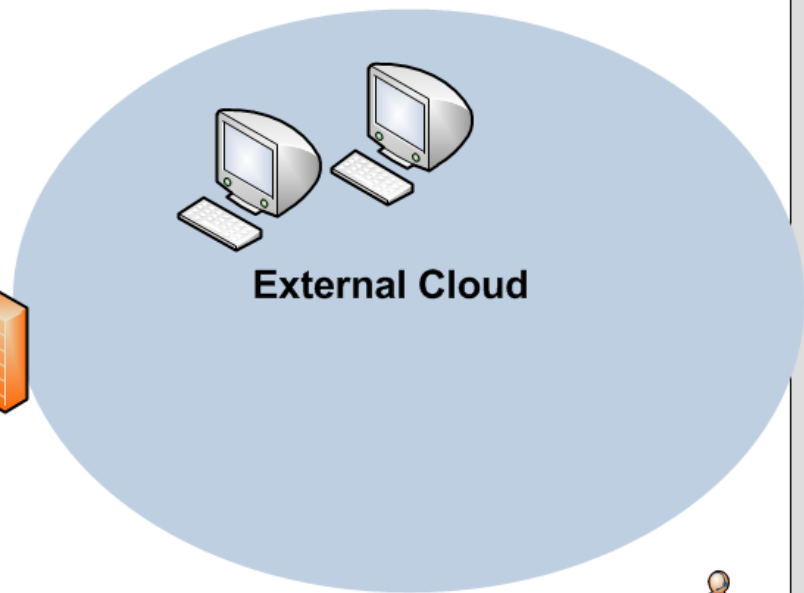
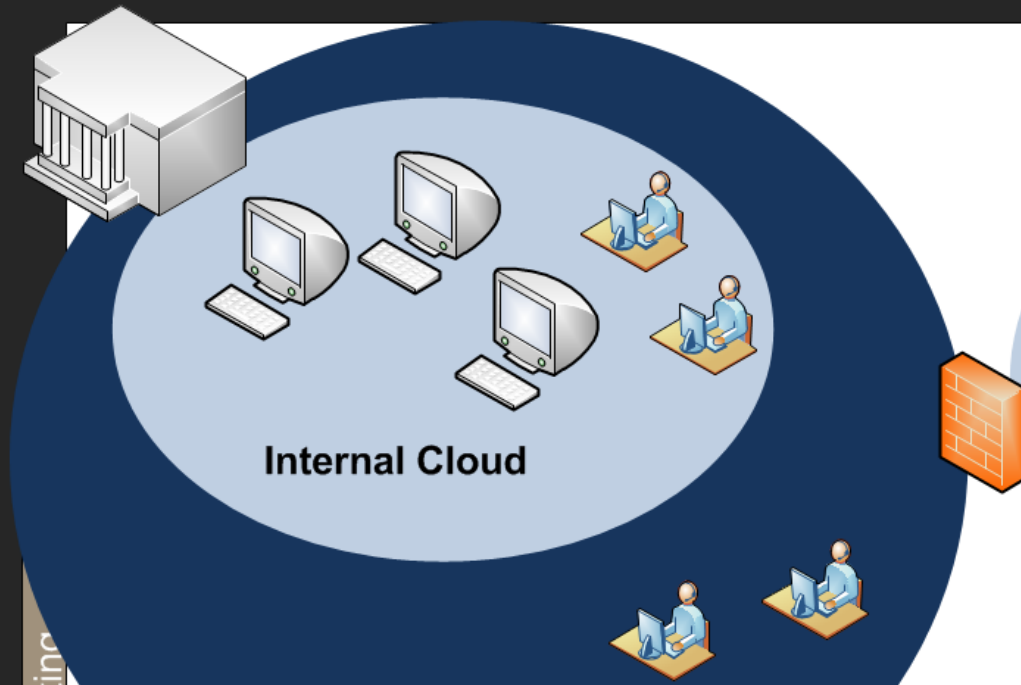
CLOUD



Rapid elasticity. Consumers can easily scale-up and scale-down, whenever required.



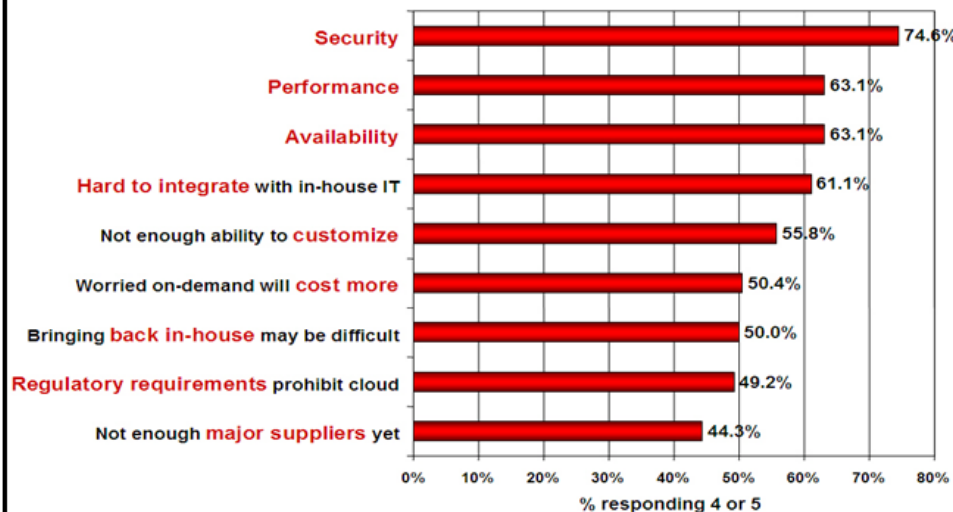
Pay per use. All access to resources is monitored, and paid for either by advertising or usage. Payment methods: per users created, per hour usage (service), etc.



External Cloud



Q: Rate the challenges/issues ascribed to the 'cloud'/on-demand model
 (1=not significant, 5=very significant)



Source: IDC Enterprise Panel, August 2008 n=244

Audit/compliance

Can I be compliant with statutory and regulatory requirements?

- Where is my data stored?
- Who handles breach notifications?
- How long is my data stored for?
- How is eDiscovery handled?

Client



Amazon SimpleDB

This produces a mixture of structured data storage with the reliability of a traditional database.



Amazon CloudFront

This allows content to be placed close to the places where it is to be consumed, the content thus gets moved to the edge of the cloud to support rapid delivery of content.

Amazon Elastic Cloud Compute (Amazon EC2)

This is the core of the Amazon Cloud, and provides a Web services API to create, manage and delete virtual servers within the Amazon Cloud. This includes US, Asia (Japan and Singapore) and European data centres (Ireland), and uses the Xen hypervisor for the management of the servers.

Amazon Simple Storage Service (Amazon S3).

This provides data storage with web services through APIs. It differs from normal filesystems in that it does not have a hierarchical structure. Instead it uses buckets, which are unique namespaces across all of the Amazon customers. It is thus not a filesystem, and is a Web service, thus applications need to be written which specifically store data into the S3 Cloud.

Amazon Simple Queue Service (Amazon SQS).

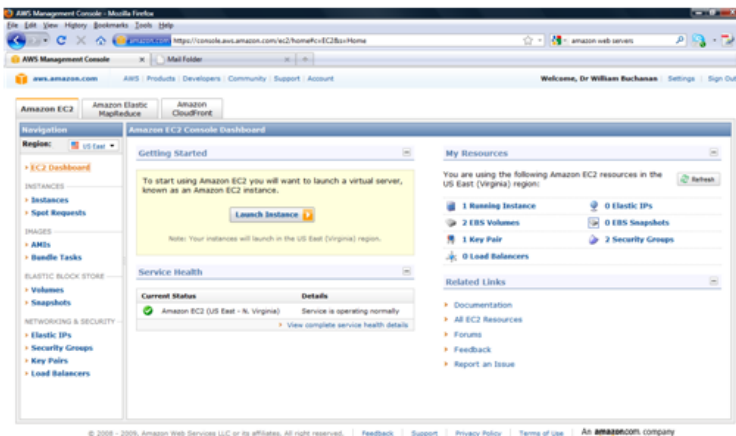
This supports a grid infrastructure, where message can be passed to a queue, and then consumed by any subscribers.

Amazon Virtual Private Cloud (VPC)

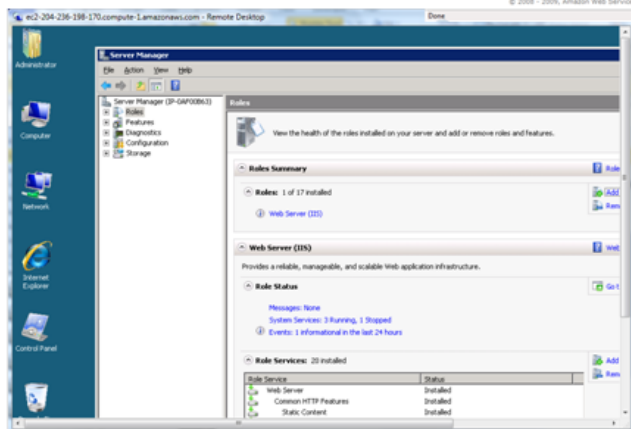
This allows for complete network infrastructures to be built, which are isolated from other network infrastructures

AWS

Cloud



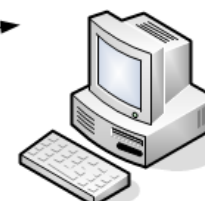
Amazon Machine Images (AMI)



i-0d895567

Machine Instances

- Command line tools
- Web Service Console



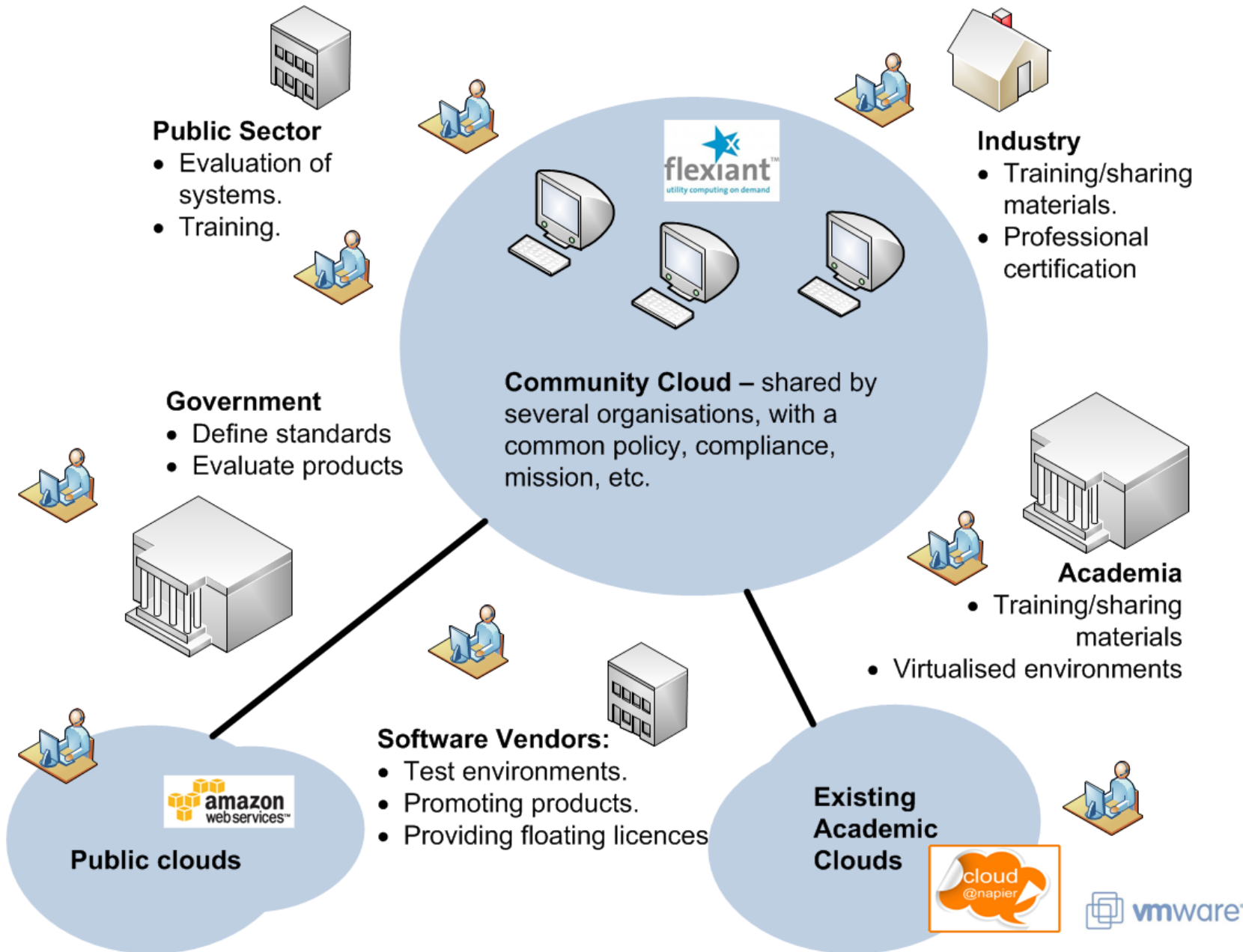
i-0d895566

```
$ ec2-describe-images -o AKIAIWUMTTAZYST2I2AA
$ ec2-describe-images
IMAGE ami-45c22e2c powerdns/image.manifest.xml 495219933132 available private
$ ec2-run-instances i-0d895566
```

Cloud Environments



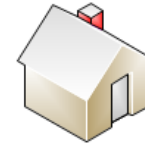
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Distance learners

- Exact environments as face-to-face students.
- Blended learners have greater choice and flexibility.



Industry

- Adding evaluation infrastructures.
- Post project work/ interesting areas of work.
- Ability to review materials presented to students.
- Ability to study within the workplace.

- ### Enhancing skills
- Supports a wide range of pre-built environments within a sandboxed infrastructure



- ### Working across institutions
- Cloud environments allow for working across traditional boundaries.



- ### Project work
- Students can start from existing well-tested environments.



- ### Engaging students
- State-of-the-art infrastructures



Group working

- Students can integrate their systems in an isolated environment.



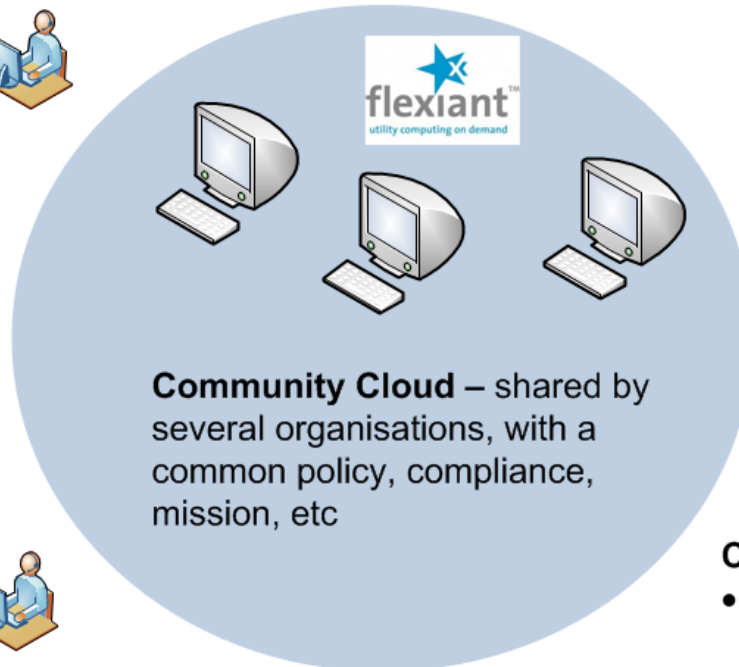
Robust infrastructures

- No more 9-5pm, Mon-Friday environments.



Snap-shots of work

- Student can create snapshots, and move back and forward amongst them.

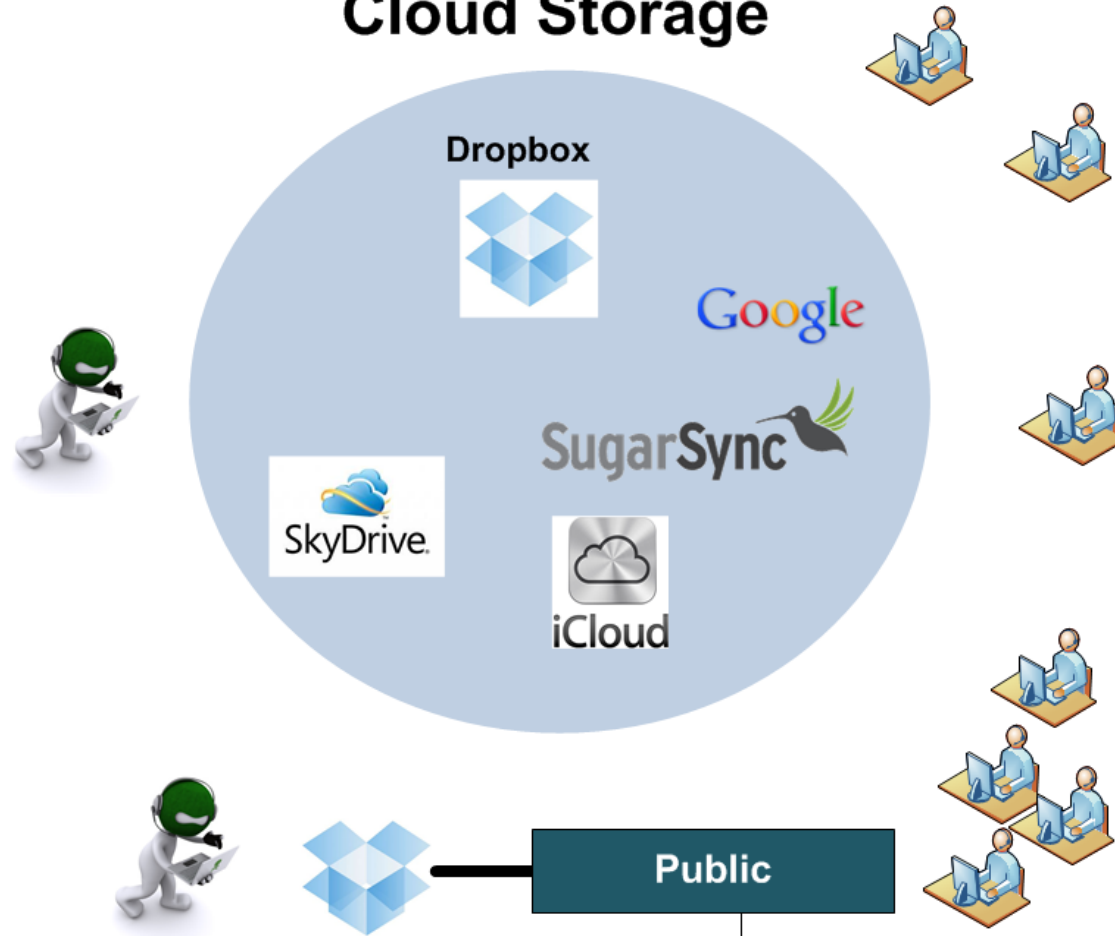


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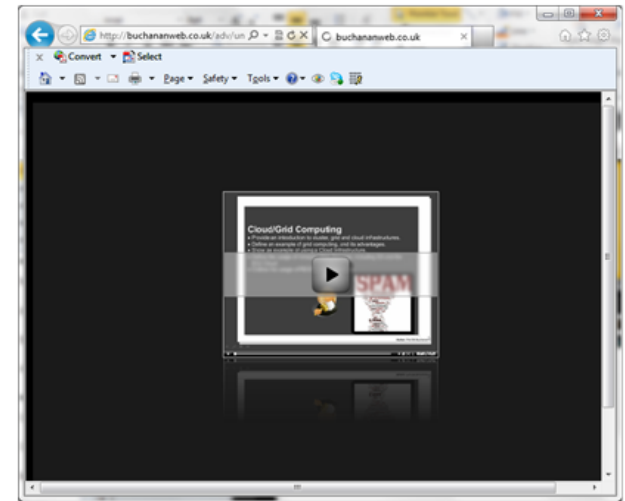
Cloud Storage



https://dl.dropbox.com/u/40355863/2012_june_napier_staff_conference_cloud.pptx



Lecture Capture



First generation: Export to Flash



Forth Generation: Mobile



Third generation: Cloud Delivery



Second generation: MP4



Demographics

Top geographies

- United States
- India
- United Kingdom
- Brazil
- Canada

Gender

- Male 83.7%
- Female 16.3%



Discovery

Top playback locations

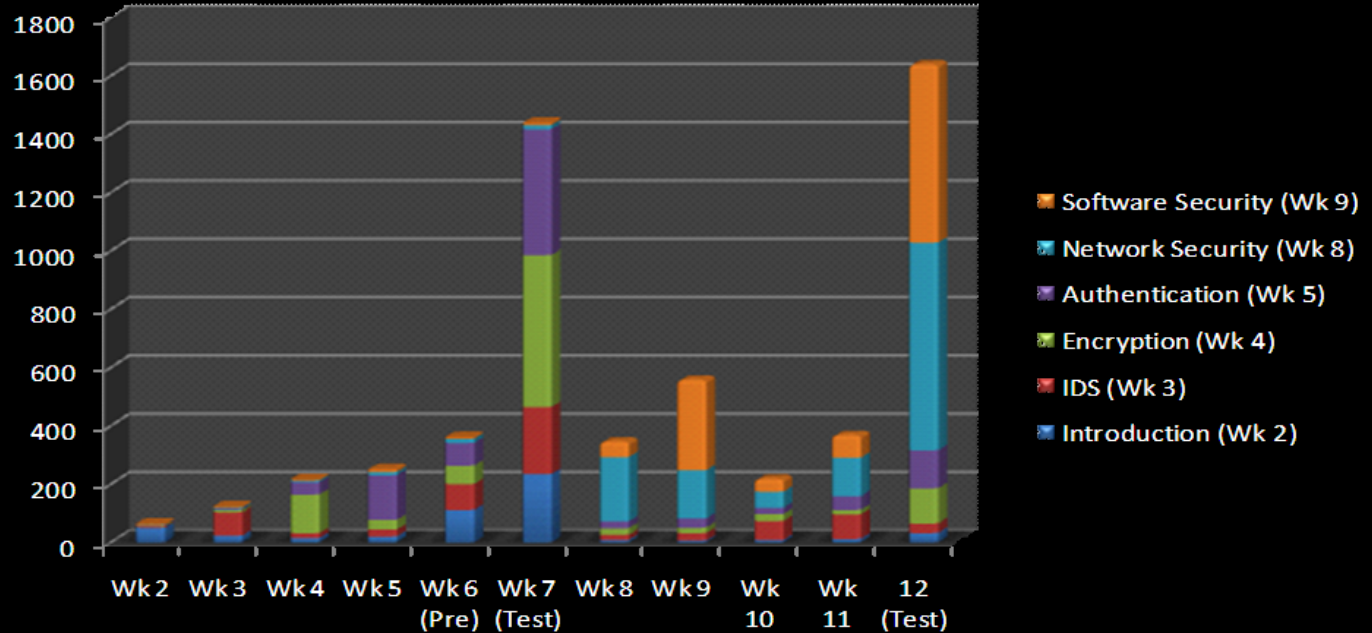
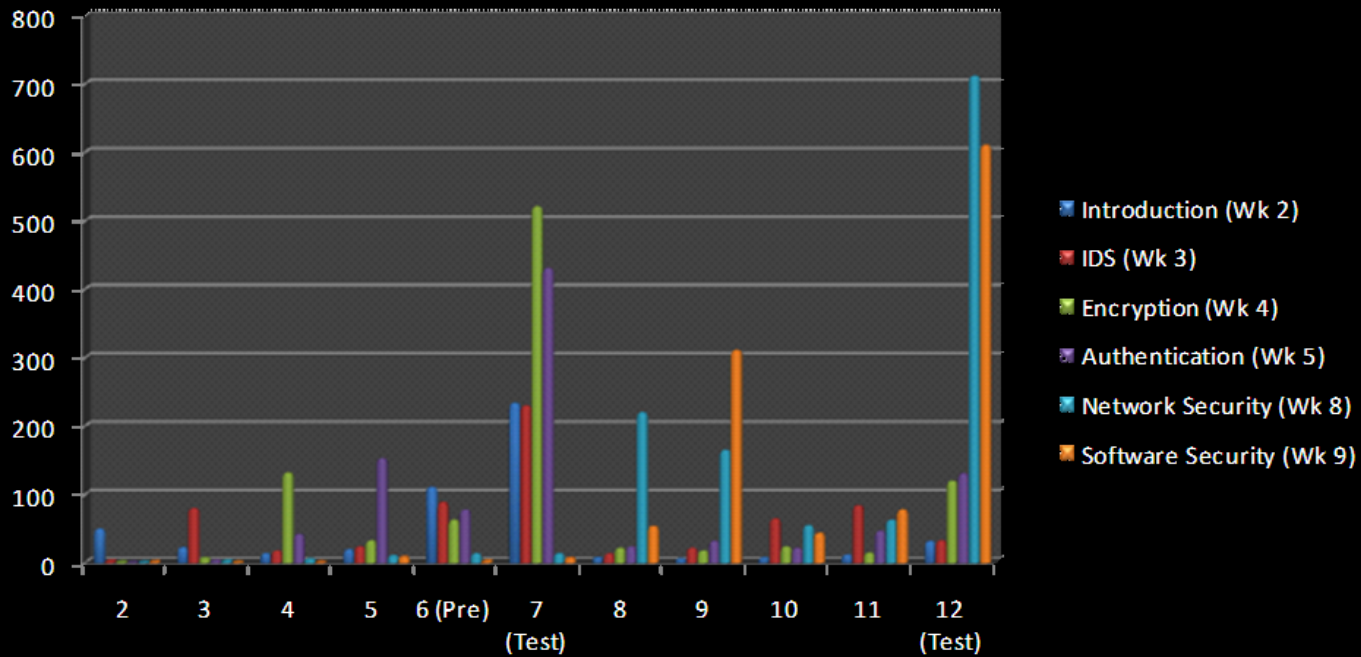
- YouTube watch-page 83.2%
- Mobile devices 16.2%
- Embedded player on other websites 0.6%
- Other 0.0%



Top traffic sources

- View referrals from YouTube 63.6%
- Mobile apps and direct traffic 32.9%
- View referrals from outside YouTube 3.5%
- Other 0.0%





Online lecture usage

Cloud Environments

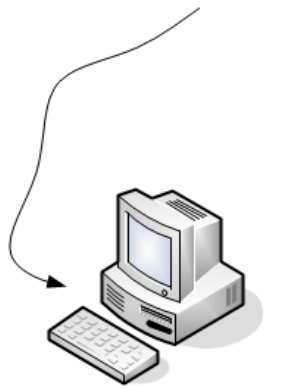


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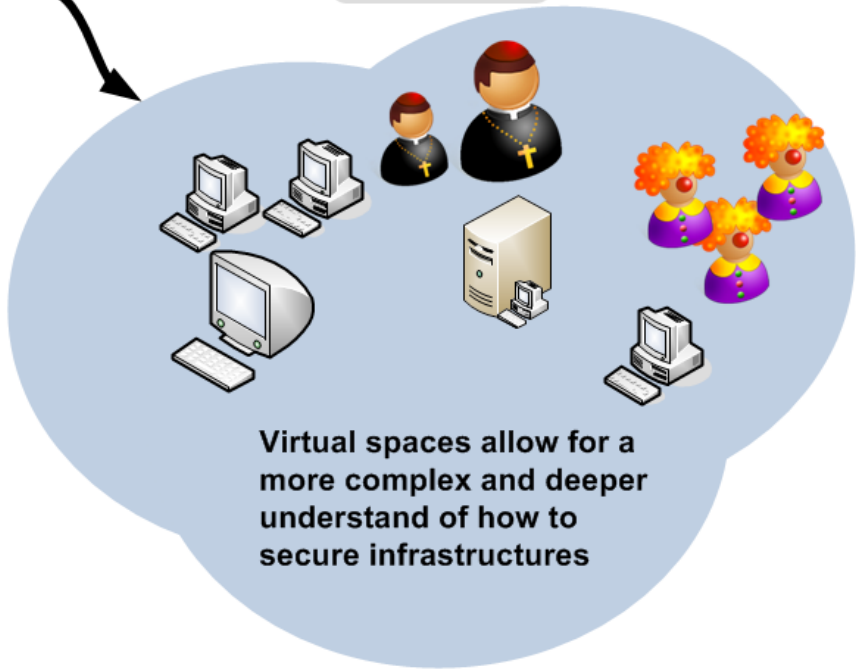


Good...

... Bad



Difficult to use many of the techniques within a real-life space



Virtual spaces allow for a more complex and deeper understand of how to secure infrastructures

Demands on professional certification



Employers now require in-depth knowledge and a range of skills

Internal Network (192.168.x.x/16)

Public Network Connection

Firewall/
Router

Controlling signals

ESXi Host
(Socesx2)

Controller
(Socesx1)

iSCSI

Shared
Storage
(4TB)

ESXi Host
(Socesx3)

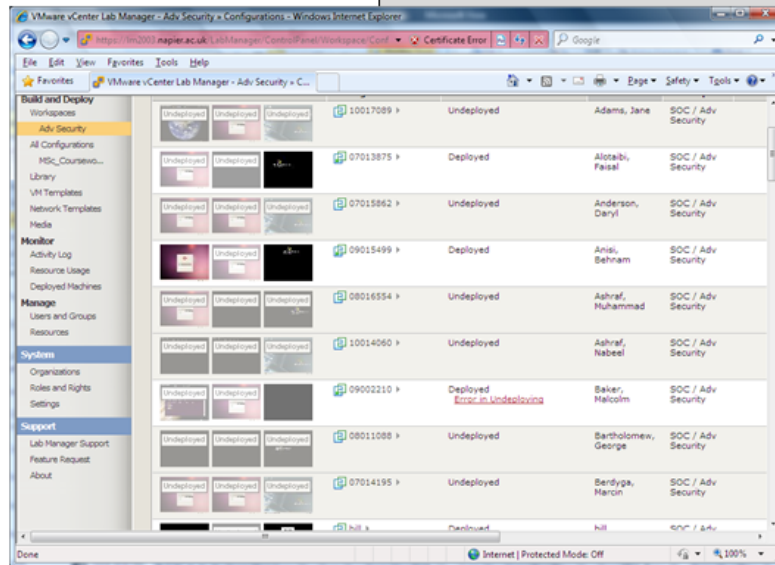
ESXi Host
(Socesx4)

Lab Manager
Cluster

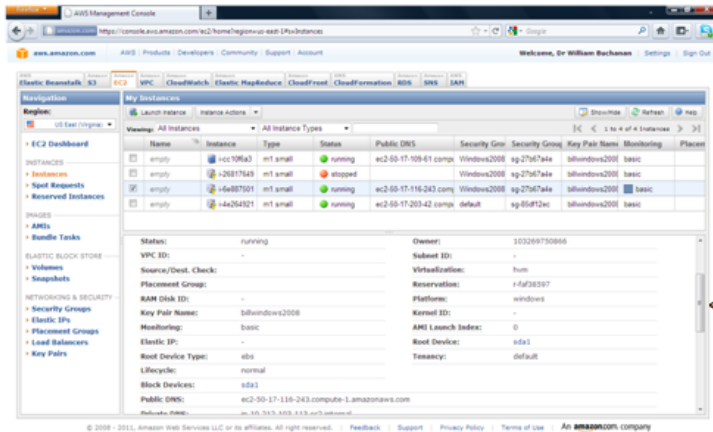
- Lab Manager
- Router/Firewall
- Storage Server
- Virtual Centre

vCenter

Cloud



Napier vCenter infrastructure

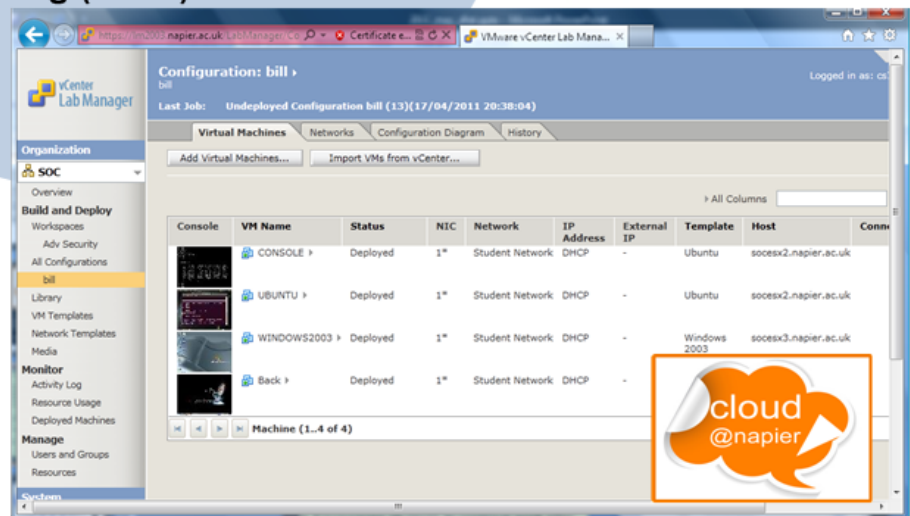


Teaching of four modules in computer security, digital forensics and database systems for 2010/2011 (inc. Host-based Forensics, Security and Forensic Computing and Adv Security and Digital Forensics at BEng/BEng (Hons)/MSc level



Virtualised and Cloud-based labs:

- Complex infrastructures for evaluation for students.
- Deep analysis of security and digital forensics in an isolated environment.
- Industry standard tools and methods.



Navigation

Region: US East (Virginia)

EC2 Dashboard

INSTANCES

- Instances
- Spot Requests
- Reserved Instances

IMAGES

- AMIs
- Bundle Tasks

ELASTIC BLOCK STORE

- Volumes
- Snapshots

NETWORKING & SECURITY

- Security Groups
- Elastic IPs
- Placement Groups
- Load Balancers
- Key Pairs

My Instances

Launch Instance | Instance Actions

Viewing: All Instances | All Instance Types

Name	Instance	Type	Status	Public DNS	Security Gro	Security Group	Key Pair Name	Monitoring	Placem
empty	i-cc10f6a3	m1.small	running	ec2-50-17-109-61.com	Windows2008	sg-27b67a4e	billwindows2008	basic	
empty	i-26817649	m1.small	stopped		Windows2008	sg-27b67a4e	billwindows2008	basic	
empty	i-6e887501	m1.small	running	ec2-50-17-116-243.com	Windows2008	sg-27b67a4e	billwindows2008	basic	
empty	i-4e264921	m1.small	running	ec2-50-17-203-42.com	default	sg-85df12ec	billwindows2008	basic	

Status: running | Owner: 103269750866

VPC ID: - | Subnet ID: -

Source/Dest. Check: - | Virtualization: hvm

Placement Group: - | Reservation: r-faf38597

RAM Disk ID: - | Platform: windows

Key Pair Name: billwindows2008

Monitoring: basic

Elastic IP: -

Root Device Type: ebs

Lifecycle: normal

Block Devices: sda1

Public DNS: ec2-50-17-116-243.com

Private DNS: ip-10-212-103-113

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ec2-50-17-116-243.compute-1.amazonaws.com - Remote Desktop

Recycle Bin

Adobe Reader 9

NetworkSims

Toolkit

```

Administrator: Command Prompt
Windows IP Configuration

Ethernet adapter Local Area Connection 2:

Connection-specific DNS Suffix  . : ec2.internal
Link-local IPv6 Address . . . . . : fe80::219b:2e16:2c4c:e592%11
IPv4 Address. . . . . : 10.212.103.113
Subnet Mask . . . . . : 255.255.254.0
Default Gateway . . . . . : 10.212.102.1

Tunnel adapter Local Area Connection* 8:

Media State . . . . . : Media disconnected
Connection-specific DNS Suffix  . : ec2.internal

Tunnel adapter Local Area Connection* 9:

Connection-specific DNS Suffix  . :
IPv6 Address. . . . . : 2001:0:4137:9e76:4c0:621:f52b:988e
Link-local IPv6 Address . . . . . : fe80::4c0:621:f52b:988e%10
Default Gateway . . . . . :

C:\Users\Administrator>
  
```



Configuration: bill

Last Job: Undeployed Configuration bill (13)(17/04/2011 20:38:04)

Virtual Machines

Console	VM Name	Status	NIC	Network	IP Address	External IP	Template	Host	Conn
	CONSOLE	Deployed	1*	Student Network	DHCP	-	Ubuntu	soocesx2.napier.ac.uk	
	UBUNTU	Deployed	1*	Student Network	DHCP	-	Ubuntu	soocesx2.napier.ac.uk	
	WINDOWS2003	Deployed	1*	Student Network	DHCP	-	Windows 2003	soocesx3.napier.ac.uk	
	BackTrack	Deployed	1*	Student Network	DHCP	-	BackTrack	soocesx2.napier.ac.uk	

UBUNTU

```
File Edit View Terminal Help
Ping Scan Timing: About 50.00% done; ETC: 12:48 (0:00:01 remaining)
Note: Host seems down. If it is really up, but blocking our ping probe
Nmap done: 1 IP address (0 hosts up)
napier@ubuntu:~$ ifconfig
eth5
  Link encap:Ethernet HWaddr 08:00:26:42:00:01
  inet addr:192.168.242.24
  inet6 addr: fe80::250:56ff:fe00:0001%eth5
  UP BROADCAST RUNNING MULTICAST
  RX packets:1000801 errors:0 dropped:0 overruns:0 on interface
  TX packets:4919 errors:0 dropped:0 overruns:0 on interface
  collisions:0 txqueuelen:1000
  RX bytes:76528956 (76.5 MB)
  Interrupt:19 Base address: 0x00000000

lo
  Link encap:Local Loopback
  inet addr:127.0.0.1 Mask:255.255.255.0
  inet6 addr: ::1%lo Scope:LOCAL
  UP LOOPBACK RUNNING MTU:65536
  RX packets:11 errors:0 dropped:0 overruns:0 on interface
  TX packets:11 errors:0 dropped:0 overruns:0 on interface
  collisions:0 txqueuelen:0
  RX bytes:744 (744.0 B) TX bytes:744 (744.0 B)

napier@ubuntu:~$
```

WINDOWS2003

```
Corp.
ator>ping 192.168.242.24
es of data:
? time=1ms TTL=64
? time=1ms TTL=64
? time=1ms TTL=64

: Lost = 0 (0% loss),
111=seconds:
Average = 0ms

ator>
```

BackTrack 4

- Partition Editor
- Services
- Shared Folders
- Time and Date
- Users and Groups
- Yakuake
- ettercap - Ettercap
- kpowersave - Battery Monitor
- Software Sources
- KInfoCenter - Info Center
- KSysGuard - Performance Monitor
- Konsole - Terminal Program

Cloud Computing

Cloud

The screenshot displays the VMware vCenter Management interface. The main window shows a list of virtual machines under the 'Virtual Machines' tab. The selected VM is 'Linux01', which is powered on and has a normal status. The details pane for 'Linux01' is visible, showing its overall status as 'Normal', guest OS as 'Ubuntu Linux (32-bit)', and VMware Tools as 'Not running (Current)'. The VM hardware section shows 1 CPU, 512 MB memory, and a 20.00 GB hard disk. The right-hand side of the interface contains panels for 'My Recent Tasks', 'Work In Progress', and 'Alarms'.

Name	State	Status	Host	Provisioned Space
BT5_6	Powered On	Normal	socesx3.napier.ac.uk	21.03 GB
BT5_7	Powered On	Normal	socesx4.napier.ac.uk	21.03 GB
BT5_8	Powered On	Normal	socesx4.napier.ac.uk	21.03 GB
BT5_9	Powered On	Normal	socesx3.napier.ac.uk	21.03 GB
BT_14	Powered Off	Normal	socesx3.napier.ac.uk	21.10 GB
Linux01	Powered On	Normal	socesx2.napier.ac.uk	20.56 GB
Linux04	Powered On	Normal	socesx3.napier.ac.uk	20.56 GB
Linux05	Powered On	Normal	socesx2.napier.ac.uk	20.56 GB

Preview: Linux01

Status
Overall: Normal

Guest OS Details
Power State: Powered On
Guest OS: Ubuntu Linux (32-bit)
IP Addresses:
DNS Name:
VMware Tools: Not running (Current)
Console:

VM Hardware
CPU: 1 CPU(s), 0 MHz used
Memory: 512 MB, 25 MB used
Hard disk 1: 20.00 GB
Network adapter 2: Fenced Lab 1 connected
CD/DVD drive 1: Disconnected
Floppy drive 1: Disconnected
USB Devices: Connect client device
Other: Additional Hardware
HW Version: 8

Alarms
All (3) | New (2) | Acked ...
socesx3.napier.ac.uk
Host storage status
vc2003.napier.ac.uk
Health status monitoring
Production

Windows7_Encase02 Send Ctrl-Alt-Delete Full Screen

Hint: Press Ctrl-Alt to release the cursor from the guest

EnCase Acquisition

Case (test2) View Tools EnScript Add Evidence

Home Evidence

Viewing (Evidence) Split Mode Process Evidence Open Remove Update Paths Change Caches Raw Search All Bookmark

Table Timeline

Selected 0/38

	Name	Primary Path	Evidence Paths	Evidence Processor Logs	Processing Status	Not Found	Has Index	GUID
<input type="checkbox"/>	1 ntoskrnl.exe	ntoskrnl.exe	•		Unprocessed			b8d36086fb3066ca9a6a3842
<input type="checkbox"/>	2 smss.exe	smss.exe	•		Unprocessed			fb0b0656de27c9c99607e428a28
<input type="checkbox"/>	3 avgrsa.exe	avgrsa.exe	•		Unprocessed			0d7573573c79edc589c9aa25
<input type="checkbox"/>	4 avgcsrva.exe	avgcsrva.exe	•		Unprocessed			764646b336d5a9c69d109966
<input type="checkbox"/>	5 csrss.exe	csrss.exe	•		Unprocessed			9ea3b03d5b1f9c2a06b0a45
<input type="checkbox"/>	6 csrss.exe	csrss.exe	•		Unprocessed			3b614374014b35cbf31ffa87
<input type="checkbox"/>	7 wininit.exe	wininit.exe	•		Unprocessed			cd9a3e66f2f9ac2b57bfbee4
<input type="checkbox"/>	8 winlogon.exe	winlogon.exe	•		Unprocessed			977be855644e20ceb0d318ab

Fields Report Evidence Paths Evidence Processor Logs Credentials Acquisition Info Sources Subjects Read Errors Lock

100% Zoom In Zoom Out Previous Item Next Item

Name smss.exe
 Primary Path smss.exe
 Evidence Paths •
 Processing Status Unprocessed
 GUID fb0b0656de27c9c99607e428a278da2b
 Cache Status None
 File Integrity Evidence cannot be verified
 Drive Type Memory Device
 EnCase Version 7.2.2.6
 System Version Windows 7
 Is Physical •

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Devices

- A wide range of devices can be supported.
- Delivery neutral content.



Access for Students

- Students can get easy access to materials.

Licences

- Flexible and floating licences



Failover

- Improved support for failover systems



“Unlimited” bandwidth and disk space

- No limits set on resources, and 24/7 uptime.



Easy Integration with a range of systems

- Cloud integration fits well with most teaching infrastructures.



Group working

- Students can integrate their systems in an isolated environment.



Robust infrastructures

- No more 9-5pm, Mon-Friday environments.
- More energy efficient.



Snap-shots of work

- Student can create snapshots, and move back and forward amongst them.

Weaknesses

- Material is more accessible.
- Links to materials often need to be double.
- Dependent on network connections.
- No formal Napier Cloud yet.



Continuation of work

- Students can carry their infrastructures throughout modules/years.

Clouds in Teaching

