Cloud Environments

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

Prof Bill Buchanan

Author: Prof Bill Buchanan

Cloud Environments

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

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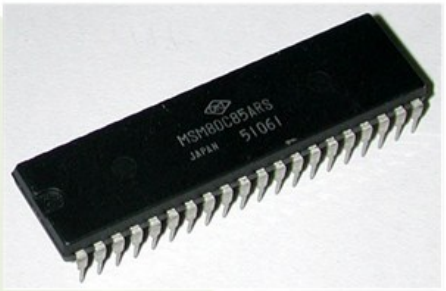
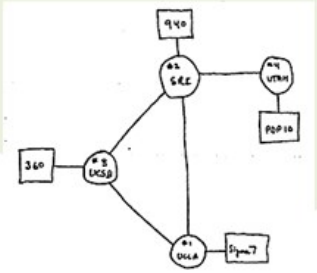
Microchip

Transistor



Microprocessor

The Cloud



The Internet

The Personal Computer

Cloud Computing

Cloud

Disruptive Techology

Terminals

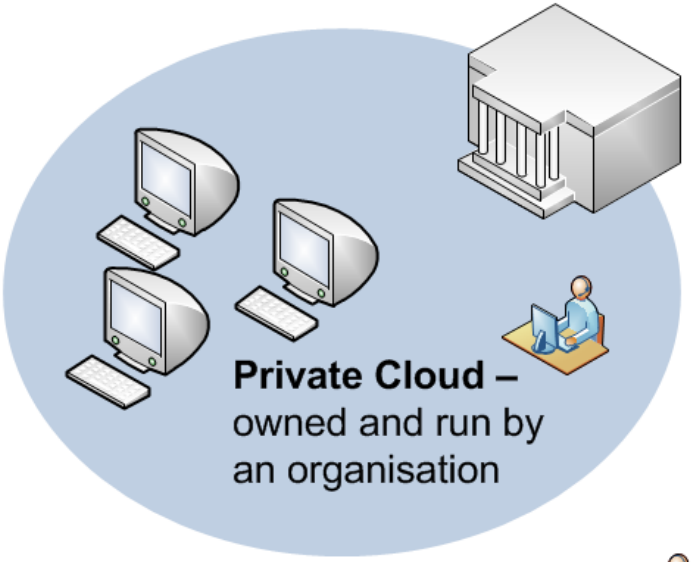
Mainframe

Stand-alone computers

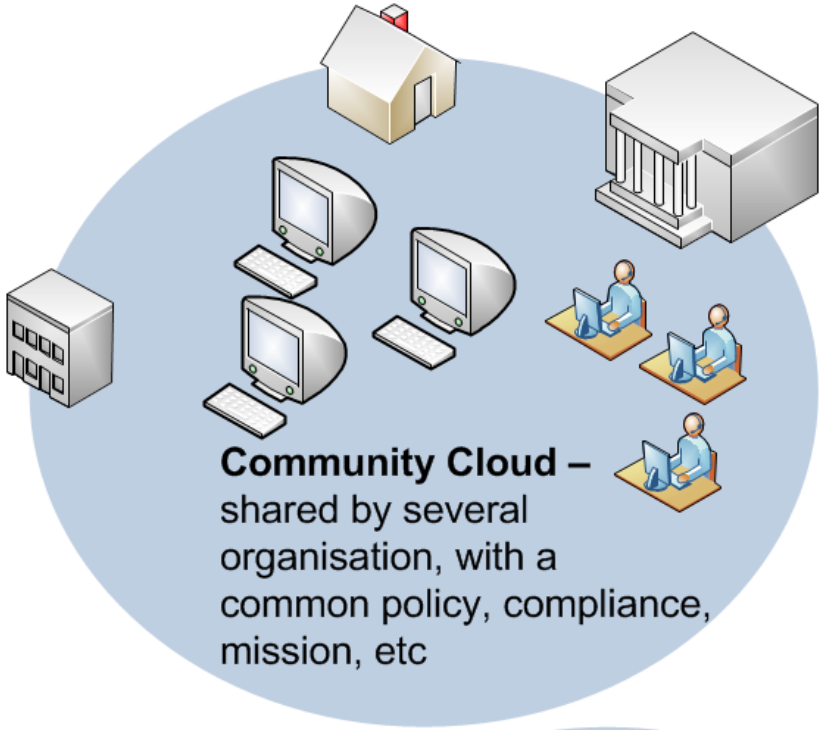
Computers connect to services (SoA)

Computers connected to servers

Servers

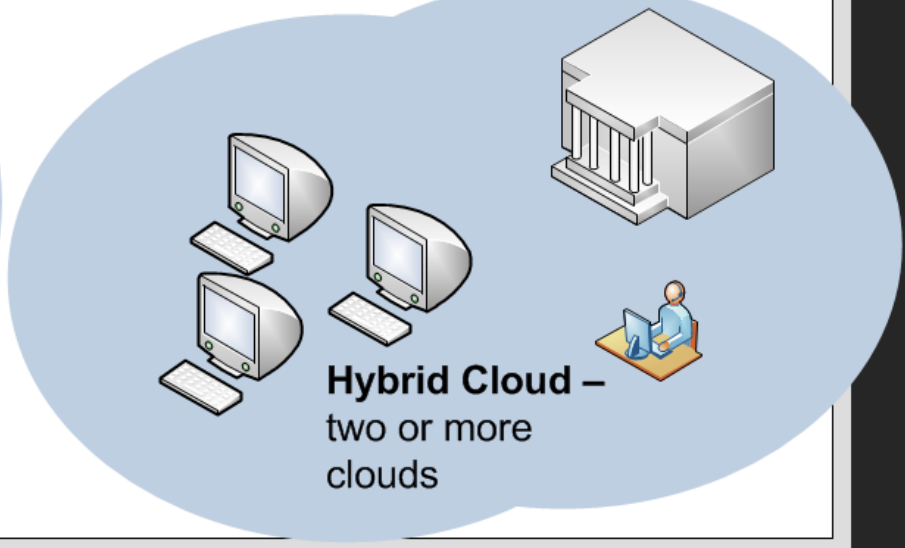


Private Cloud – owned and run by an organisation

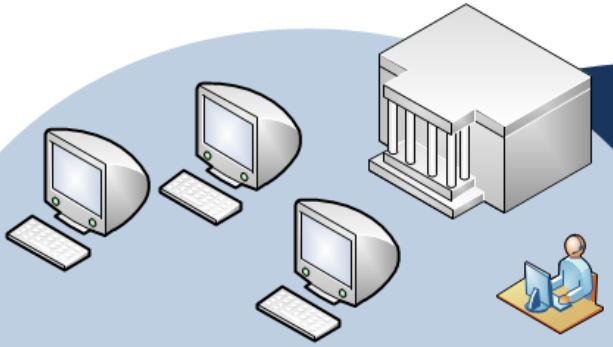


Community Cloud – shared by several organisation, with a common policy, compliance, mission, etc

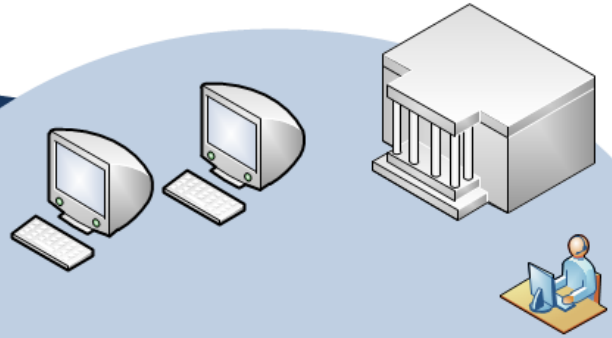
Public Cloud – owned by an organisation selling a cloud infrastructure



Hybrid Cloud – two or more clouds

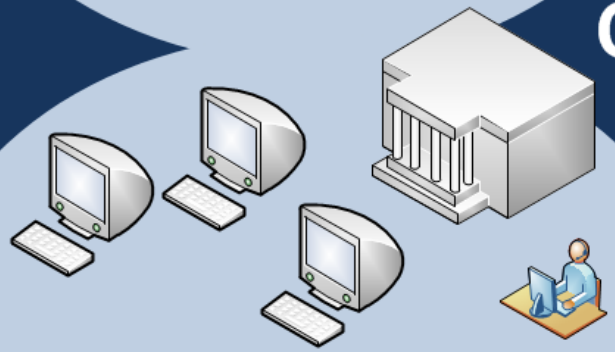


On-demand self-service. Consumers get server CPU, memory, bandwidth and storage resources whenever required.

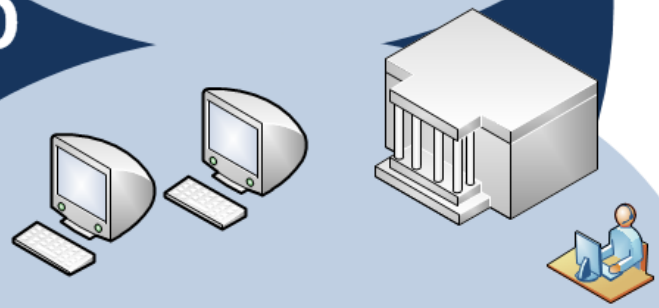


Location independent resource pooling. Multiple customers use shared resources within the provider, without actually knowing where the exact location of these are.

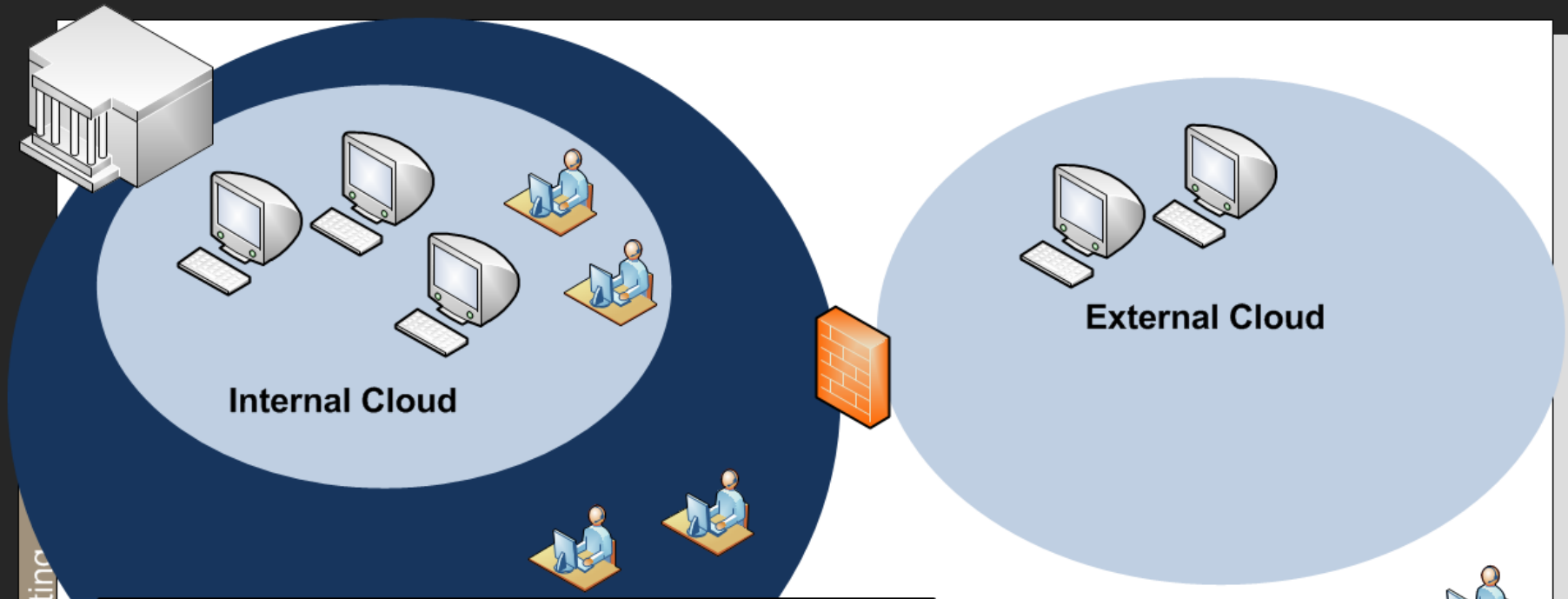
CLOUD

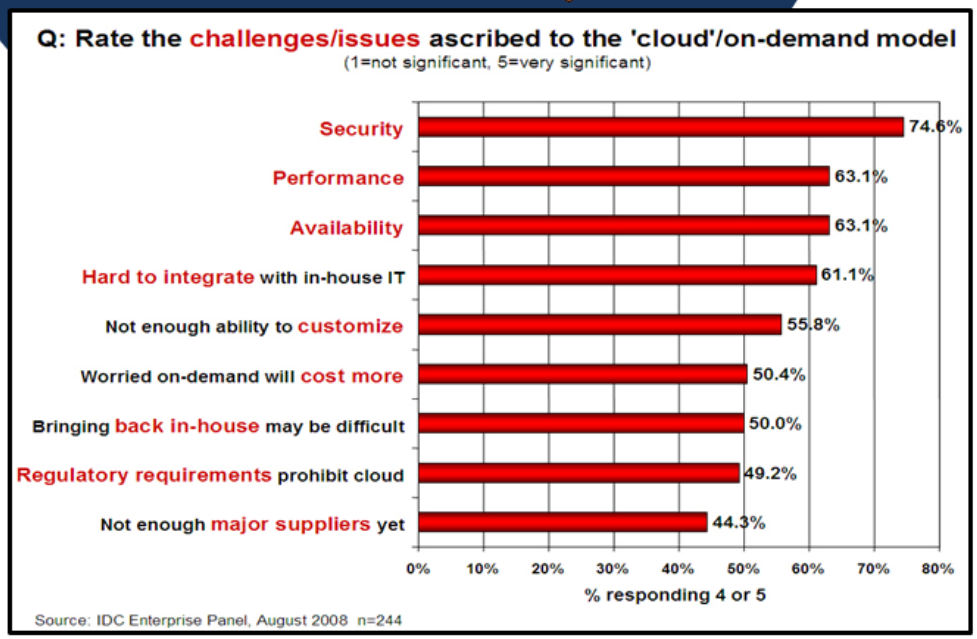


Rapid elasticity. Consumers can easily scale-up and scale-down, whenever required.



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.





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?

Cloud Computing

Cloud

Client

amazon web services

Pay-per-usage

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 hierarchal 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.

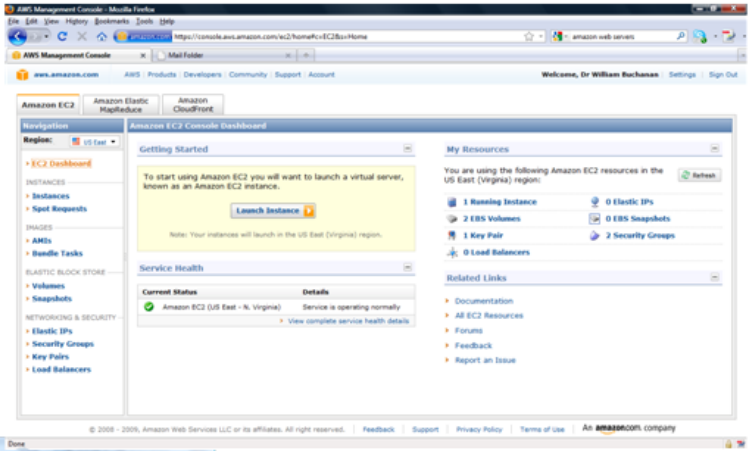
Amazon Simple Queue Service (Amazon SQS).
This supports a grid infrastructure, where message can be passed to a queue, and then consumed by any subscribers.

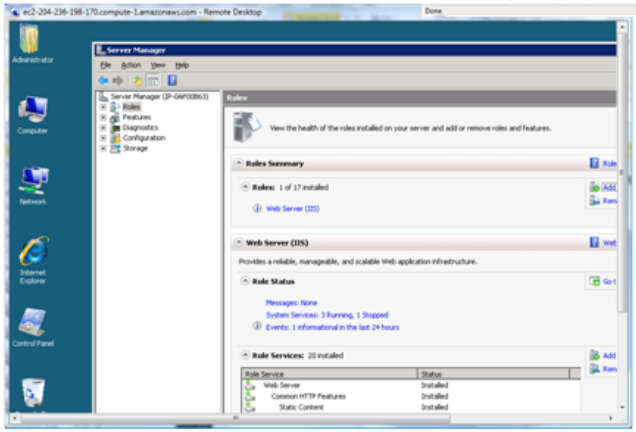
Amazon Virtual Private Cloud (VPC) This allows for complete network infrastructures to be built, which are isolated from other network infrastructures

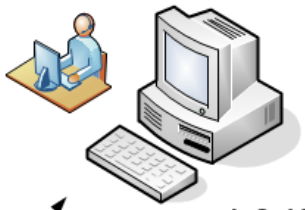
AWS Cloud

Amazon Web Services

Amazon Machine Images (AMI)



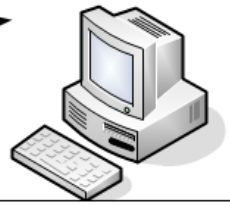




i-0d895567

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
```

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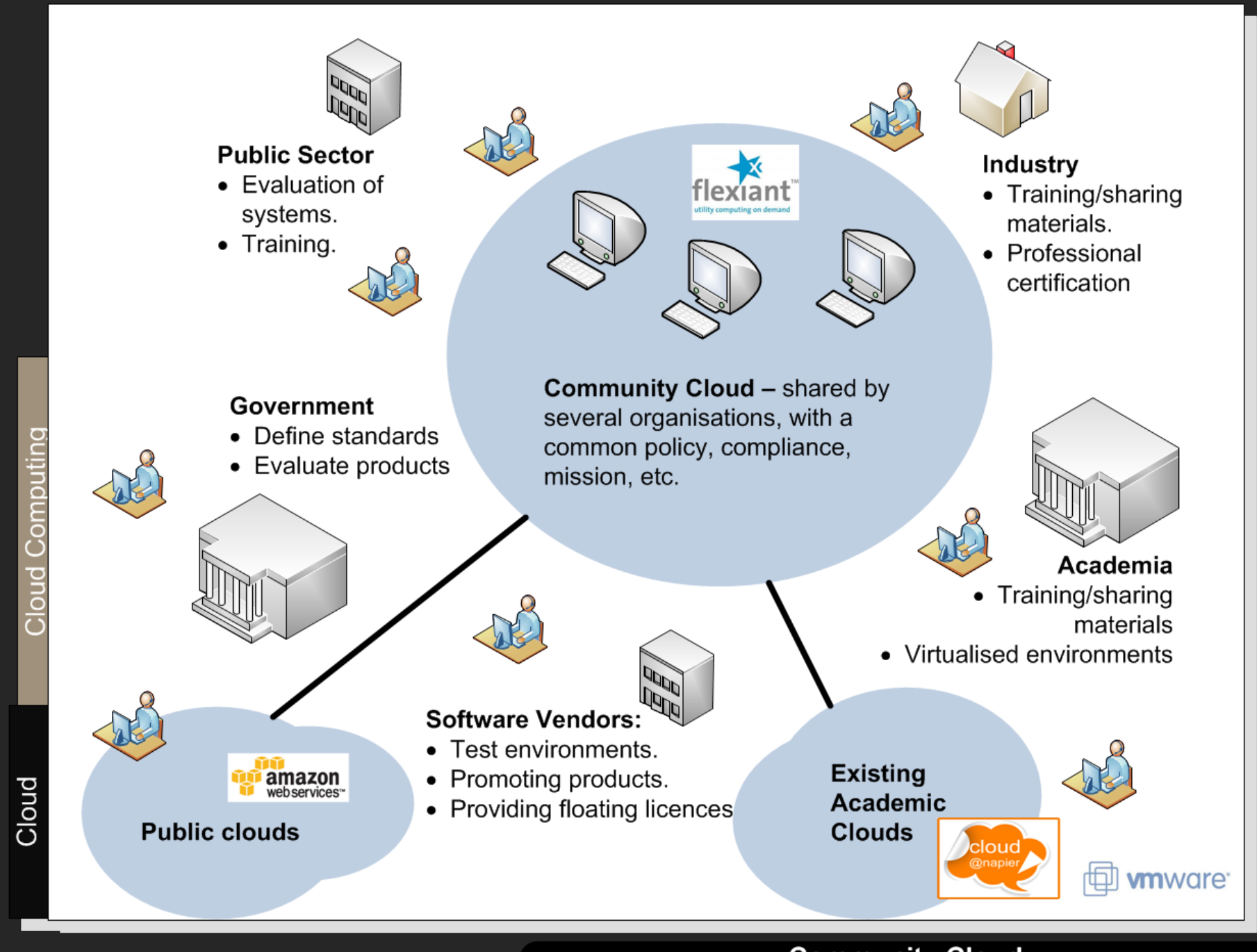
Cloud Computing
Cloud
Public Sector
• Evaluation of systems.
• Training.
Industry
• Training/sharing materials.
• Professional certification
flexiant
utility computing on demand
Community Cloud – shared by several organisations, with a common policy, compliance, mission, etc.
Government
• Define standards
• Evaluate products
Academia
• Training/sharing materials
• Virtualised environments
Software Vendors:
• Test environments.
• Promoting products.
• Providing floating licences
amazon web services
Public clouds
Existing Academic Clouds
cloud @napier
vmware
Community Cloud

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 enviroments 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

Community Cloud – shared by several organisations, with a common policy, compliance, mission, etc

Continuation of work
- Students can carry their infrastructures throughout modules/ years.

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 snap-shots, and move back and forward amoungst them.

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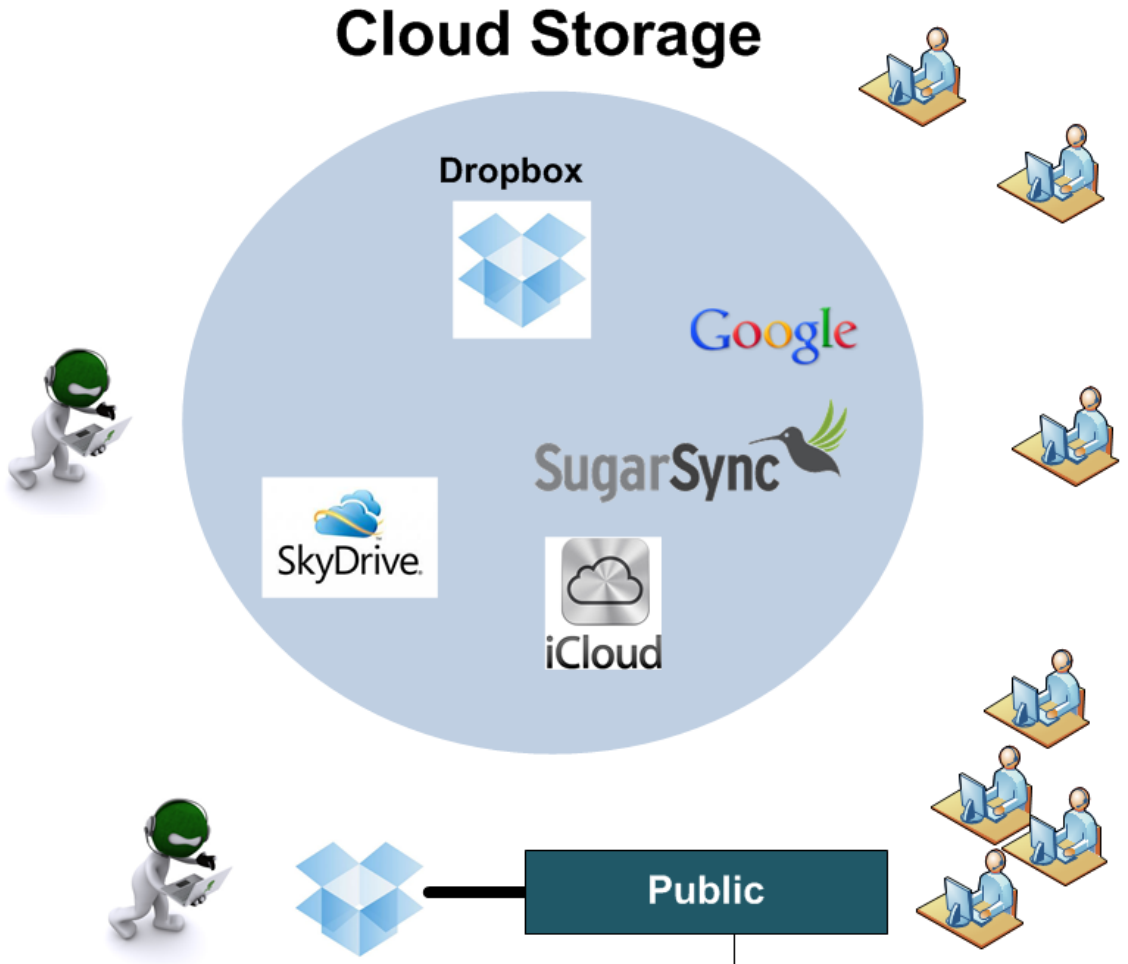
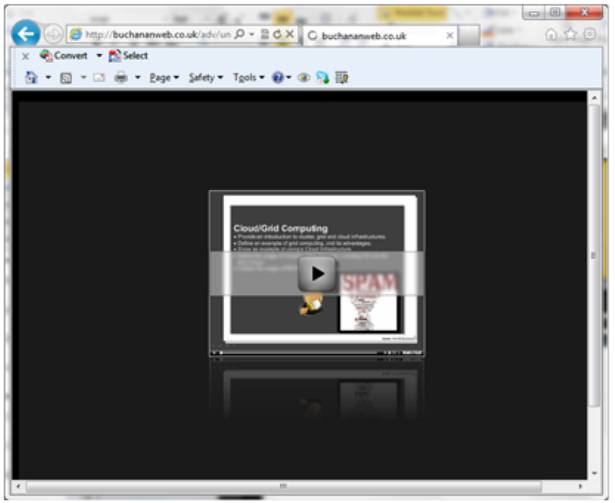

Cloud Storage
Dropbox
Google
SugarSync
SkyDrive
iCloud
Public
https://dl.dropbox.com/u/40355863/2012_june_napier_staff_conference_cloud.pptx

Cloud Computing

Cloud

Lecture Capture



First generation: Export to Flash

Forth Generation: Mobile

Third generation: Cloud Delivery

Second generation: MP4

Cloud Delivery of Content

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%

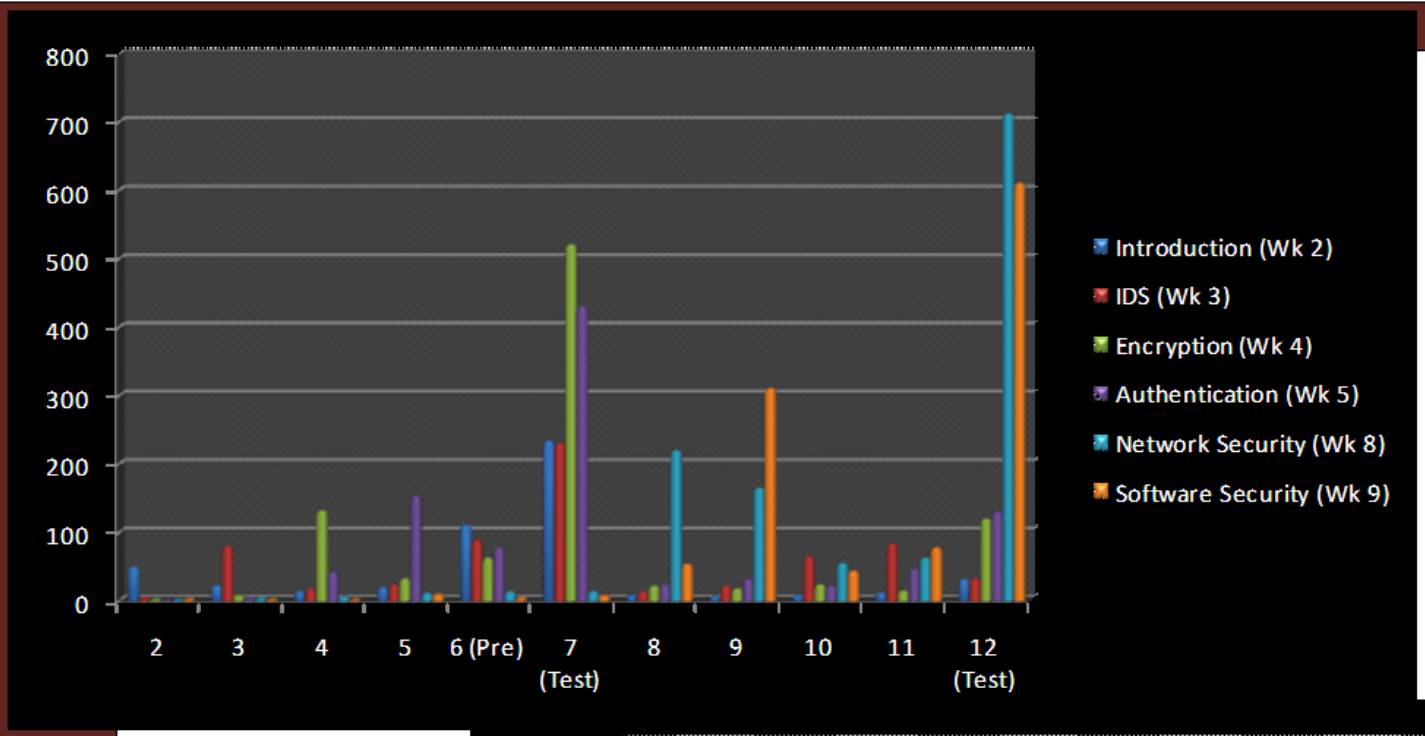
View referrals from outside YouTube 3.5%

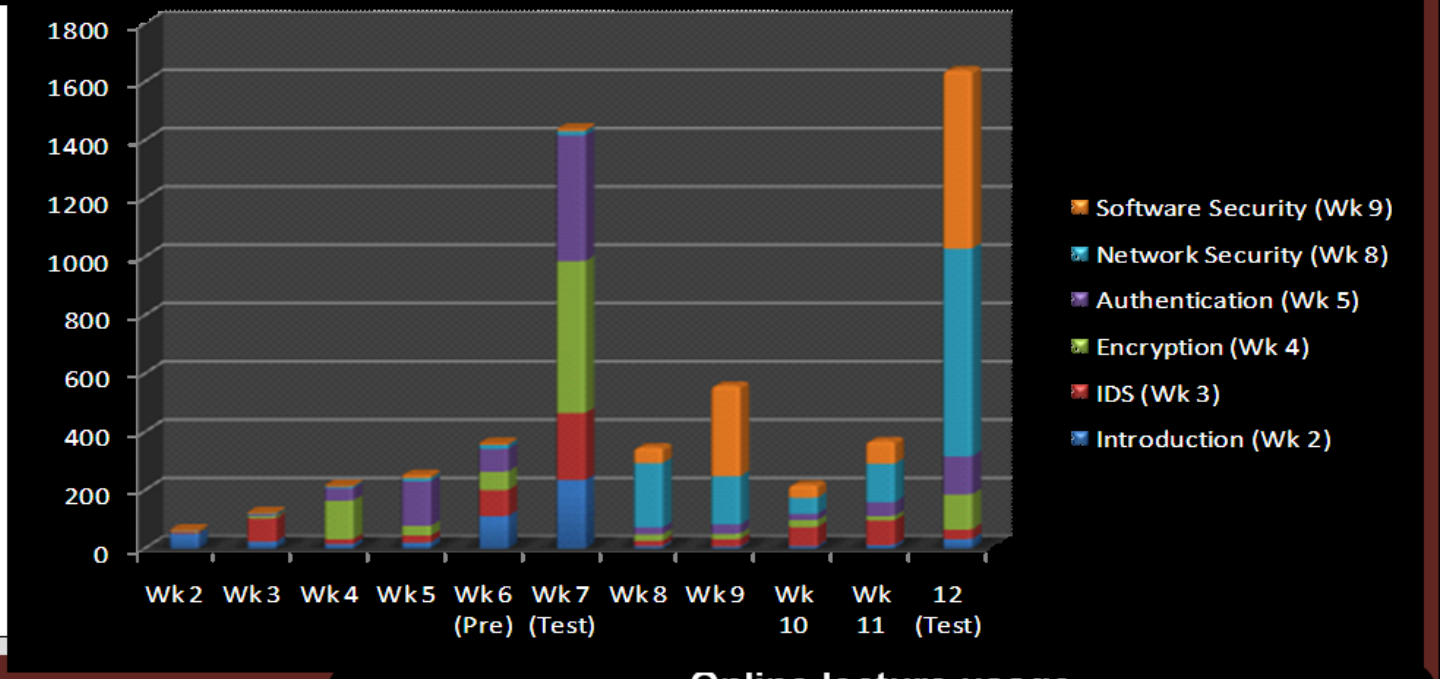
Other 0.0%

Cloud Computing

Cloud

Cloud Delivery of Content





Online lecture usage

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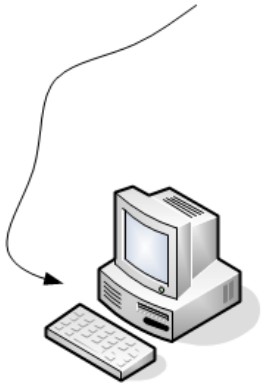
White Hat

Good...

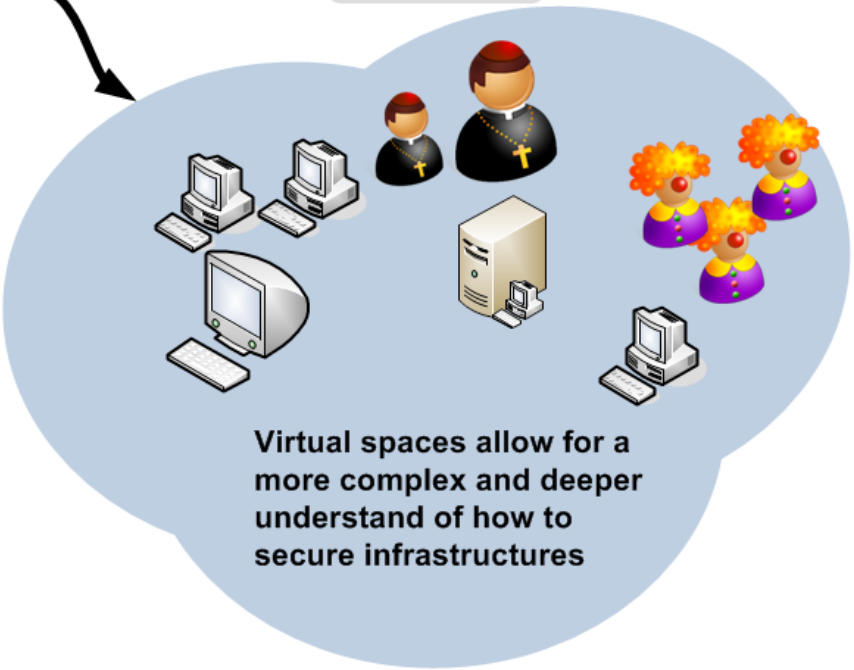
... Bad

Black Hat

Grey Hat



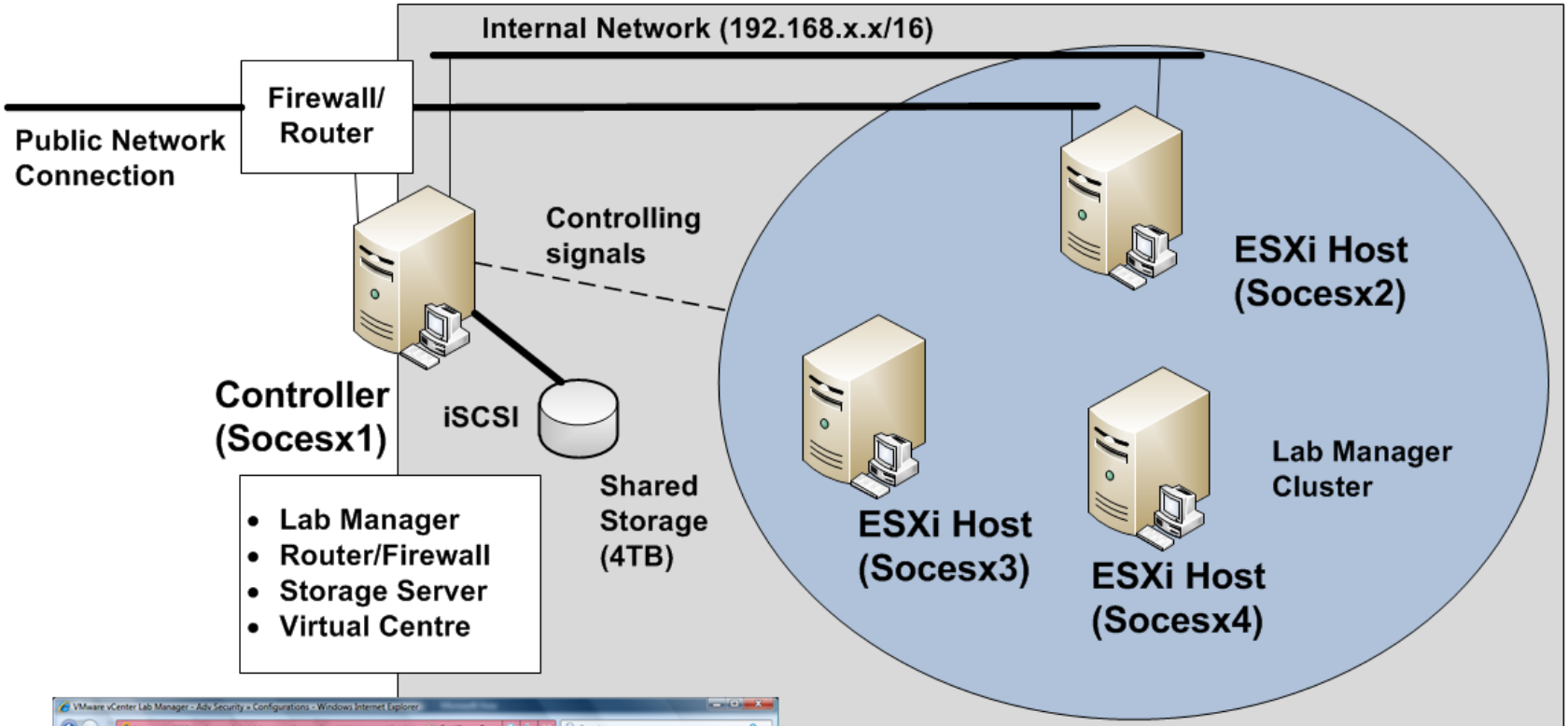
Difficult to use many of the techniques within a real-life space

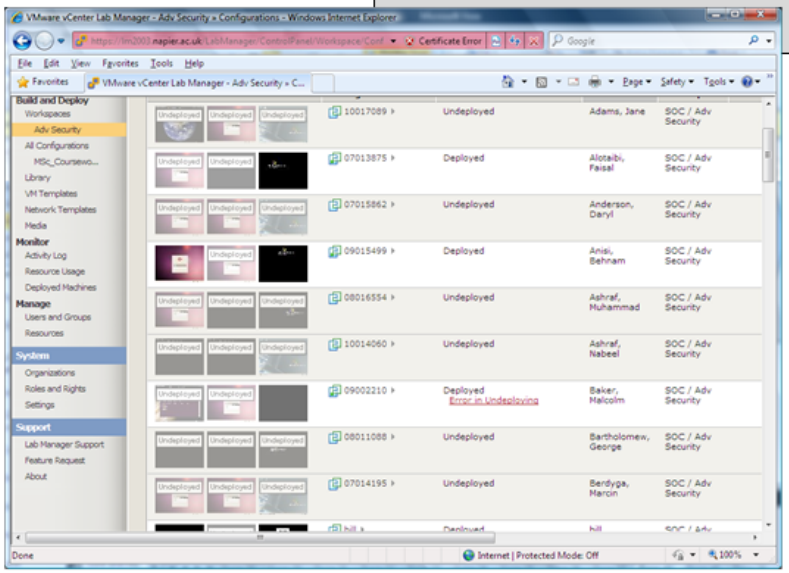


Virtual spaces allow for a more complex and deeper understand of how to secure infrastructures

Demands on professional certification

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





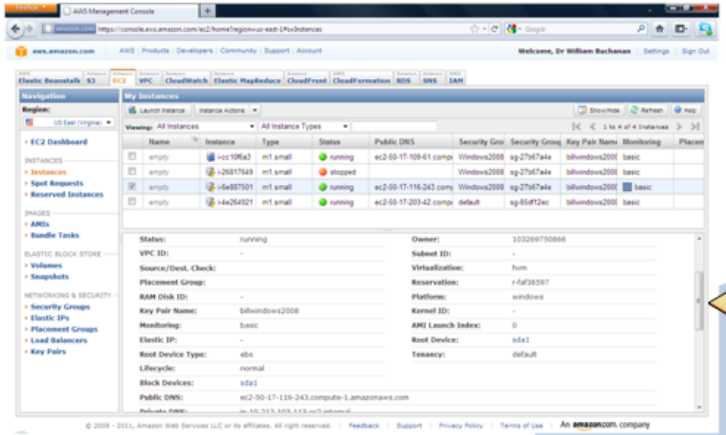
vCenter

Cloud

vmware

cloud
@napier

Napier vCenter infrastructure



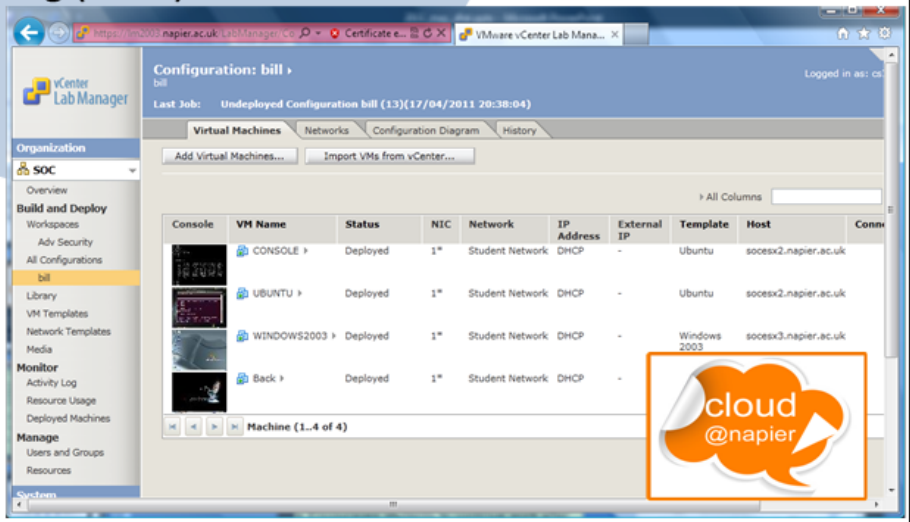
Virtualised and Cloud-based labs (AWS):

- Range of state-of-the-art operating systems and tools.
- Evaluation of Public Cloud resources.

amazon web services™

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

vmware

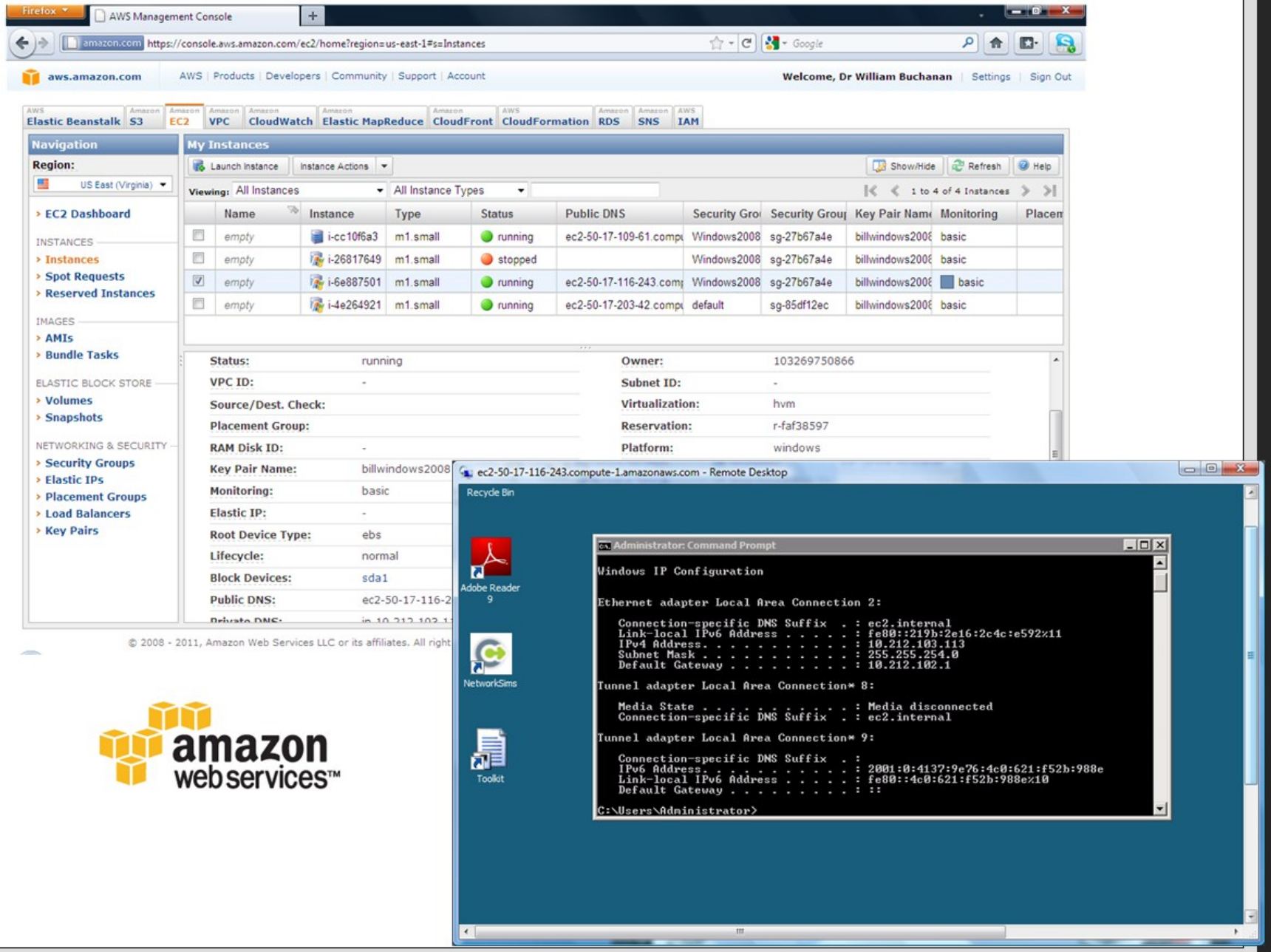


Virtualised and Cloud-based labs:

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

Cloud Computing

Cloud



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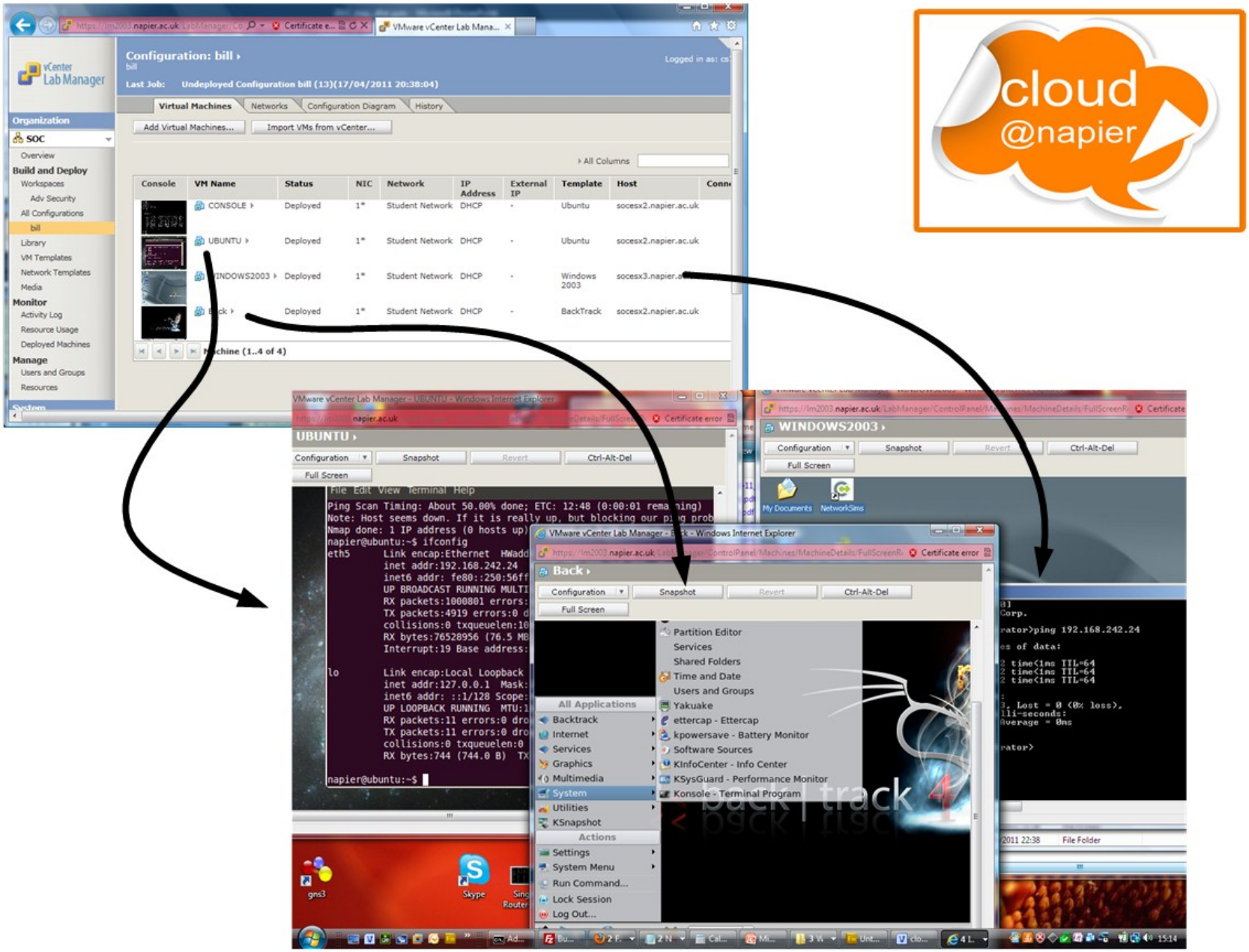

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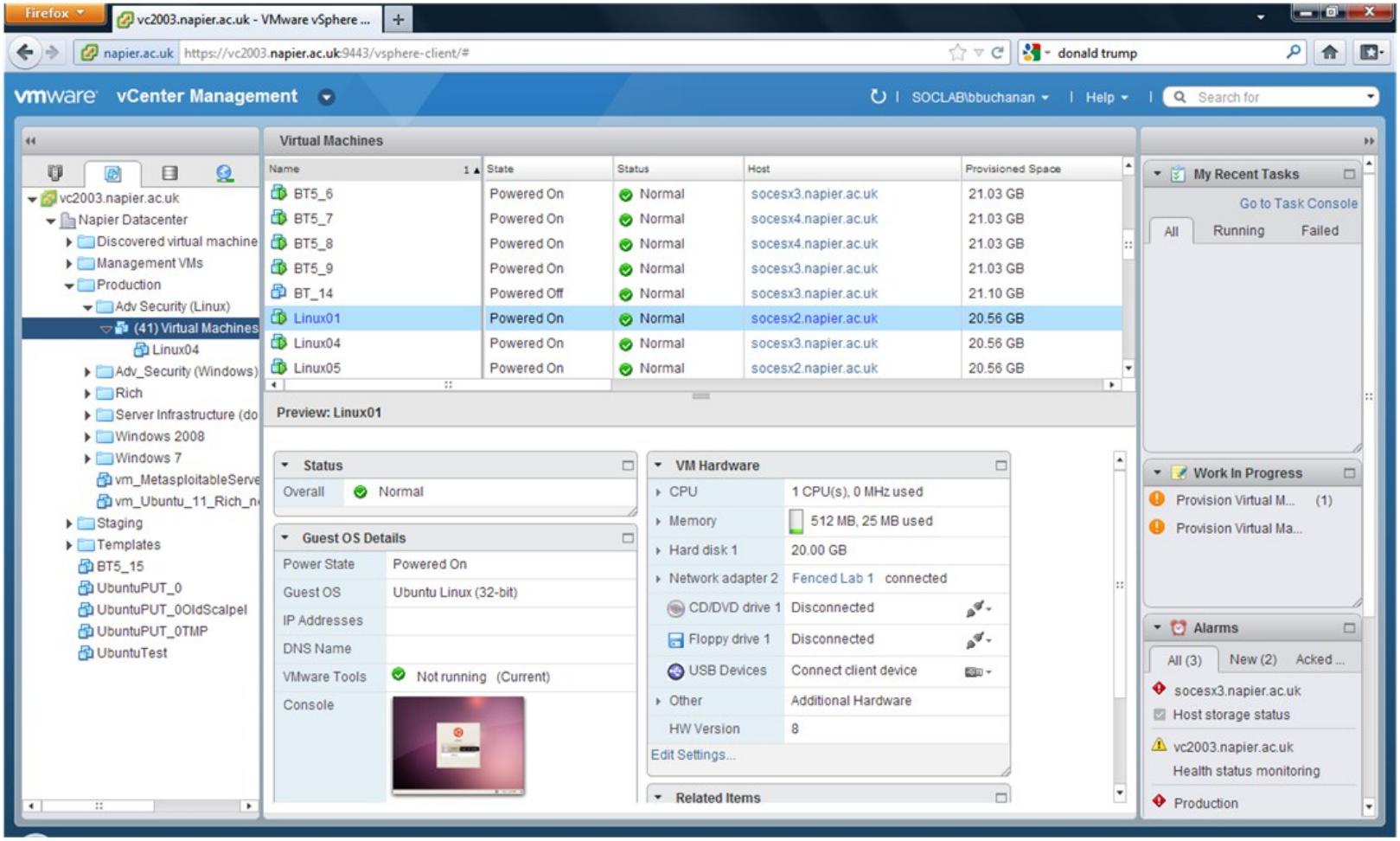
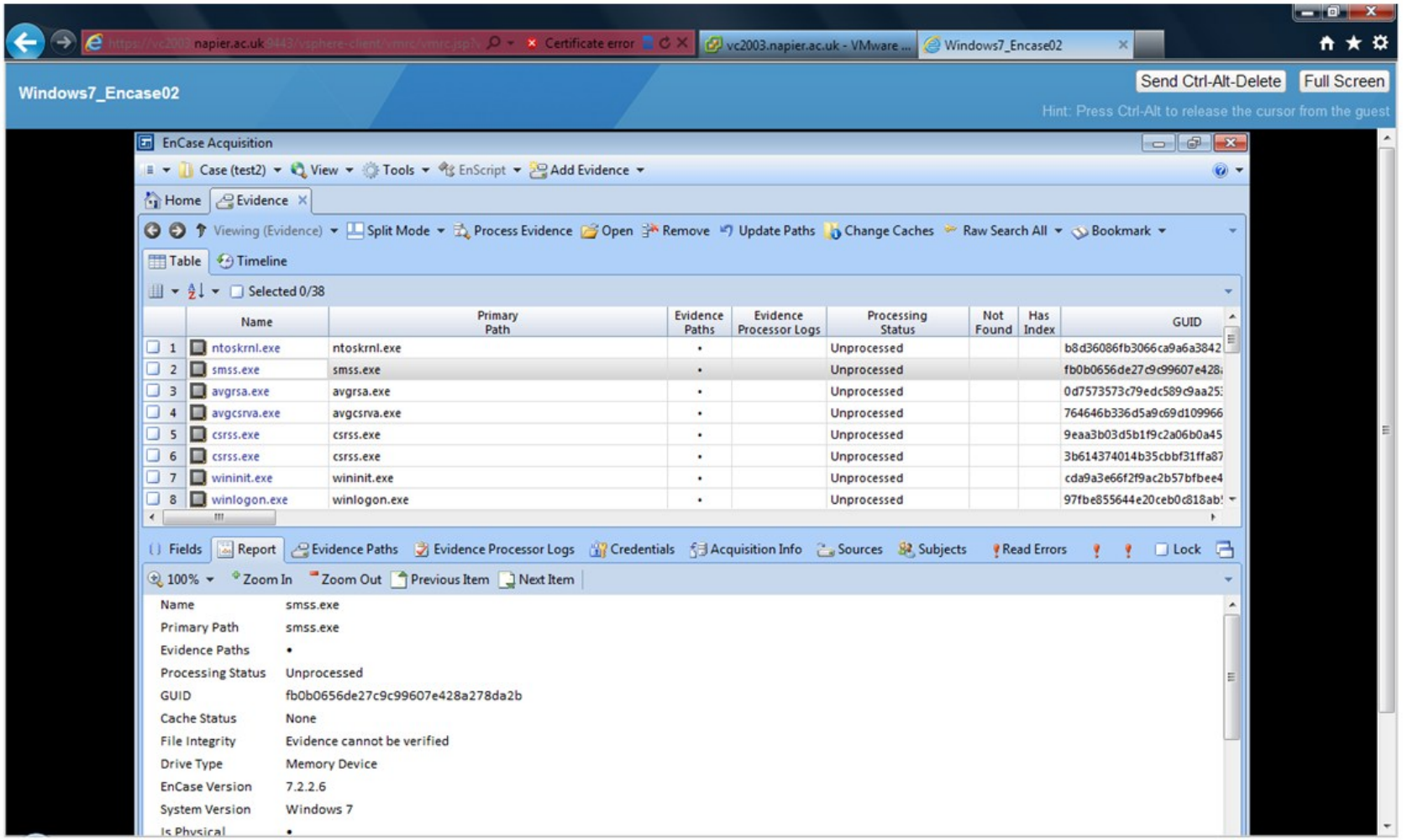


Virtual Training

Cloud

Virtual Infrastructure



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Virtual Infrastructure

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Clouds in Teaching

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

Access for Students
- Students can get easy access to materials.

Licences
- Flexiable and floating licences

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

Failover
- Improved support for failover systems

"Unlimited" bandwidth and disk space
- No limits set on resources, and 24/7 uptime.

Continuation of work
- Students can carry their infrastructures throughout modules/ years.

Easy Integration with a range of systems
- Cloud integration fits well with most teaching infrastructures.

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

Group working
- Students can integrate their systems in an isolated environment.

Snap-shots of work
- Student can create snap-shots, and move back and forward amoungst them.