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# Cloud Computing in Healthcare

## Possibilities & Challenges

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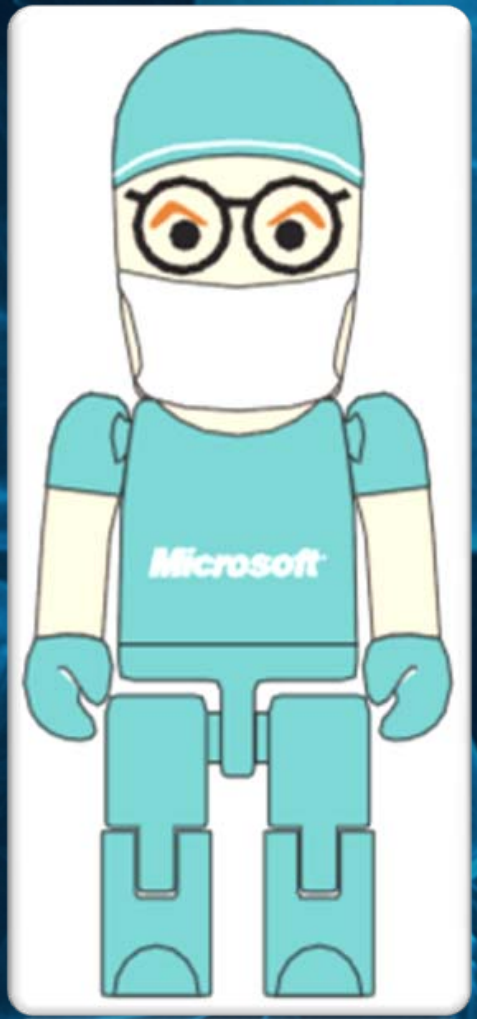

# What is Cloud Computing?

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"... we've redefined cloud computing to include everything that we already do. I can't think of anything that isn't cloud computing. "

*Larry Ellison, Oracle CEO*

"... Today's IT departments will come to be viewed as an evolutionary dead-end – a temporary aberration necessitated by client-server computing but wiped out by The Cloud, which is emerging as the dominant mode for corporate computing"

*Nicholas Carr, Author of "Does IT Matter?" and "The Big Switch"*

"a computing paradigm where the boundaries of computing will be determined by economic rationale rather than technical limits."

*Prof. Ramnath K. Chellappa (Emory University)*

"Just an old idea whose time has (finally) come"

*Berkeley University , "Above the Clouds"*

# Characteristics of Cloud Computing

Microsoft

- **The illusion of infinite computing resources**

provisioning:

| | |
|---|---|
| Client Software | E.g.: Windows, Linux, Browser, Mobile Phone |
| Software as a Service (SaaS) | E.g.: Live Messenger, HealthVault, SalesForce.com, Google, Bing |
| Platform as a Service (PaaS) | E.g.: Microsoft Azure, Google AppEngine |
| Infrastructure as a Service (IaaS) | E.g.: Live SkyDrive, IronMountain, Amazon EC2 and S3 |

- **The ability to pay for use** of computing resources

them as needed, thereby rewarding conservation by letting machines and storage go when they are no longer useful.

# Possibilities & Applications

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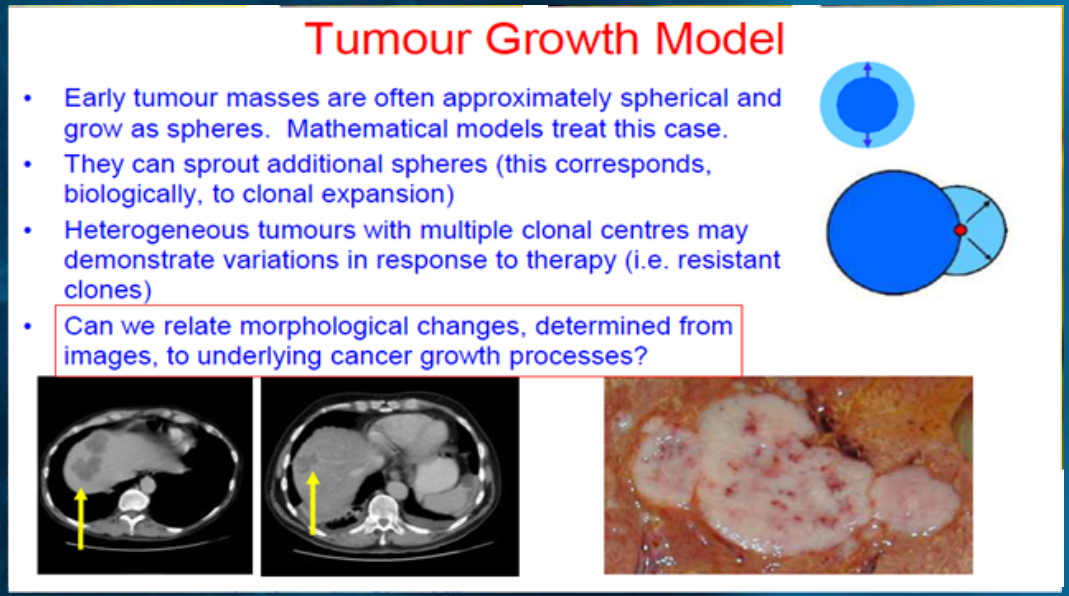
- What if we apply elastic computing to healthcare?

Automatic and semiautomatic analysis of n-dimensional medical images, aiming to improve measurement of anomalies, detecting possible tumours and increasing the efficiency and accuracy of radiologists and clinicians.




Sir Michael Brady FRS FREng FIET FBCS FMedSci
Professor of Information Engineering
Oxford Cancer Imaging Centre
University of Oxford

# Cloud Computing enabling eHealth

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## Capabilities Required:

- Identification & Authorisation
- Document & Message Exchange
- Storage & Computing
- Real-time communication
- Health Records

## Existing Cloud Services:

- OpenID, LiveID
- .NET Services, Amazon
- Azure, Google AppEngine, S3
- Live Services, Skype
- HealthVault, Google Health

# The Economics of Cloud Computing

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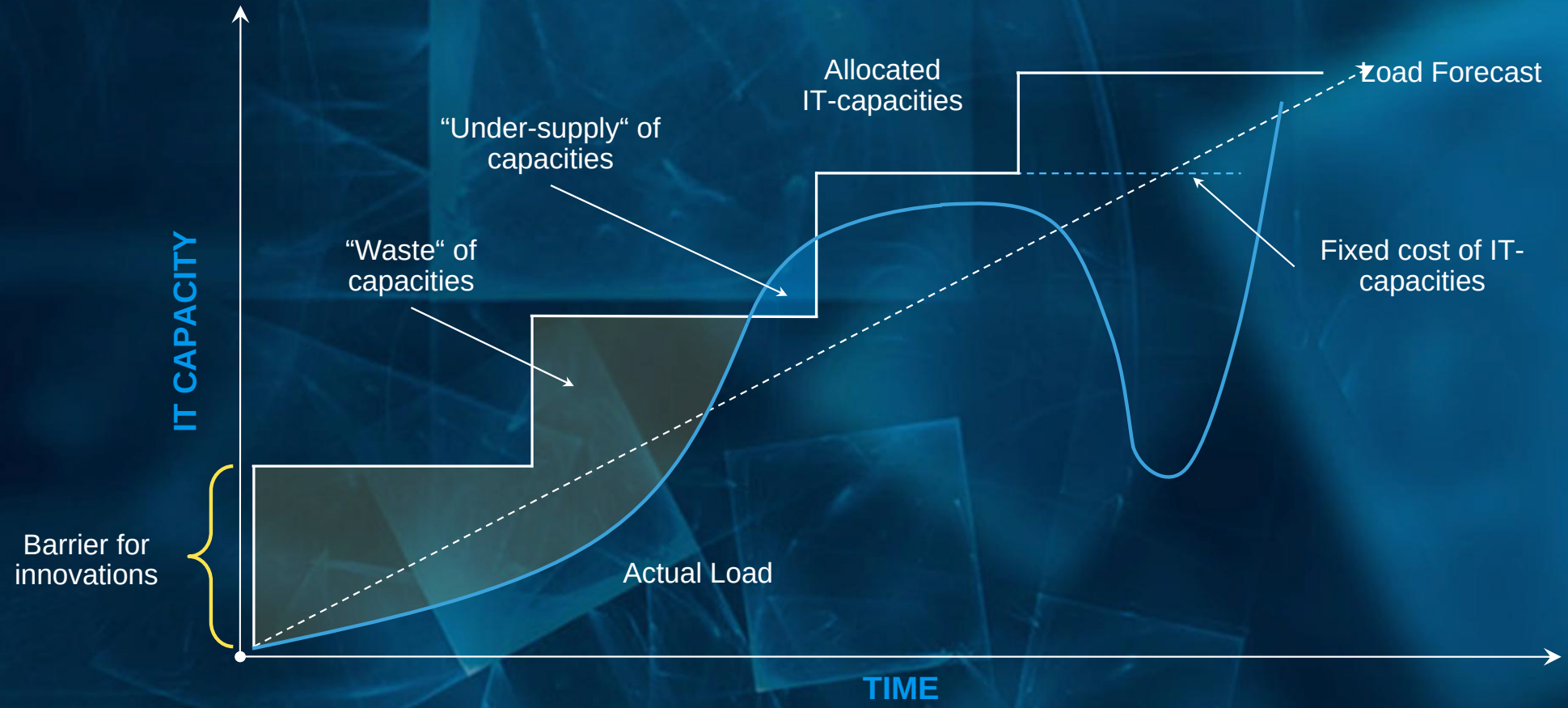
## Traditional IT Economics:



# The Economics of Cloud Computing

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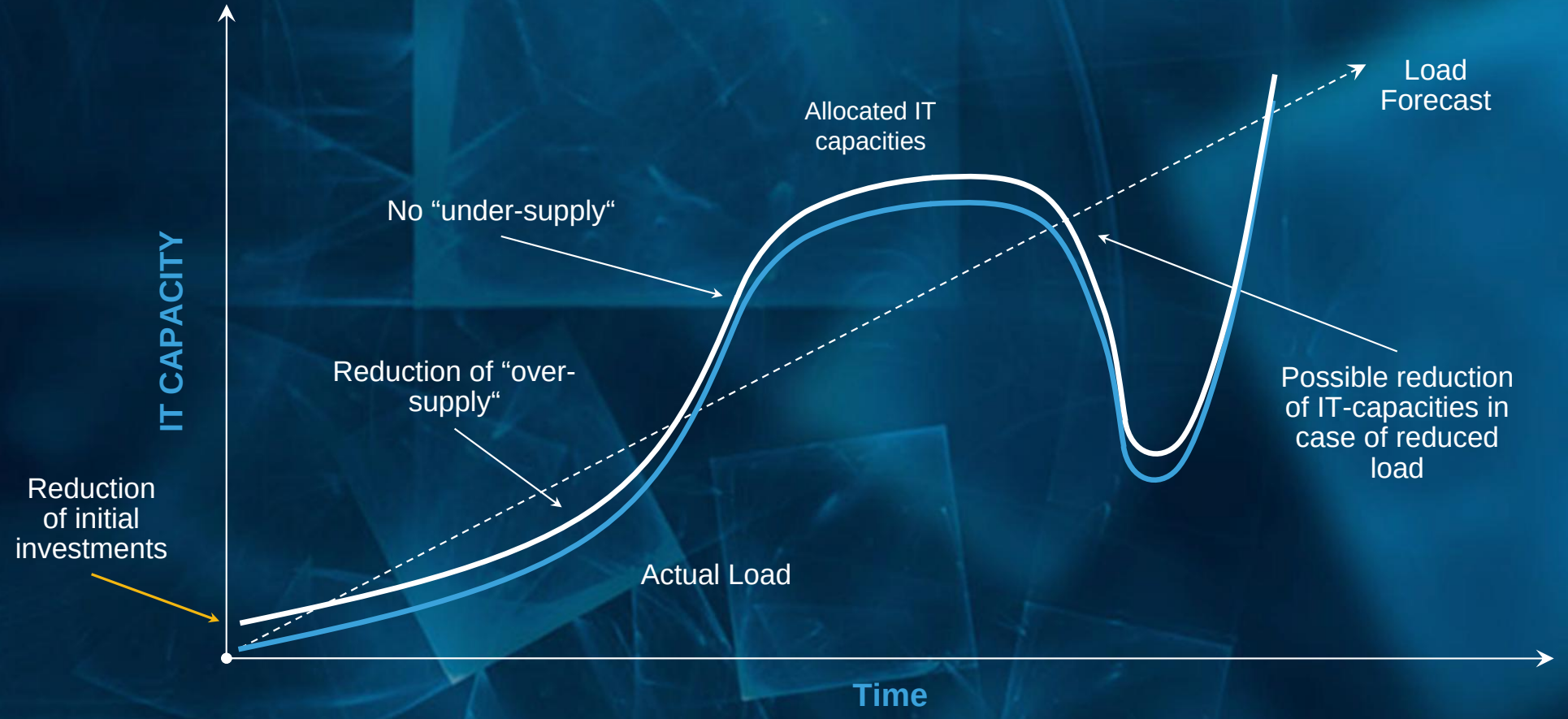
## Cloud View of IT Economics:



# An eHealth Example in Australia

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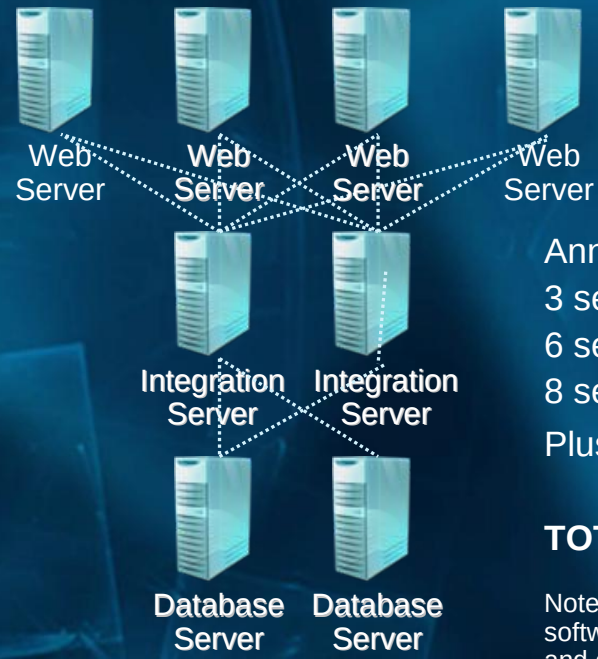
- Electronic Document Exchange:
  - 200 million clinical documents per annum (avg: 7 per second, peak 5x)
  - Each document encrypted & uploaded to a repository
  - Each document downloaded & decrypted on demand
  - Additional processes at low volume
  - Each document is average 20kb
- Physical Architecture estimate:




Annual Cost Estimate:

3 servers: $ 102,000

6 servers: $ 187,000

8 servers: $ **214,000**

Plus DR: $ **44,000**

**TOTAL: $ 258,000**

Note: cost is for hardware, software, bandwidth, storage and operations management only

# An eHealth Example in Australia

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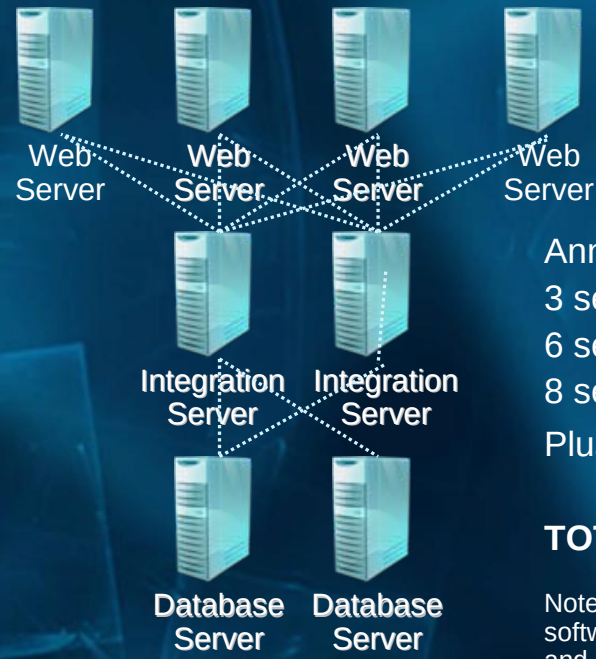


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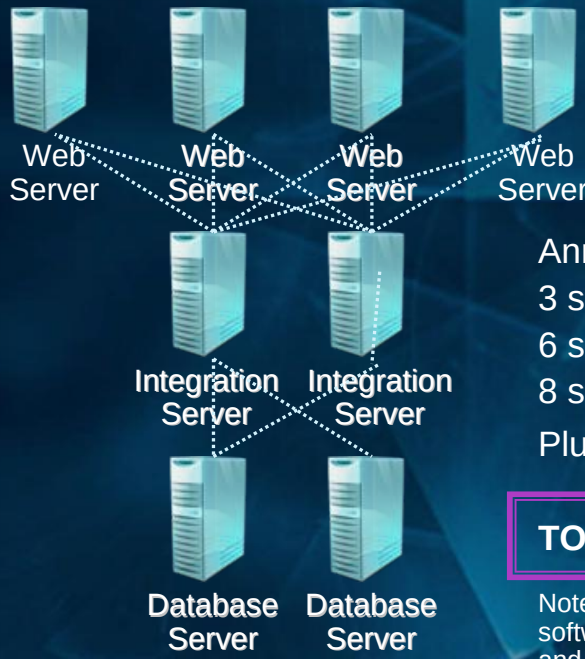


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- Cloud Computing Architecture:


Compute Time:

15,000 hrs @ $0.12 /hr

**$18,000**

Bandwidth:

In: 4,000 GB @ $0.10 /GB

Out: 4,000 GB @ $.15 /GB

**$1,000**

Auth/Authz and Messages

Txns: 800 m @ $1.50 /mil

Auths: 400m @ $1.50 /mil

**$1,800**

Storage:

SQL: 40GB @ = $4,800

Azure: 4TB @ $1.80/GB pa

**$12,000**

**TOTAL: $32,800**

# Why Now, Not Then?

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- Construction of extreme scale data centres demonstrated efficiency gains from massive volume
- Adoption of Web 2.0 services like Skype, Hotmail, Google and cloud applications like Animoto
- Pathfinders like Amazon who demonstrated the business model
- Technology innovation in virtualisation and compute algorithms, such as Google's MapReduce, Open Source Hadoop, Microsoft's Dryad
- Commoditisation of computing, storage and networking infrastructure

# Obstacles to Cloud Computing

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- Service Availability
- Data Lock-in
- Data Transfer & Performance Bottlenecks
- Scalable Storage
- Software Licensing & Billing
- Data Confidentiality (including Privacy)

# Privacy Concerns in Cloud Computing

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"... Cloud computing is definitely the new black, and it looks like it is going to drag privacy into fashion with it."

*Robin McKenzie, Blog Entry, Princi*
*Information Integrity Solutions Pty*

The location of information in the cloud may have significant effects on the privacy and confidentiality protections of information. Information in the cloud may have more than one legal location at the same time, with differing legal consequences.."

*World Privacy Forum Report: Privacy in the*
*Risks to Privacy and Confidentiality from Cl*
*Computing, 2009*

"... You already have zero privacy – get over it."

*Scott McNealy, CEO Sun Microsystems*

# Dealing with Location Privacy Issues

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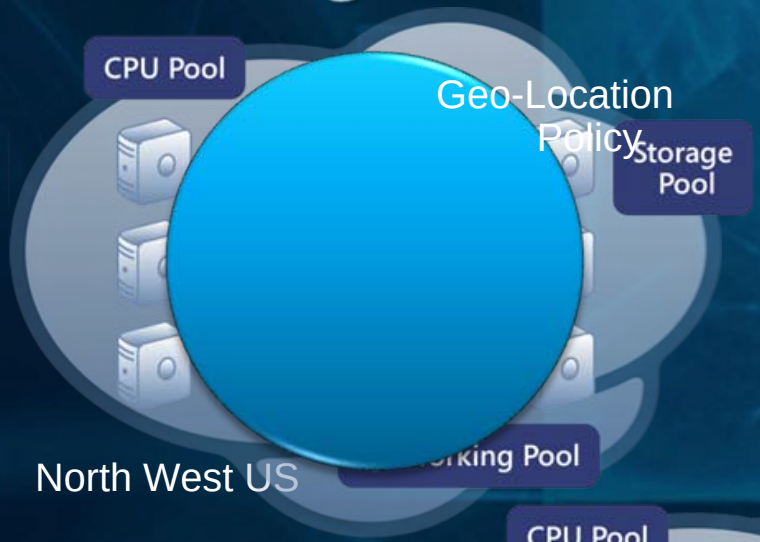


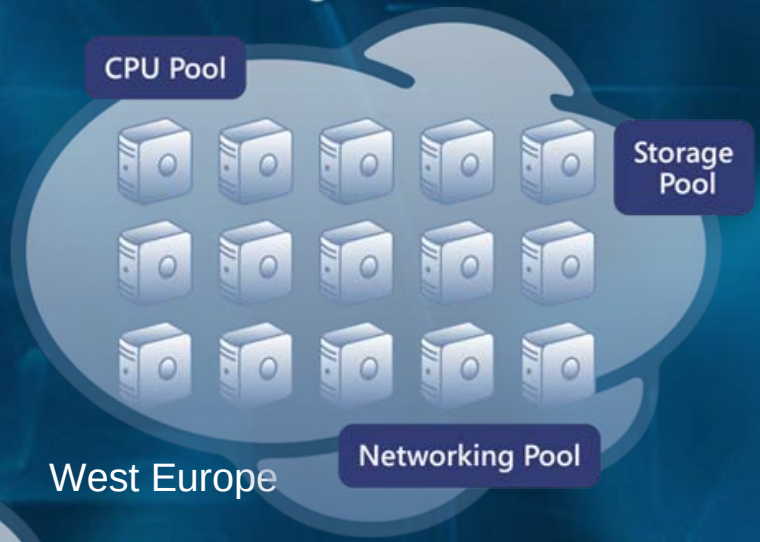


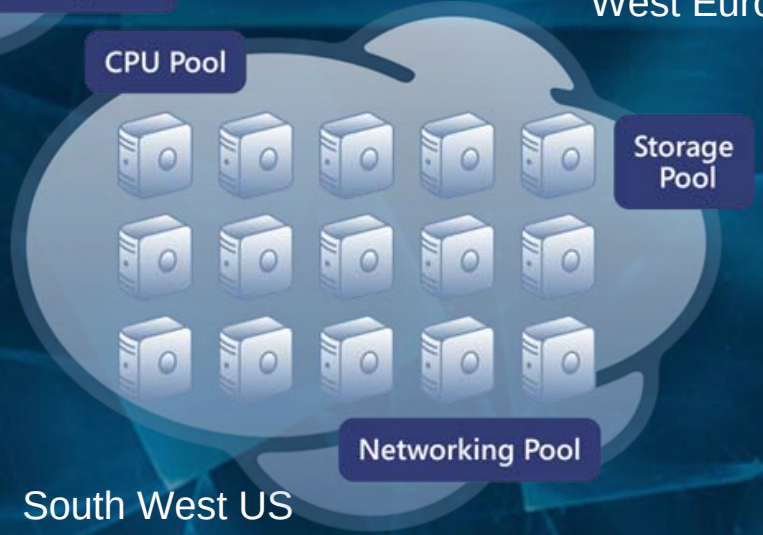


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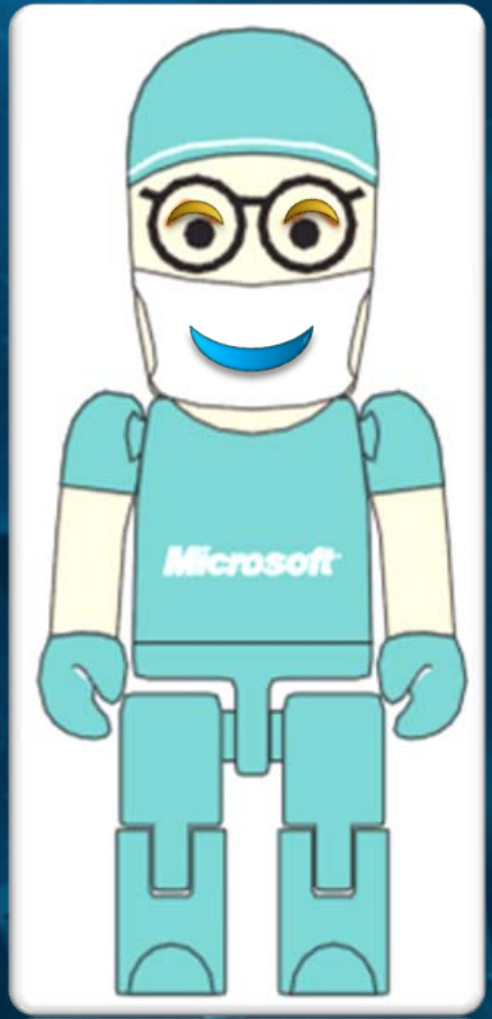


Thank you

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# Microsoft®

*Your potential. Our passion.™*

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