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Coleraine Connected

Global Bandwidth Infrastructure for Next Generation Internet "*Preparing for the Bandwidth Tsunami*"

presenter:

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What is Cloud Computing?

Developments in ICT mean it is now possible for different teams, offices or even organisations to share the same ICT infrastructure over physical links.

The different hardware can be brought together and used to deliver increased flexibility and responsiveness to business needs while reducing costs over an "Extended Intranet".

Essentially, it means moving from ICT that has been procured separately by organisations as their own infrastructure, to a new model in which ICT is provided as a utility.

This shift, known as 'cloud computing' has been likened to the changes in the electricity industry during the early part of the 20th century, when organisations moved from buying their own generators to procuring electricity as a utility.

Ref: "Government ICT Strategy Smarter, cheaper, greener" , The Cabinet Office, 2010

Cloud according to IBM..

- **Cloud computing is a means of providing service delivery for consumer and business needs in a simplified way,** providing unbounded scale and differentiated quality of service to reduce capital and operational costs, and an environment that scales easily to effectively meet customer needs.
- Benefits of cloud computing:
- Predictable any time, anywhere access to IT resources
- Flexible scaling of resources (resource optimisation)
- Rapid, request-driven provisioning
- Lower total cost of operations

Ref:Service Management and Cloud Computing

"Martini Services": access anytime, anyplace, by any means!

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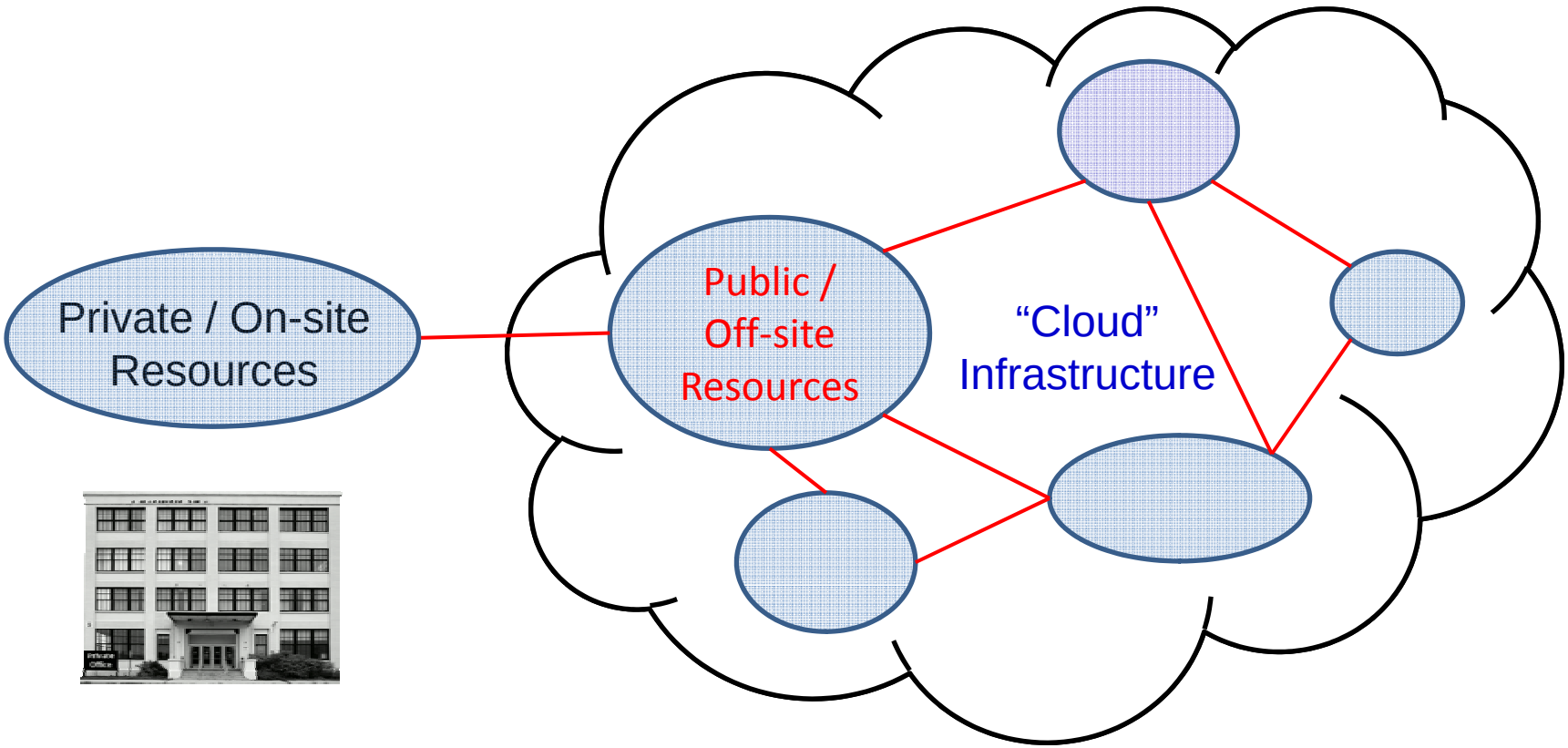
Cloud Computing



Cloud computing uses virtualisation technologies to provide on-demand data centre resources over the Internet

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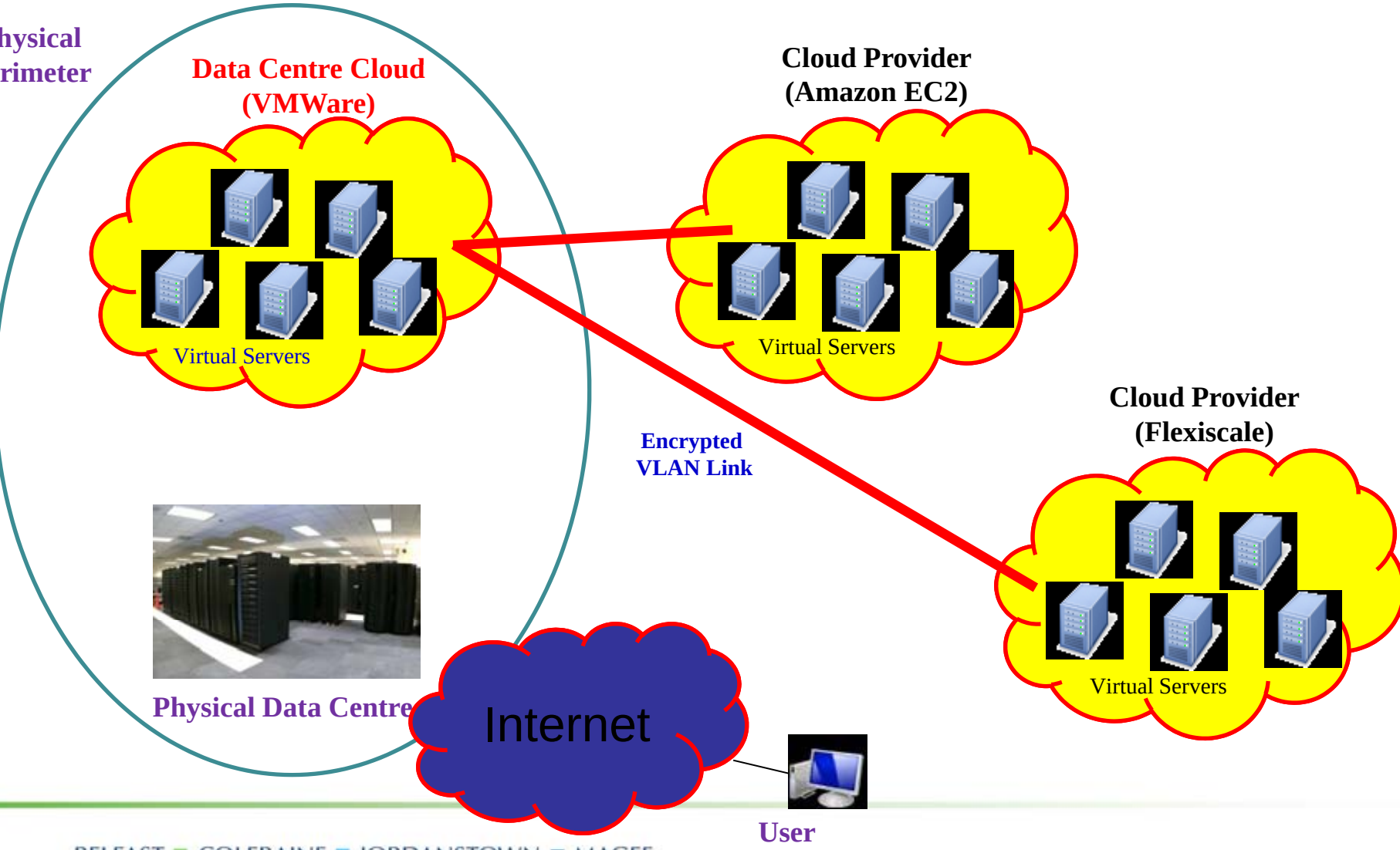
A Cloud Example....



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Some definitions

1 Gigabyte - The prefix giga means 10^9, therefore 1 gigabyte is 1,000,000,000 bytes

1 Terabyte (TB) equals 1,000,000,000,000 bytes = 1000^4 or 10^{12} bytes.

An Exabyte is a billion gigabytes- 1 EB = 1,000,000,000,000,000,000 B = 10^{18} bytes or 1 billion gigabytes

A Petabyte is equal to one quadrillion bytes or 1000 terabytes or 1,000,000 gigabytes. 1 PB = 1,000,000,000,000,000 = 10^{15} bytes

A zettabyte is equal to one sextillion bytes which is- 1,000,000,000,000,000,000,000 bytes = 1000^7, or 10^{21}. .....a lot!!!

Prefixes for binary multiples

Factor	Name	Symbol	Origin	Derivation
2^{10}	kibi	Ki	kilobinary: $(2^{10})^1$	kilo: $(10^3)^1$
2^{20}	mebi	Mi	megabinary: $(2^{10})^2$	mega: $(10^3)^2$
2^{30}	gibi	Gi	gigabinary: $(2^{10})^3$	giga: $(10^3)^3$
2^{40}	tebi	Ti	terabinary: $(2^{10})^4$	tera: $(10^3)^4$
2^{50}	pebi	Pi	petabinary: $(2^{10})^5$	peta: $(10^3)^5$
2^{60}	exbi	Ei	exabinary: $(2^{10})^6$	exa: $(10^3)^6$

Examples and comparisons with SI prefixes

one **kibibit**	1 Kibit = 2^{10} bit = **1024 bit**
one **kilobit**	1 kbit = 10^3 bit = **1000 bit**
one **mebibyte**	1 MiB = 2^{20} B = **1 048 576 B**
one **megabyte**	1 MB = 10^6 B = **1 000 000 B**
one **gibibyte**	1 GiB = 2^{30} B = **1 073 741 824 B**
one **gigabyte**	1 GB = 10^9 B = **1 000 000 000 B**

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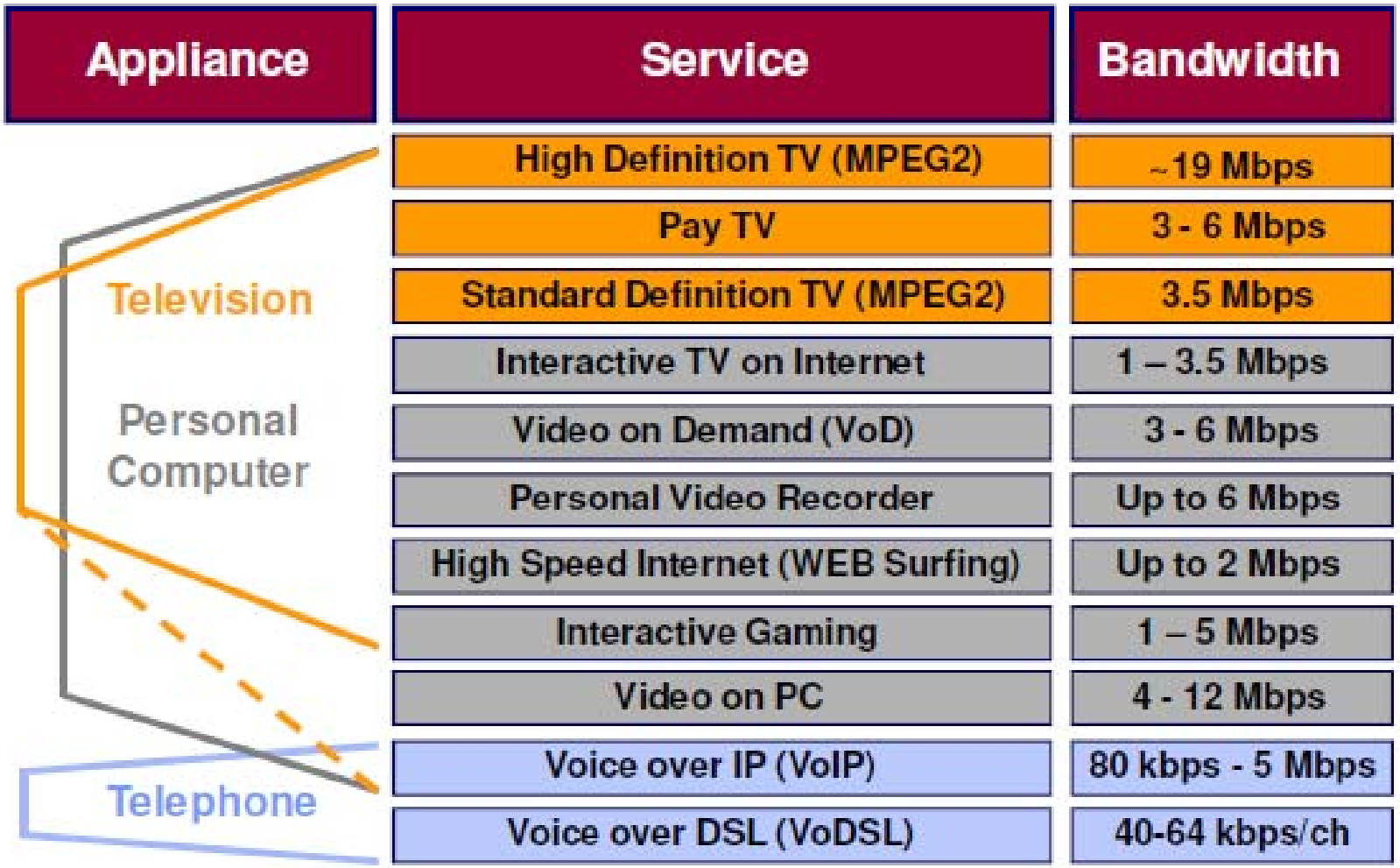
Exemplar bandwidth Requirements- single channel use

Source- www.adc.com



Appliance	Service	Bandwidth
Television	High Definition TV (MPEG2)	~19 Mbps
Television	Pay TV	3 - 6 Mbps
Television	Standard Definition TV (MPEG2)	3.5 Mbps
Personal Computer	Interactive TV on Internet	1 – 3.5 Mbps
Personal Computer	Video on Demand (VoD)	3 - 6 Mbps
Personal Computer	Personal Video Recorder	Up to 6 Mbps
Personal Computer	High Speed Internet (WEB Surfing)	Up to 2 Mbps
Personal Computer	Interactive Gaming	1 – 5 Mbps
Personal Computer	Video on PC	4 - 12 Mbps
Telephone	Voice over IP (VoIP)	80 kbps - 5 Mbps
Telephone	Voice over DSL (VoDSL)	40-64 kbps/ch

Initial Tsunami waves..

- **On the entertainment front, video has always been identified at the top of the list of bandwidth-demanding applications. Recent studies noted that the new 3-D HD video applications which are expected to be commercially available in 2010 will require 160Mbps downstream speed.**

- **Developmental applications such as Ultra High HDTV, Quad HD, and Holographic Video will also require far more bandwidth than even the highest resolution HDTV today. Upstream speeds will become more important as today's Internet users seek to share and store more content.**

From DSM FTTH 2009

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Larger waves predicted...

- **“In 2013, Internet video will be nearly 700 times the U.S. Internet backbone in 2000. It would take well over half a million years to watch all the online video that will cross the network each month in 2013. Internet video will generate over 18 exabytes per month in 2013.”**
- **“Video communications traffic growth is accelerating. Though still a small fraction of overall Internet traffic, video over instant messaging and video calling are experiencing high growth. Video communications traffic will increase tenfold from 2008 to 2013.”**
- **“Real-time video is growing in importance. By 2013, Internet TV will be over 4 percent of consumer Internet traffic, Video-on-demand (VoD) traffic will double every two years through 2013.”**

Cisco Visual Networking Index: Forecast and Methodology, 2008–2013

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What of mobile?

- **Globally, mobile data traffic will double every year through 2013, increasing 66x between 2008 and 2013.**
- **Mobile data traffic will grow at a CAGR of 131 percent between 2008 and 2013, reaching over 2 exabytes per month by 2013.**
- **Almost 64 percent of the world's mobile data traffic will be video by 2013. Mobile video will grow at a CAGR of 150 percent between 2008 and 2013.**

Cisco Visual Networking Index:
Forecast and Methodology, 2008–2013

The big waves..

- **Annual global IP traffic will exceed two-thirds of a zettabyte (667 exabytes) in four years. Last year's forecast anticipated a run rate of 522 exabytes per year in 2012. ...thats 522 billion gigabytes!**

- **The economic downturn has only slightly tempered traffic growth, and this year's forecast predicts 510 exabytes per year in 2012, growing to 667 exabytes per year or 56 exabytes per month in 2013.**

- **In 2013, the Internet will be nearly four times larger than it is in 2009. By year-end 2013, the equivalent of 10 billion DVDs (approx 4.5GB each) will cross the Internet each month! Where can we store all the data?**

Other example Drivers..

Optimisation of ICT Infrastructure and Energy-Efficiency Techniques in Next Generation Interne

H. Abaci, G. Parr, S. McClean, A. Moore, F. Saffre (BT Adastral Park)

India-UK Advanced Technology Centre of Excellence in Next Generation Networks, Systems and Services.
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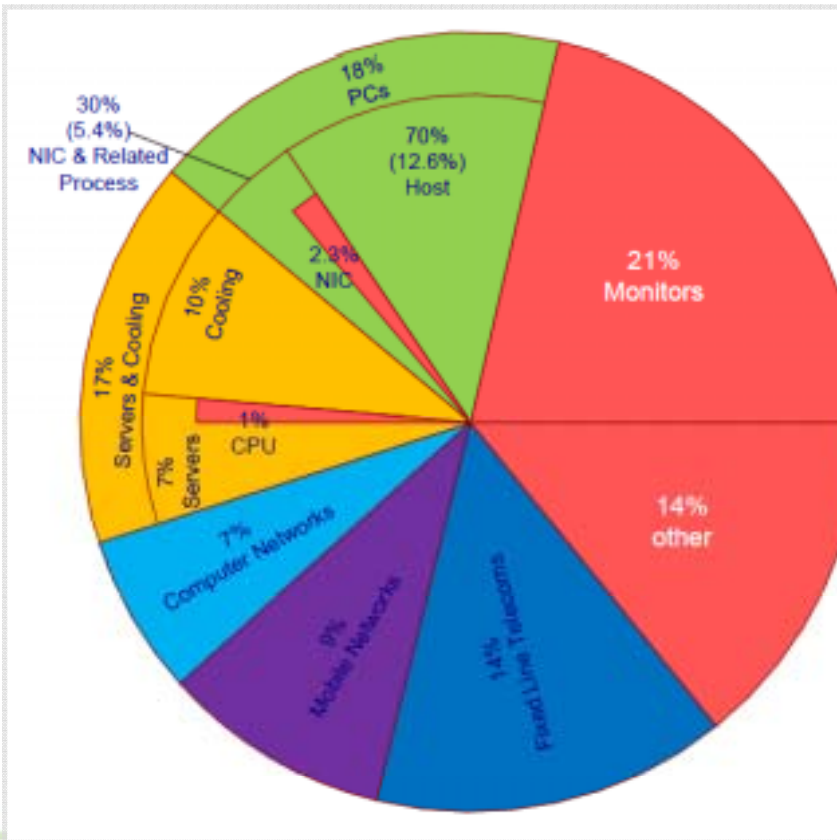
Ref: Smart 2020 report



Coleraine & KELVIN

- The Key Selling points for locating a Managed Data Centre facility through a POP at the KELVIN Landing Station location at Coleraine include:-

Security

- Improved ability to monitor and protect the physical and software elements from security threats and unauthorised access/attack through direct connection to the Hibernia fibre

Resilience

- The capability of self-healing and maintaining Service Level Agreements (SLAs) at an acceptable level through the reduction of the presence of faults and challenges to normal operation

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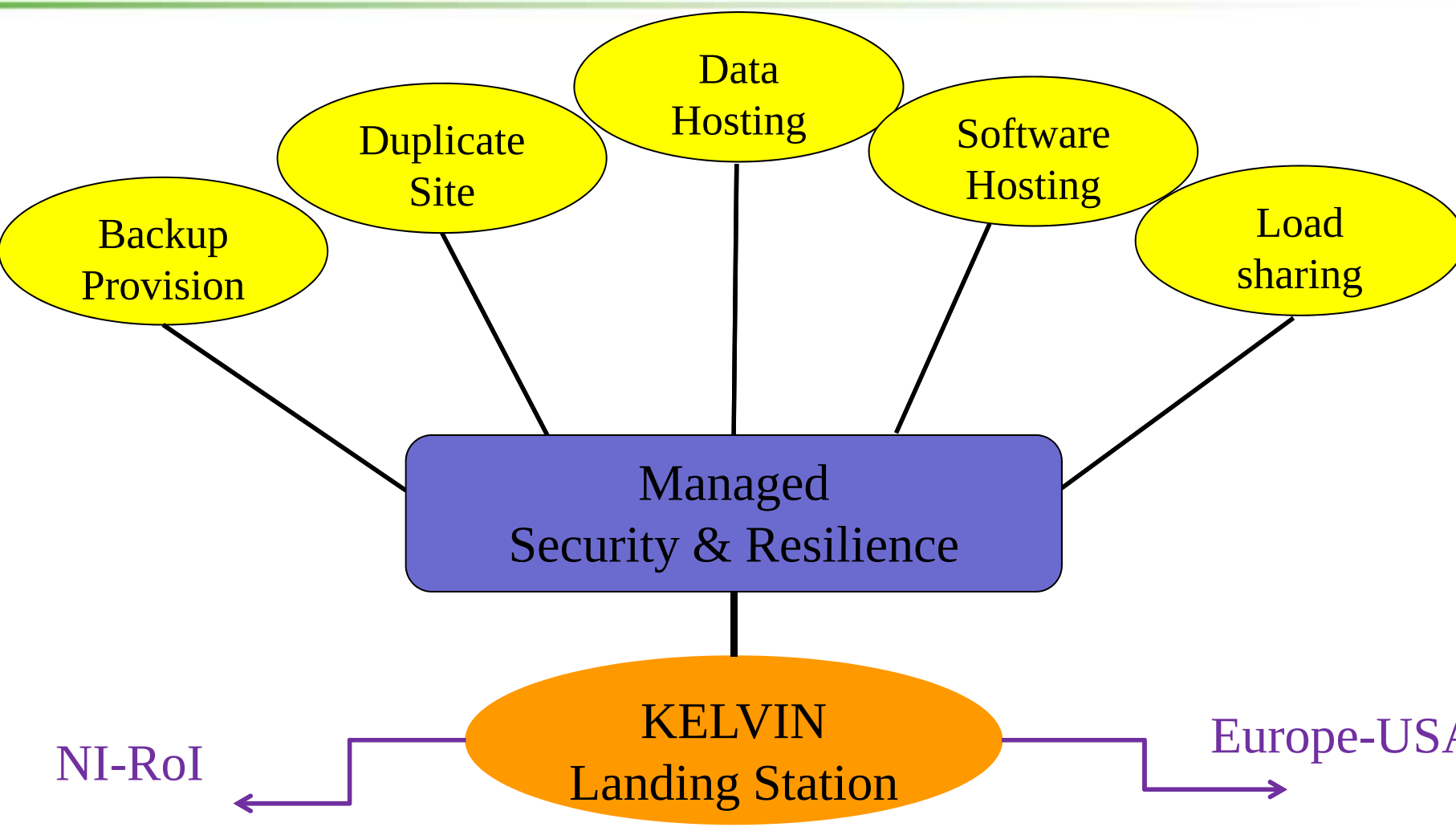
Exemplar Service Offerings



The Government as a Custome

Example Areas for Exploration in response to Digital Britain-

- The Government Cloud (G-Cloud)

  Allowing government bodies to select and host ICT services ~£3.2 billion savings per year

- Data Centre Rationalisation

  Consolidate from hundreds to between 10-12 highly strategic locations ~ £300 million savings per year

- The Government Applications Store (G-AS)

  Reduction in applications contracts ~ £500m savings per year

- Shared Services on the Cloud

  HR, Finance, procurement, supply chain ~ £100 million

- Common Desktop- Thin Clients...Energy savings

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Potential Applications

- Replication site for government data (tax, health, customs, e.gov
- Apple iStore for music, video and applications
- Amazon transactions
- eBay transactions
- Microsoft technical support and application data components
- Aerospace Engineering and modelling
- NASA/ESA images
- Oil/Gas Exploratory Data Analytics
- Banks- Financial models and real-time transactions
- Multiple Retailers Data Store (e.g. Tesco, Sainsbury)
- Social Networking- Content Storage-Delivery and Management
- BBC iPlayer for TV, radio broadcasts and Internet Services

Links to University R&D

Links to local Research Expertise and Innovative Courses at the University of Ulster at Coleraine campus include:-

Biomedical Sciences:-

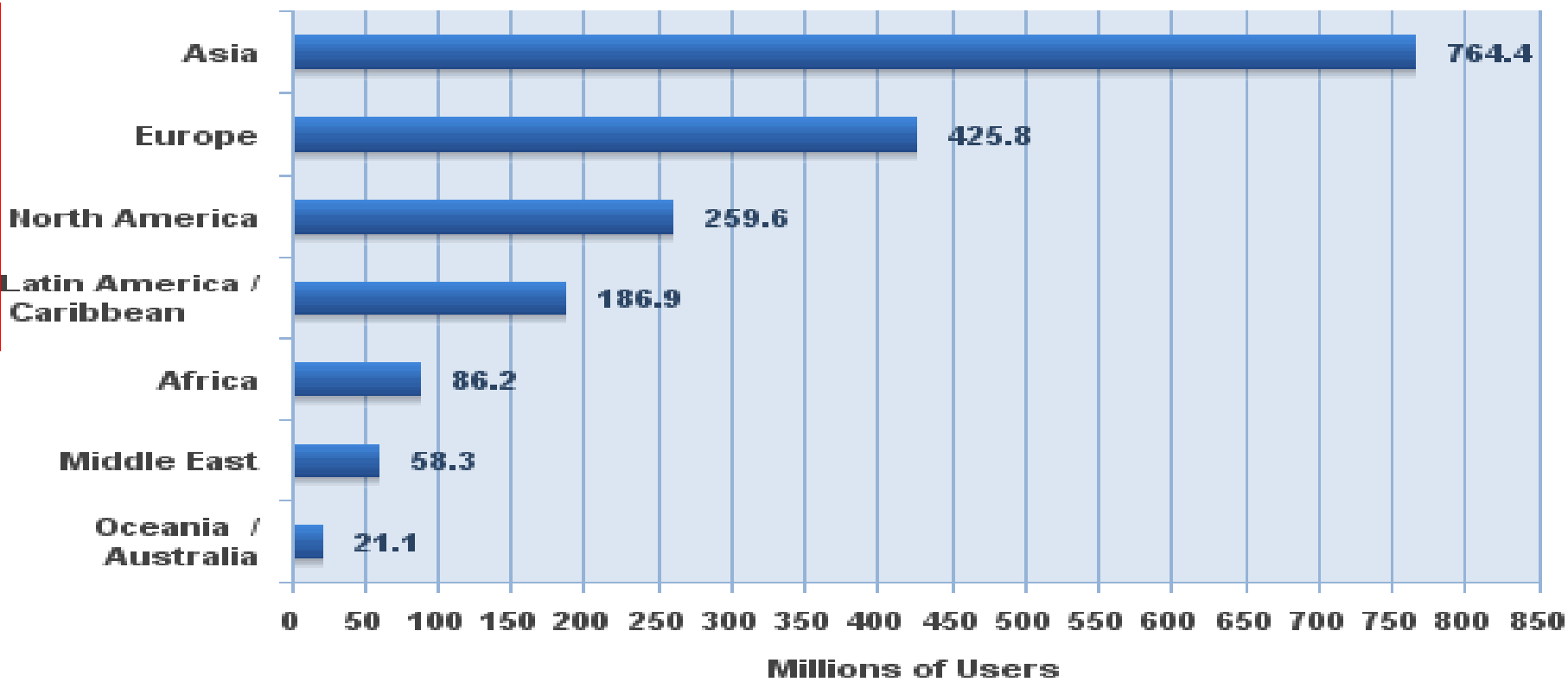
- Pharmacology
- Drug discovery
- Gene Sequencing

Computer Science Research Institute

- High Speed Data Mining
- Medical /Aerial Imaging
- Telecommunications Engineering- applications & services
- System Protocol development
- Networking and Computational Mathematics-NETCOM Laboratory

GeoPhysics- Earthquake Data Analysis and Prediction Models

Internet Users in the World by Geographic Regions - 2009



Source: Internet World Stats - www.internetworldstats.com/stats.htm
Estimated Internet users are 1,802,330,457 for December 31, 2009

Next Steps....

Develop a co-ordinated marketing message for KELVIN with DETI Support....Go after the BRIC!

Develop Thematic case studies for potential national and international clients (NI and then specific). Speak loudly of Coleraine unique offering as it supports the vision of KELVIN for all of the island. Not to exploit it would be a wasted opportunity!

Ensure we have adequately resourced courses at undergraduate and postgraduate level at Coleraine campus to feed spin-off R&D and support services e.g

MSc in Telecommunications & Internet Systems

BSc in Financial Engineering

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Thank You

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