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HPC a University View

(a.k.a. High Throughput Computing, High Powered Computing, High Performance Technical Computing, Grid Computing, Scientific Computing, Capacity Computing, Capability Computing, Cluster Computing, Beowulf Computing.)

Dr Oz Parchment
Director of Research Computing
Chair of the HPC-SIG

University of Southampton

High Performance Computing

- More than just powerful computers, HPC is about addressing all aspects of a computational work-flow (compute, networks, facilities, software, data, people), and optimizing them for efficient performance.
- University Research Computing provide all these components and more to their communities:
  - For some researchers local facilities are sufficient.
  - For others, local HPC provides an easy and accessible stepping stone or test-bed

University HPC

HPC & large scale storage is ***basic research infrastructure.***

The university HPC sector expanded rapidly with SRIF3 investments. This led to a local consolidation of HPC facilities –***internal shared services-*** (“private clouds”)

- forms an ***essential*** part of a significant proportion of research within the HE sector and ***demand is growing***.
- Unique ***first-touch*** with the research community and is an ***incubator*** for future generations of computational researchers.
- Has a low “activation barrier”, facilitating ***blue skies*** research.
- Engages with and responsive to, the **local research community and the University’s strategy**
- **SUSTAINABILITY a Perennial issue**

HPC-SIG

- Formed in 2005
- Members are HPC Service Providers in Universities.
- **35 Members covering,**
  - Most research intensive Universities
- **Affiliate membership**
  - EPSRC/STFC/NERC
  - Public Sector
  - Charities
  - Commercial
  - JANET

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HPC-SIG

- **To collect, disseminate and promote best practice in HPC provision, management and support**
- **To act as a link between National HPC provision and local University/campus level provision**
- **To act as an outreach vehicle promoting the use of HPC across all academic sectors**
- To facilitate communication between academic and industrial/commercial HPC providers/users
- **To secure the role of HPC as a vital research tool across all academic disciplines**
- To demonstrate the value of HPC facilities in higher education and to ensure that these facilities can be delivered with the best possible value for money

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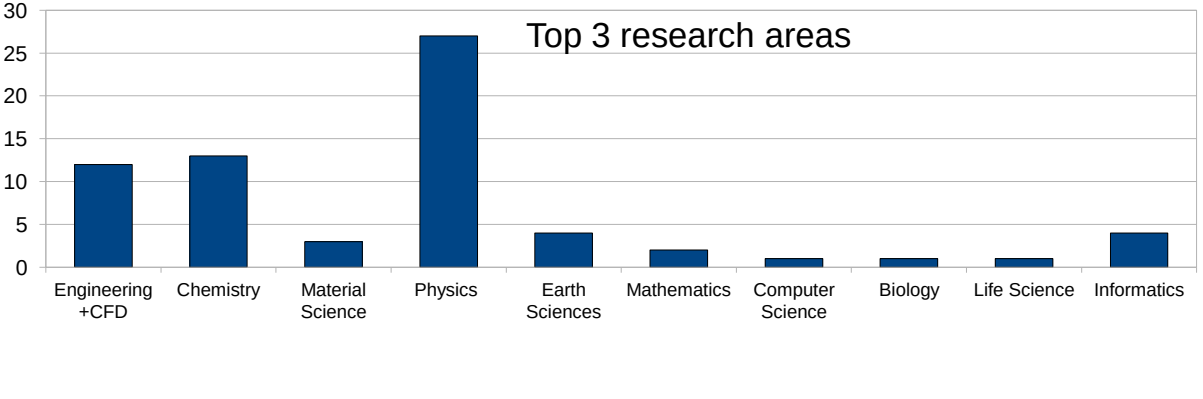
2013 HPC-SIG Short Survey

Achieved a ~70% response rate, which showed

- ~16000 users across the institutions



- ~1,400 Teraflops of performance
- ~7,000 Terabytes of Storage

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2013 HPC-SIG Short Survey

- Average of 4 FTE in support of HPC. (0.5 – 12)
- All sites deliver some training and teaching
- Equipment Budgets ranges from ~£50K - £1.5M per annum
- Equipment budgets tend to be opportunistic, some Universities have this base-lined these tend to be at the higher end.
- Most institutions will have base-lined,
  - some FTE in support of HPC
  - Data Centre costs (which are not trivial!)

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HPC @ University of Southampton

1,030,000X

Pegasus (1950's)

ICL (1960's & 70's)

IBM3090 (1980's)

IBM SP2 (1990's)

Iridis1-4 (2001-2013)

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High Performance Computing Strategy

- Oversight group chaired by **PVC for Research and Enterprise**
- A **10 year strategy** agreed by UEG in Jan 2008.
- Increase the **depth and breadth** of research disciplines in which HPC is a **key capability** in the pursuit of knowledge.
- Place HPC at the University on a **sustainable** funding model.
  - Additional FTE
  - Platform refresh every 3 years.

Creating Critical Mass

- Computational Modelling at Southampton has a broad and vibrant community (http://cmg.soton.ac.uk)

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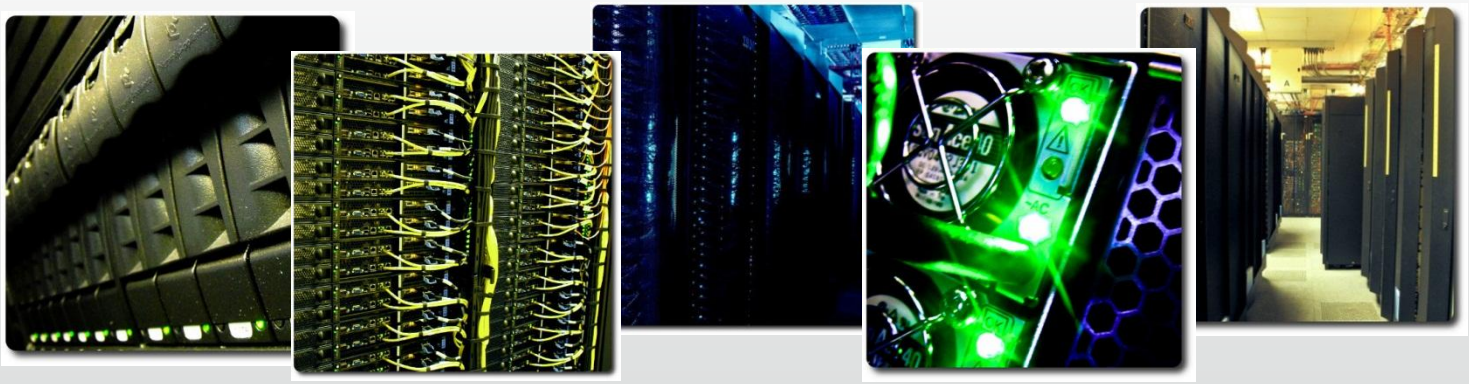
IRIDIS 3

- The **MOST POWERFUL** university owned machine in the UK (2009/11)
- #74 **MOST POWERFUL** in the world (2009)
- The **GREENEST** Supercomputer in the UK (2010)



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Iridis3 Usage

- 805 registered users
- 334 PI's with registered projects (136 for Iridis2)
- 88% Utilisation (01/2010 – 06/2012)

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Who uses HPC

- Engineering Sciences
- Electronics & Computer Science
- Chemistry
- Biological Sciences
- Social Sciences
- Medicine
- Psychology
- Management
- Geography
- Mathematics
- Physics & Astronomy
- ISVR
- Optoelectronic Research Centre
- Ocean & Earth Sciences
- Archaeology
- Civil Engineering

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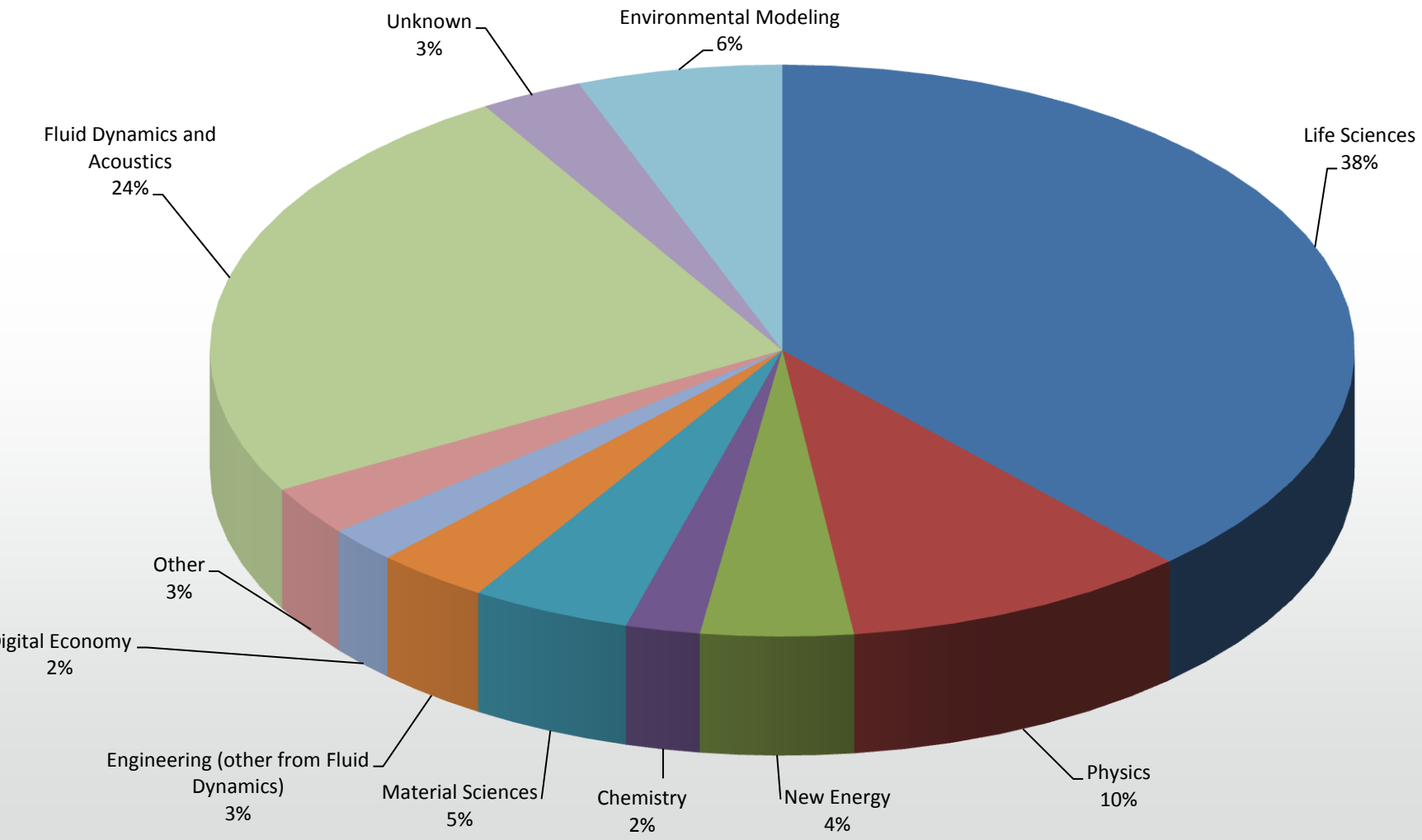
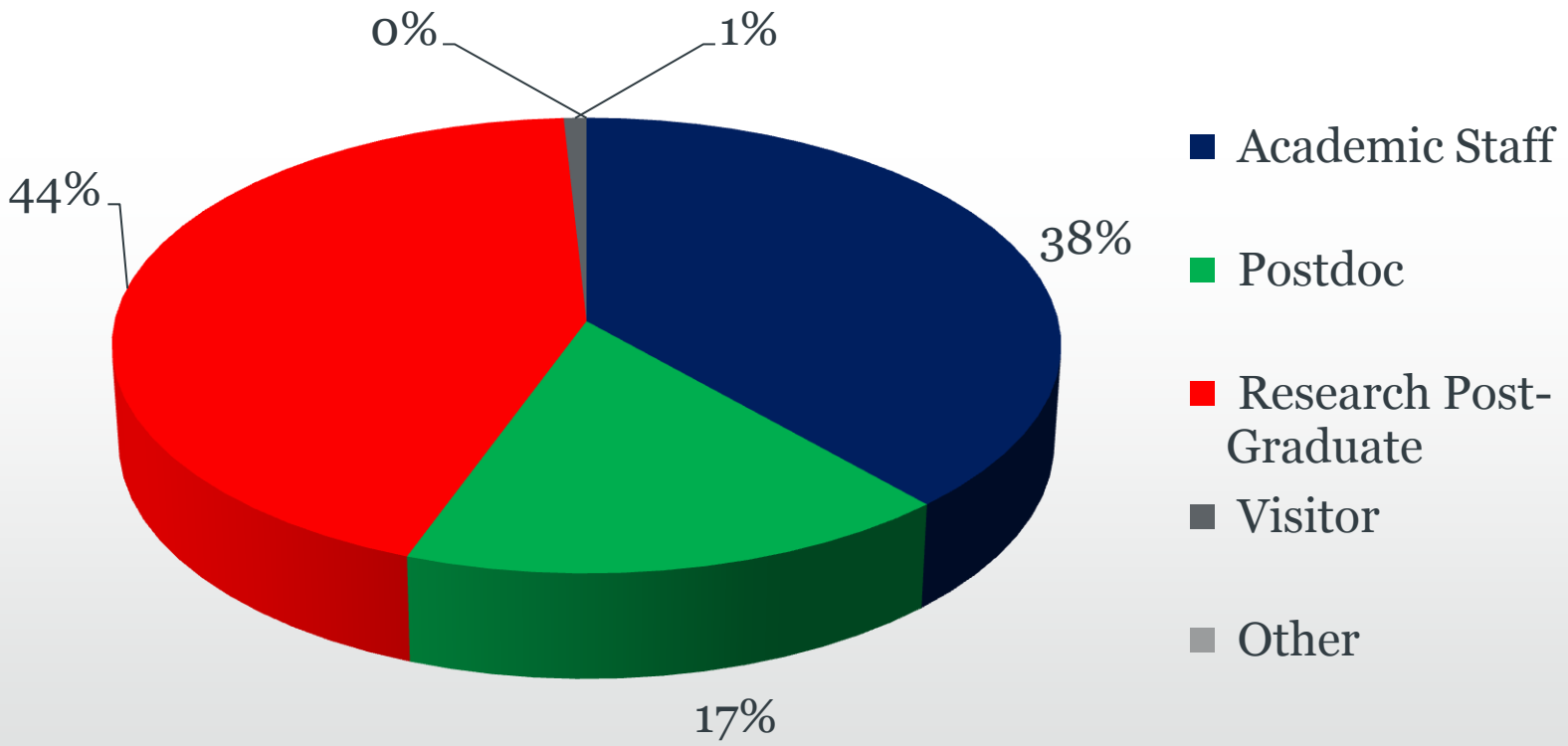
Iridis3 usage by Domains (2010- Date)

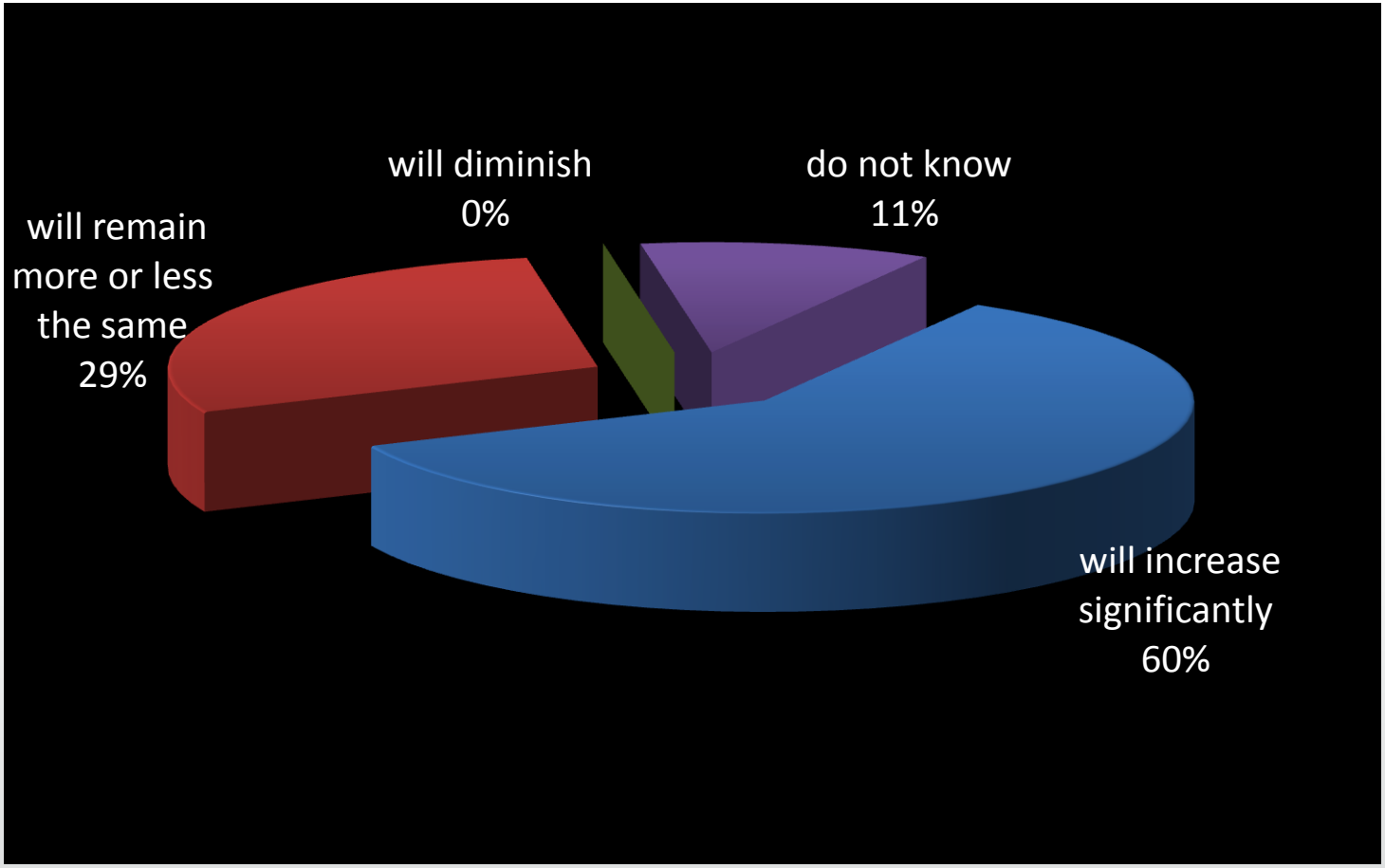


Southampton HPC User Survey 2012

S1.Q1 Please choose the category that best describes you



In the next five years how do you expect your demand for HPC will change?



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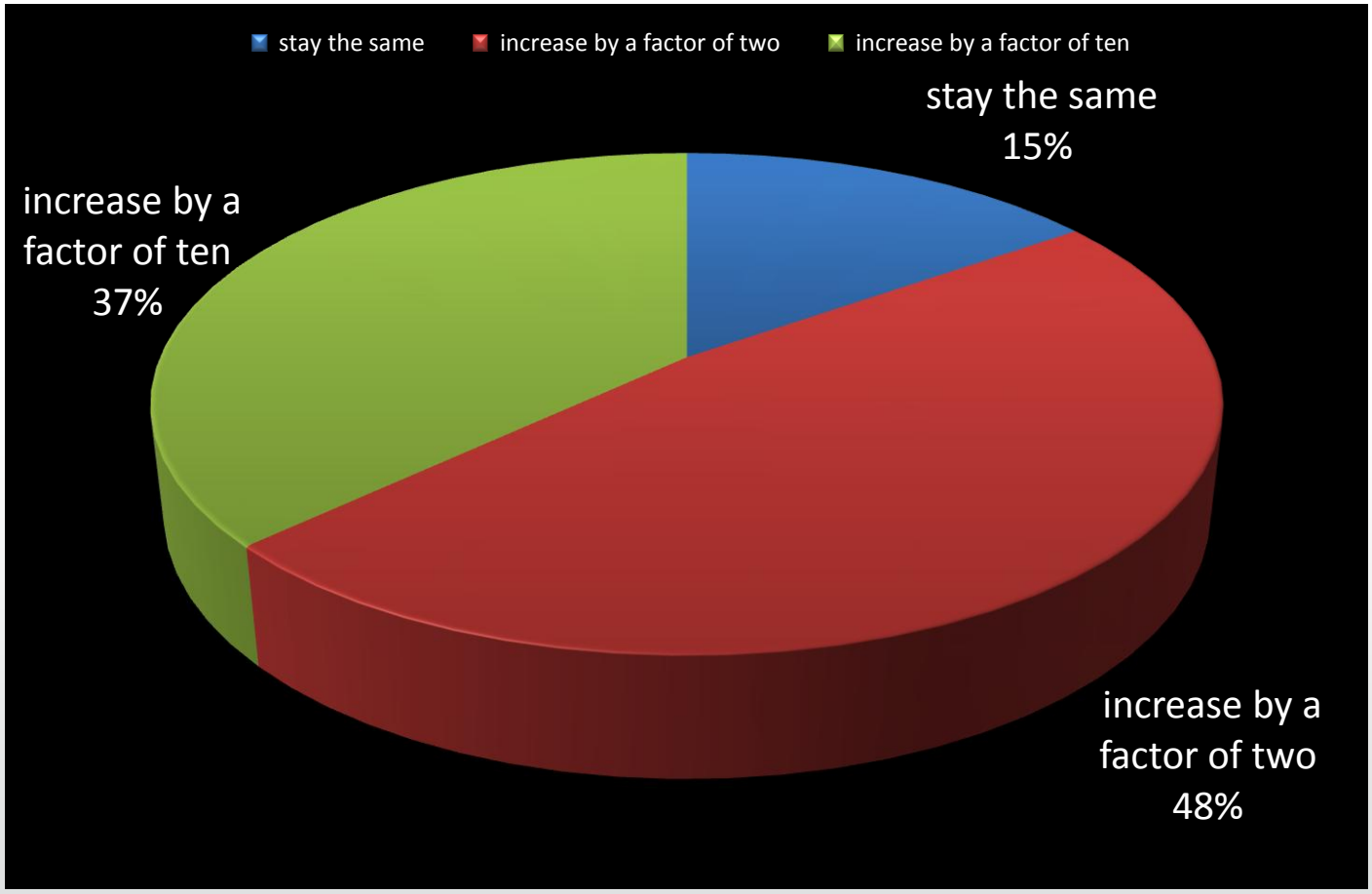
How do you expect your file storage needs will change in the near future (<5 years)?



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Iridis4 -2013

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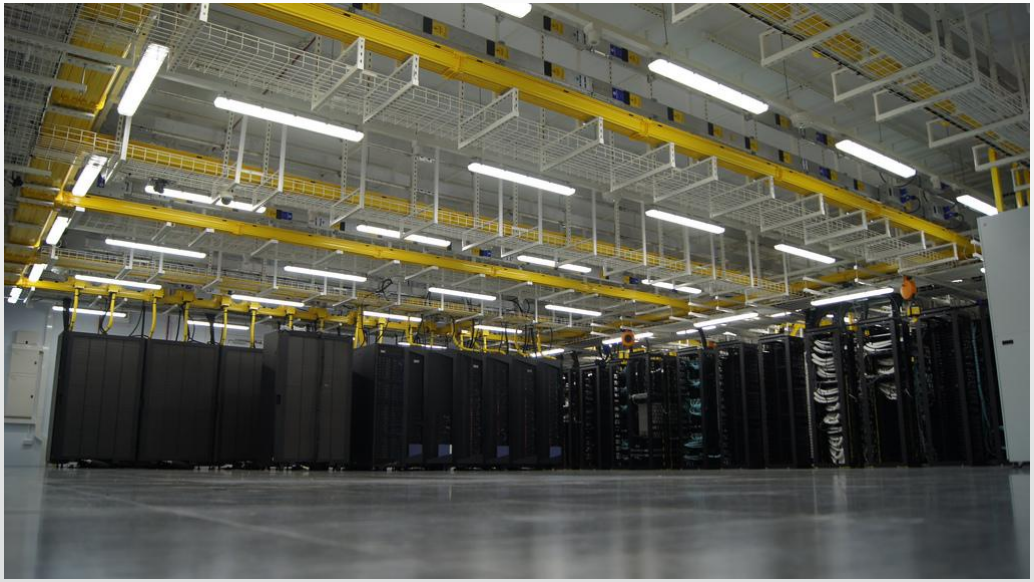
Iridis4 – 2013

- The **most powerful academic supercomputer** in England;
- **Top3** academic supercomputer in the UK
- A **Top 20** academic supercomputer in Europe;
- A **Top 40** academic supercomputer in the World

- 12200 Cores (250 TFlops); [+350% performance increase]
- 1.04 PB of disk storage; [+300% capacity increase]

IBM
IBM



HEFCE Review of SRIF3

- The recent HEFCE review of SRIF 2006-2008 through which was achieved a step change in the development of University level HPC & e-Infrastructures noted that;
  - **New equipment, including major expensive items of generic research infrastructure, is essential**
    - **For enhancing research output and quality,**
    - **For supporting interdisciplinary research and joint working,**
    - **For training researchers and post-graduates and**
    - For use by external firms and organisations

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HEFCE Review of SRIF3

- **It is also noted that the HEI's surveyed by HEFCE were clear that significant capital investments would be required into the future.**