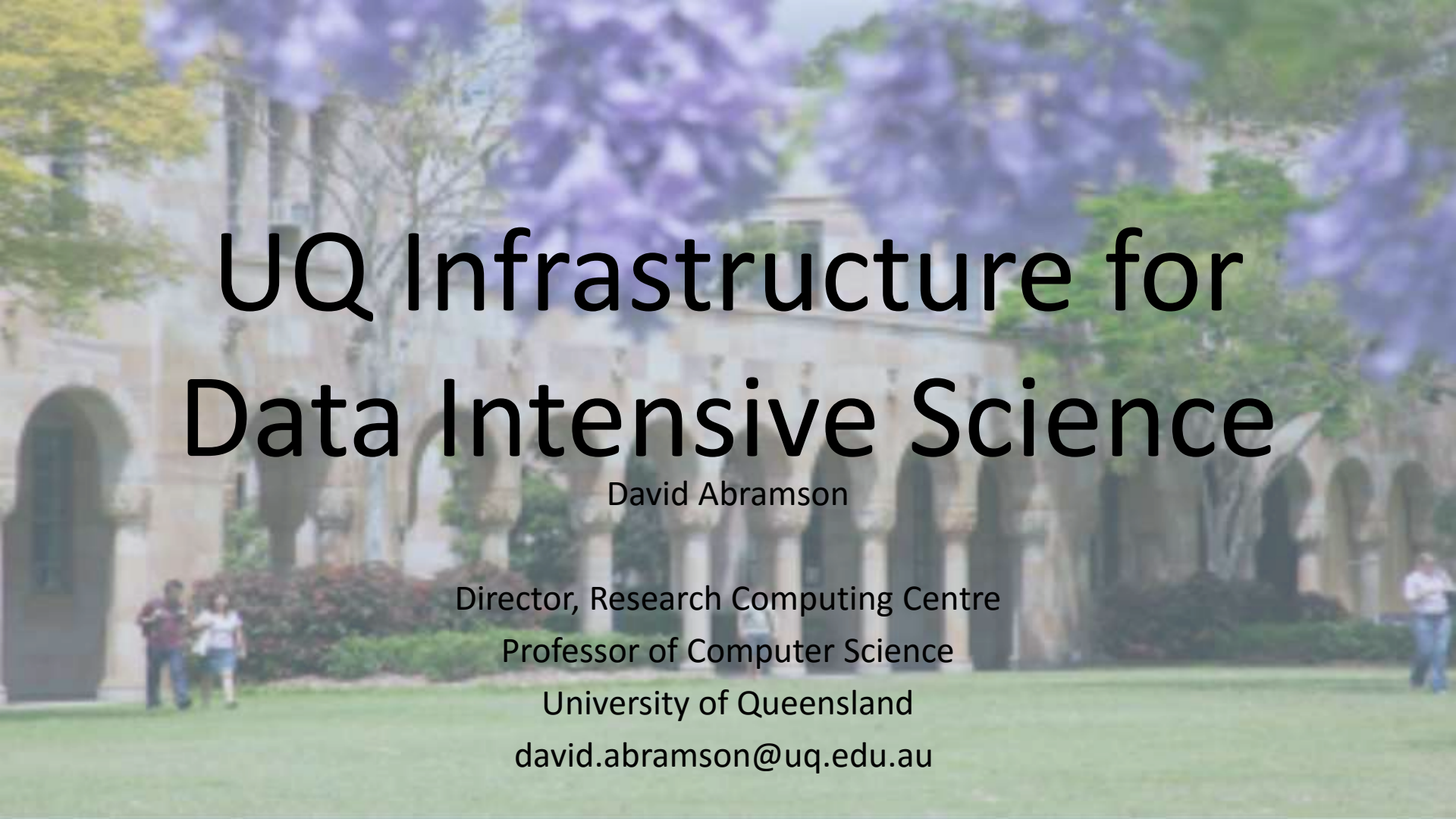


The background of the slide is a photograph of a university campus. It features a large, light-colored stone building with multiple arches and columns. In the foreground, there is a green lawn. To the left, a few people are walking. On the right, a person is standing. Large, leafy trees are visible, with some having purple blossoms. The overall scene is bright and sunny.

UQ Infrastructure for Data Intensive Science

David Abramson

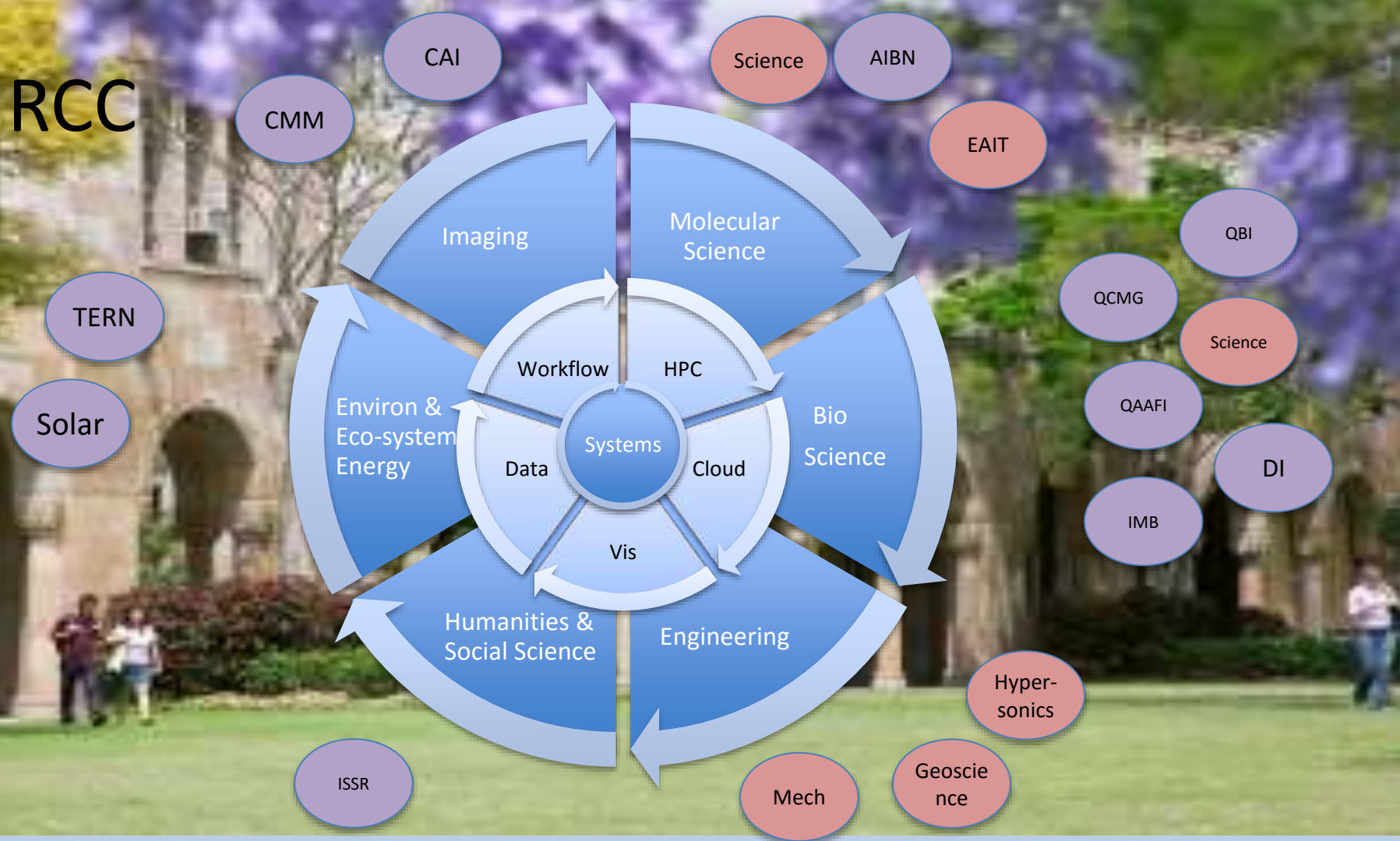
Director, Research Computing Centre

Professor of Computer Science

University of Queensland

david.abramson@uq.edu.au

RCC



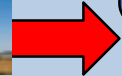
Data – What's the big deal?

- Data is predicted to transform the 21st century
- Exponential growth in the amount captured, generated and archived
- Unprecedented challenges for researchers
- Queensland based RDSI and NeCTAR funded research cloud node, called QRIScloud at the Polaris data centre some 30 km from the St Lucia campus.

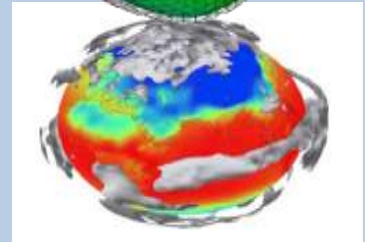
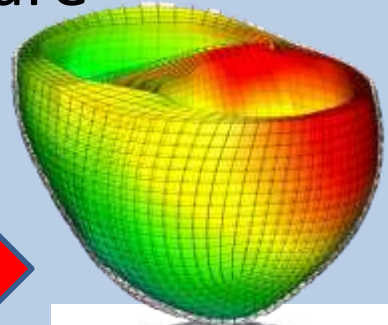


Data-Intensive Computing

- Very large data-sets or very large input-output requirements
- Two data-intensive application classes are important and growing



Data Mining &
Data Analytics

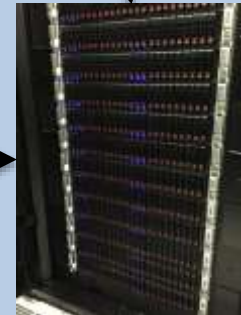


A Modern Digital Pipeline

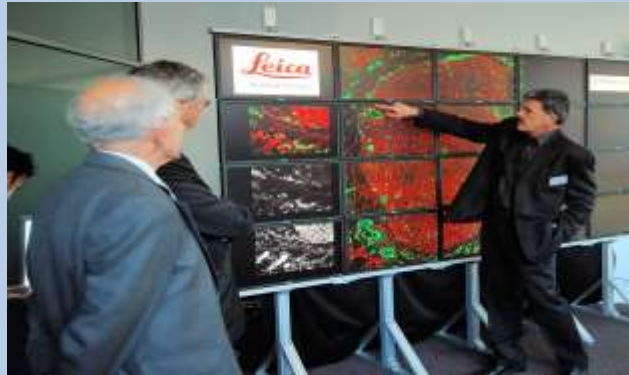
Capture



Store



Process



Interpret



ImageTrove

myTardis

OMERO

Managed Data



Clinical Data

MeDiCI

Synchronous



Asynchronous

Unmanaged Data

S3,
Swift

Cloud
Access

MeDiCI

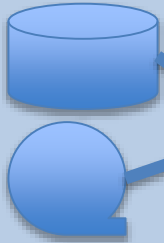


QRIScloud Compute and Storage Fabric

UQ Landscape



$n \times 10G$
NFS?

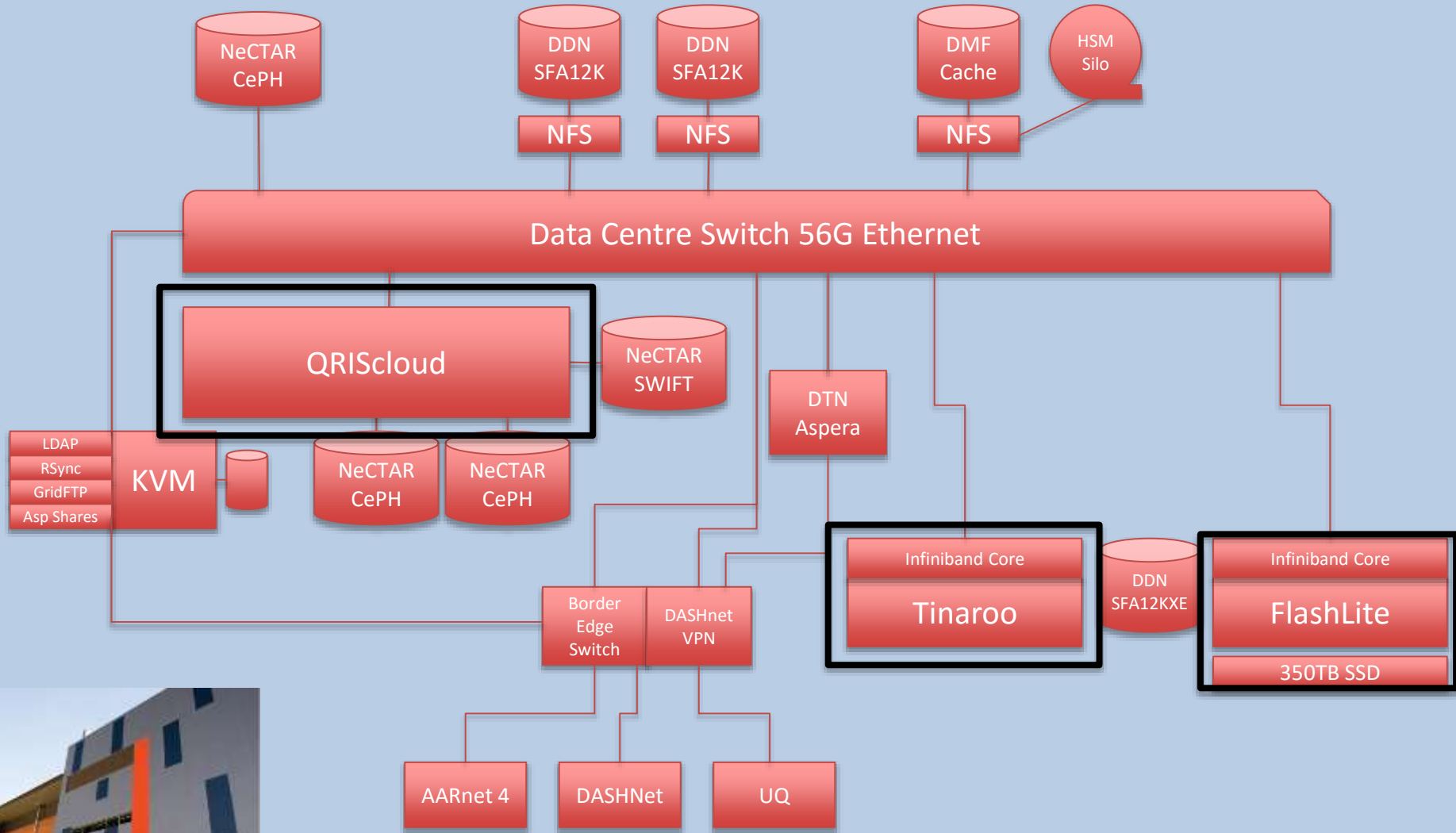


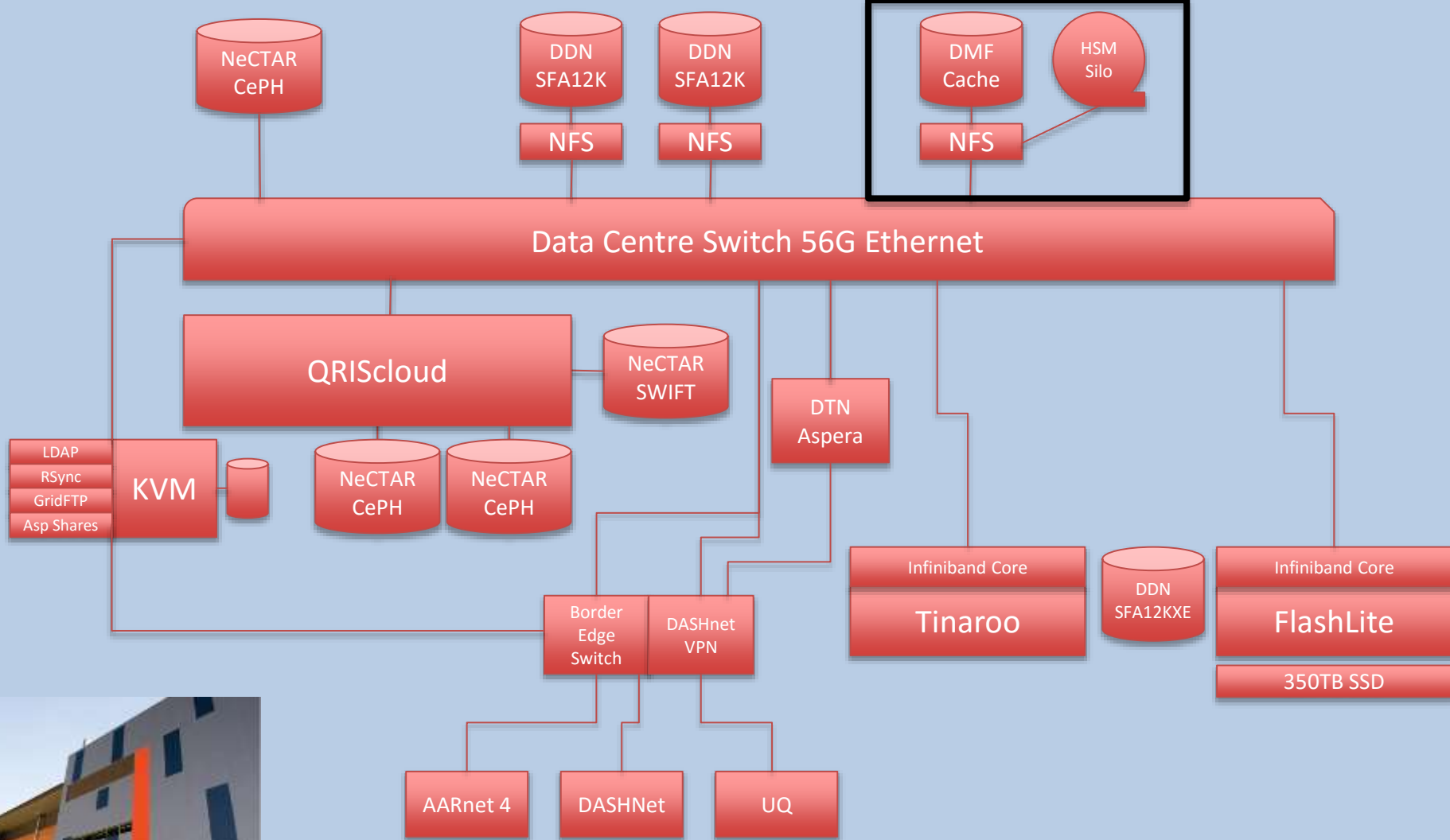
Polaris

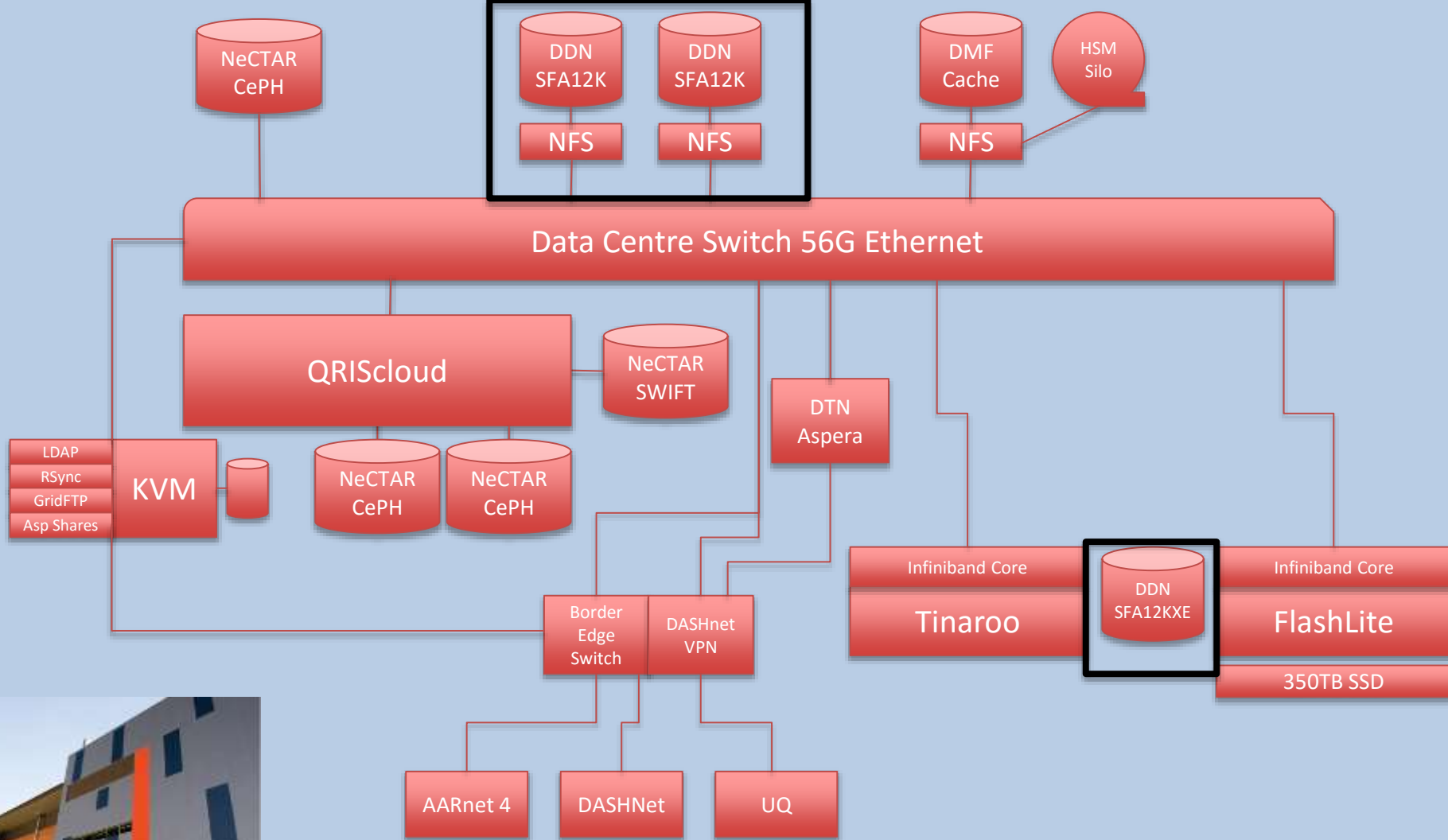
MeDiCI

- Centralising research data storage and computation
- Distributed data is further from both the instruments that generate it, some of the computers that process it, and the researchers that interpret it.
- Existing mechanisms manually move data
- MeDiCI solves this by
 - Augmenting the existing infrastructure,
 - Implementing on campus caching
 - Automatic data movement
- Current implementation based on IBM Spectrum Scale (GPFS)

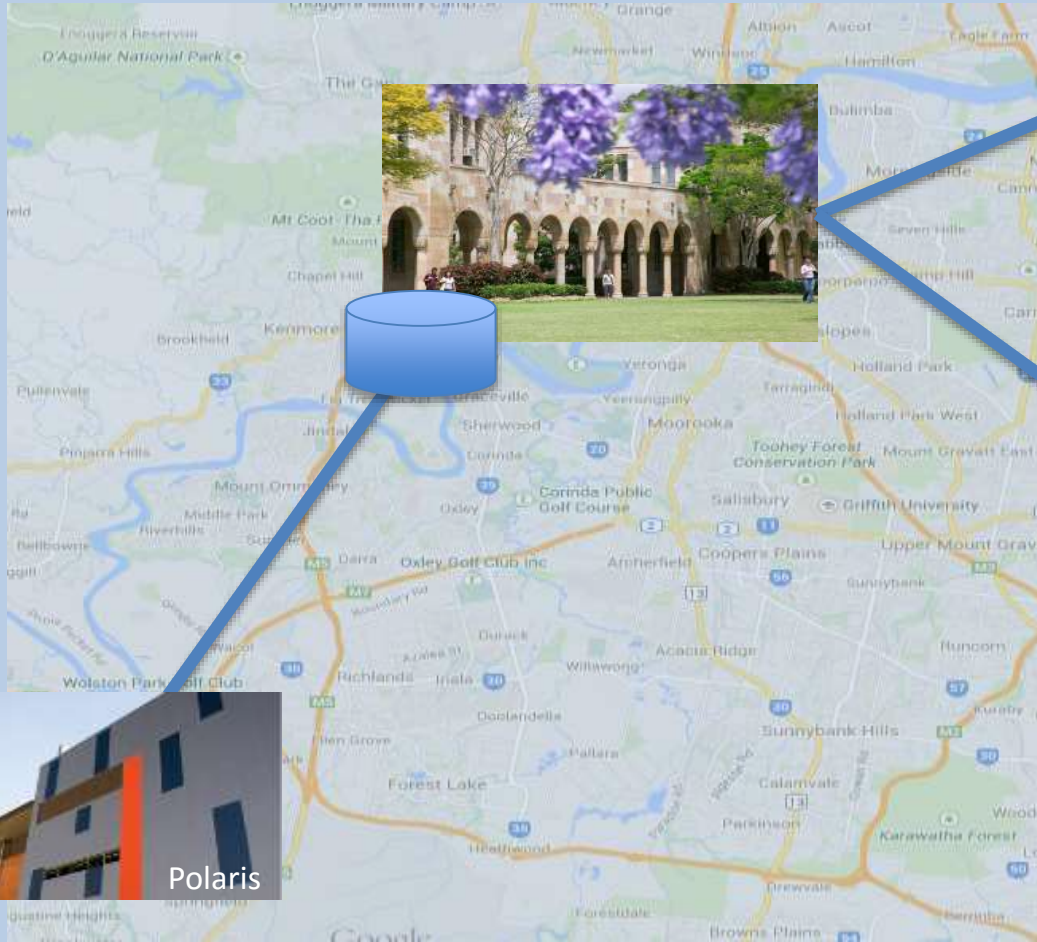








Caches work!

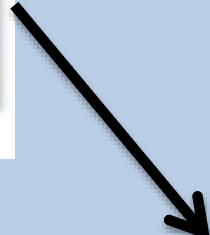


A Modern Digital Pipeline

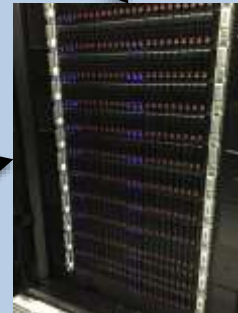
St Lucia



Polaris



NeCTAR



FlashLite





IMB



AIBN



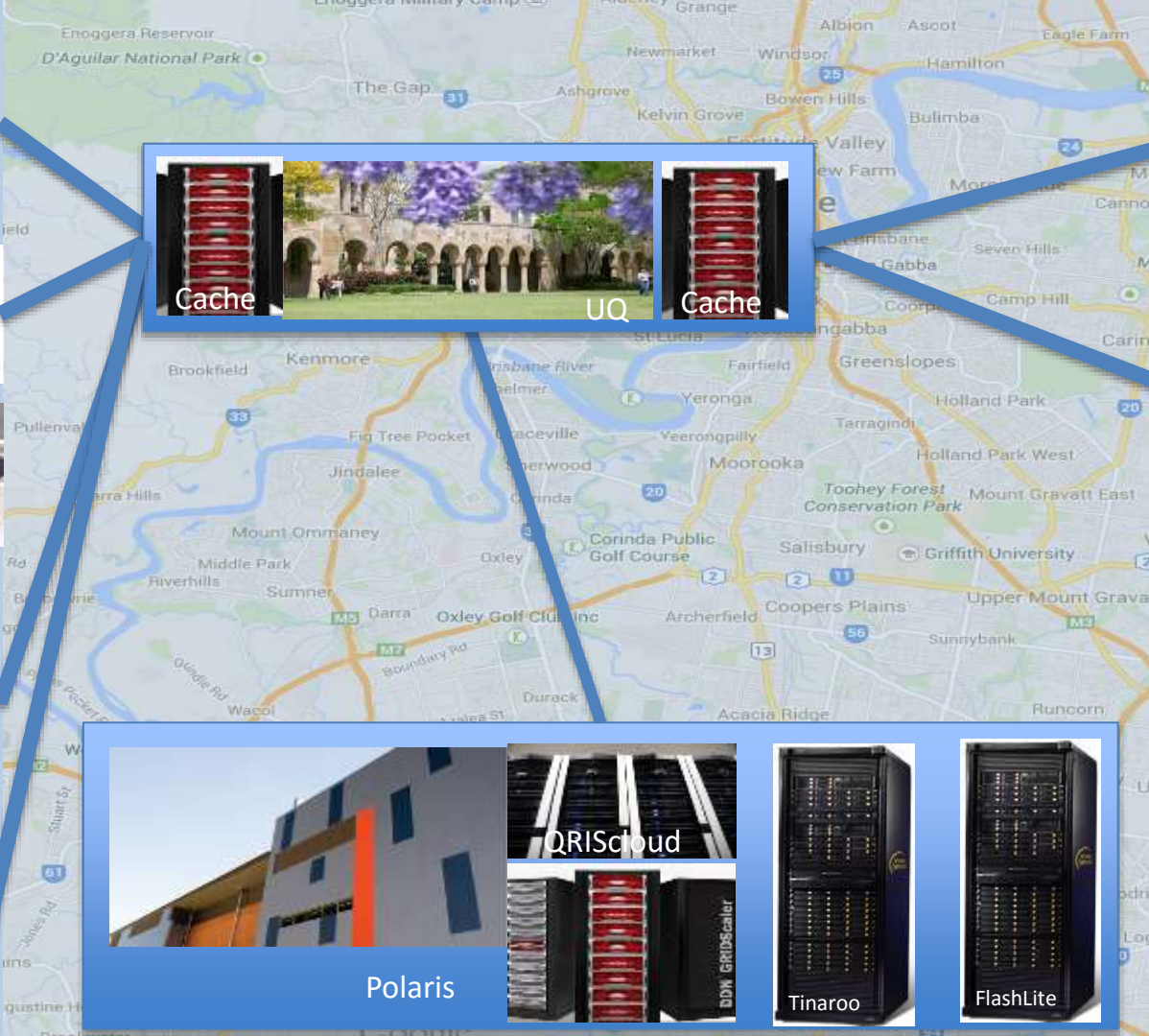
QBI



CAI



CMM



Cache



UQ



Cache



Polaris



QRIScloud



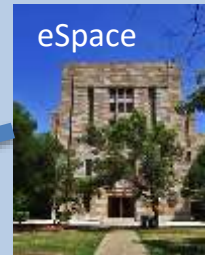
BDW GRIDScaler



Tinaroo



FlashLite

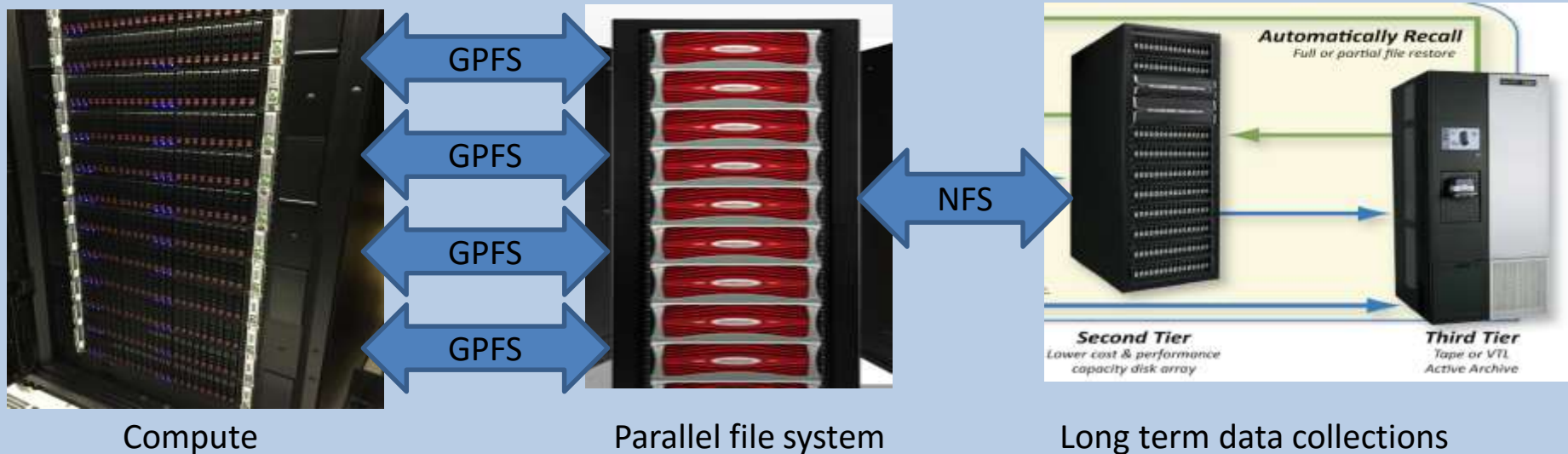


eSpace



Science

MeDiCI Storage Architecture



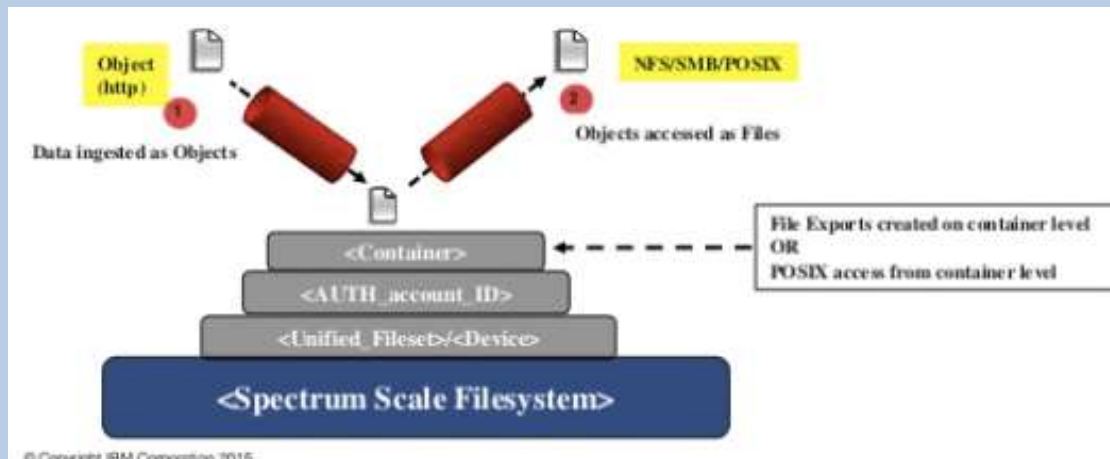
Identity!

- No single UID space across UQ/QCIF users
- Need to map UID space between UQ and Polaris
- GPFS 4.2
 - mmname2uid/mmuid2name



Object Storage

- S3 style objects becoming defacto standard for distributing data
- http put/get protocol
- Swift over GPFS
 - Unified Object/file interfaces



MeDiCI PoC

- 2 DDN GS7K, 1 IBM ESS, 1 DDN GS12K
- Queensland Brain Institute (QBI)
 - Genomic studies with large temporary storage requirements
 - 1000 Genome processing
- AIBN
 - Genomic sequences
- CAI
 - MRI data.
- Faculty of Science including
 - Chemistry, Agriculture and Food Science, Maths and Physics and Geocomputation (Earth
- Centre for Microscopy and Microanalysis (CMM)
 - Electron microscope data
- The Library
 - e-Space to link publications to data

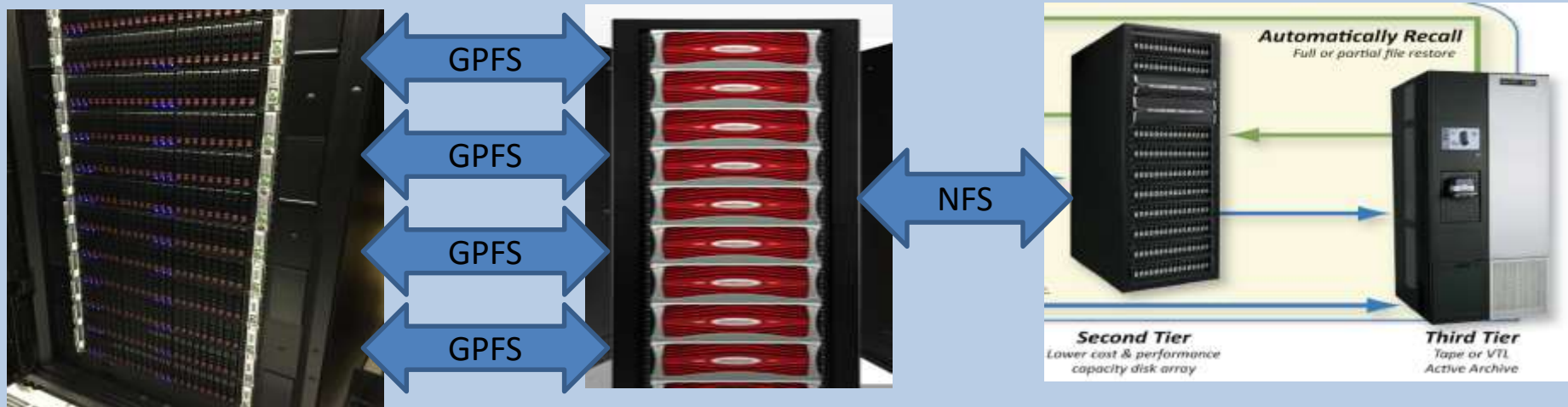


FlashLite: A Data Intensive Platform

- Parallel
 - High performance network
 - Good numeric performance
- Massive memory
 - Ability to hold whole data sets or data bases in memory
- High IO throughput



FlashLite Storage Architecture



FlashLite

DDN SFA12KXE

SGI DMF Disk/Tape

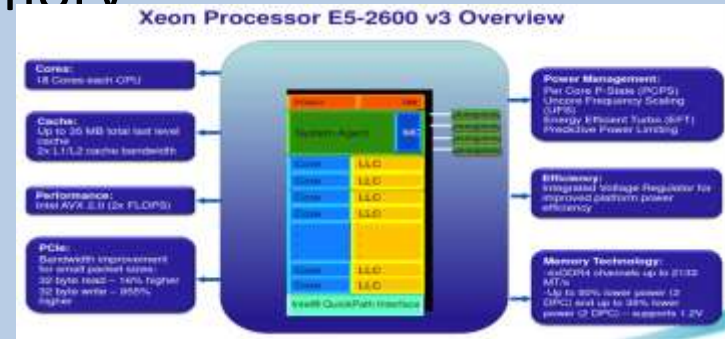
Compute

Parallel file system

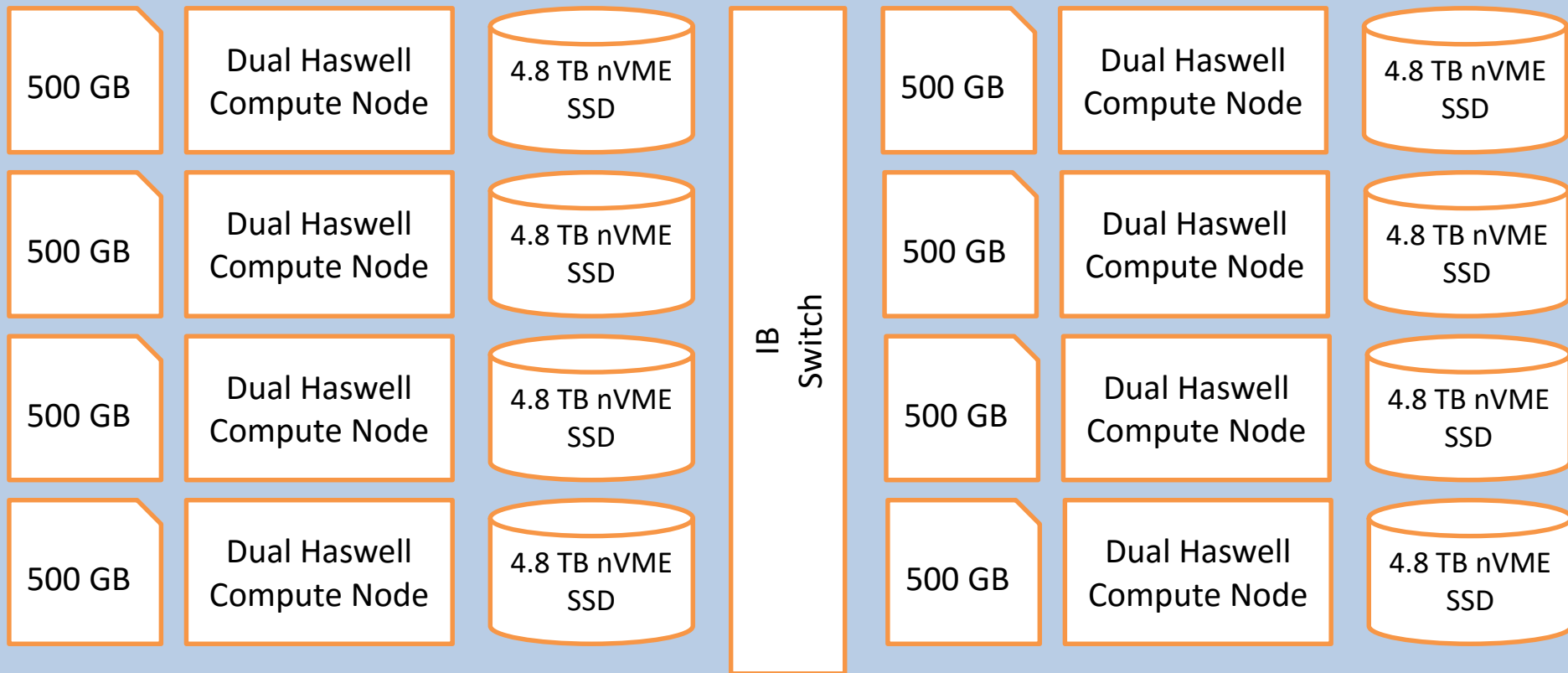
Long term data collections

What is FlashLite?

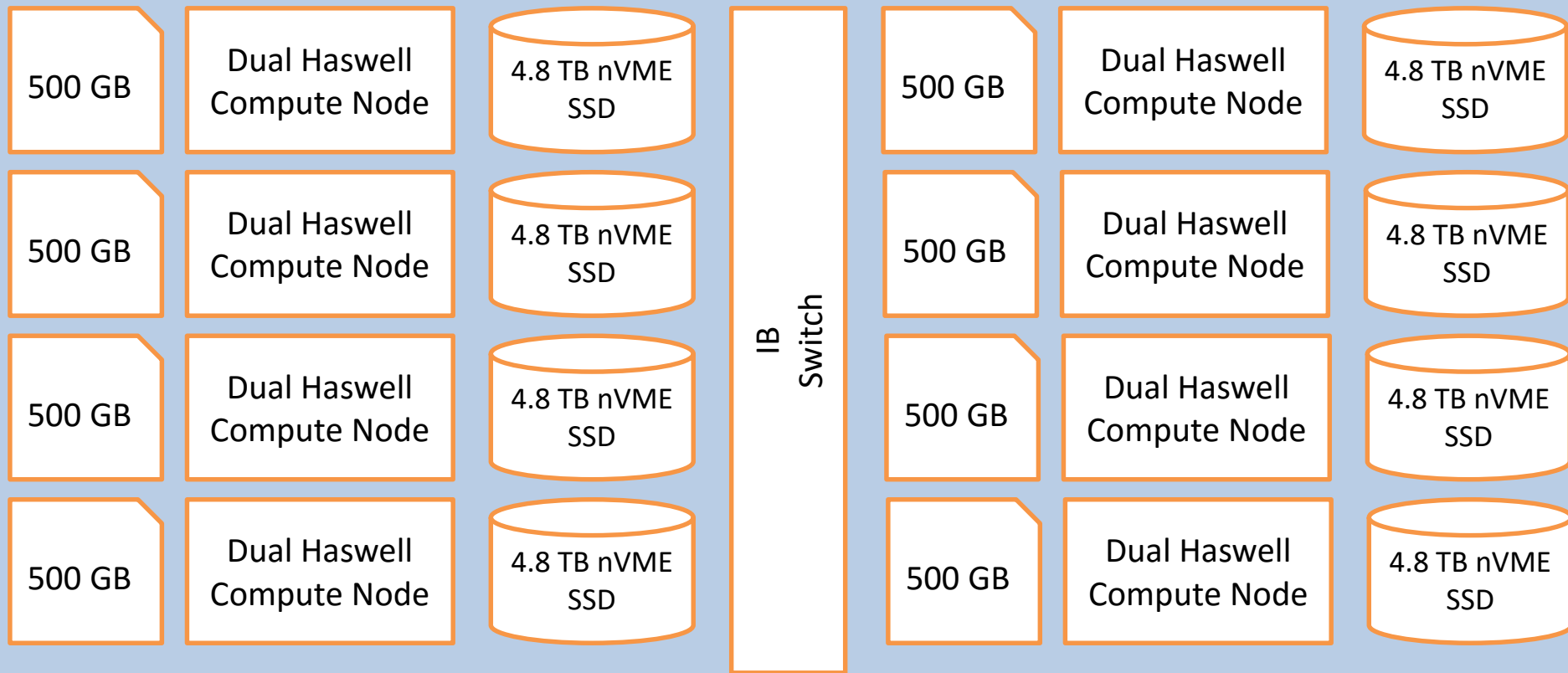
- FlashLite
 - ~ 70 compute nodes (~1600 cores)
 - Dual socket Intel E5-2680v3 2.5GHz (Haswell)
 - 512 GB DDR-2
 - 4.8 TB NVMe SSD
 - ScaleMP vSMP virtual shared memory



FlashLite: Message Passing Machine

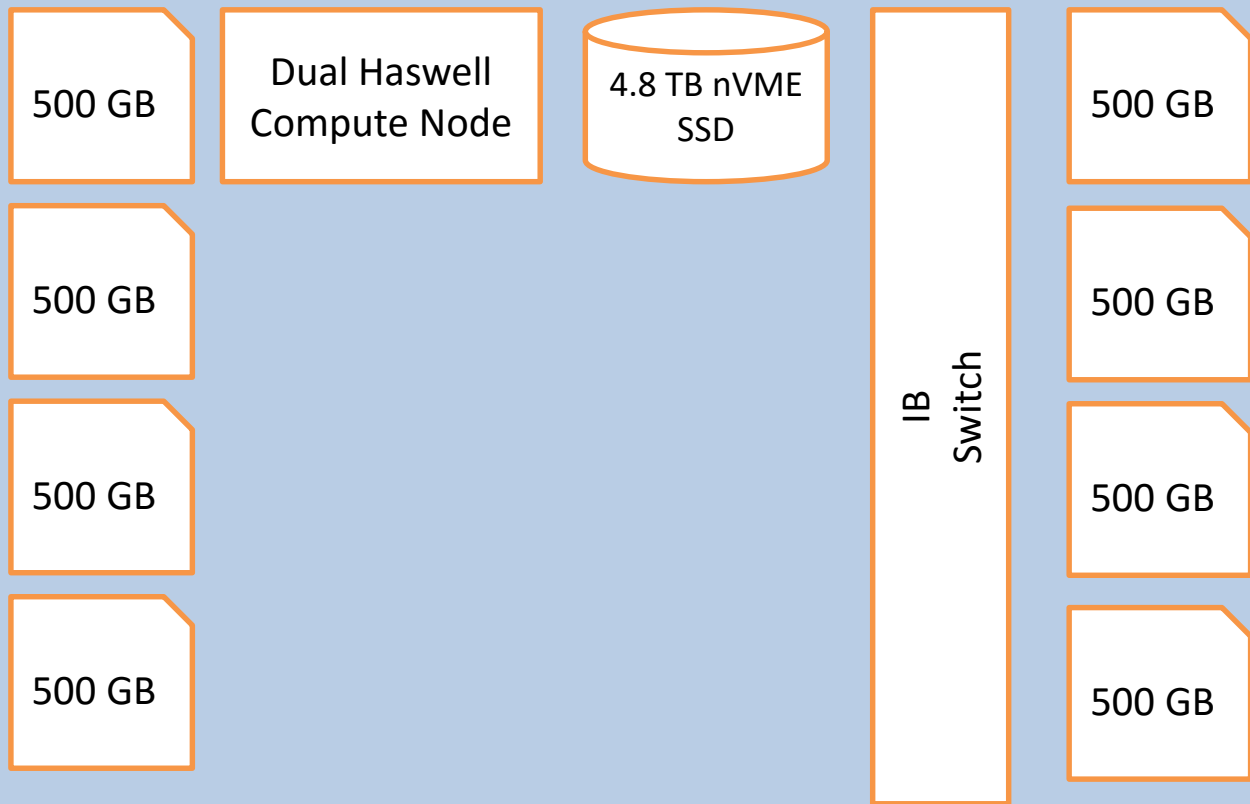


FlashLite: Shared Memory machine



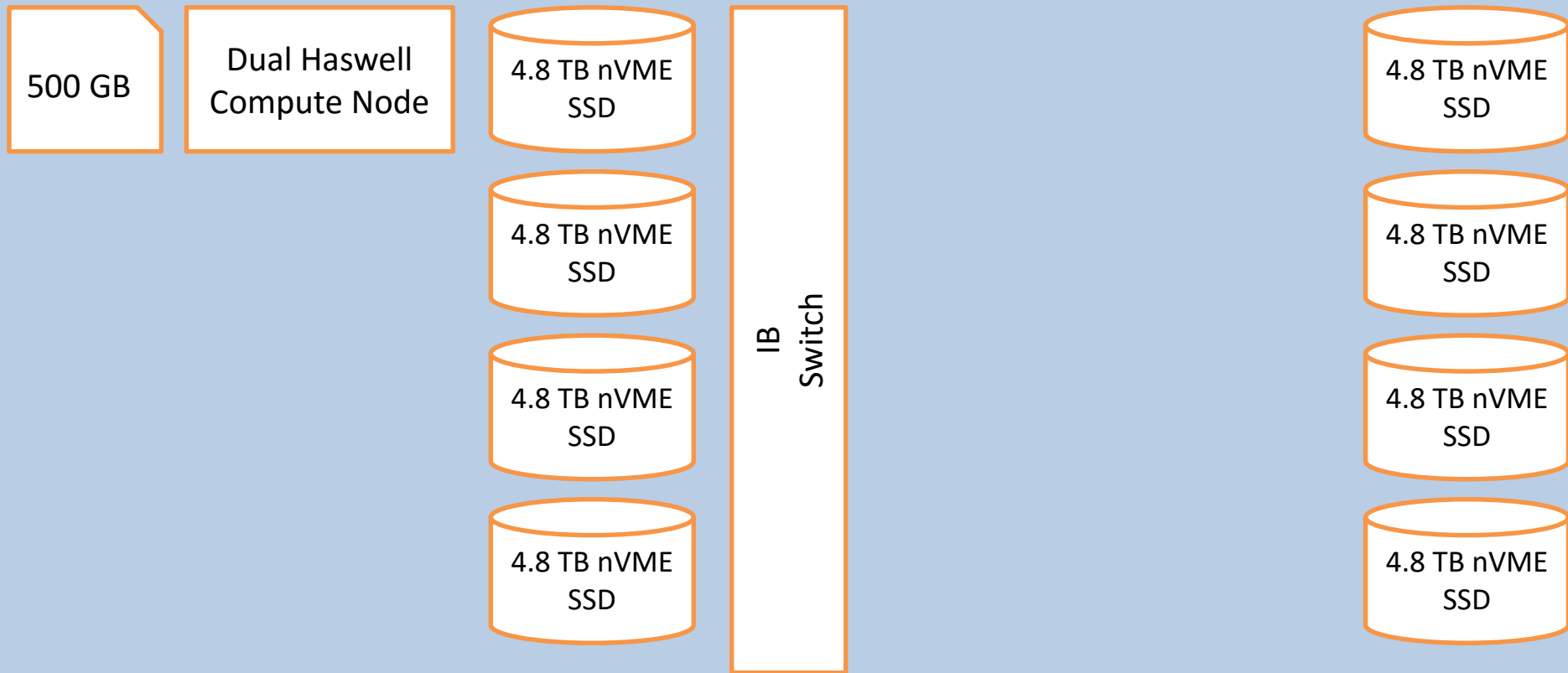
vSMP aggregation SW

FlashLite: Large Memory machine



vSMP aggregation SW

FlashLite: Large SSD machine



Conclusions

- MeDiCI
 - Caching works!
 - Current PoC based on IBM GPFS (SS 4.2)
 - Two DDN appliances on campus
 - One DDN GS12K in data centre.
 - One IBM ESS server under evaluation at Polaris
 - Evaluating refactoring existing DDN SFA12Ks
 - Yet to implement UID mapping, test object store
- FlashLite
 - Parallel computer
 - Very large amounts of local memory and Flash disk

