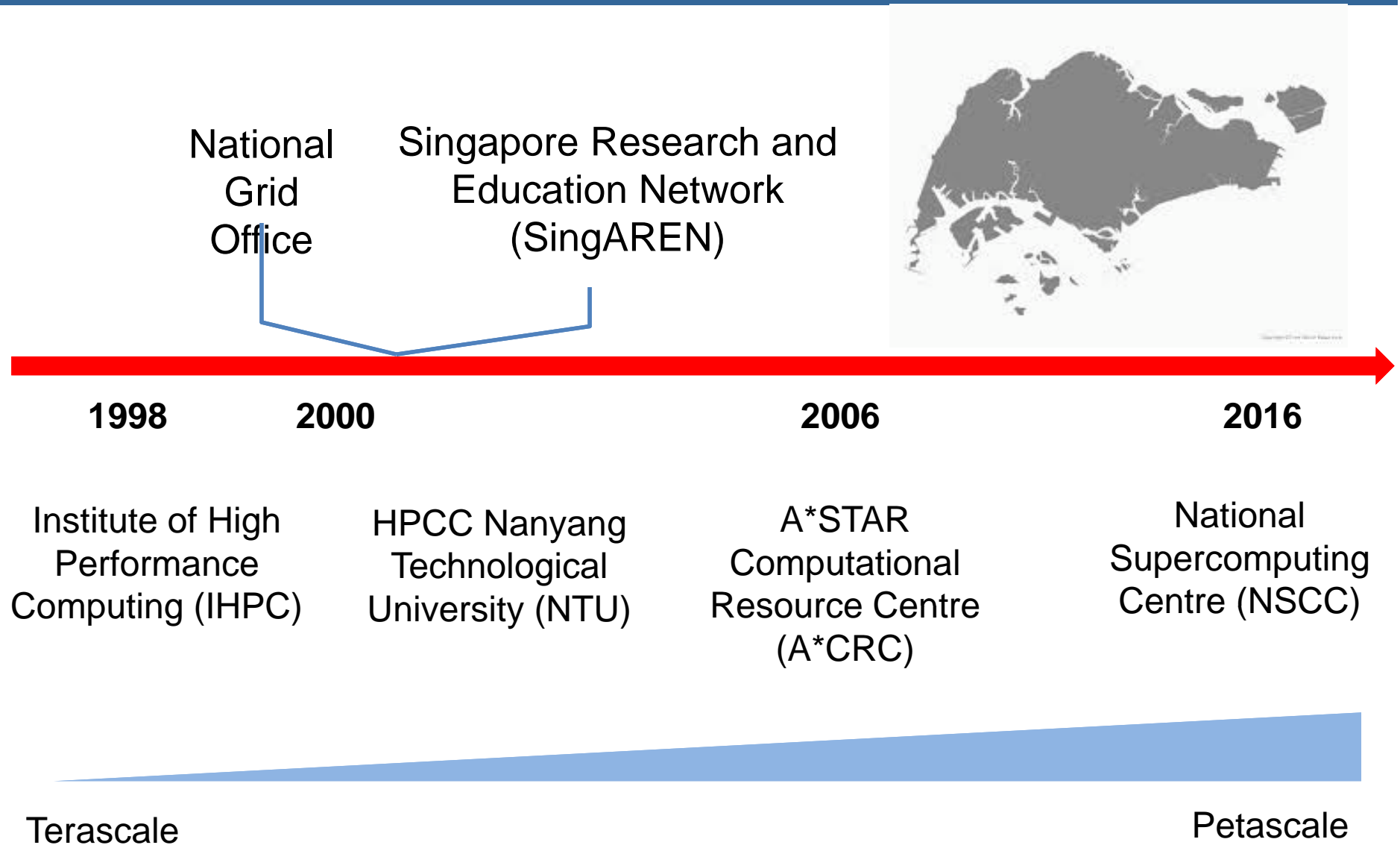


Update on e-Science Infrastructure and Capabilities

Singapore

Development of e-Science Infrastructure in Singapore



National Supercomputing Centre (NSCC) Singapore

- A **state-of-the-art petascale** High Performance Computing (HPC) facility with **multi-petabyte data storage**, and **multi-gigabit speed global connectivity**.

To enable users to solve complex scientific and technological problems. To stimulate industry to use high performance computing for problem solving, testing designs and advancing technologies.

- Linked by **high bandwidth networks** (STAR-N) to provide high speed access to users everywhere.



Prof. TAN Tin Wee
Director, NSCC



NSCC Hardware Specifications



1 PetaFlop System

- **1,288 nodes** (dual socket, 12 cores/CPU Intel Xeon E5-2690v3)
- **128 GB DDR4 / node**
- **10 Large memory nodes** (1x6TB, 4x2TB, 5x1TB)

FUJITSU



> 13PB Storage

- **HSM Tiered, 3 Tiers**
- **I/O 500 GB/s flash burst buffer,**
10 Infinite Memory Engines (IME)

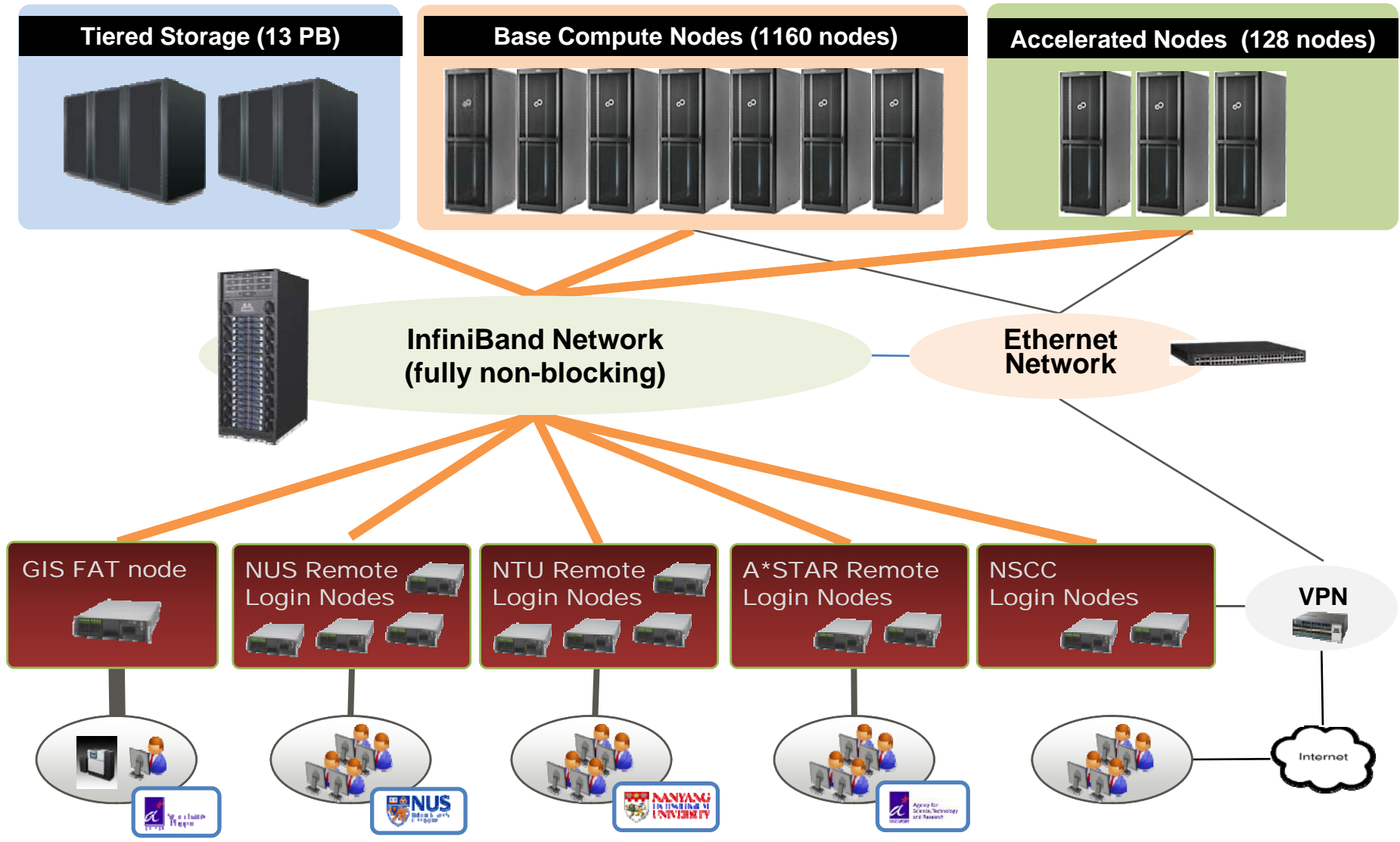


EDR Interconnect

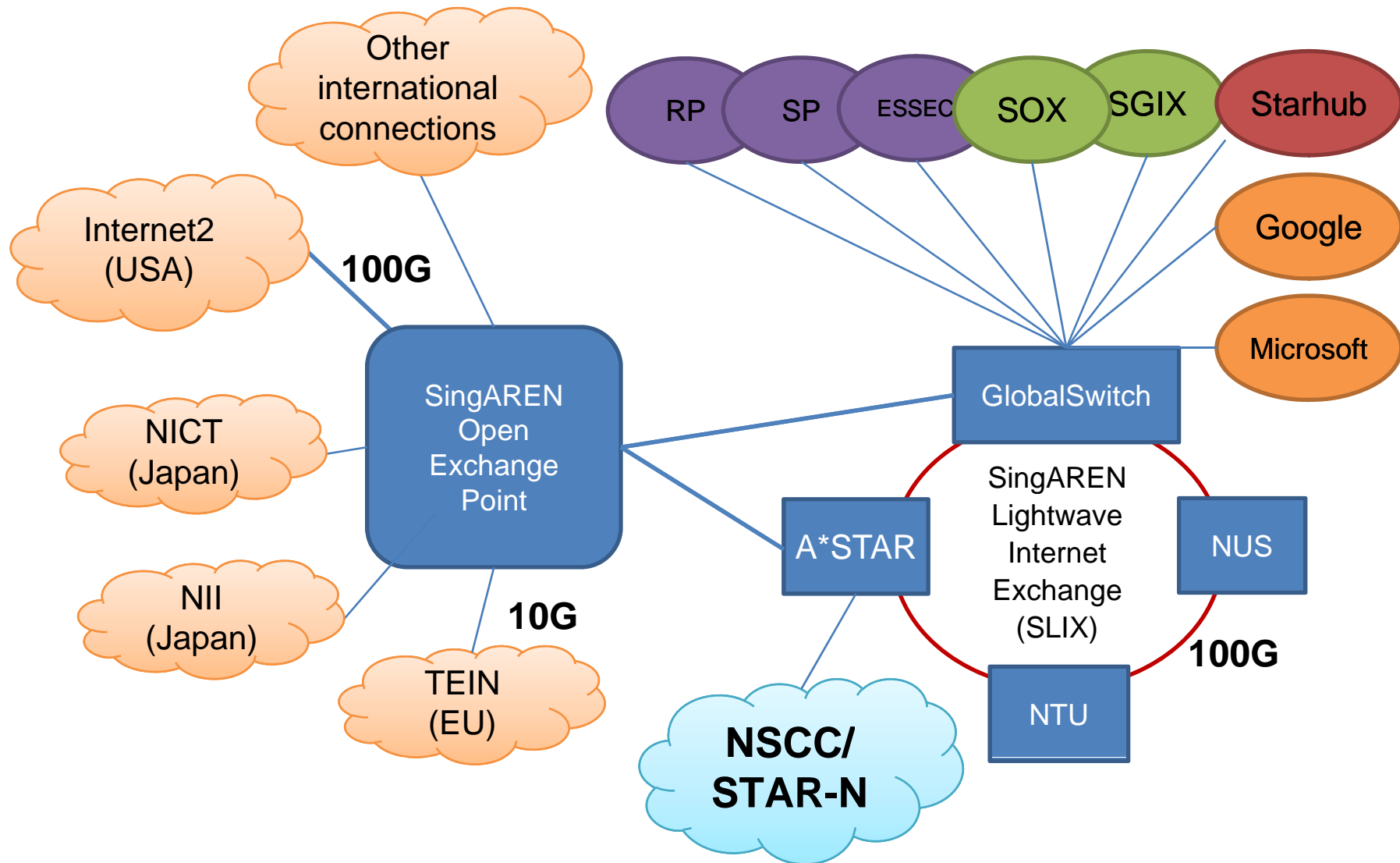
- **EDR (100Gbps) Fat Tree topology within cluster**
- **InfiniBand connection to remote login nodes** at stakeholder campuses (NUS/NTU/GIS) at 40/80/500 Gbps throughput

Mellanox
TECHNOLOGIES

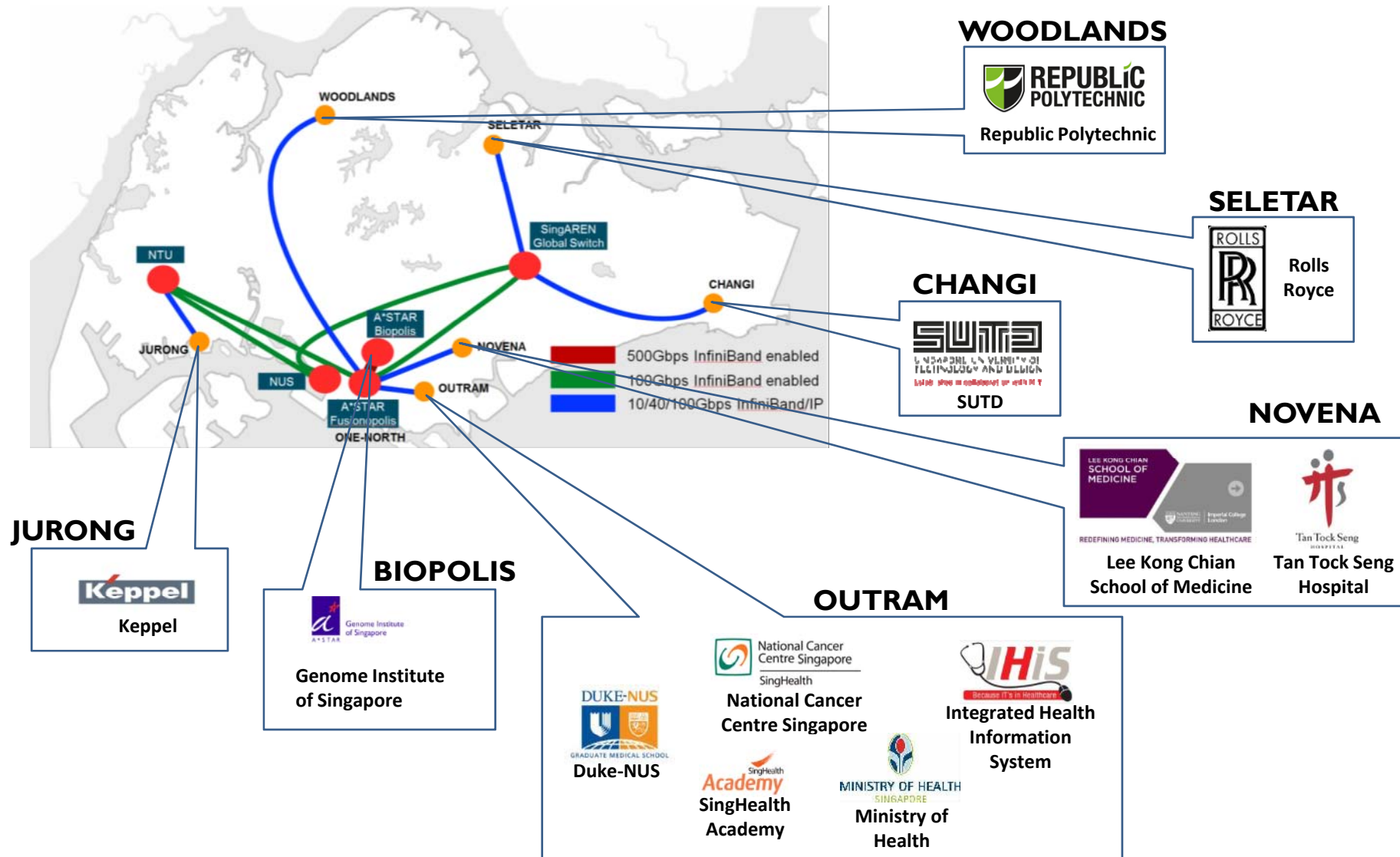
NSCC Network Architecture: Extending Access via Long Range InfiniBand



NSCC Connectivity via SingAREN Network



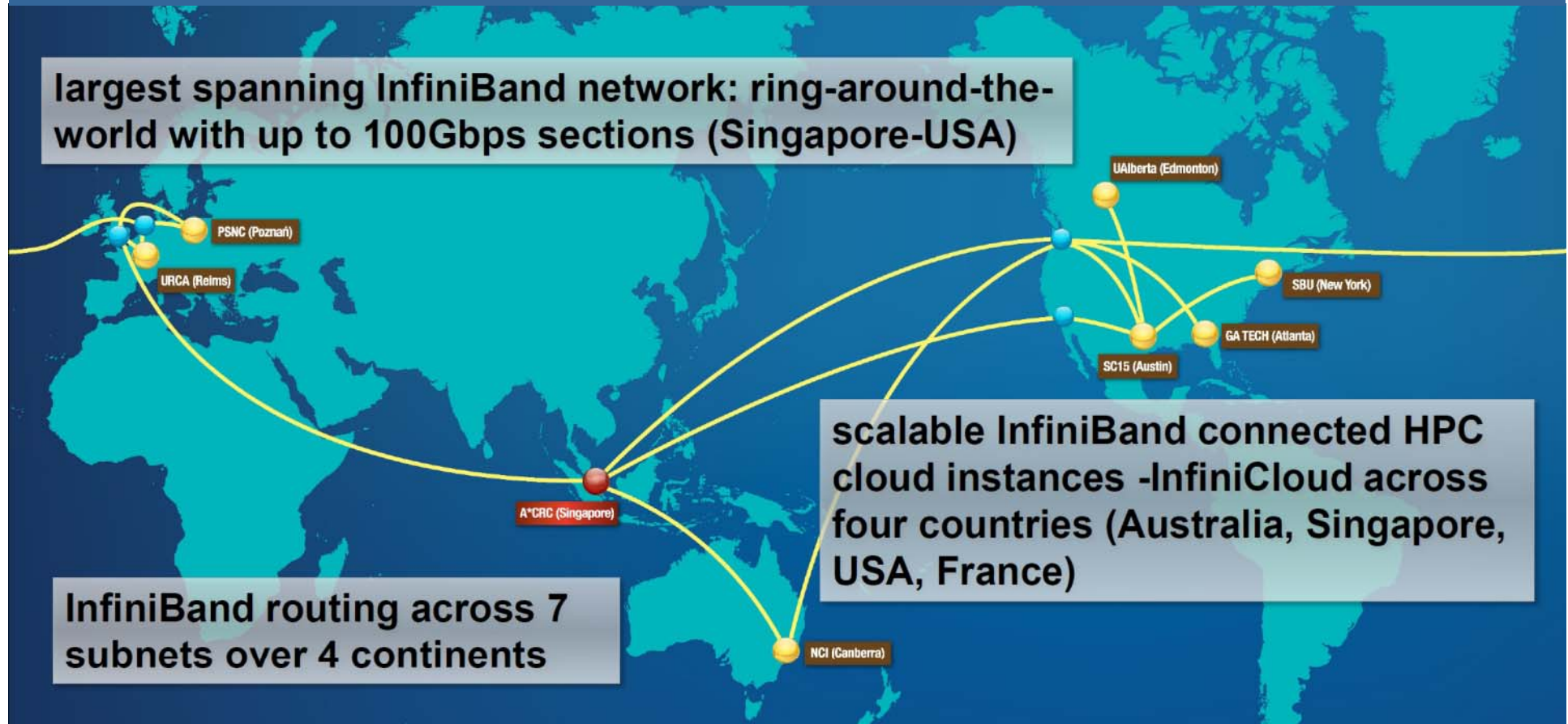
Extending Connectivity within Singapore (2016-2017)



Beyond Singapore

Development of global
distributed computing
capabilities

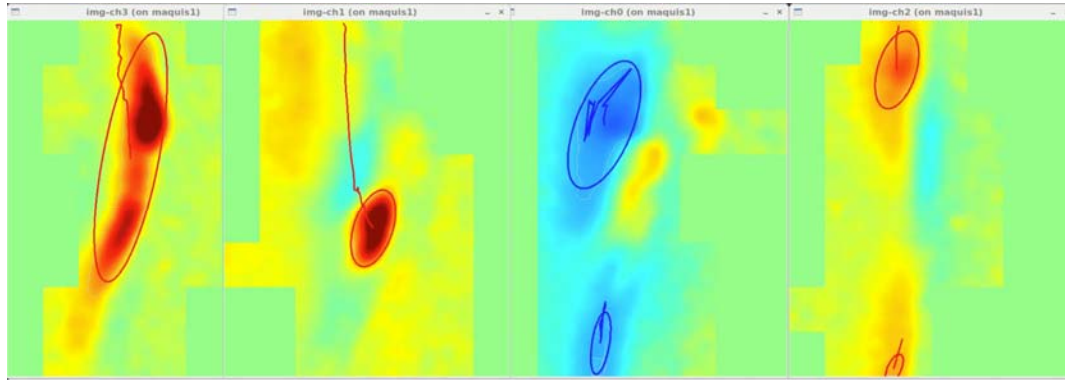
InfiniCortex: distributed supercomputing with long-range InfiniBand



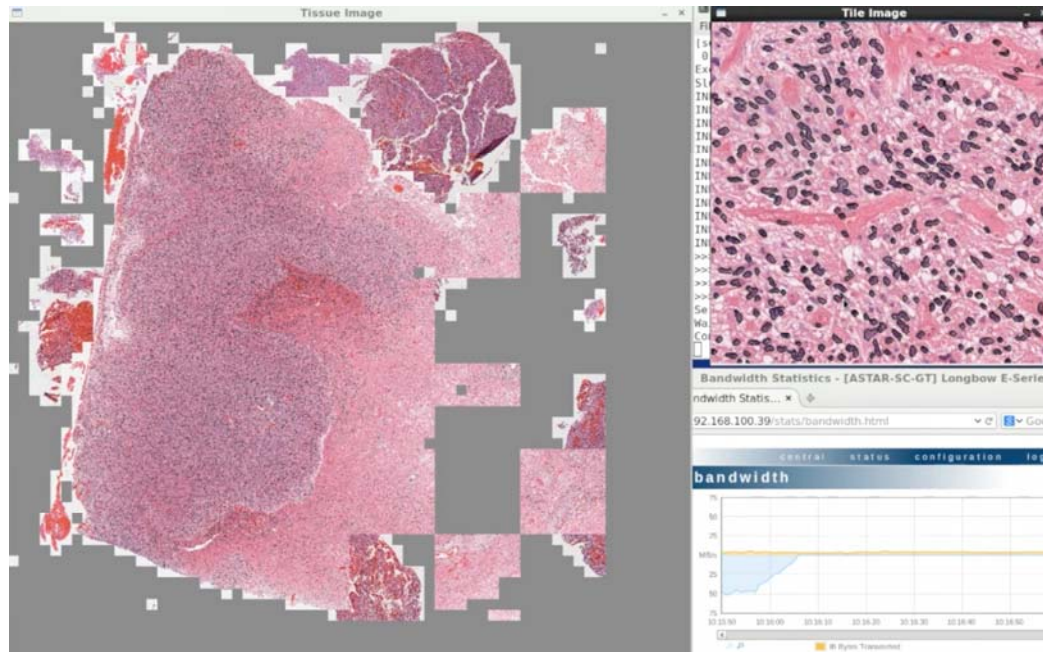
- Global **long-range InfiniBand** network linking HPC facilities as **one distributed supercomputer** (Dr. Marek Michalewicz, CEO A*CRC)



InfiniCortex: examples of distributed supercomputing applications

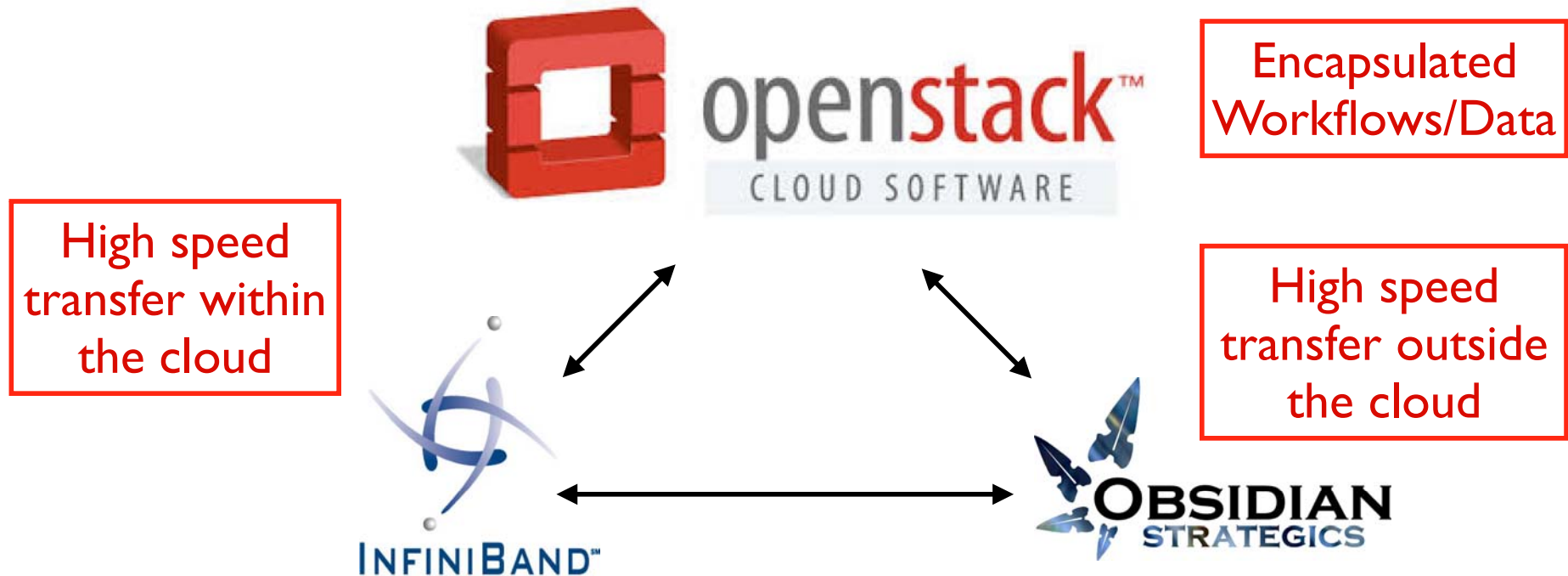


- **Fusion reactor simulation** (ORNL, U. Tennessee, Rutgers U)



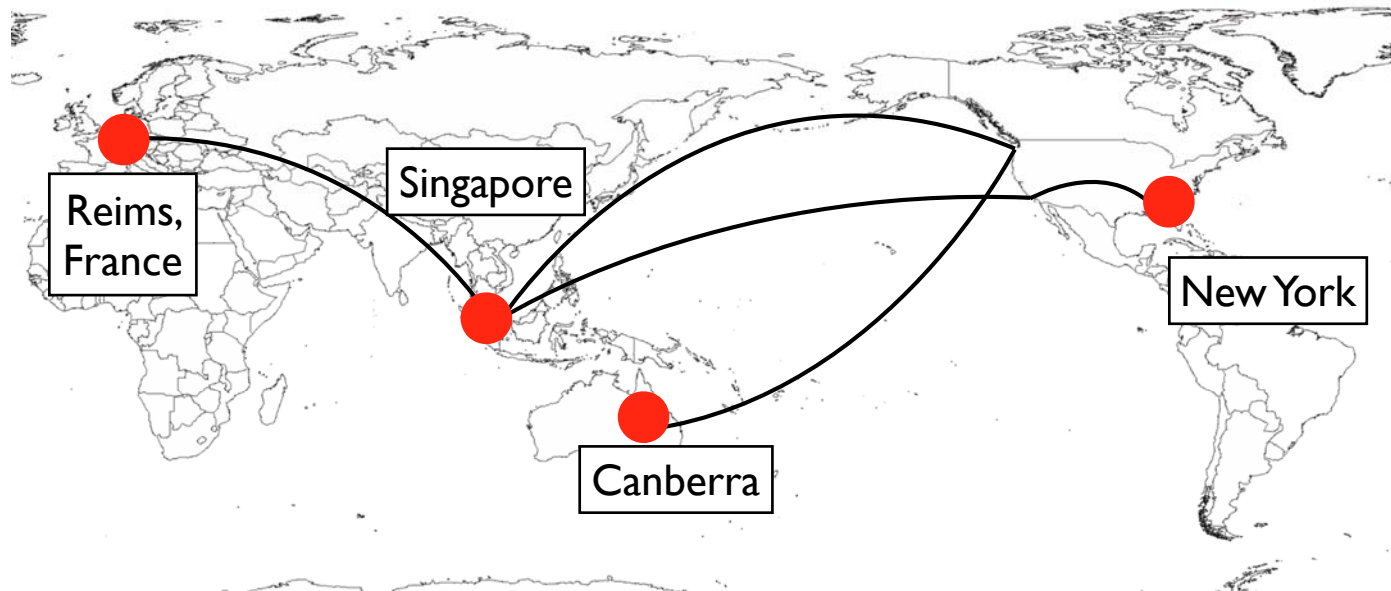
- Segmentation and feature analysis of **histology images** for cancer markers (ORNL, Stony Brook)

InfiniCloud: flexible HPC cloud computing



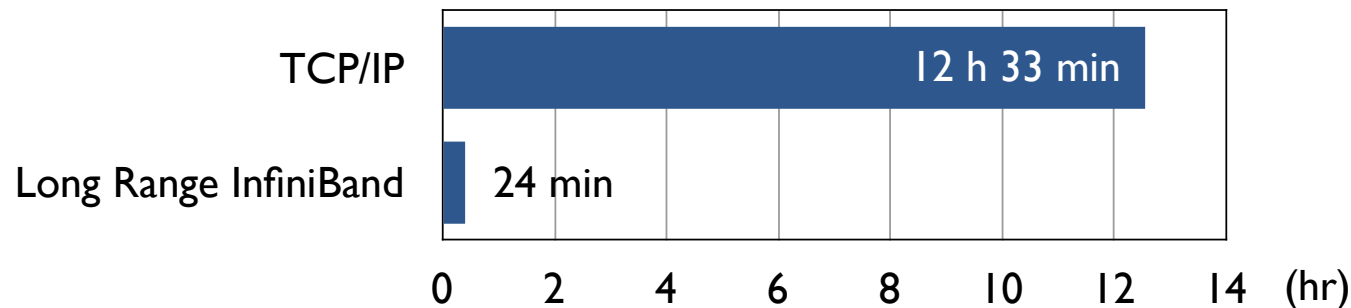
- **Cloud** infrastructure for flexible computing
- High speed **InfiniBand** interconnect
- **Long-range InfiniBand** (global reach)

Global HPC cloud cluster connected by long-range InfiniBand



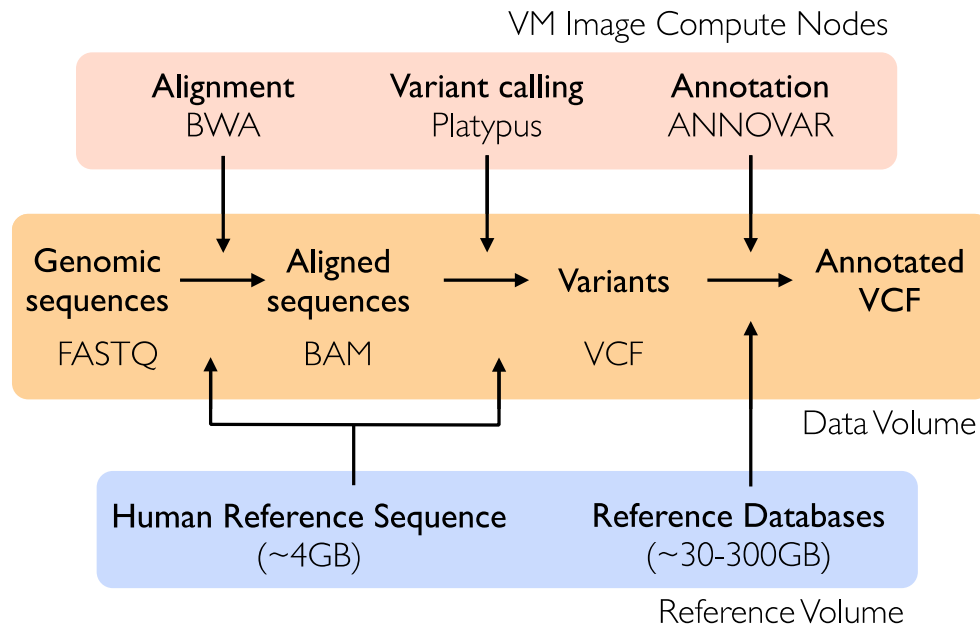
- Global **HPC cloud cluster** spanning **4 continents**
- Unified control from Singapore

Transfer times for 1 TB data over 30,000 km

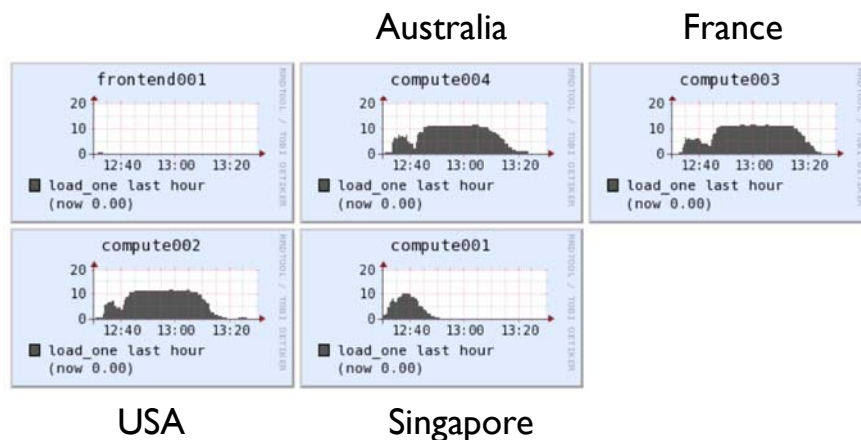


- High-speed **long range InfiniBand** for distributed data-intensive computing

Geo-distributed pipeline for identification of mutations in cancer samples



- **Automated provisioning** of geo-distributed virtual cluster
- **Encapsulated binaries/workflows** in VM images



- Distributed computing of samples **over 4 continents**

Thank You!