National Supercomputing Centre (NSCC) Singapore e-newsletter

NEWSBYTES

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CORPORATE NEWS

New supercomputer powers Singapore's healthcare research

Agreement signed between NSCC and National University Health System (NUHS) to build a petascale national supercomputing resource that will serve Singapore's medical and healthcare research needs by middle of next year.

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Hospitals around the world produce an average of 50 petabytes of data per year or a staggering 50 million GB of storage space. Research into modern medical technologies and applications that rely on tools such as artificial Intelligence (AI), machine learning and automation, helps to make sense of the massive amounts of data to improve patient outcomes. The development of such tools can be exponentially enhanced using supercomputers as it allows medical researchers to build more complex AI models that can accommodate the large amounts of data. However, to run AI and machine learning at scale, it requires massive amounts of computing power to train the models.

The five-year Research, Innovation and Enterprise 2020 (RIE2020) plan had allocated funds for research and development (R&D) in three high impact areas, including healthcare. Collaborating to provide the infrastructure and operational components respectively, the new system, which will be sited at NUHS, will benefit clinical researchers who will be able to train and run complex computations of healthcare models. This supercomputing infrastructure will be used to train AI models that predict patient health trajectories and recommends when a patient's condition may deteriorate.

"The National University Health System sees a large number of patients per day and generates large amounts of data which can be used to train AI models that improve the quality of care," said Associate Professor Ngiam Kee Yuan, Group Chief Technology Officer, NUHS. "Normally, these could take days to process but the new supercomputer could help to cut our training times down to hours allowing our medical and para-medical staff to optimise patient trajectories and to improve the quality of patient care," he added.

For more information, please refer to the media release.

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Providing a resilient network fabric for users of NSCC's high performance computing facilities

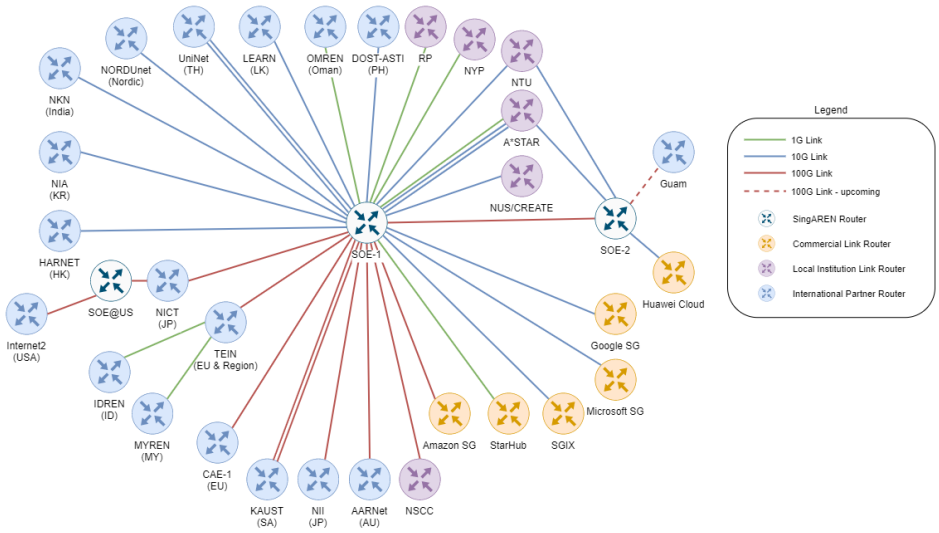
As part of the National Research Infrastructure, the Singapore Advanced Research and Education Network (SingAREN) Lightwave Internet Exchange (SLIX) facilitates access to major computational and storage resources both in Singapore and overseas. Through SLIX, SingAREN is instrumental in providing the essential network infrastructure fabric that facilitates end-user access to NSCC's high performance computing facilities. In working closely and synergistically with NSCC, SingAREN supports NSCC 2.0 with this essential network fabric for high performance computing within and outside Singapore.

In adopting a collaborative approach to work with key SLIX partners, namely A*STAR, NTU and NUS, SingAREN continuously explores relevant technologies to keep the SLIX infrastructure up-to-date and adopts technological enhancements to implement new value-added services to benefit the Research and Education (R&E) community. Pervasive upgrade of the SLIX 2.0 backbone to higher bandwidth and advanced network capabilities helps to meet increasing R&E demands.

Strong cooperative arrangements have been developed with NSCC that leverages on SingAREN's infrastructure and services to expedite deployment of cost-competitive high-speed R&E networking to facilitate access to high performance computing services. Adoption of advanced technologies, which align with those used by other consortium research infrastructures and platforms, enhances high speed connections and large data transfers. In partnership with NSCC to facilitate test-bedding and trial of advanced technologies, SingAREN has worked with NSCC on the proof-of-concept for the use of Quantum Key Distribution in providing Quantum Safe Network capabilities for secure data transfer.

On the international front, SingAREN collaborates with other national REN (NREN) peers on international connectivity to facilitate collaborative research. Indeed, through these efforts in the past 15 years, SingAREN has established SingAREN Open Exchange (SOE) as a major regional Research and Education Network (REN) hub, thereby reaping mutual benefits for both Singapore and other global partners. Through establishing important global links with various key international partners, SingAREN has built a baseline REN infrastructure and services thus enabling researchers in Singapore to benefit from the high bandwidth international links for the exchange of data required for their research.

Serving as a crucial step forward in advancing research collaboration and sharing, SingAREN has co-organised the Data Mover Challenge with NSCC. This global competition brings contestants together to compete on the best method, based on the most advanced and innovative technologies and solutions, to transfer large amounts of data over very long distances via Data Transfer Nodes (DTNs). This is an important area that enables researchers to have access to very large datasets that are located across the globe.



Beyond just meeting the growing connectivity requirements of the R&E community, SingAREN provides the network infrastructure and associated value-added services to interconnect member institutions within and outside Singapore. SLIX is implemented as a resilient and secure network infrastructure with a long-term leased fiber plant that results in lower overall total cost of ownership.

Putting in place a Business Continuity Plan (BCP) enhances resilience for a robust and reliable REN infrastructure. SingAREN's BCP comprises primary and secondary Points of Presence (PoPs) at two separate data centre locations, at Global Switch and Equinix respectively. Network resilience is provided via linkages to SLIX partners and international access via these two PoPs, thereby catering for automatic failover arising from PoP breakdown and link breakage. NSCC leverages on SingAREN's network infrastructure to achieve resilience and business continuity. In particular, NSCC relies heavily on the connectivity between NSCC Aspire 1 facilities at Fusionopolis and the NSCC's Active Business Continuity Plan (ABCP) for disaster recovery storage which is located at NTU.

Cybersecurity threats are continually on the rise along with digitalisation efforts. SingAREN enhances security preparedness with implementation of cybersecurity monitoring with an alert notification system to protect the R&E network and systems. Cybersecurity monitoring and alert mechanisms help to defend against Distributed Denial of Service (DDoS) and other malicious attacks. Early warning and alert infrastructure with the provision of regular and timely reports to enhance vigilance can protect SingAREN member institutions against cyber-attacks.

One of SingAREN's value-added services to improve R&E business and operational effectiveness includes Singapore Access Federation (SGAF), which is eduGAIN inter-federation identity and access management service. SGAF enables Single Sign-On to simplify user account management and convenient login to NSCC resources. Eduroam service enables users from SingAREN member institutions to roam globally and continue access to Internet at visited institutions in various parts of the world. A secure SingAREN value-added web-based service, FileSender SG, enables users to send large files of up to 50 GBs to others in the R&E community at a much faster speed of 40 MB/s. A 12GB file takes only 5 minutes to be uploaded/downloaded.

Besides expanding connectivity to the wider community of institutional users and international partnerships, SingAREN has established international partnerships with other NREN in the region, USA and Europe to facilitate international research and collaboration. SingAREN welcomes new ideas which can benefit the R&E community.

Have an idea or proposal on how the R&E network infrastructure in Singapore can be improved? Visit https://www.singaren.net.sg/ or contact SingAREN at contact@singaren.net.sg.

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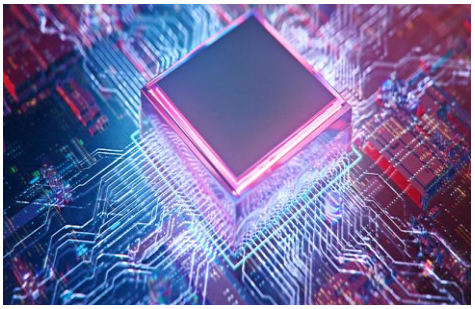
Harnessing supercomputers to correct quantum errors

Researchers at SUTD and Yale-NUS are tapping HPC resources to study the occurrence of errors in quantum computations and devise models to better correct errors.



A quantum computer is composed of a relatively large number of "qubits" and it is inherently a many-body quantum system. An actual implementation of a quantum computer will have to deal with two fundamentally different sources of noise i.e. classical and quantum noise. Classical noise is due to electric or magnetic fields fluctuations and/or the presence of charges in the apparatus. Quantum noise is due to system impurities like nuclear spins or defects. It is thus appropriate to describe a quantum computer as a many-body open quantum system, where the term "open" signifies that the system interacts with some environment.

"Currently, our best performing codes to study complex quantum systems are based on representing the large vector space needed to characterise a quantum system via a product of large tensors called tensor network. Therefore, we make significant use of NSCC's CPU cores and we require a significant amount of memory. We also need to simulate many different noise realisation and for this we need to submit a large number of jobs just to get a single data point. We are extremely grateful to NSCC and the supercomputer resources they have available."

Dario Poletti
Principal Investigator
Singapore University of Technology and Design

The occurrence of errors in quantum computations or in the storage of quantum data, has been studied for many years, and several key strategies devised are quantum error corrections or dynamical decoupling. A team of researchers at Singapore University of Technology and Design, led by A/Prof Dario Poletti, and A/Prof Ng Hui Khoon and her group at Yale-NUS and the Centre for Quantum Technologies, NUS, are tapping onto NSCC's supercomputing resources to tackle the study of quantum error correction and dynamical decoupling for a quantum computer under the effects of quantum and classical noise, i.e. studied as a many-body open quantum system.

The aim of the research is to produce improved models for the environment and the resulting noise on the quantum computing system. With such models, one can better understand how well quantum error correction and fault-tolerant schemes can deal with the adverse effects of noise on the state of the quantum computer.

To find out more about how NSCC's HPC resources can help you, please contact e-news@nscc.sg.

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THE LAST BYTE...
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Shared articles and news from the HPC world.

How cloud-based supercomputing is changing R&D

The cloud has made the processing power of the world's most powerful computers accessible to a wider range of companies than ever before.

Instead of having to architect, engineer, and build a supercomputer, companies can now rent hours on the cloud, making it possible bring tremendous computational power to bear on R&D. But where should companies start? What kinds of projects could benefit from this investment? Read more at Harvard Business Review here.

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Earth has a digital twin

Elon Musk and Jeff Bezos have joined NASA in exploring space and looking for new worlds, but there is another world right here on earth, and it's a virtual world being built by NVIDIA.

In the ultimate 'digital twin,' the NVIDIA Omniverse is a real-time virtual world collaboration platform for 3D workflows that can be used to twin facilities such as factories, self-driving cars, robots, cities, and even the world itself. Ultimately, this global twin can be used to look into the future, understand the impact of global warming, and model different responses. Read more at CDO Trends here.

Credit: CDO Trends

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How much has quantum computing actually advanced?

Q&A with the former chief architect of Google's Sycamore, John Martinis.

Lately, it seems as though the path to quantum computing has more milestones than there are miles. Judging by headlines, each week holds another big announcement—an advance in qubit size, or another record-breaking investment. For a measured perspective on how much quantum computing is actually advancing as a field, we spoke with John Martinis, a professor of physics at the University of California, Santa Barbara, and the former chief architect of Google's Sycamore. Read more at IEEE Spectrum here.

Credit: IEEE Spectrum

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