National Supercomputing Centre (NSCC) Singapore e-newsletter

NEWSBYTES

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CORPORATE NEWS

A JOB WELL DONE ASPIRE 1!

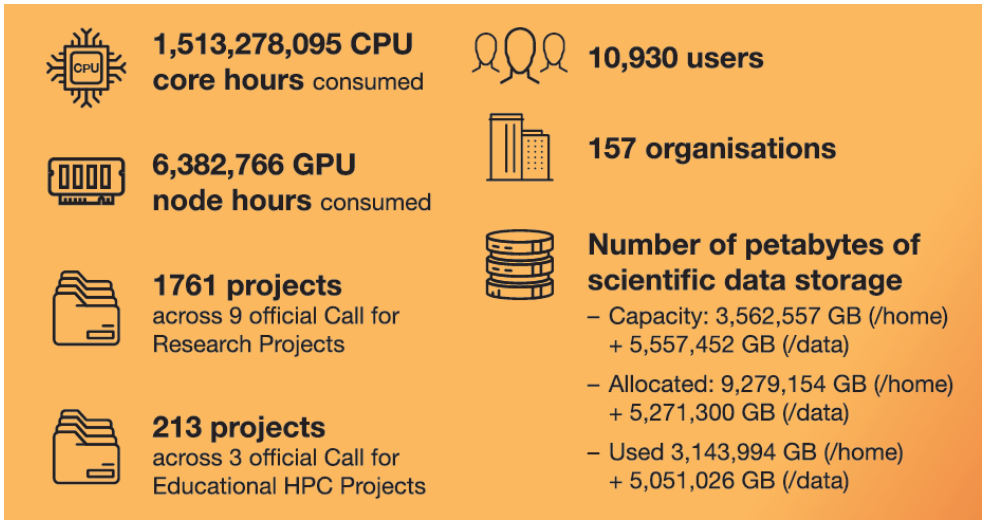
NSCC bade a fond farewell to Singapore's first national petascale supercomputer, the ASPIRE 1. Having served the research community with much needed high performance computing (HPC) for 7 years, the ASPIRE 1 was officially decommissioned on 31 August 2023.

In 2016, the *Advanced Supercomputer for Petascale Innovation Research and Enterprise 1* (ASPIRE 1) came online as Southeast Asia's most powerful supercomputer. ASPIRE 1 was ranked 93rd in the 2016 TOP500 list of

the world's most powerful supercomputers, and located in one of the greenest data centres in Singapore achieving a PUE of 1.08 at its height and averaging a PUE of 1.3 by operating a hot direct to chip water-cooled supercomputer with dry cooler and rear-door heat exchangers with few CRAC aircon units. Located on the 17th floor of Fusionopolis, ASPIRE 1 is one of the highest operational supercomputers housed in a high-rise building.

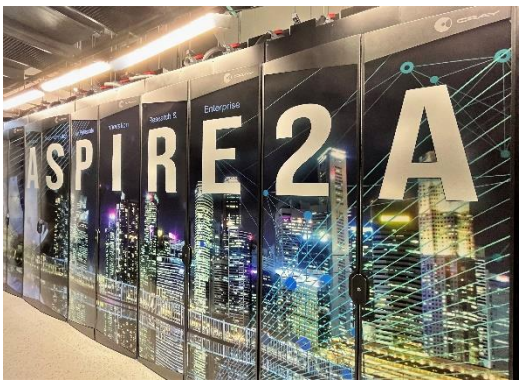
On 31 August 2023, ASPIRE 1 ceased its operations and was officially shut down. The shut down was carried out during a decommissioning ceremony which was attended by NSCC staff, key decision makers, stakeholders and partners from the Singapore HPC community. The ceremony celebrated the journey, milestones and achievements of ASPIRE 1 in the past seven years. It was also an opportunity to update the key Singapore HPC community on current HPC capabilities and the plans ahead for Singapore HPC.

Over the past seven years, demand for ASPIRE 1 has been off the charts with demand outstripping its capacity. ASPIRE 1 has undoubtedly benefitted the research and development community in Singapore and has brought science and innovation to greater heights. ASPIRE 1's journey and its highlights were captured in a farewell video which can be viewed via this link.



As we say goodbye to the nation's first national petascale supercomputer, ***Singapore's newest petascale supercomputer, the ASPIRE 2A***, will now take centre-stage.

Launched earlier this year, the ASPIRE 2A is a green, warm water-cooled system - one of the first known deployments in a tropical environment. ASPIRE 2A will provide an aggregate of up to 10 PFLOPS of raw compute power and is almost seven times more powerful than ASPIRE 1. The ASPIRE 2A will strengthen and support local research at universities, research institutes, government agencies and companies in areas like climate change, biomedical science and smart nation activities as well as across a wide array of scientific fields. Visit www.nscc.sg to find out more about ASPIRE 2A and its capabilities.



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NUHS and NSCC launch Singapore's first-ever supercomputer designed for the healthcare sector

The Prescience supercomputer, a first in Singapore's healthcare sector, is deployed to train artificial intelligence models that will boost the delivery of healthcare here.

Healthcare staff at the National University Health System (NUHS) can now use Artificial Intelligence (AI) to estimate the duration of a patient's hospitalisation, much like how hotels have precise information on room occupancy rates. This would allow NUHS to better tailor treatments and allocate hospital resources.

Doctors may also now use locally trained Large Language Models (LLMs) to summarise patients' case notes with just the click of a button, thus freeing up time for more direct patient care.

These initiatives are part of the NUHS AI programme developed using the petabytescale edge supercomputing infrastructure named "Prescience" located at the National University Hospital. Fully operational since 31 July 2023, Prescience is Singapore's third national supercomputer and the first in the healthcare sector.

NUHS inked a collaborative agreement with the National Supercomputing Centre (NSCC) Singapore on 3 December 2021 to build this supercomputer dedicated to healthcare and medical research.

Researchers are now able to use medical big data to train AI models using multiple NVIDIA DGX A100 compute nodes that can accommodate the large sizes of LLMs, which was previously not possible with single graphical processing unit (GPU) systems.

Associate Professor Ngiam Kee Yuan, Group Chief Technology Officer, NUHS, said: "Using the Prescience supercomputer, we are now able to train our own large language model for Singapore's healthcare needs. From synthesising precise local medical knowledge to reducing the administrative work of our doctors and nurses, this LLM will bring benefits to both healthcare workers and patients."

Mr Bernard Tan, Director of Strategy, Planning and Engagement at NSCC, said: "The launch of the NUHS supercomputer is timely because of the all-time interest in Generative AI, and especially with the worldwide demand crunch for the computing resources needed to drive such AI-driven technologies. The Prescience supercomputer will significantly benefit Singapore's healthcare research community and enable local healthcare professionals to develop tools that can increase the efficiency of healthcare delivery and accelerate healthcare innovations which ultimately benefit patients here. NSCC will continue to partner with Singapore's healthcare clusters and government agencies to ensure Singapore's Human Health and Potential domain has the supercomputing capacity and capabilities to be competitive and innovative."

With the supercomputer, NUHS now has its own version of LLMs to boost productivity of healthcare professionals and improve patient care. The NUHS RUSSELL-GPT can summarise patient case notes and write referral letters for doctors in a matter of seconds.

This language model also allows NUHS staff to ask questions, such as those related to medical conditions and clinical practice guidelines, to aid them in their work. Plans are under way to progressively roll out the language model throughout the NUHS cluster.

This model is also used in the Patient Trajectory Prediction AI Model to predict individual patient healthcare journeys through the analysis of all historical data. Research is under way to use this model to predict the severity and trajectory of common conditions, such as urinary tract infections, to help right-site patients.

Another initiative made possible with Prescience is the SMILE AI (Smart Monitoring and Intelligent Learning for Enhancing oral health) project, which entails training two distinct machine learning models – one using 3D dental scans, and the other using Xrays of the upper and lower jaw, in what is known as dental panoramic tomogram.

The 3D teeth charting model generates digital representations of the condition of teeth and their positions in the mouth, replacing manual tooth charting by dentists and facilitating enhanced visualisation. Instead of waiting for up to a day to get a dental cast done, it will take no more than five minutes for dentists to scan a patient's teeth and collect information to initiate treatments.

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Strengthening cooperation and partnership between ThaiSC and NSCC

As part of the continuing series of activities and the strong partnership between the two most established HPC centres in ASEAN, NSCC and ThaiSC held its second workshop, and the first in-person meeting, to strengthen technical and corporate cooperation between the two centres.

A delegation from NSCC visited our HPC counterparts at ThaiSC in Bangkok for a workshop and continuing series of activities that is part of a recent MoU that was signed between ThaiSC and NSCC at the SCA23 in March. The MoU outlined and strengthened the already close cooperation between ThaiSC and NSCC by promoting further collaborations between the two HPC centres. The aim of the collaboration was to promote and nurture HPC partnerships in areas like HPC resource and capability development, joint training and staff upskilling.

Over a span of 3 days, the two HPC centres discussed a number of matters centred around best practices in technical operations, the opportunities and challenges of running HPC centres, closer training and talent development collaboration, and potential new joint initiatives in the months to come. The NSCC delegation was also fortunate to be given a tour of the new LANTA supercomputer and data centre facility.

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Enhancing the safety of electric vehicles through HPC

Researchers from NUS tap on supercomputing to simulate the multi-physical processes of lithium-ion batteries in order to develop cooling strategies for more advanced battery designs. These efforts are poised to contribute significantly to the realisation of an EV-powered society and a greener future in Singapore.

With the introduction of the Singapore Green Plan 2030, the Singapore government has set ambitious targets to achieve net-zero emissions by 2050. In order to reach this goal, various green initiatives are being implemented, one of which is Singapore's aim to operate a fully electric and hybrid fleet of 10,000 vehicles by 2030 and to achieve the vision of 100% cleaner energy vehicles by 2040.

Electric vehicles powered by lithium-ion battery (LIB) have high electrical energy densities and run the risk of thermal runaway (TR) under conditions like overcharging, superheated working environments, collision, and crashing. Therefore, it is important to predict the safety rick of LIBs under

a series of abuse conditions such as over-charging and discharging, to propose reliable thermal management and cooling strategies.

The Energy Innovation Laboratory (EIL) at the National University of Singapore's (NUS) Department of Mechanical Engineering, led by Professor Zhang Huangwei, is leveraging on NSCC's ASPIRE 2A supercomputing resources to actively develop a BatteryFoam solver package based on the open-source OpenFOAM® platform. The group's primary objective is to leverage BatteryFoam to carry out computational studies on multiphysical processes of LIBs, including electrochemical reactions, electrical parameter variation, thermodynamic processes, and the critical thermal runaway investigation and mitigation.

"With the multitude of strengths offered by the ASPIRE 2A supercomputer, our study has the capability to perform computations on a scale of tens of millions of cells for simulation cases using multiple nodes and CPU cores. Moreover, the parallel processing abilities allow us to complete numerous simulation cases simultaneously within a short time frame."

Yan Ding
PhD Student & BatteryFoam Solver Developer
Department of Mechanical Engineering, National University of Singapore (NUS)

The team uses an Electrochemical-Electrical partial model to comprehensively analyse the electrochemical reaction intensity, open-circuit voltage, working voltage, overpotential, ion current, and in-plane current density. Furthermore, the thermal coupling model will provide valuable insights into temperature distribution and heat generation power within the battery. Built on the research findings from the BatteryFoam, the effective thermal management and cooling strategies for LIBs are developed alongside more advanced battery designs. These efforts are poised to contribute significantly to the realisation of an EV-powered society and a greener future in Singapore.

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

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The latest issue of Supercomputing Asia is now available online!

In a fast-moving field such as high-performance computing (HPC), where the rate of new developments can rapidly outpace education delivery, staying up-to-date in essential hardware and software is all the more crucial.

In this issue, we explore the impact of HPC in delivering education in Asia, from serving digitally enhanced learning methods to providing AI-powered tools in the classroom. This issue's cover story, in particular, takes a look at the different initiatives happening around Asia to increase the level of computer proficiency in the region.

Get the latest stories when you download a copy of Supercomputing Asia, NSCC's official publication, here.

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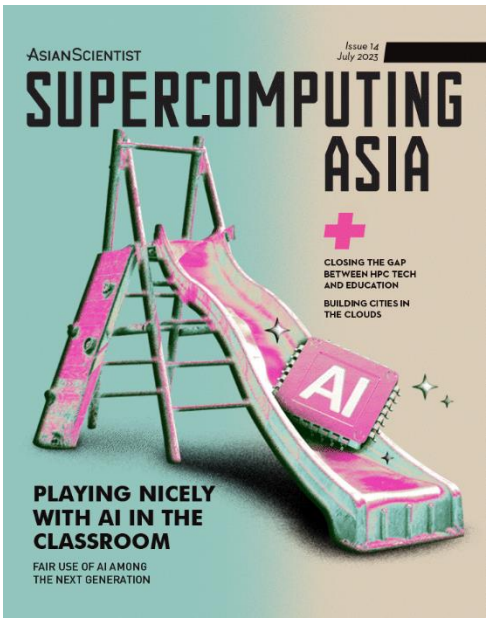

THE LAST BYTE...
<SHARED CONTENT>

Shared articles and news from the HPC world.

Singapore's data-centre market to surpass 1GW milestone, challenges ahead: Cushman & Wakefield

The data-centre market in Singapore is on track to exceed one gigawatt (GW) in 2024.

Credit: The Business Times

However, because of a limited future supply of such facilities, other markets will overtake its operational capacity in the coming years, said Cushman & Wakefield in its latest Asia-Pacific Data Centre Update. Outside mainland China, Singapore now has the largest data-centre market on a city basis in the Asia-Pacific, with around 917 megawatts (MW) of capacity in operation, and 209MW either planned or under construction. Read more at The Business Times here.

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NIST finalizes 3 algorithms for post-quantum cryptography

After selecting four cryptographic algorithms designed to withstand attack by quantum computers, the National Institute of Standards and Technology (NIST) has started the process of standardizing these algorithms.

Credit: NIST

NIST has released draft standards for three of the four algorithms it selected in 2022, while the draft standard for FALCON, the fourth algorithm, will be released in about a year. In other words, NIST is calling on the cryptographic community to provide feedback on the draft standards. It will accept feedback on its post-quantum cryptography standardization project until 22 November 2023. Read more at EDN here.

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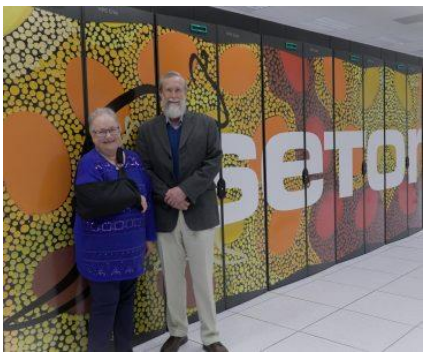
Pawsey's Progress: Tracing the Path from Radar Innovation to Radio Astronomy to Supercomputing Excellence

The Pawsey Supercomputing Research Centre has contributed to revealing the mysteries of the Universe: finding slowly spinning neutron stars, weighing galaxies to identify dark matter, finding gravitational waves, even hunting for signs of interstellar civilizations.



Credit: HPC Wire

Modern astronomy is driven by data, a lot of it. So the Pawsey Supercomputing Research Centre has become an essential tool for astronomers. The Centre, for example, helped reveal mysterious objects such as a slowly spinning neutron star that had been predicted to exist theoretically but never observed. PhD candidate Tyrone O'Doherty and Curtin University Astrophysicist Dr Natasha Hurley-Walker identified the object using the MWA, a low-frequency radio telescope in outback WA, but the strings of numbers they collected only emerged as pictures thanks to the power of the Pawsey's Cray XC30 supercomputer system known as Galaxy. Read more at HPC Wire here.

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