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Vincent Lim Head of DC Senior Facilities Manager Vincent@nscc.sg

#### **ASPIRE 2A – Driving Singapore's Next Generation of HPC-enabled Research**

- Awarded to HPE in April 2021
- Heterogeneous system A general purpose use machine with expanded storage and a major enhancement to the national R&E network infrastructure
- System being commissioned expected to come online and be available to users in Q4 CY2022







#### ASPIRE 2A – In the Top500 of the World's Top Supercomputers





#### **Features**

- Power-saving 300sqm Double-height computer room air conditioning (CRAC)less DC (ie no air-conditioning for Area A hall)
- Unique DC design for Tropics Hot Hall ambient temperature Water-Dry Cooler ٠ system
- Leveraging Singapore tech Cool Hall rear-door heat exchange (RDHX) with ٠ KoolLogix Thermosiphon gas system (patented)
- Digital monitoring Digital Twin Design with IoT sensor and intelligent monitoring ٠ /AI-assisted operations
- Environmentally sustainable Awarded a Singapore Building and Construction ٠ Authority (BCA) Green Mark Platinum Award (2021)



**TCOMS** Marine Wave Basin







Synchrotron Light Source (SSLS)

Singapore



- New Purpose-built Data Centre:
  - Singapore's First Tropical Supercomputing DC
  - Award-winning Green Data Centre Singapore's Building Construction Authority (BCA) Platinum Green Mark Award - Aircon-less compute area, locally-designed cooling racks, warmwater cooled, etc. Estimated PUE <1.18.</li>
  - The Data Center has been awarded the BCA Green Mark Platinum award (2021)
  - IOT / Digital monitoring Equipped with intelligent monitoring / AI-assisted operations, advanced DCIM and leveraging Digital Twin technology with integrated IoT sensors, data analysis with CFD and AI, to facilitate controls optimise real-time DC operations.



- The Data Centre is designed into 2 separate areas.
  - <u>Area A:</u> Compute System (HPC Cray EX) of the Supercomputer.
    - Cooled by warm water cooling with dry coolers for heat dissipation.
    - The area will use natural air to dissipate radiant heat. (Singapore tropical temperature environment)
    - CRAC-less (no aircon)
  - <u>Area B:</u> Other servers, hard disk for storage, network equipment, etc.
    - The area is maintained at 26°C.
    - KoolLogix Rear Door cooling
    - Thermosiphon method using gas instead of liquid

# Infrastructure / Layout





- Area A was designed based on the tropical data centre report released by IMDA.
- The HPE Cray supercomputer is in liquidcooled cabinetry, which supports direct liquid cooling of all components in a compact bladed configuration.
- Area A holds 4 racks of Cary EX and 2 CDU
- The 24KW of radiant heat produced by the racks and CDU is dissipated by natural air.
- The room temperature is around 34.5 to 35.4 Degrees Celsius.
- If the temperature reaches 35.5 Degrees Celsius, the exhaust system will exhaust the hot air and bring in fresh air to cool the room. Once the temperature reaches 33.5, the system will shut down and close the exhaust.



#### HPE Cray EX cabinet exploded view



Liquid-cooled PDU





- The CDU does its inner loop heat exchange with an outer loop linked to a dry cooler.
- Loop temperature is about warm water in, 40 Degrees Celsius and warm water out, 45 Degrees Celsius
- The temperature in Singapore is about 24 to 38 Degrees Celsius which provides a good Delta for the heat exchange.



HPE Cray EX liquid cooling flow







- Area B is designed to maintain at 26°C based on our CFD.
- KoolLogix Rear Door cooling
- Thermosiphon method using gas instead of liquid



#### Work Example

- Each HRM is rated 20kW and uses ~ 200W
- If each row consist of 10 units of 10kW/rack
- Then you need only 5 units of HRM
- And you use only ~1000W
- Allows you to also add N+x HRM

#### **Conclusion**

- Lower CapEx from HRM as needed requirement
- Lower OpEx from HRM power consumption
- Room for row HRM redundancy
- No requirement for Aisle Containment System
- Savings on Computing Space Floor Area
- No requirement for Row Based Cooling
- Lower of Carbon Emissions





PID Control Valve Signal

from Central Control Box

Heat Rejection

Condenser

- No mechanical fluid drivers
- Based on fluid thermal properties
- Reliance on header pressure and gravity















Production and installation



# Thank You

contact@nscc.sg