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RACE: RMIT's Cloud Supercomputing Facility to Accelerate Data-Intensive Research

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RMIT researchers are increasingly challenged by the size, dimension, and complexity of their data, the need to develop and run sophisticated data processing and analysis pipelines, and the need for computing-intensive simulations to compare with and interpret physical experiments. To partially address these challenges, the RMIT Advanced Computing Ecosystem (RACE) model provides scalable, high-performance resources through commercial cloud services. This pioneering facility, supported by AWS, Microsoft and AARNet partnerships and the Victorian Government's Higher Education Investment Fund, leverages the power of cloud computing to advance data-intensive research from local to global scales.

As Australia's first dedicated commercial cloud supercomputing facility at a university, RACE facilitates research excellence and strengthens partnerships across industry, government, and academia. Through partnerships with AWS and Microsoft Azure, RACE offers cutting-edge cloud services, including advanced data storage, cloud computing, and supercomputing capabilities. Positioned at the forefront of technological innovation, RACE also facilitates access to emerging technologies like AI and quantum computing. This strategic integration accelerates the transition from data to knowledge, enabling swift, groundbreaking discoveries and advancements in research. By utilising state-of-the-art commercial cloud infrastructure, RACE enhances computational capacity and empowers researchers to explore new frontiers in data-intensive research.

Since its launch in October 2022, RACE has onboarded more than 800 researchers and PhD students, enabling rapid testing of ideas at speeds over 100 times faster than traditional on-site servers. In recognition of its outstanding contributions, RACE was recently awarded the CAUDIT Excellence in Research Support 2024, and two recent examples highlighted on the AWS website:

• Geospatial Data Management: Professor Matt Duckham partnered with RACE to manage, update, and learn from increasing volumes of geospatial data. They built a statewide knowledge graph of Victoria, with over 2 million interlinked geospatial records processed in under an hour, a task that would typically take days on a regular computer. These partnerships are pushing the boundaries of research and technology, contributing to Australian sovereign capability, and preparing RMIT for the next wave of geospatial data.

• Aerospace Simulations: The Sir Lawrence Wackett Defence & Aerospace Centre, led by Prof. Pier Marzocca, has partnered with RACE to accelerate aerospace simulations. This collaboration has significantly increased the number of analyses that can be run, reducing the time-to-solve by several orders of magnitude. The team is now able to handle 40 million simultaneous equations for more than 400,000 iterations per run, optimising designs and reducing the number of costly physical tests. Leveraging RACE's data and computing ecosystem, the centre has started storing input and output data securely, enabling seamless sharing with other collaborators. This enhances collaborative opportunities and allows for comprehensive data analysis and reuse, reducing the team's solving time for analyses from nearly 3 months to just 3.5 days using RACE.

In addition to its cloud services, RACE further enhances the research ecosystem through:

1. Comprehensive Training: Offers varied training formats to lower technical barriers, empowering users with essential cloud computing skills.

2. Tailored Consultation: Provides customised cloud solutions to optimise costs and maximise efficiency for innovative research projects.

3. Expert Support: Embeds specialists within project groups, providing direct assistance to overcome data and computing challenges, fostering a collaborative environment that drives excellence.

RACE leverages advanced computing capabilities, including AI and quantum computing, to transform complex data into actionable insights and groundbreaking discoveries through cross-disciplinary collaboration. By enhancing data management aligned with FAIR and CARE principles, RACE ensures data is efficiently accessible, interoperable, and ethically handled, empowering researchers to produce impactful, socially responsible insights. This approach fosters world-class outcomes in research and reinforces Australia's global standing in innovation.

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