



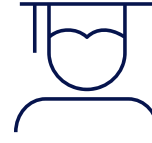
Partnerships with
Universities and
industry



Innovation
Central



Specialised
Centres



Research
Chairs



Skill & Talent
Development

The National Industry Innovation Network: driving adoption of technology by industry

Prepared by the Centre for Networks at Curtin University in conjunction
with members of the NIIN



Executive Summary

The development and adoption of digital technologies is critical to Australia's future.

Australia's capacity to be competitive, productive and economically complex is largely driven by its ability to embrace digital technologies. While development of new technologies is important, it is the adoption of technology by industry that offers the greatest gains, including improved competitiveness and differentiation. The past decade of digital disruption is a case study in how quickly the fortunes of nations that adopt digital can change. Technologically progressive economies out-perform the average, led by economically complex countries such as Singapore, Germany, the UK and South Korea.¹ Investment in digital infrastructure also delivers higher economic returns than investment in traditional infrastructure.²

The National Industry Innovation Network (NIIN) accelerates technology adoption and skills development by industry.

The NIIN focuses on solving problems of national significance through collaboration at a number of levels. What differentiates the NIIN from other models is its focus on creating large-scale digital solutions that can change practice, business and operating models. The NIIN is designed to de-risk adoption of technology by creating effective, efficient and collaborative vehicles for industry to develop, test and ultimately adopt technology. The NIIN creates a balance between value and individual technologies by focusing on the convergence of different technologies, not discrete technologies.

The NIIN is also active in responding to current and likely skills shortages related to digital technologies to fill both specialist roles and blue tech jobs. Importantly the NIIN provides opportunities for students to work with digital technologies as part of their industry projects.

The NIIN is industry-led and university-enabled.

The NIIN is a coalition of industry and university partners committed to accelerating development and adoption of technology by government, multinationals and SMEs. Challenges come from industry, but the solutions are co-designed. The NIIN is comprised of six innovation centres, six research chairs, a global academy program and three special purpose centres including the Centre for Networks at Curtin University and the Cisco-La Trobe Centre for AI and Internet of Things at La Trobe University. The NIIN is anchored by leaders in their research fields and industry practitioners.

The NIIN can play a role in helping to accelerate adoption of digital technologies.

The NIIN's ecosystem-based approach to technology adoption is unique and effective. The NIIN is ideally placed to partner government and industry:

- Understanding where digital technologies offer greatest benefit to Australia
- Rapid prototyping, testing and validation of technologies in target industry verticals
- Digital skills development
- Articulating how technologies (and the convergence of those technologies) is progressing elsewhere
- Helping to model the economic and strategic benefits of early industry adoption

1. About the NIIN

The NIIN is a collective of industry and university partners committed to advancing the use of digital technology. The NIIN is anchored by six innovation centres, six research chairs, two health labs and the Cisco-Curtin Centre for Networks. The purpose of the NIIN is to help industry solve critical challenges using digital technology in collaboration with researchers and students. The NIIN represents a digital innovation ecosystem comprising companies (vendors and end user customers) and universities. Since it was established the NIIN has created linkages that allow industry and education to mobilise quickly around national challenges. This model also reflects that urgency is required if Australia is to realise opportunities and mitigate competitive threats.

Figure 1. NIIN ecosystem and members

NIIN founding member:

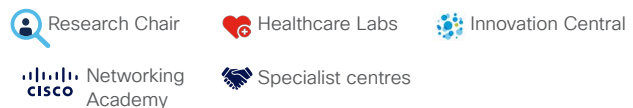


NIIN industry members:



The network comprises:

- Research Chairs
- Innovation Central Hubs
- Specialist Centres
- The Cisco Networking Academy
- University partnerships



Since its inception in 2018 the NIIN has:



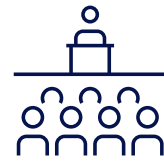
Delivered 250+ industry projects



Attracted \$550M in funding



Delivered 150+ collaborative workshops



Delivered 150+ industry events



Conducted 1500+ client engagements



Worked with 150+ collaborators



Engaged 300+ students

Figure 2. Overview of NIIN Impact and Activities

Over the past two years, the NIIN has created insights into nationally significant issues including:

- **Securing Australia’s Critical Infrastructure:** The NIIN is building solutions to threats for critical infrastructure operators including transport, utilities, education, healthcare, communications, defence industries and supply chain.
- **Using advanced networks the NIIN accelerates progress towards Net Zero:** Advanced networks need to be optimised for Net Zero, and they need to be measurably energy efficient in their own right. Today advances in underlying digital networks and tools are unlocking new possibilities and allowing the implementation of every organisation’s Net Zero goals.

Foreword

Two of the major disruptions gathering pace in the Australian economy are digital transformation and reducing greenhouse gas emissions to Net Zero.

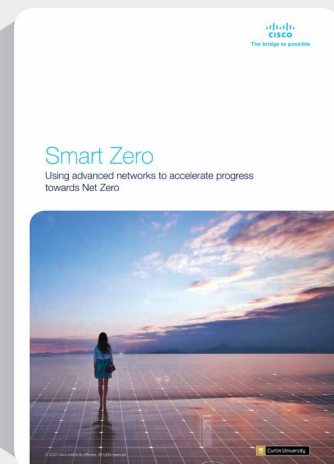
Momentum has already been established in relation to digital. Australia has a strong track record for early adoption of technology across a range of industry sectors, as well as creation of new products and services for the global market. The depth of specialist capability inside Australian universities has been a major factor in Australia’s capacity to participate in and benefit from digital.

The scale and depth of the environmental threat posed by human induced emissions are universally accepted. Globally, governments have expressed the urgency required to minimise climate change, however the translation of targets into outcomes will require increased efforts across many sectors. The task is huge, requiring an enormous investment into alternative energy sources to replace fossil fuels while expanding the energy services that underpin our modern civilisation. The opportunity for Australia to create new industries is equally large.

Australia’s progress on dealing with climate change is gathering pace. To ensure that the ever-increasing investment in net zero activities driven by government and the private sector is maximally efficient, we must implement smart digital approaches to operate the new and emerging zero emissions technologies, integrate them into our complex society and accurately collate the data that gives us confidence that our efforts are delivering results. We must step beyond manual, analogue processes to a technology-based approach that is more scalable, accurate and secure.

This report, prepared by global IT leader Cisco and innovative global university Curtin, explores how digital and net zero converge and poses the question: *can we accelerate Australia’s progress to net zero by leveraging digital technologies and advanced networks?* The answer is resoundingly yes. Australia needs to mobilise all its resources in the quest for net zero and we deserve to know that the anticipated benefits are real. Solving problems at the intersection of digital and net zero will require collaborative action from government, universities and the private sector to harness Australia’s collective research capability.

Dr Alan Finkel AC



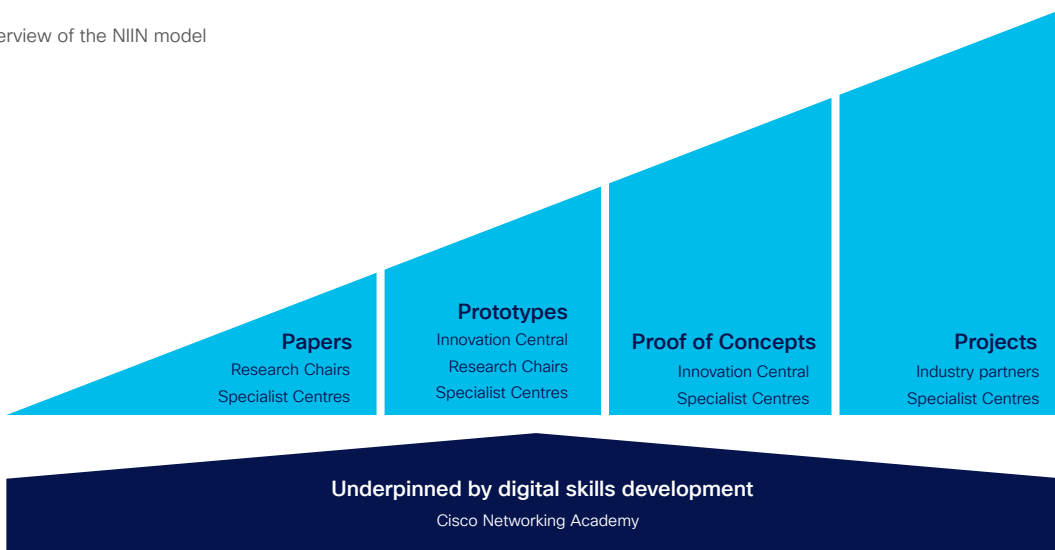
- **Building intelligent transport systems to create connected, safer journeys:** The NIIN is improving the transport system in NSW by digitising transport assets such as buses, ferries and light rail vehicles. This enables a real-time view of supply and demand and performance creates new services, emerging travel options, new travel experiences and connected safer journeys for the New South Wales community to enjoy while showing them the energy savings.
- **Making hospitals more dynamic:** The global pandemic demonstrated how hospitals adapted to changing requirements; general wards were converted into Intensive Care Wards, carparks became triage and testing centres, and clinical settings needed to be reconfigured to deal with infection control changes. A dynamic hospital is in its physical construction and scalability, functionality, security and resilience because of its of its underlying technology infrastructure.
- **Creating pathways towards virtualised care:** Australia's health system has moved beyond telehealth to virtualisation of a broad range of health services. This includes the virtual emergency department, monitoring and diagnostics, e-Concierge and digital admissions. A prominent demonstration of virtualised care is the Virtual Emergency Department project in northern Melbourne which is using technology to improve clinical outcomes and patient experience. In Victoria, since July, the virtual ED has treated over 28,000 people and eliminated ~71% of ambulance trips to the physical ED.
- **Identifying opportunities for transformation of Australia's aged care sector:** The NIIN's Health Transformation Lab brings together the best health research and technology capability to create solutions that are addressing the Aged Care Quality and Safety Commission's key recommendations.
- **Trailblazer:** the NIIN will play a critical role in delivery of the two Federally-funded Trailblazer initiatives (mining and resources trailblazer anchored by Curtin and the University of Queensland University and defence trailblazer anchored by UNSW and Adelaide University). The NIIN's focus is on ensuring that applied research and skills initiatives have a clear pathway to adoption.

The NIIN has delivered over 250 industry projects demonstrating the NIIN's importance in engaging universities with industry. The projects span all industries including mining and resources, health, transport, agriculture, insurance, and government.

2. The NIIN model

The NIIN model recognises that solving problems of national significance requires collaboration at several levels. What differentiates the NIIN from other models is that all of its work builds towards large-scale digital interventions that can change practice, business models and operating models. The model is anchored in thought leadership (papers), supports rapid innovation in various forms and culminates in large-scale projects. The entire process is underpinned by a focus on digital skills that are required for Australia to maximise value from technology. The model focuses on development of commercial grade prototypes and a ‘make your own’ ethos that ensures companies immersed in its innovation centres can learn and hone skills that can be applied back in their own organisations.

Figure 3. Overview of the NIIN model



Innovation Central

These consist of a network of innovation centres, staffed with Relationship Managers and underpinned by a proven innovation management methodology, that help drive industry-university collaboration by connecting researchers / students to real-world industry problems that need solving.

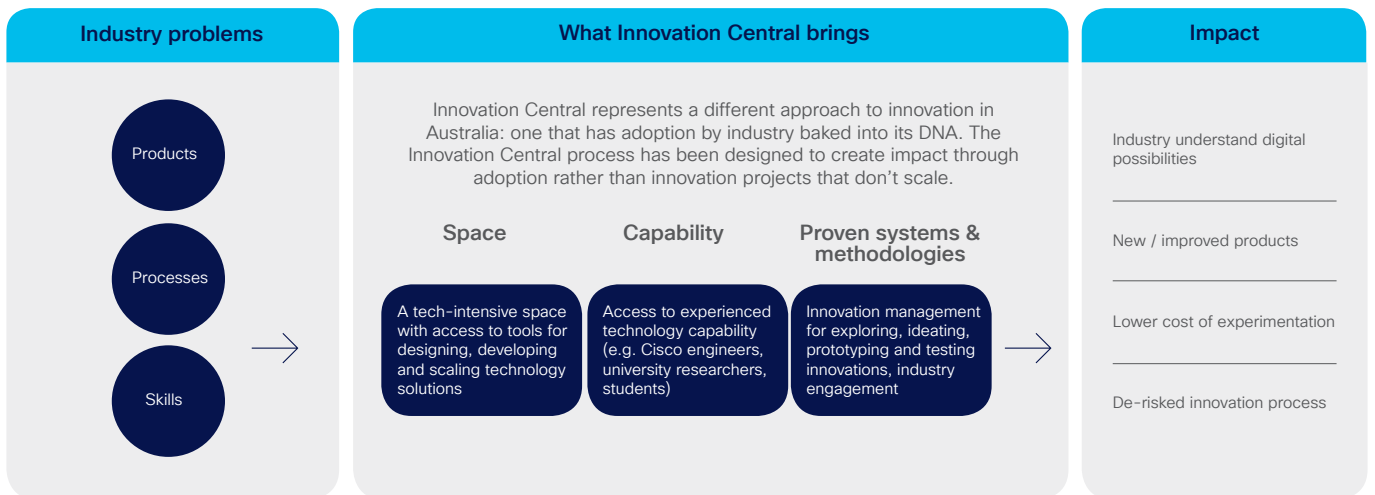
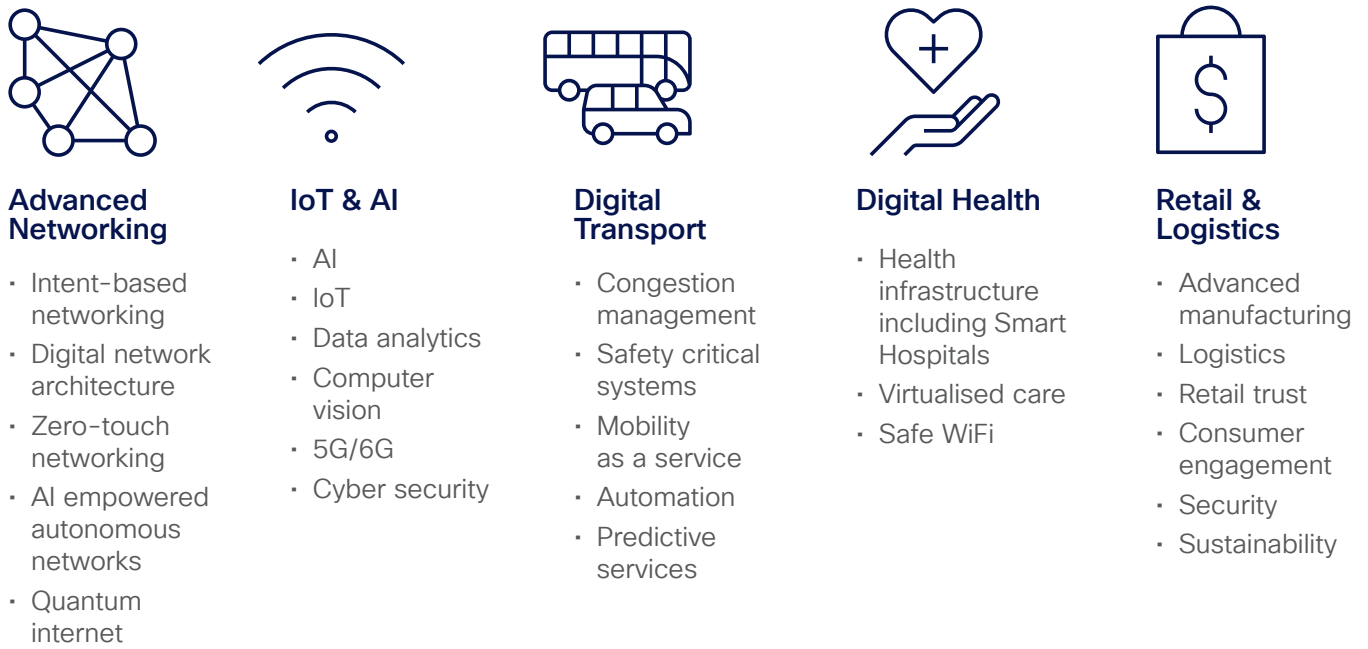


Figure 4. Overview of the Innovation Central model

Research Chairs

Research Chairs are provided with early access to next-generation technologies to pursue leading-edge innovations. Research Chairs have already been established across five areas, with further Research Chairs planned:

Figure 5. List of Research Chairs Exploring New Digital Frontiers and Via Applied Research to Create Industry Impact



Specialist centres including health labs

A number of specialist centres have been established: typically they are grounded in either a specific technology or an industry application.

Figure 6. List of Specialist Centres Developing Commercial Prototypes Leading to Industry Impact



Technology focus

Cisco-Curtin Centre for Networks:

A global centre of excellence in intent-based networking for applied, experimental and blue-sky research in fundamental topics focused on building network infrastructure for the future internet.

Cisco-La Trobe Centre for AI and IoT:

A first-of-its kind research centre in Australia focused on exploiting the synergy between state-of-the-art AI and IoT technologies through partnering with industry and end-user communities.

Industry focus

Cisco-Flinders Digital Health Research Centre:

A multidisciplinary research centre focused on developing and deploying computational solutions which provide benefits to the management of health in numerous social and clinical settings, including home and workplace.

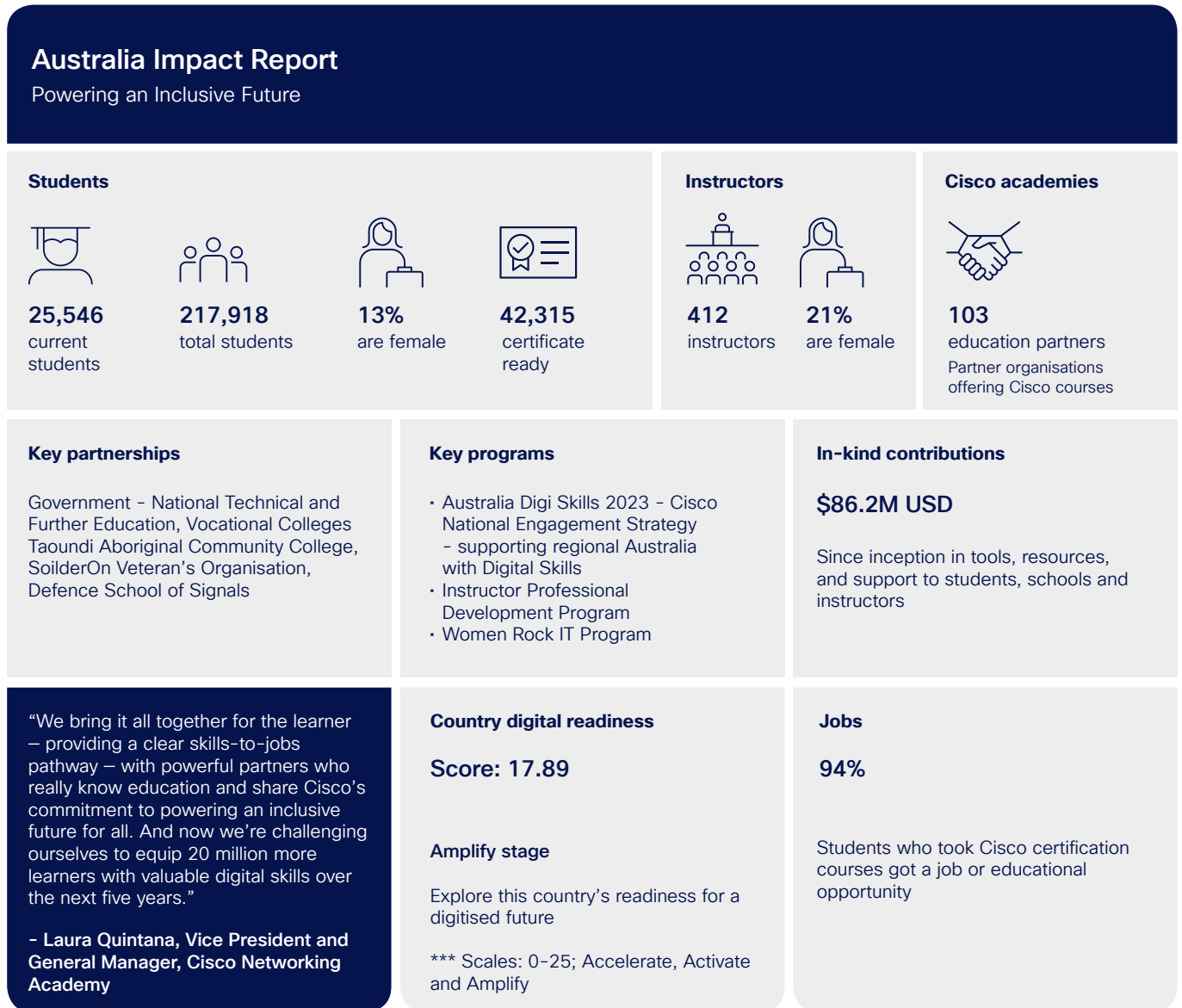
RMIT Health Transformation Lab:

An innovation lab that brings together design, systems thinking, technology and communication process transformation to reshape healthcare. The lab is headed by Professor Vishaal Kishore who was a former Deputy Secretary of the Victorian Department of Health.

The Cisco Networking Academy: delivering impact for over 25 years

Achieving Australia’s economic objectives will rely on the development of a technically skilled, digitally literate and industry-ready workforce. Training hubs are being established to complement the more than 100-plus Cisco Networking Academy sites already operating across the nation. Working in conjunction with higher education institutions, more than 200,000 students have completed courses, with various internships awarded each year. More importantly over 94% of those students secure a job after completing their course and the academy constantly refreshes its programs to ensure it is delivering the skills that are demanded by industry.

Figure 7. Cisco Networking Academy impact report



For every specialist technical role that is created in the digital economy, there are potentially multiples of ‘blue tech’ roles created. Blue tech (or digital trades) are technology-intensive jobs requiring vocational qualifications. Demand for these skills will be particularly acute in sectors that are growing as a result of technological change including healthcare, wholesale / retail, professional services and technology. Over the next 15 years, an additional 5.6 million new jobs could be added to the Australian economy and 25% of these new jobs will be technology-related roles.³ Cisco is working with partners in the vocational education sector including TasTAFE to grow blue tech skills in high priority fields such as cyber security.

3. The NIIN’s focus on Digital Technologies






NIIN’s role in accelerating development and adoption of technologies

The NIIN understands the importance of Digital technologies to Australia’s economy. The NIIN believes it is important to both identify and develop programs to improve adoption of digital technologies within Australian industry.

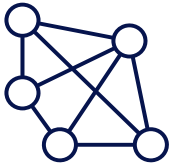
The NIIN recognises that digital technologies should be developed locally and adopted by Australian industry to create sovereign capability. Establishing sovereign capability will help companies move up the digital value chain and drive improved competitiveness and productivity. The NIIN’s network of research and innovation assets are uniquely placed to drive and accelerate adoption of technology across a range of verticals including health, education, transport, advanced manufacturing, mining and resources, and retail.

Perspective on Technologies that are a Major Focus for NIIN

NIIN members have a perspective on a number of discrete technologies that are critical to Australia’s competitiveness. These technologies are reflected in both the research and teaching programs of NIIN universities and the industry partners they work with. This section provides elaboration on five areas that are particularly critical to the work of the NIIN:

	Advanced Communications Networks	Advanced networks continue to evolve to support new digital services. Networks need to deal with exponential increases in data volumes, increased application and distributed compute complexity and more sophisticated and better resourced cyber attackers.
	Wireless technologies	There is significant convergence already occurring between 5G and WiFi6, with the potential for this to include 6G when and as that technology matures. Many examples and use cases use a combination of technologies including 5G and WiFi6.
	Cloud Native - Distributed Computing	The percentage of modern cloud-native applications within an enterprise will continue to grow. Most growth will stem from newer applications displacing legacy systems to deliver better velocity, availability and efficiency.
	AI and Machine Learning	AI and machine learning are critical in their own right but the convergence with other technologies (Internet of Things, edge computing, cyber security, cloud, advanced networks) is creating new frontiers of innovation.
	Cyber Security	Every sector is at risk from a cyber security perspective. While most risks are common to all sectors, some are more acute and difficult to manage in specific settings. Cyber attackers are becoming increasingly sophisticated in the use of encryption to disguise or hide threats.

The NIIN analysis of these five technologies reveals that while each is important in its own right, it is the convergence of these technologies that offers the biggest opportunity for Australia. Urgent action is required to ensure Australia capitalises on current momentum and areas of early adoption.



Advanced Communications Networks

Traditional networks are under intense pressure due to security, scalability and functional requirements. Urgent action is required to transition to networks that are software-defined, intent-based and automated with security embedded into the network fabric. Advanced networks underpin the delivery of all applications across every vertical. Despite their low profile (compared to other Digital technologies) they are a vital cog in the ongoing operation of Australia's economy.

Importance of this technology

Advanced networks continue to evolve to support new digital services. Networks need to deal with exponential increases in data volumes, increased application and distributed compute complexity and more sophisticated and better resourced cyber attackers.

Applications are becoming cloud native and will be built using serverless containers. The applications will be dispersed across global networks. There will be more 'advanced networks' in every flow.

Improved accuracy of future Net Zero strategies is dependent on leveraging the network to increase trustworthiness of sensors generating environmental data.

Major industry applications of the technology

All industry sectors can benefit from advanced networks, although some sectors have been earlier adopters:

- **Education:** A high proportion of Australian universities have deployed advanced networks to enable hybrid learning, student experience and collaborative research. The same networks (paired with IoT sensors) are also creating efficiencies through improved campus utilisation, reduced emissions and infrastructure optimisation.
- **Mining and resources:** Mining customers are converging their IT and OT networks, but legacy network designs and compartmentalised security approaches are making the transition challenging. Adoption of advanced networks that understand intent, are programmable and software-defined will assist. Adoption of industry-aware AI / ML will further improve operation and provided enhanced security.
- **Banking and Finance:** There has been a significant acceleration of digital transformation, including deployment of cloud services, digital banking, and virtual experts in the banking and finance sector. This is driving uptake of new intent-based networking solutions that enable banks and finance organisations to support new hybrid work models, deliver a seamless online customer experience, and simplify secure access to multi-cloud applications – while improving security, flexibility and operational efficiency of the network.
- **Retail:** Retailers increasingly need to compete on customer experience, which requires networking solutions that can scale with increasing traffic and enable IT teams to proactively address networking issues before they impact on customer conversion or retention.

Advanced networks will increasingly focus on Supply Chain Resiliency and provide enhanced visibility through the supply chain. These supply chains need to be secured for both IT and OT applications.

The future of advanced networks

- **Self-healing networks:** The future of connectivity is self-healing networks that can learn, predict, and plan. The NIIN, via its partner Cisco, is augmenting the network for the future, bringing together new predictive technologies with its broad portfolio of observability, visibility, and detection technology to improve reliability and performance across all operational scenarios. Predictive analytics engines will help IT teams prevent issues and elevate the user experience.
- **Quantum:** Quantum communication and quantum networks will enable the transmission of significantly higher amounts of data across large distances while ensuring that they are 'unhackable'. Using entanglement, interlinked qubits can be used to 'teleport' information while ensuring the complete security of the transmission.
- **Convergence of AI and networks:** Networks are becoming increasingly complex and future operation of all businesses will require a move to machine scale networks (programmable, scalable and automated).

What's needed to accelerate adoption of this technology

- Applied industry vertical research to de-risk the adoption of advanced networks in specific industries.
- Access to environments that mirror the industrial systems for prototyping and testing of applications.
- Analysis of global reference deployments and detailed case studies to assist industry adoption.
- Networking skills including degree / postgraduate skills, PhD and post-doc specialists and blue tech skills for technology-intensive roles requiring vocational qualifications.
- Collaborative environments including precincts where multinationals, SMEs, universities and technology providers can create ecosystems around critical technologies.

How NIIN can help accelerate adoption

- **Access to vendor technologies in advanced networking:** Utilising NIIN's foundation partner, Cisco, the latest advanced networking and future developments are available for industry and university to test, develop and conduct applied research. Cisco's \$6.8B in R&D investment is accessible via the NIIN and its innovation centres.
- **Development of Industry Test Environments:** The NIIN has built six innovation centres whose network deployments are used by industry (tier 1 / 2 / 3) to develop and test industry solutions. Deployment of these technologies is particularly valuable when underpinning industry-led precincts.
- **Development of Autonomous and Zero Touch Configuration:** The Cisco-Curtin Centre for Networks is developing the necessary AI/ML skills and solutions to enable autonomous and zero touch configuration of advanced networks. This will simplify the design and operation of advanced networks and enable use cases such as self-healing.
- **Cisco Networking Academy:** Cisco trained more than 200,000 students in Australia in advanced networking skills, including CCNA and CCNP.
- **Leadership in Smart Zero:** The Centre for Networks led development of a first-of-its-kind study of the convergence of digital and decarbonisation. The study highlights the role advanced networks will play in helping to automate and secure the measurement, monitoring and reporting related to Net Zero and how it will help organisations avoid emissions. The NIIN's members Cisco and Curtin University are leveraging Curtin's advanced SDA network to automate and validate IoT data related to environmental emissions.
- **Capability in quantum network security and computing:** The Centre for Networks is a world-leader in developing technologies for dynamic quantum networks (utilising standard installed telecom infrastructure). The centre is building a dynamic quantum network test-bed suitable for field trials with the aim to be operational by the end of 2023.

Case study

Improving undercover cropping and advanced manufacturing

Description

The Cann Group and La Trobe Innovation Central Melbourne partnered on training neural networks to detect disease and low yield as well as predict potential manufacturing faults. This involved using drones to capture hyper spectral images for immediate AI processing using hardware accelerators that teach neural networks to recognise problems early.

Industry Challenge

Detect disease and low yield in crops, and close the knowledge gaps between genotype and phenotype to make higher quality products.

Outcomes

Boosted the quality and productivity of growing seeds through advanced data analytics and visualisation techniques.

- Cann Group Limited
- LaTrobe University
- Cisco





Wireless Technologies (5G, 6G and WiFi)

Wireless networks are critical for personal, corporate and industrial use. The evolution of 5G and WiFi (particularly WiFi6) is creating a step change improvement to performance and transforming entire industries. Once considered an augmentation to fixed networks, these technologies are now used for complex, mission critical applications. Changes to licensed and un-licensed spectrum will unlock new business and operating models and help organisations meet future needs. A focus on sustainability and efficient power usage are creating new challenges.

Importance of this technology

Open Roaming will ensure the importance of WiFi by simplifying the process for authenticating corporate and personal use.

5G represents a step change in performance from 4G, and some advantages over WiFi in specific environments and applications:

- Peak data rates (from 1Gbps to 10 Gbps)
- Data bandwidth (from 2Mbps to 1Gbps)
- Reduced latency (from 10 ms to <1 ms radio)
- Connection density (from 1,000/Km² 1000000/ Km²)

New Area Wide spectrum allocation will enable industry to deploy thousands of small 5G non-public networks to meet the need for industrial applications. Factories will be able to lease spectrum from the ACMA to deploy their own 5G network.

Major industry applications of the technology

There is significant convergence already occurring between 5G and WiFi6, with the potential for this to include 6G when and as that technology matures. While the commentary below focuses on 5G and its application, the reality is that many of these examples and use cases use a combination of technologies including 5G and WiFi6.

- **Advanced manufacturing:** Global manufacturers – such as Ford, Volkswagen, Audi, Konecranes and Bosch – are trialling 5G use cases. Ford is testing the use of 5G through virtual reality, to allow Autonomous Guided Vehicles (AGV) to move component parts across the factory. Major use cases include predictive maintenance, collaborative robots and production system monitoring
- **Mining:** Mining companies have been early adopters of 4G and WiFi mesh networks. These networks have supported a wider range of autonomous vehicles operating in separated areas on the mine site. Future evolution of 5G and WiFi will enhance the services on the mine and provide additional options for commercial deployments.
- **Agriculture and food:** 5G will support more efficient agriculture operations, including enabling crop surveillance, by transmitting high-quality video data from drones in real time, powering autonomous farming vehicles with automated collision avoidance and enabling real-time insights to be gathered from massive-scale IoT deployments.
- **Health:** 5G will support more connected healthcare including enabling high-bandwidth remote imaging, supporting high-speed data transfers for health field operations and asset tracking for medical equipment.
- **Supply chain and logistics:** 5G will support more efficient supply chain operations including enabling the movement and integrity of goods to be tracked throughout the supply chain, powering autonomous delivery of goods and supporting route optimisation capabilities that reduce transportation time.
- **Smart cities:** 5G will support more environmentally sustainable cities including enabling data from sensors to be aggregated for automated emissions monitoring and powering smart grids.

The Future of WiFi, 5G (and 6G)

- Non-public 5G deployments for intra-site environments that demand high bandwidth, high resilience and low latency.
- Convergence of WiFi and 5G to manage information technology and operational technology networks.
- Increased development and deployment of Open Radio Access Network (ORAN) that allows interoperation between cellular network equipment provided by different vendors.
- Variance of 6G standards and adoption of different approaches across specific regions.
- Continued 6G development including improved network performance, adoption of new frequency bands (i.e. Terahertz Communications), integration of multiple new technologies (e.g. Non-Terrestrial Networks) and continued decentralisation with end-to-end AI distributed throughout the network.
- Advanced optical communications that become a backbone network technology for 5G and 6G backhaul and provide the required bandwidth and latency KPIs for those technologies.

What's needed to accelerate adoption of this technology

- Applied research to de-risk the convergence of 5G and WiFi6 including focused work on mobile edge computing to support use cases that utilise robots such as smart manufacturing and robotic manufacturing lines.
- Access to low-risk environments for prototyping and testing of industrial 5G-enabled applications.
 - Analysis of global reference deployments in advance of 5G spectrum being made available in Australia, with a particular focus on advanced manufacturing (Europe and the US).
 - Precincts where multinationals, SMEs, universities and technology providers can collaborate on 5G and converged WiFi network solutions.
 - Representation from Australia at international standards bodies (e.g. 3GPP) to ensure Australian industry are adopting technologies that are likely to be included in any future standardisation (as well as having engineers skilled in supporting these standards).

How NIIN can help accelerate adoption

- **The Centre for Networks:** The centre is a world leader in future telecom networks with significant research activities in ultra-low latency and high bandwidth autonomous networks based on 5G and 6G technologies, as well as mobile edge computing for supporting use cases that utilise Robots such as smart manufacturing and robotic manufacturing lines. The C4N is led by Professor Reza Nejabati, who is a world leader in future design of telecommunications networks. The Centre also benefits from a state-of-the-art 5G and edge computing test-bed supporting use cases that require advanced ML and AI algorithms such as remotely operated robots.
- **5G test lab at La Trobe University:** La Trobe University and Optus have collectively invested \$6.8M to develop a 5G Ideation Lab within La Trobe's Digital Innovation Hub. There are plans to extend the lab through deployment of non-public 5G to create a 5G industry platform where industry can explore and test new 5G applications in real-world conditions.
- **A national network of innovation centres:** The NIIN's network of innovation centres provide an environment for exploring 5G applications in collaboration with university researchers and students. The innovation centres bring a proven methodology for ideating, developing and testing digital innovations in real-world field environments. The co-location of La Trobe's 5G test lab and Innovation Central Melbourne (based at La Trobe University) provides further amplification of 5G innovation capability.
- **Cisco Networking Academy:** Cisco trains has trained over 200,000 students in Australia in advanced networking skills including in wireless technology such as wireless LAN design and mobility applications.
- **Line Zero - Factory of the Future:** Line Zero - Factory of the Future at the Tonsley Innovation District in Adelaide is an industrial-scale sandpit for manufacturers, researchers and an ecosystem of large and small firms. The facility - which is built on a scalable communications platform including WiFi6, 5G and LoRaWAN - is fully digitised, creating a test bed environment for the development of innovative manufacturing processes, systems, applications and products.

Case study

Enhancing Telehealth

Description

The Victorian Virtual ED (a Northern Health Initiative) and La Trobe Innovation Central Melbourne partnered on using augmented reality, collaborative technologies and machine learning to drive a better telehealth experience with a focus on improving:

- Virtual triage for emergency departments
- Remote monitoring
- Nursing handover notes
- Residential aged care
- E-Family mental health

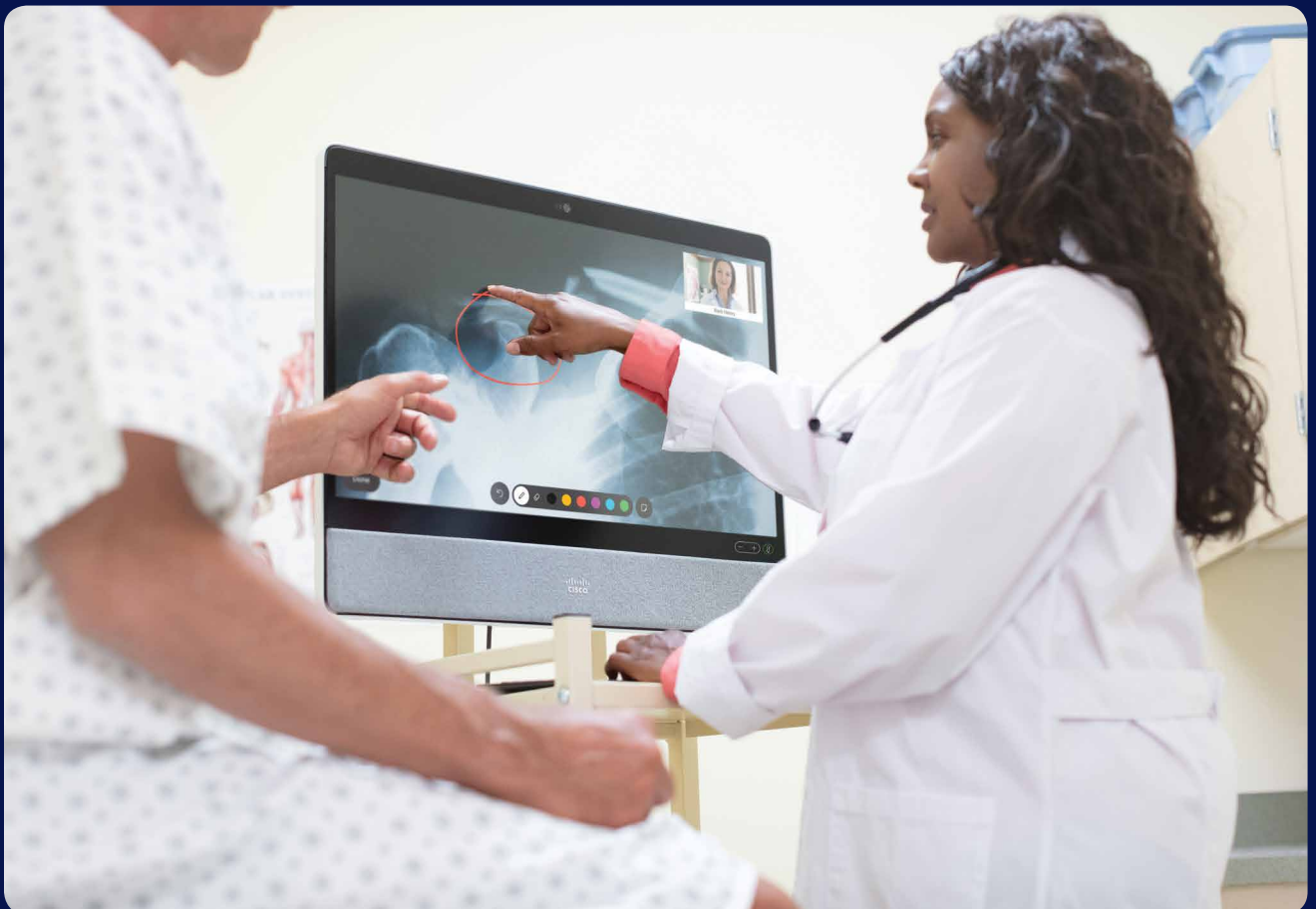
Industry Challenge

As uptake of telehealth technology grows, there is demand for new solutions that deliver a more seamless connected experience for patients and healthcare professionals alike.

Outcomes

Since October 2020, the Victorian Virtual ED has supported more than 28,000 patients and achieved an emergency department diversion of around 71%

- Victorian Virtual Emergency Department
- LaTrobe University
- Queensland University of Technology
- Cisco





Cloud Native – Distributed Computing

The pace of change related to distributed and cloud computing continues to accelerate. The way modern applications are built, deployed and operated is being radically transformed from monolithic developments into microservices and serverless. This will ease development, lifecycle management, increase the velocity of features, and improve the availability of the services offered. The design of cloud and edge computing will evolve to deliver real time analytics generated by AI/ML engines as companies look for benefits such as speed of deployment, commercial and operational agility and security.

Importance of this technology

The number of Enterprise applications will continue to rise and grow – 50% in 2 years from 2019–2021.⁴

- Monolithic applications will be replaced by applications built using containers and serverless architectures.
- Applications will be distributed across national and international networks connected via advanced networks.
- Visibility of application performance across heterogeneous networks will become critical.
- New approaches will allow organisations to use the same application platform architecture to power the entire development and software portfolio.

Major industry applications of the technology

The percentage of modern cloud-native applications within an enterprise will continue to grow. Most growth will stem from newer applications displacing legacy systems to deliver better velocity, availability and efficiency. These newer applications will be born cloud-native, as either microservices or serverless apps. Existing applications and capabilities will be re-architected as cloud-native, dropping the percentage of monolithic bare-metal and virtual machines apps steadily over the next few years.

- **Advanced manufacturing:** In manufacturing, cloud and edge computing will enable digitisation of the entire manufacturing value chain – from merging product planning and development information into supply chain data, to monitoring production across multiple factories in real-time.
- **Health:** Cloud-based solutions are helping the healthcare industry store massive datasets for EHR (Electronic Health Records) and radiology images, analyse and monitor data related to diagnosis and treatment of different diseases at scale, and power more flexible and hybrid work with on-demand access to computing resources.
- **Supply chain and logistics:** Cloud is powering more interconnected, intelligent and automated supply chains and enabling supply chain operators to scale up and down operations at a speed that was previously unthinkable. Cloud supports digital transformation at every stage of the supply chain journey from planning to procurement, fulfilment and customer service.

The future of distributed (cloud, edge) computing

- The future will see the continued convergence of traditional cloud computing / AI with edge computing / AI.
- Real-time insights into application use and performance, as well as network telemetry, will provide better visibility into systems so that performance can be optimised. These systems will be increasingly dependent on AI / ML to provide performance at machine scale. Industry specific application data on bespoke networks will also benefit from AI / ML.
- Collection and analysis of the application and networking telemetry will be used to improve data analytics – from descriptive analytics through to diagnostic, predictive and prescriptive analytics.

What's needed to accelerate adoption of this technology

- Analytics – industry specific environments to collect, analyse and develop new insight.
- Applied research related to the distribution of industry applications across hybrid cloud.
- Access to industrial low-risk environments for prototyping and testing of cloud and edge computing applications.
- Stronger cyber security protections for cloud and edge computing platforms.
- Precincts where multinationals, SMEs, universities and technology providers can collaborate on the development of new applications leveraging a hybrid cloud with rich analytics tools.

How NIIN can help accelerate adoption

- **Cisco-Curtin Centre for Networks:** The centre has a major research focus on zero down time and near zero latency mobile edge computing for time and bandwidth critical mobile applications.
- **Technology leadership from industry partners:** Cisco and its industry partners are global leaders in cloud and network management systems. Major areas of expertise include cloud management and operations, collaboration and unified communications management, and internet and cloud intelligence.
- **A national network of innovation centres:** The NIIN's network of innovation centres provide an environment for exploring cloud and edge computing applications in collaboration with university researchers and students. The innovation centres bring a proven methodology for ideating, developing and testing digital innovations in real-world field environments. Deployment of IoT technologies that rely on cloud and edge computing capabilities is a major area of focus for NIIN's innovation centres and has been supported in the past through partnership with CSIRO's Data61, which contributes domain expertise in cloud analytics and platform services.

Case study

Proactive Asset Management using industrial IoT and remote diagnostics to reduce plant downtime

Description

Alcoa and Curtin University partnered on an initiative to reduce plant downtime by enabling a more proactive approach to asset maintenance. The approach involved leveraging Azure Sphere for industrial IoT and remote diagnostics of sensors to detect faults in process variable readings.

Industry Challenge

Asset maintenance is typically reactive due to failure or predictable via regular shutdowns regardless of whether it is needed. Significant amounts of IoT data are generated in field assets that are not effectively mined to assist with predictive failure.

Outcomes

Early field trials are currently in place. It is expected that the initiative will enable significant cost savings by reducing unplanned maintenance and downtime.

- ALCOA
- Curtin University
- Cisco





AI and Machine Learning

AI/ML will transform all aspects of application development, network operation, and supply chains. In short – AI/ML will transform how society operates. Australia must urgently invest in all areas of development including those related to industrial applications and networking.

Importance of this technology

AI and machine learning are important in their own right but it is their convergence with other technologies (Internet of Things, edge computing, cyber security, cloud, advanced networks) that is creating new frontiers of innovation. As AI / ML become more sophisticated, new knowledge will be created at an explosive rate, supplementing decision-making by leveraging deep data domains.

Major industry applications of the technology

- **Advanced manufacturing:** The convergence of AI, IoT and robotics is enabling new applications in advanced manufacturing. For instance, manufacturers are able to reduce production downtime with predictive maintenance that uses machine learning to monitor equipment and make predictions about potential failures in real-time.
- **Health:** Through the convergence of machine learning, real-time data visualisation and communications technologies, a telehealth system could be implemented that provides predictive analytics to patients recovering at home where the home is configured to make remote consultations and assessments more effective and faster.
- **Transport:** Machine learning is enabling digital transformation of transport including traffic flow forecasting, congestion management, pot hole detection / predictive maintenance, air quality mapping, parking availability prediction, traffic monitoring, public transport scheduling, roadside maintenance scheduling, and mobility-based energy modelling. Machine learning is also powering new intelligent transport networks that enable capacity to be managed in real-time through predictive analytics on network usage. An

intelligent transport network, for example, can help enable mass transit systems to respond to surges in demand such as if a sports match finishes early.

- **Education:** Integration of AI is enabling a new level of personalisation in learning. AI has the potential to personalise tutoring to the learning styles and preferences of individual students. Smart content can pace instruction to individual students' speeds while AI-assisted grading can assess assignments instantaneously, providing students with personalised feedback on how they can improve.
- **Social and affordable housing:** AI can deliver powerful insights and model multiple 'what if' scenarios, predicting impacts on both financial and social factors. For example, AI has significant potential to help housing organisations identify applicants who are most in need of urgent housing, as well as allow for provision of targeted support to prevent rent arrears.
- **Justice and public safety:** AI can help to reduce overcrowding in prisons by leveraging data to reveal offenders who are more or less likely to commit crimes again. Those who are revealed to be of limited risk to the community can be offered alternative sentencing outside of the prison system.

The future of distributed (cloud, edge) computing

- Quantum AI systems will be able to process large amounts of information more quickly and accurately.
- **Edge AI:** A new paradigm for processing AI workflows away from centralised data centres (the cloud) and on devices that are closer to physical devices / sensors (the edge).
- **Explainable AI:** A set of processes and methods that allows human users to comprehend and trust the results and output created by AI models. AI explainability also helps an organisation adopt a responsible approach to AI development.
- **Responsible and Trustworthy AI:** The practice of designing, developing and deploying AI with good intentions to empower employees and businesses, and fairly impact customers and society – allowing companies to engage trust and scale AI with confidence.

What's needed to accelerate adoption of this technology

- Applied research focused on providing real-world benefits and impact of AI in health, biomedicine, law, critical infrastructures and defence.
- Applied research focused on facilitating trustworthy AI and IoT based inference and predictive analytics models that are efficient for multiple prediction tasks.
- Access to low-risk environments for prototyping and testing of AI innovations that power OT and hardware such as autonomous vehicles.
- Precincts where multinationals, SMEs, universities and technology providers can collaborate on AI and machine learning solutions.

How NIIN can help accelerate adoption

- **Cisco-La Trobe Centre for AI and IoT:** The centre specialises in exploiting synergy between AI and IoT technologies (e.g. federated learning, edge AI, on-device AI). The Centre is led by Cisco's Chair of AI and IoT Professor Wei Xiang who is a world-leading expert in AI and IoT and was responsible for establishing Australia's first IoT engineering honours degree program that is fully accredited by Engineers Australia. The centre represents La Trobe University in the SmartSat CRC and manages the CRC's cohort of 73+ PhD students.
- **Digital Transport Research Chair at UNSW:** UNSW is a leader in the development of Artificial Intelligence (AI), Machine Learning (ML), and Data Science (DS) and is home of the world-leading algorithmic decision theory group, led by the only Laureate Fellowship in the country dedicated to Trustworthy AI research (ARC Laureate Fellow Professor Toby Walsh). It also has a depth of expertise in robotics and AI, such as Professor Flora Salim, Cisco Chair of Digital Transport, with novel and state-of-the-art research in AI and machine learning for time-series, spatio-temporal data, mobility, transportation, and human behaviour at scale. UNSW has recently launched the UNSW AI Institute to support the activities of more than 300 academic members of the institute.
- **A national network of innovation centres:** The NIIN's network of innovation centres provide an environment for exploring AI applications in collaboration with university researchers and students. The innovation centres bring a proven methodology for ideating, developing and testing digital innovations in real-world field environments. The co-location of the Cisco-La Trobe Centre for AI and IoT and Innovation Central Melbourne (based at La Trobe University) further amplifies AI innovation capability.

Case study

Reducing congestion and creating safer communities

Description

Transport for NSW and Cisco partnered to transform the future of transport. Utilising innovative world-leading technology, the NIIN's Innovation Centre in Sydney developed proof of concept solutions for real time condition reporting across buses, ferries, and light rail vehicles to provide real-time visibility into impending issues and enable data-driven decision making.

Industry Challenge

Reducing customer impact and potential congestion from service failure while ensuring cost-effective communication solutions and ensuring it can scale to meet the demands of the NSW transport infrastructure.

Outcomes

Discovered new insights into asset performance and customer behaviour through sensor fusion while reducing overall mobile broadband data costs by filtering non-interesting data at the edge and using condition-based monitoring to trigger events.

- Transport for NSW
- University of NSW Sydney
- Cisco





Cyber security

Threat actors are becoming better coordinated and better armed. Adversaries increasingly use automation to attack, and it's only a matter of time until AI is used in cyber warfare. Cyber security is critical to enabling organisations to defend against threats and safeguard the most vital aspects of their organisations. It protects industry, individual and government data and building trust in critical digital systems. Trust and confidence in cyber systems allows swifter innovation and accelerates the pace of technology uptake.

Importance of this technology

- Every sector is at risk from a cyber security perspective. While most risks are common to all sectors, some are more acute and difficult to manage in specific settings.
- OT systems are being connected to IT infrastructure and indirectly often to the internet, creating a large and more complex attack surface
- Cyber attackers are becoming increasingly sophisticated in the use of encryption to disguise or hide threats

Major industry applications of the technology

- **Communications:** The importance of communications infrastructure – and the surface area for cyber attacks – grew during the COVID-19 pandemic as more people worked remotely. Any disruption to fixed, 4G, 5G and satellite communications technologies would have profound consequences on Australia's economy, as well as citizens' health and safety.
- **Defence:** The Defence ecosystem is more interconnected and complex than at any time in the past. This interconnectedness creates strategic and operational benefits but also creates risks including an even larger attack surface. Attackers are becoming better equipped and capable of engaging in and sustaining machine-scale cyber warfare by using AI and ML to take the war in cyber space from human to machine scale.
- **Energy:** The energy sector is becoming increasingly digitised and now operates vast networks of OT which, if compromised, can result in significant physical disruption and/or destruction. Attacks have been reported in global news recently, such as the cyber-attack that forced US-based Colonial Pipeline Co. to shut down pipeline operations for six days. During that time, the average national cost of fuel rose to its highest level in over six years.
- **Health:** Healthcare organisations are particularly vulnerable and targeted by cyber attackers because they possess high monetary and intelligence value information. This includes patients' protected health information, financial information and intellectual property related to medical research and innovation.
- **Transport:** Transport networks have become increasingly digitised, with a wide range of data flowing across systems. As more devices and control systems are connected online, more vulnerabilities will appear, increasing the potential for devastating impacts – including potential for loss of life.

The future of distributed (cloud, edge) computing

- Zero Trust architectures are being widely adopted particularly in the most secure environments (e.g. Defence) to allow organisations to mitigate, detect and respond to risks in their environment. This includes alignment to government-based Zero Trust frameworks e.g. CISA ZT Maturity Model.
- Identity and networks are the foundations of digital trust and the core technology platform for sustained cyber resilience. The data network will increasingly become the first line of defence against cyber aggressors.
- Automated diagnostic tools and intervention mechanisms will increase the scale, accuracy and agility with which organisations can respond to cyber attacks.
- Entire supply chains – not just the organisation – will need to be secured through visibility and management of the entire supply chain including third- and fourth-party risks.

What's needed to accelerate adoption of this technology

- More mature and resilient infrastructure that is architected to be secure by default, leveraging infrastructure maturity assessments.
- Improved cyber security literacy at an organisation-wide level including a mindset shift where cyber security is considered everyone's responsibility, not just the responsibility of the CIO or Chief Information Security Officer (CISO).
- Applied research focused on the use of intent-based networks that respond to – and prevent – attacks, supply chain security, and security of OT / edge devices.
- Skills including advanced technical capability and blue tech skills (tech-intensive skills requiring vocational qualifications).
- Applied research focused on building resilient architectures.
- Access to low-risk environments for prototyping and testing of cyber secure innovations that are needed for IT and OT systems.
- Precincts where multinationals, SMEs, universities and technology providers can collaborate on cyber security.

How NIIN can help accelerate adoption

- **Cisco-Curtin Centre for Network – Quantum Security:** Prof. Reza Nejabati, Cisco's Future Networks Research Chair, is a leading expert in quantum and the Centre will focus on a range of quantum technologies including quantum security.
- **Digital Health Research Chair with specialisation in cyber security:** Cisco's Digital Health Research Chair, Professor Trish Williams, is a leading expert in the intersection of digital health and cybersecurity. Prof Williams' work has included remodeling of the Infrastructure Maturity Assessment (IMA) used to benchmark hospitals in Australia (which has been adopted by HIMSS in the US) and the creation of Safe Wi-Fi for hospitals.
- **Cisco Networking Academy:** Cisco has trained over 200,000 students in Australia in advanced networking skills including specialist qualifications in cyber security
- **Technology leadership from industry partners:** Cisco and its industry partners are global leaders in cyber security. Cisco's own cyber threat intelligence organisation, Talos, in conjunction with Cisco CSIRT and Cisco IT, blocks billions of cyber threats a day within its own network and can enable organisations to undertake continuous threat modelling at machine scale.
- **Australian Cyber Collaboration Centre (A3C):** A3C assists businesses to understand and navigate the cyber ecosystem to address their specific cyber needs. A3C is a central connection point for businesses looking to improve their cyber resilience by identifying and prioritising cyber vulnerabilities, providing and facilitating rigorous testing of hardware and software, and providing world-class cyber training to upskill and increase the pool of cyber talent.
- **QUT Centre for Future Enterprise (CFE):** CFE leads global research into trusted retail and logistics to help brands and logistics providers unlock consumer trust and provide new and unique secure, technology-driven retail experiences. The research focuses on the convergence of retail, supply chain, consumer behaviour and engagement, data privacy and cyber security. Through Innovation Central Brisbane, CFE provides opportunities for brands to prototype and commercialise trusted retail and logistics applications.

Case study

Synchronising occupancy and utilisation in corporate real estate

Description

Gartner and La Trobe Innovation Central Melbourne partnered on a pilot initiative that will transform the way corporate real estate is managed. The initiative uses AI and machine learning to measure occupancy and utilisation in corporate real estate using existing Cisco infrastructure, with the goal of reducing unnecessary energy usage.

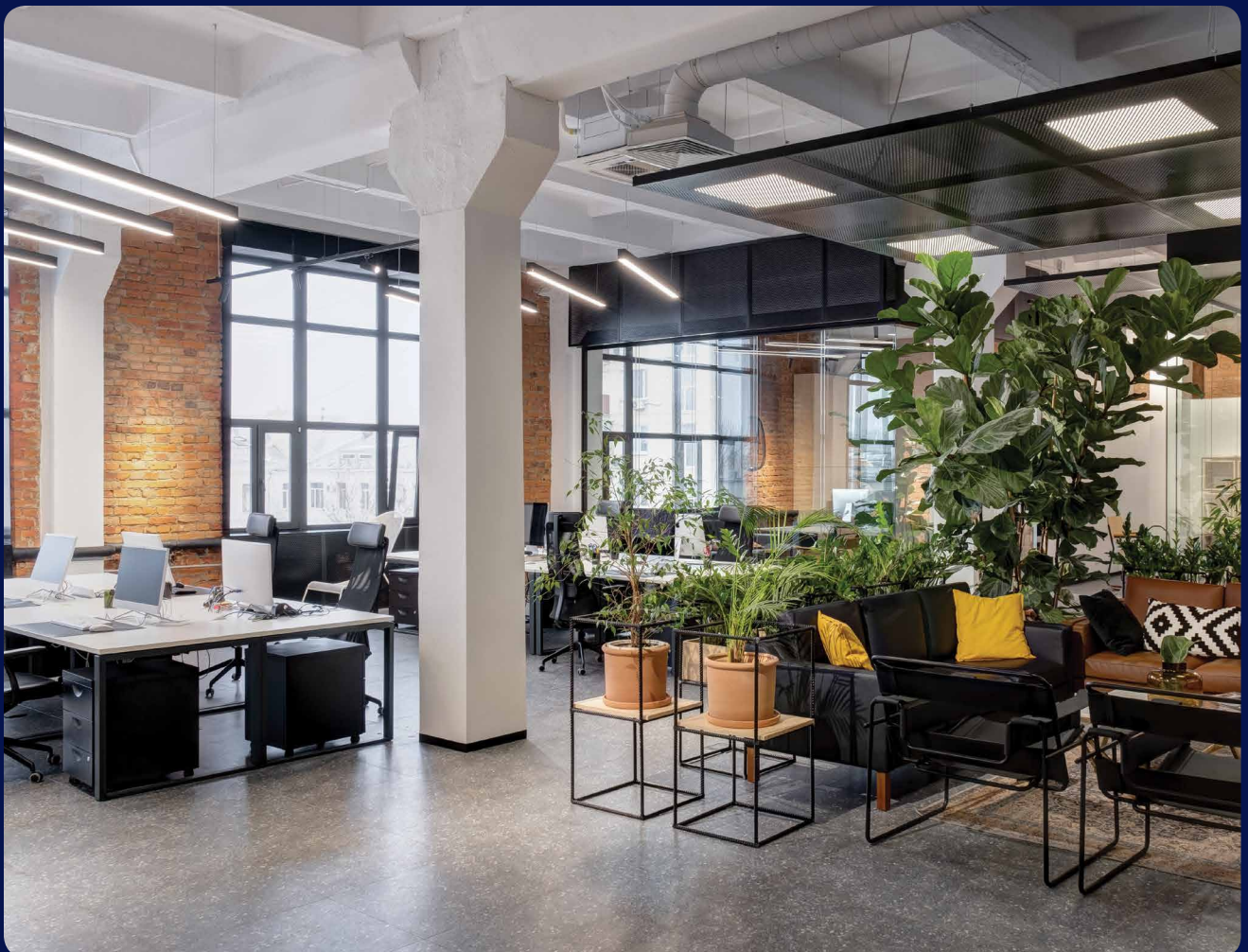
Industry Challenge

There is pressure to change the ways workplaces are used to create measurable cost savings and reduce GHG emissions.

Outcomes

Realised cost savings on energy usage and enabled executive decisions to be made on improved workplace design based on advanced data analytics and visualisation.

- LaTrobe University
- Queensland University of Technology
- Cisco



6. Taking it forward

The NIIN's ambition is to continue to evolve by expanding its network of research partners, building partnerships with organisations who have reach into SMEs and attracting medium to long-term funding aligned with National priorities and Sovereign Capability.

As part of its expansion and continued evolution, the NIIN is committed to helping government accelerate adoption of digital technologies. The NIIN's ecosystem-based approach provides broad coverage of digital technologies as well as deep industry relationships across every major city and geographic area of Australia.

The NIIN welcomes the opportunity to partner with industry and government on:

- **Helping government and industry understand where technologies offer greatest benefit to Australia:** There is a major opportunity to prioritise technologies based on their potential benefits to Australia's economy and society. Such a prioritisation can help to drive research into areas of highest value for Australia.
- **Articulating how technologies (and the convergence of those technologies) is progressing elsewhere:** Understanding how digital technologies have been adopted and applied in other jurisdictions such as the US, Singapore, Germany, the UK and South Korea can help reveal important lessons that will accelerate uptake in Australia.
- **Rapid prototyping, testing and validation of digital technologies in target industry verticals:** The NIIN is uniquely placed to use its network of R&D infrastructure to apply technologies to industry problems in high-priority verticals such as advanced manufacturing, transport, resources, defence, health and education.
- **Helping to model the economic and strategic benefits of early industry adoption:** Research into the economic impact of accelerated adoption of digital technologies.
- **Digital skills development:** Identifying and responding to skills shortages including specialist technical skills and blue-tech skills (technology-intensive jobs based on vocational qualifications).
- **Strengthening global collaboration:** leveraging Cisco and the broader NIIN's global networks including supply chain partners, customers and international collaborators to create strengthen overseas linkages.

About the Centre for Networks

The Centre for Networks is a global centre of excellence in intent-based networking. The Centre leverages the Cisco Digital Network Architecture (Cisco DNA) for applied, experimental and blue-sky research in fundamental topics for building network infrastructure for the future internet.

The academic research focus includes autonomous networks, beyond 5G, intent-based networking and quantum internet. Industrial research is around the needs of industry with a focus on 5G, health, mining, education and defence.

Sponsors in the Curtin-Cisco Centre for Networks



Prof. Reza Nejabati

Visiting Professor, Curtin University, WA, Professor, University of Bristol, UK

The Centre is chaired by Professor Reza Nejabati. Professor Nejabati is internationally recognised in the fields of Autonomous and Intent Based Networks as well as Quantum Networks. He received the prestigious IEEE Charles Kao Award in 2016 and has made important contributions in 5G, Smart City, Quantum Communication, and Future Internet Experimentation.



Carl Solder

Chief Technology Officer, Cisco Australia

Carl Solder is the Chief Technology Officer for Australia & New Zealand. Prior to this role, Carl was Cisco's vice president of engineering for the enterprise networking and cloud engineering organisation at Cisco's headquarters in San Jose, California. He held various roles in San Jose over 14 years.

The NIIN would like to acknowledge the input of other Cisco Research Chairs



Prof. Wei Xiang

AI and IoT
La Trobe University, VIC

Professor of AI and IoT and Director of the Cisco-La Trobe Centre for AI and IoT, based at La Trobe's Bundoora's campus. Wei is engaged with Innovation Central Melbourne and focuses on the development of R&D Strengths around AI, IoT, data analytics, computer vision, and 5G/6G.



Prof. Trish Williams

Digital Health
Flinders University, SA

Professor in Digital Health Systems at Flinders University in South Australia. Co-Director of the Flinders Digital Health Research Centre and Director of the Cisco-Flinders Digital Health Design Lab. Engaged with developing the Innovation Central Adelaide.



Prof. Flora Salim

Digital Transport
University of New South Wales, NSW

A thought leader in digitisation of transport, based at Innovation Central Sydney. Focus areas include congestion management, safety critical systems, mobility as a service, automation, and predictive services.



Prof. Michael Rosemann

Trust, Retail & Logistics
Queensland University of Technology, QLD

A thought leader in trust, trust management and trust establishment across retail and logistics, based at Innovation Central Brisbane. Research brings together and covers areas such as advanced manufacturing, retail trust, consumer engagement, security and sustainability.



A/Prof Kumudu Munasinghe

Defence and Critical Infrastructure
University of Canberra, ACT

A Thought leader in Next Generation Mobile and Wireless Networks, Internet of Things, Green Communications and Cyber Security. Head of School - IT Systems, Associate Professor in Network Engineering, and leader of the IoT Research Group at the University of Canberra.

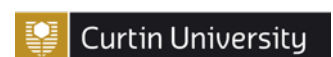
Acknowledgements

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Learn more about NIIN at cisco.com/au/niin



Cisco-Curtin Centre for Networks