



Digital Infrastructure for The Smart Nation

HARNESSING INTERCONNECTION TO POWER SINGAPORE'S DIGITAL ECONOMY

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Executive Summary

Singapore is deeply invested in becoming the trusted node in Asia for digital business, digital innovation and digital talent.

This is backed by a robust Smart Nation vision that aims to engender digital transformation and innovation primarily across five key domains - Health, Transport, Urban Solutions, Finance, and Education. Smart Nation best practices require an integration of data from disparate agencies and a seamless digital engagement between all key stakeholders.

Achieving Singapore's Smart Nation vision requires an interconnected digital infrastructure. The power of interconnection enables the breaking down of silos within and between government agencies, allowing interagency and interdepartmental collaboration on a scale that has not yet been seen. From a technology perspective, there has been a realisation that shifting non-mission critical data and workloads to a hosted private cloud is insufficient for the scalability required for the innovations that lie

ahead. This has led to a shift of focus to hybrid, multi-cloud environments. The Singapore Government is accelerating this shift to cloud by adopting a cloud first approach and actively encouraging agencies to move the majority of workloads to the cloud. To support such a move however requires an interconnection platform that offers connectivity to an ecosystem of partners and services, ultimately needed for agency-wide digital transformation. This offers agencies access to the best resources, a platform for innovation, and high-quality services.

Agencies face technology challenges which need to be overcome. These challenges typically include migrating legacy systems customised over many years to a hybrid cloud model, a lack of technology skills to enable the shift to the cloud, a siloed approach to business, and strict security and compliance requirements. Against this background, this whitepaper discusses the implications of Singapore's Smart Nation vision for public sector agencies and how they will have to leverage the best interconnection capabilities to boost performance and drive innovation.





| Singapore's Smart Nation Vision

Singapore's Smart Nation vision was first announced by Prime Minister Lee Hsien Loong in 2014. He stated that the aim is to make Singapore an “outstanding place for people to live, work and play in, where the human spirit flourishes.”

Singapore has a population of 5.6 million and land area of 718 square kilometres, making it a very densely populated nation. It is essential for Singapore to fully leverage technology for its economic competitiveness as well as for its quality of life. Globally, governments are recognising the benefits of technology-driven Smart City initiatives to meet the needs of more densely populated, more diverse and growing urban populations.

Singapore is widely considered to be a Smart City leader, having embarked on a large-scale government effort to resolve complex urban policy issues and foster technology-led innovation. The initial focus of the eGovernment or Smart City initiatives was on efficiency in service delivery. The Smart Nation initiatives have since broadened in scope and vision with the aim to drive a complete digital transformation of Singapore. This involves a ‘whole-of-government’ approach to digitalising multiple aspects of the ways in which Singapore residents live, work, study, and play. These

approaches involve collaboration with multiple stakeholders including private technology companies and educational institutions.

Examples of early success of this collaborative approach can be seen today - such as the Moments of Life mobile app that supports citizens' needs at key junctures by simplifying and bundling a suite of services and information into one single platform. The app has been consistently expanding and key features of the app have been developed for families with children aged 6 and below, job seekers and senior citizens. A more recent example is how the country was able to scale its existing citizen engagement solutions - the Command, Control and Communication (C3) system provided the right platform for cross-agency coordination and a unified channel for all COVID-19 related information for citizens.

Achieving its Smart Nation vision requires Singapore public sector agencies to adopt and access the most agile and flexible technology - using it fully to digitally transform large swathes of economic and social activity.





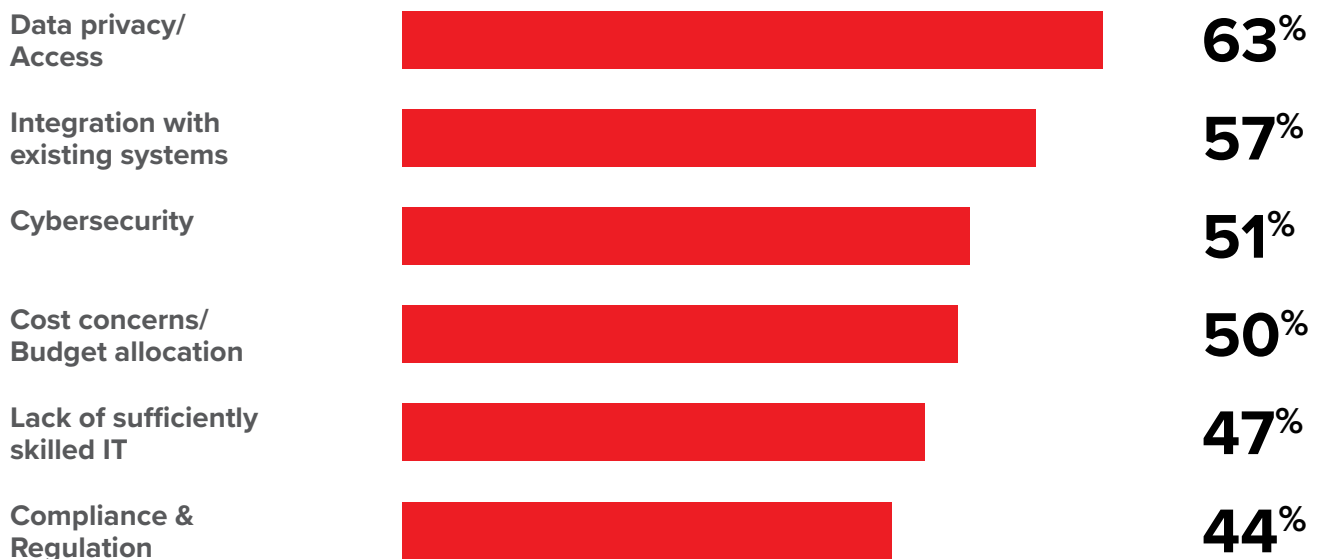
Implications of Smart Nation Vision for Public Sector Agencies

Facilitating widespread digital transformation in Singapore means that agencies need to shift their workloads to the cloud and continue to focus on citizen experience. Smart Nation initiatives rely on the agility and flexibility that only cloud computing can offer. Public sector agencies are being encouraged to adopt a cloud first approach and shift the majority of their workloads to Government Commercial Cloud (GCC) by 2023. The focus has shifted from a hosted private approach to a hybrid, multi-cloud

architecture, using cloud federation, and a multi-cloud management system, which can be used with other clouds, including existing on-premises government data centres.

Ecosystem research shows that data privacy, integration with existing systems and cybersecurity are leading challenges to technology adoption for public sector organisations in Singapore (Figure 1).

FIGURE 1:
Leading Challenges to Technology Adoption -
Public Sector Organisations in Singapore

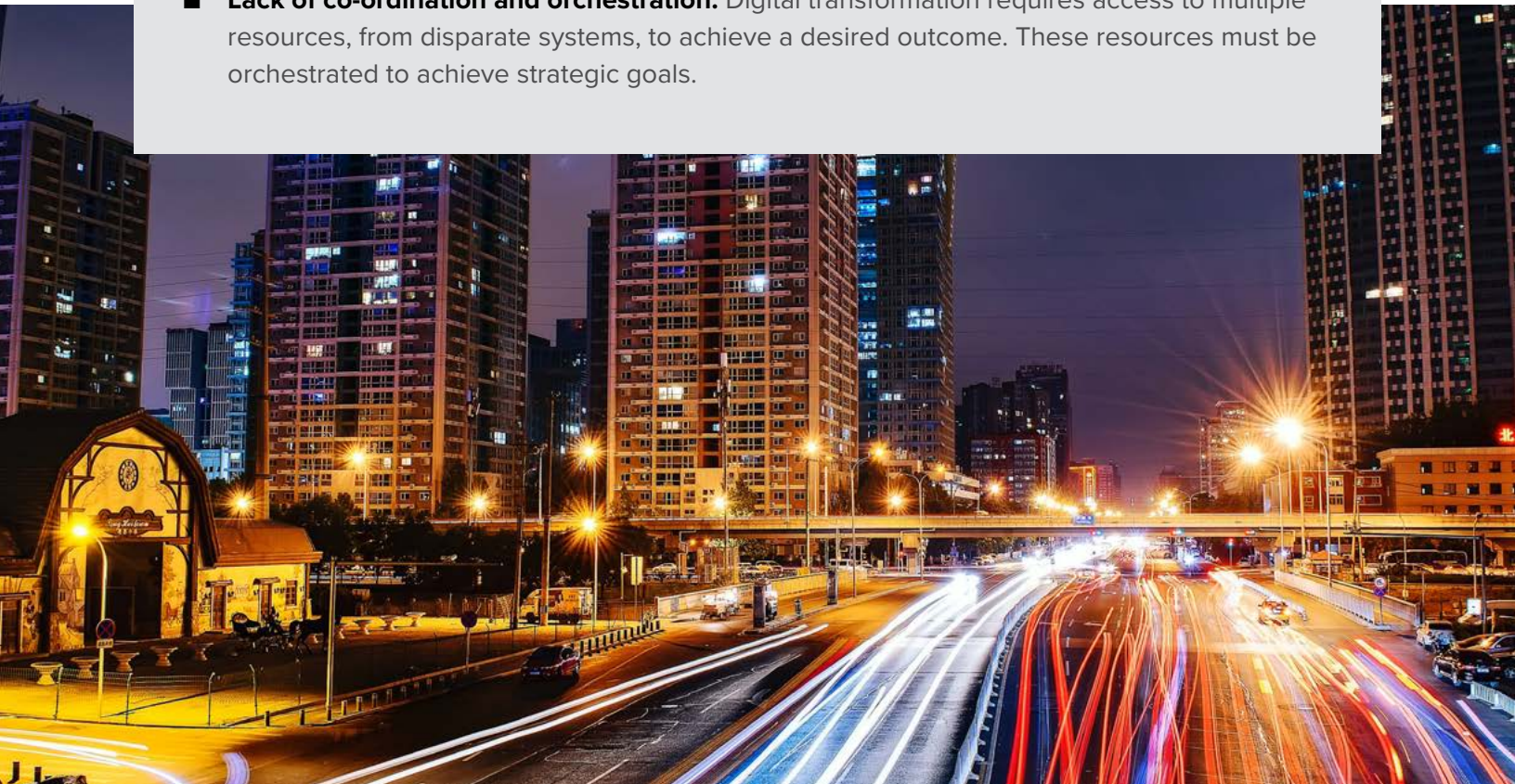


Source: Ecosystem, 2021



GOVERNMENT DIGITAL TRANSFORMATION, UNDERPINNED BY SHIFTING WORKLOADS TO CLOUD COMPUTING POSES CHALLENGES INCLUDING:

- **The existence of legacy systems.** These were designed for specific purposes and often conflict with many of the requirements of cloud computing, in particular the need for the interconnection of more people, places, clouds, and data. Integrating these systems with new technology is a leading challenge.
- **Widely distributed systems with limited connectivity.** Specific accountabilities have traditionally been linked to each distributed system leading to siloed efforts, policy, and systems. Breaking down these silos and enabling greater interconnectivity requires radical changes to policies and processes.
- **Issues with data privacy, control, and security.** Data inconsistencies across different systems need to be resolved with data governance structures which can ensure the availability, integrity, and security of data. New vulnerabilities emerge with new technologies and require a change in cybersecurity postures.
- **Skills shortages.** Adopting new technologies and facilitating exchanges between agencies requires new capabilities and skills. Skills associated with new technologies are scarce and expensive. Government agencies will need to work with each other to share available skills and capabilities, collaborate closely and use automation wherever possible.
- **Lack of co-ordination and orchestration.** Digital transformation requires access to multiple resources, from disparate systems, to achieve a desired outcome. These resources must be orchestrated to achieve strategic goals.



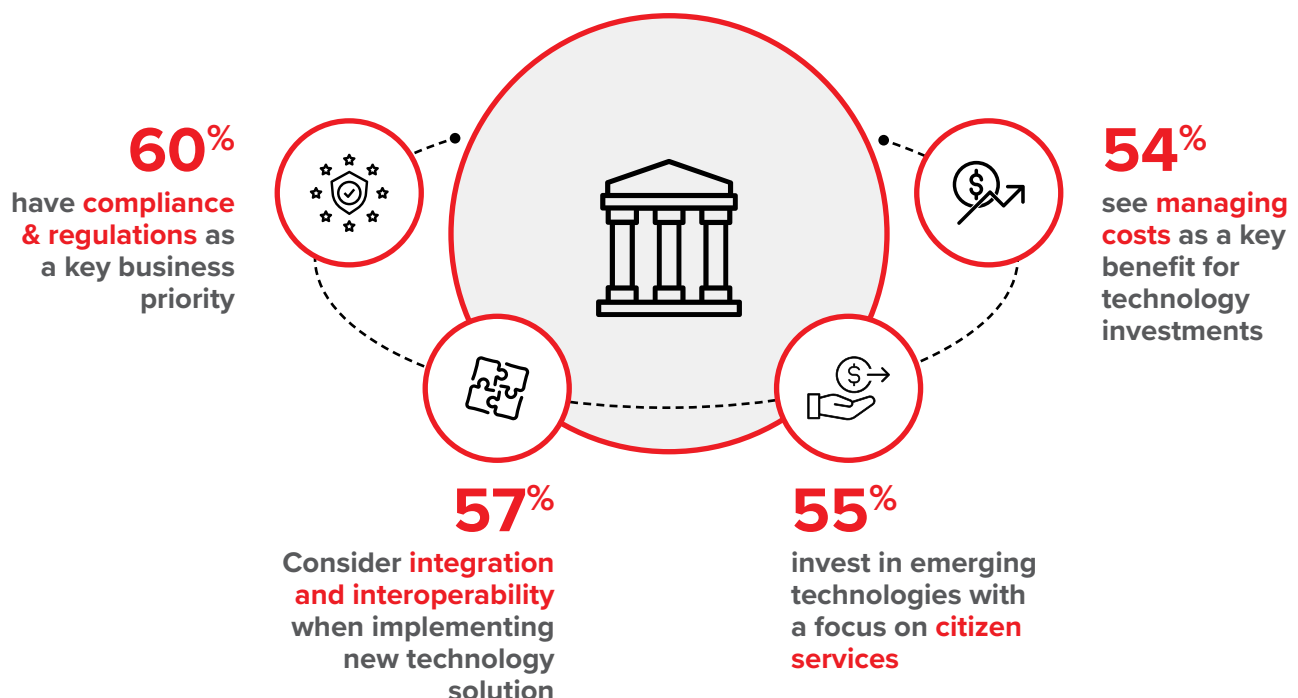
The Need for Trusted Interconnected Government

Public sector organisations in Singapore are focused on four key considerations in their technology activities (Figure 2), according to Ecosystem research findings. More stringent Personal Data Protection Act (PDPA) regulations and lessons learned from security lapses such as the SingHealth breach have caused agencies to place greater emphasis on compliance and regulations. Comprehensive digital risk management is rapidly becoming a ‘hygiene factor’ for public sector agencies as they focus on innovation and agility through hybrid cloud deployment.

The COVID-19 pandemic has led to an even greater focus being placed on citizen services as agencies seek to provide tools to help manage the pandemic such as TraceTogether, while encouraging more digital and less face-to-face engagement.

With ageing legacy systems and high levels of customisation, agencies are also seeking ways of integrating systems and creating more interoperability between them while getting more value for money.

FIGURE 2:
Technology Adoption Considerations in Singapore’s Public Sector





Governments have been trying to change traditional siloed IT infrastructures and create interconnection and interoperability between agencies for many years.

Interconnection - the private exchange of data - is core to integrating data, applications, clouds, networks, employees, and citizens.

The solution is a unified infrastructure approach that offers the following benefits:

- Integration between physical and virtual components of digital infrastructure
- Seamless access to entire digital ecosystems (multiple clouds, service providers, developer communities, big data/AI providers, other agencies etc.). The provision of interconnection to multiple cloud providers that are shared by government agencies is the key to a trusted interconnected government. It is also critical for the provision of high-quality digital citizen engagement and regulatory compliance, and the creation of synergies and cost efficiencies.
- Interconnection as a digital infrastructure foundation which can offer access to resources as needed, at scale.

For public sector digital transformation, hybrid and multi-cloud environments connect multiple agencies with all their stakeholders, offering superior connectivity and a much better user

experience. Importantly, they offer levels of agility and flexibility that are necessary for digital transformation at scale, future proofing government as it adds new services and digitalises citizen engagement.

The Singapore Government's move to a cloud first strategy enables interagency connectivity and allows users to access multiple clouds from any location or device.

This is driving the need for higher levels of interconnection with multi-cloud environments which will enable a secure single point of interconnection to multiple cloud providers. It will also make it easier to ensure agency-wide compliance with regulations and governance structures, reduce latency, and offer the ability to scale up and down on demand.

Interconnected governments need a platform where agencies can choose from a selection of cloud services, automated management tools and products to achieve their objectives.

This type of singular interconnected infrastructure reduces risk by future proofing investments. Agencies can easily scale down services which they do not use, reducing cost. They can switch to completely different services on demand which means that vendor lock-in and associated costs are minimised, and consumption of digital infrastructure is orchestrated.





Addressing Smart Nation Priorities

The Smart Nation priority is to harness technology to address national challenges and drive transformation in Health, Education, Transport, Urban Solutions, and Finance. To achieve this, agency and departmental silos will need to be broken down and a common approach to hybrid multi-cloud is necessary. Sharing resources where possible will be needed.

Many ministries received a sizable budget for development activities in 2020, with the immediate focus on economic recovery and in alignment with the Smart Nation plans.

The COVID-19 crisis has made a pivot to a new normal real - with an exponential increase in remote workforce and digital citizen services. Many of these transformations will be permanent.

Public sector organisations will need a platform that can accommodate multiple agencies and their ecosystems, while offering the necessary agility to manage any future

disruptions. Interagency collaboration, often involving multiple agencies working together simultaneously will be critical to innovation and digital transformation projects. Singapore has made great strides in this area - E.g., integrations between Ministry of Manpower (MOM) and Immigration & Checkpoints Authority (ICA). These best practices can be shared across and replicated by other agencies.

Digital citizen engagement is a critical success factor for governments around the world. It can be approached in a two-pronged way. Firstly, by encouraging digital government to provide digital citizen services. Secondly, initiatives which empower citizens and small and medium enterprises (SMEs) digitally, such as Singapore Digital's activities aimed at senior citizens and SMEs (starting with local F&B stalls). The provision of high-quality digital citizen engagement requires access to multiple resources necessitating a high number of connections.

Singapore's transparent and highly pragmatic regulatory environment makes it attractive for businesses both local and overseas. Uniform compliance with regulations such as the PDPA will become more important especially as agencies share and collect larger amounts of data.



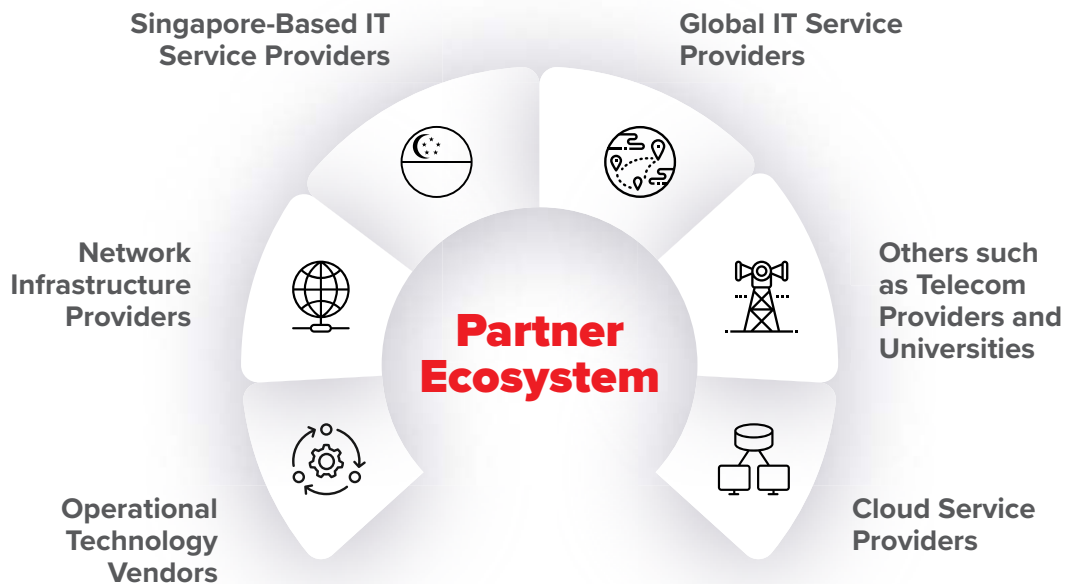
Smart Nation Vision: Government Agencies Must Work with an Ecosystem of Partners

The Smart Nation vision cannot be achieved with a few technology partners - government agencies need to work with an ecosystem of partners (Figure 3).

The success of the Smart Nation initiatives is dependent upon access to the best skills and the best technology. This necessitates close collaboration between partners and the use of 'best of breed' technology providers for a particular activity.

For example, agencies may wish to purchase compute from AWS, enterprise applications from Microsoft and SAP, and AI capabilities from Google. They may also work with Bosch, Siemens, and Hitachi on IoT projects as well as IT services providers to fully integrate and manage multi-cloud solutions. They need to have connections with all the partners in the ecosystem to optimise the performance of their solutions - and there should be a seamless integration and interconnect between these multiple solutions.

FIGURE 3:
A Smart Nation Needs a Robust Ecosystem of Partners





I The Rising Need for Interconnection

Achieving the Smart Nation vision is not a simple task. Government agencies need to partner with a digital infrastructure company that offers the largest choice of connections to drive interagency interoperability, and digital orchestration.

Government services must be able to extend across the island, digitally transform the economy and create the best platform for innovation. Interconnection enables agencies and their stakeholders to gain access to multiple clouds and consume services as needed, from any location and on any device. Agencies can gain high speed access to private clouds, public clouds and other service and technology firms, on demand.

To enable cloud migration and overcome legacy challenges, agencies need the best partners for the implementation of hybrid and multi-cloud environments. They need a partner that can enable them to control where and how they operate network and IT infrastructures allowing them to deliver high-performance services regardless of user location. This can only be done by a vendor-neutral partner that offers a

large number of interconnection and connectivity services. Seamless access to digital ecosystems facilitates cost effective and rapid cloud-driven innovation and the development of government shared services which can offer secure data sharing.

Within an interconnected digital infrastructure, value increases with the number of connections.

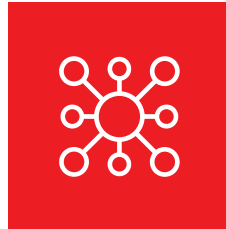
Agencies can choose to build up these connections themselves or they could work with a partner. If agencies want the best performance, rapid adoption of cloud technology, and the ability to innovate quickly, the digital infrastructure partner that offers a variety of connections is preferable. Ideally this partner will offer a wide choice of competing vendors on a platform that ensures portability. This also minimises the risk of vendor lock-in, effectively future proofing agencies.



FIGURE 4:
Key Benefits of Interconnected Digital Infrastructure

CONNECTION DENSITY

Higher number of connections on one site, gives easier, high performance access to multiple resources



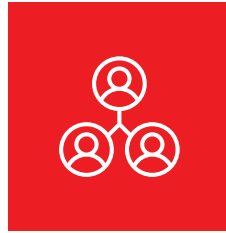
HIGH PERFORMANCE

On premise connections deliver lower latency and higher performance



CONNECTED CITIZENS

Offers seamless service delivery to citizens and other stakeholders anywhere and on any device



COMPLIANCE AND SECURITY

Interagency and inter departmental sharing on one site make data governance and dynamic security posture easier to manage



Source: Ecosystem, 2021





Conclusion

Singapore's Smart Nation initiative is leading to a large-scale migration to multi-cloud environments which are the core of digital transformation in the public sector. Such an IT environment facilitates the breakdown of departmental and interagency silos which is necessary to enable greater cross agency collaboration and to foster innovation.

Public sector agencies require an interconnected digital infrastructure to underpin their multi-cloud environments. The greater the number of connections in one place, the more value agencies can gain in terms of access to best of breed resources, performance, and innovation. To excel, Singapore public sector agencies need the same kind of infrastructure that is used by the world's largest and most innovative

enterprises. They need access to the best resources and the best performance in terms of quality of service and latency.

Using a shared digital infrastructure for government agencies can also allow resource usage to be scaled up and down quickly on demand and offer enhanced levels of security. This shared infrastructure, also makes compliance and data governance simpler to manage, across all agencies and departments.

Ultimately an integrated and interconnected government digital infrastructure will enable the Smart Nation vision. It will provide the Government with the digital foundation for Smart Nation, bringing connectivity for "Everyone, Everything, Everywhere, All the Time" (E3A).



This white paper is sponsored by Equinix. It is based on the analyst's subject matter expertise on the area of coverage in addition to specific research based on interactions with technology buyers from multiple industries and technology vendors, industry events, and secondary research.

The data findings mentioned in all Ecosystem reports are drawn from Ecosystem's live and ongoing studies on the Ecosystem research platform, based on participant inputs that include decision-makers from IT and other Lines of Business, from small, medium and large enterprises.

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About the Author



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Andrew Milroy is a well-known and respected thought leader and speaker in the APAC region. With more than two decades of experience in the technology sector, Andrew has worked with clients in a variety of tech domains including cybersecurity, cloud computing, IoT, blockchain, service provider strategies, and customer experience. His most recent work has been focused on the current challenges in technology markets, cybersecurity and digital transformation.

Since moving to Singapore in 2011, he has held regional leadership roles with Frost & Sullivan and Ovum (now Omdia). Prior to working in Singapore, Andrew gained invaluable technology knowledge and insights while working in Europe, the United States, and Australia.

Andrew is frequently invited to speak, chair and moderate at major technology events. He is also widely quoted on the global broadcast media, including BBC, CNBC, Bloomberg and Channel News Asia.

Andrew has a BSc from Newcastle University (UK), an MA from Middlesex University (UK) and an MBA from MGSM (Australia). Andrew is a long suffering Sheffield United supporter and enjoys hiking and running in his spare time.



I About Equinix



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I About Ecosystem



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Ecosystem's research originates from its custom designed "Peer-2-Peer" platform which allows Tech Buyers to benchmark their organisation in "real-time" against their industry or market. This bold new research paradigm enables Ecosystem to provide Tech Vendors access to ongoing and real time Market Insights in an affordable "as-a-Service" subscription model.