

Singapore Employs IoE Connections as Foundation for “Smart Nation” Vision



EXECUTIVE SUMMARY

Objectives

- Leverage ultra-high-speed, pervasive, intelligent, and trusted “infocomm” infrastructure as foundation to become world’s first Smart Nation
- Create globally competitive infocomm industry to foster innovation
- Develop infocomm-savvy workforce
- Spearhead transformation of key economic sectors, government, and society through more sophisticated and innovative use of telecommunications

Strategy

- Work closely with citizens, businesses, and educators to create and implement Intelligent Nation master plans

Solutions

- Next-Generation Nationwide Broadband Network provides ultra-high-speed connectivity to 99 percent of residents
- Wireless hotspots provide Internet-based services in areas frequented by students, tourists, professionals, and business travelers with portable devices
- Shareable infrastructure for sensing technology enables applications for healthcare, transportation, supply chain, logistics, and other areas

Impact

- Nearly ubiquitous connectivity
- Improved efficiency
- Interoperability of strong industry players
- Improved synergy of public and private sectors

Background

In January 2014, Cisco released the results of an in-depth analysis of the economic benefits of the Internet of Everything (IoE) for the public sector. Cisco’s model revealed that some \$4.6 trillion in “Value at Stake” would result from the adoption of IoE capabilities across 40 key public sector use cases over the next 10 years, including smart water, smart buildings, smart energy, smart parking, and more (<http://bit.ly/1aSGIzn>).

As a next phase of its analysis, Cisco engaged Cicero Group, a leading data-driven strategy consulting and research firm, to undertake a global study of IoE capabilities across these 40 use cases – how the best public sector organizations are “connecting the unconnected,” as Cisco terms it. To that end, Cicero Group conducted interviews with dozens of leading public sector jurisdictions – federal, state, and local governments; healthcare organizations; educational institutions; and non-governmental organizations (NGOs) – to explore how these global leaders are leveraging IoE today.

The research examined real-world projects that are operational today, are being delivered at scale (or through pilots with obvious potential to scale), and that represent the cutting edge of public sector IoE readiness and maturity. The aim of the research was to understand what has changed in terms of the jurisdictions’ people, processes, data, and things, and how other public sector organizations can learn from (and replicate) the trail blazed by these global IoE leaders. In many cases, these jurisdictions are Cisco customers; in others, they are not. The focus of these jurisdictional profiles, therefore, is not to tout Cisco’s role in these organizations’ success, but rather to document IoE excellence, how public sector entities are putting IoE into practice today, and to inform a roadmap for change that will enable the public sector to address pressing challenges on multiple fronts by drawing on best practices from around the globe.

Implementing technology strategies in 10-year spans, the Singapore Government has so far connected nearly 99 percent of its residences to an ultra-high-speed fiber-optic network.

About Singapore's Technology Journey

As a relatively young nation since achieving independence in 1965, Singapore has developed into an economic powerhouse and continues to grow and innovate as a world-class hub for trading and logistics, smart manufacturing, and biomedicine. Singapore has become a regional business headquarters for modern services ranging from finance to IT. Since 2006, the World Bank has consistently ranked Singapore as the top location globally for ease of doing business. A stable, trusted, and pro-business environment has allowed innovation to flourish in the tiny city-state.

Technology Innovation. Singapore's progress as a technology hub is particularly impressive, growing from a mere 850 IT professionals in 1980 to nearly 150,000 in 2013. This has been accompanied by a seven-fold jump in computer adoption by firms – from 13 percent in 1982 to 96 percent in 2013.

Singapore also enjoys a high mobile penetration rate of 156 percent. Singapore has been ranked second globally for five consecutive years in the Global IT Report by the World Economic Forum, and ranked first in the "Environment Index," which evaluates how well a country's market and regulatory framework supports information and communications technology (ICT) uptake, entrepreneurship, and innovation. Singapore also topped the "Impact Index," which gauges the broad economic and social effects of ICT in boosting competitiveness and well-being. In 2014, the country launched a S\$500 million program, ICT for Productivity and Growth, to further accelerate the adoption of technology solutions among companies to boost their growth.

ICT Master Plans. The Infocomm Development Authority (IDA) is charged with developing information technology and telecommunications within Singapore, with a view to serving citizens of all ages and companies of all sizes. It uses ICT master plans worked on in collaboration with Singapore's Ministry of Communication and Information, as well as industry leaders, to chart the vision for Singapore's information and communications ("infocomm") sector. IDA then aligns its activities to these plans, and in so doing actively supports the growth of innovative technology companies and startups; engages with leading global IT companies; and develops superior information technology infrastructure, policies, and capabilities for Singapore.

Singapore's current vision to become the world's first Smart Nation grew out of its last plan, the Intelligent Nation 2015 Master Plan. The country continually seeks to encourage a technology-savvy public, promote technological education, and support industrial development and entrepreneurial interests. Implementing technology strategies in 10-year spans, the Singapore government has so far connected nearly 99 percent of its residences to an ultra-high-speed fiber-optic network. As part of its Smart Nation vision, Singapore is now in the midst of planning and deploying a pilot version of a mesh network of sensors nationwide that will provide advanced data gathering and analytics capabilities to improve operations in healthcare, logistics, and other key sectors.

Objectives

The World's First Smart Nation. The technology-savvy city-state is now implementing a bold plan to be the world's first Smart Nation, underpinned by the use of data and analytics to improve people's lives. It is leveraging the capabilities of its world-leading open access fiber network; expanding the intelligent infrastructure to street-level coverage with new aggregation-gateway boxes for an integrated sensor-rich network; and exploring a new heterogeneous network across fixed and mobile infrastructures. This is coupled with a new Smart Nation Operating System that enables anticipatory government and city services, and empowers citizens with rich data insights to improve their lives. With a robust and future-proof infrastructure foundation, Singapore hopes to pioneer a new tech industry in Smart Nation capabilities. This will include developing creative talent in data analytics and other disruptive technologies, such as smart robotics, the Internet of Things (IoT), Big Data, cloud computing, and so forth. The program is also coordinating with initiatives in the areas of governance, data protection and sharing, and cybersecurity. Early pilots have been conducted in the Jurong Lake District, and nationwide deployment will be completed under the new Infocomm and Media Masterplan over the next few years.

IDA looks at how technology can transform sectors—such as healthcare or logistics—before zooming in on pertinent areas for further research.

Moving Toward a Maker Culture. The IDA has championed new initiatives for technology companies. The IDA Labs provide startups with an environment to prototype, experiment, and collaborate to build products and solutions that address real-world challenges. Innovative products by early-growth tech companies are also given crucial help via *Accreditation@IDA* – a scheme to build their credentials and be in a better position to win projects with government agencies and large enterprises. IDA's Accelerator program further promotes a vibrant startup community by helping promising companies to scale and grow globally. Overall in 2013, a total of US\$24.7 billion in venture capital funding went to Singapore-based tech companies, according to the *Asian Venture Capital Journal* (including government, private, and angel funding). Singapore is ranked in the top 20 in the Startup Genome Report's Startup Ecosystem Index. Total infocomm industry revenue grew a robust 45 percent year-over-year, from S\$102.46 billion to S\$148.11 billion in 2013.

Strategy

On a broad scale, Singapore's master plans are about transformation of the entire nation. IDA's approach, therefore, extends beyond government services. IDA looks at how technology can help transform sectors – such as healthcare or logistics – before zooming in on pertinent areas for further research.

Trend Sensing

Master planning requires a keen grasp of current and future technological trends to predict how the world will be in a decade. It requires careful study of macroeconomics as well as short-term and medium-term trends. Technology changes are occurring so quickly that even the IDA admits it has to continually fine-tune its assessments. If a technology or its adoption moves faster than anticipated, the IDA adjusts its plans accordingly.

In addition to technology adoption, the IDA also considers socioeconomic patterns in the master plans. Singapore understands that its small size, finite labor force, and aging population mean it must rely on technology to improve productivity and efficiency. Where possible, therefore, the nation encourages automating work to free up labor for higher-value jobs.

Educational Support

To promote technological interests within the country, IDA sponsors the Infocomm Club Programme, which encourages students in primary education, secondary education, and junior colleges to pursue infocomm-related studies. IDA also offers undergraduates the Enhanced Learning in Information Technology (ELITE) program, which mentors infocomm students and provides work and sponsorship programs following graduation. In addition, IDA presents the IDA Junior College Computing Award to students demonstrating aptitude in the computer sciences, and the Integrated Infocomm Scholarship for those at the polytechnic and university levels.

Industry Development

To encourage infocomm startups, IDA offers an accreditation program to provide visibility and a competitive edge to promising, early-growth technology companies. According to the IDA website, the program provides these companies “the credentials that will speed up their go-to-market strategy and secure customers and partners, including the government and large enterprise buyers.”

The accreditation program looks at an early-growth tech company holistically, before deciding if it meets the criteria to be accredited. Should a company fail to meet the standards, it still gains valuable feedback about what it should do before applying again. Companies that receive IDA’s accreditation are then considered first, where relevant, for innovative technological government projects. In the Smart Nation vision, these companies would not only enhance the country’s technological and business environment, but also offer successful solutions for Singapore to offer to a global market.

Singapore has also recently established a set of labs to encourage small and medium-sized businesses and startups. These labs allow different companies and groups of people to gather, explore and germinate new ideas. This meeting point brings together researchers and universities, companies and designers to help exchange and generate new product ideas. The nation’s efforts have paid off: Google and Amazon are opening new facilities in Singapore as a result of the country’s advanced ICT ecosystem.

Additional ICT Support

Other IDA measures include the Partnership for Capability Transformation (iPACT), which works to strengthen relationships among businesses in the ICT community. IDA works closely with the IT industry to identify and follow international standards, and encourages manufacturers in marketing Singapore’s ICT exports.

IDA also offers a variety of programs that provide funding, education, and support for technology that increases productivity, such as e-commerce consulting for the shipping, trucking, and retail industries.

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The Nationwide Broadband Network is designed, according to iN2015, “to transform Singapore into an intelligent nation and a global city, powered by info-communications.”

Solution

iN2015 Master Plan

Next-Generation Broadband Infrastructure

Singapore’s Nationwide Broadband Network (NBN) is a fiber-to-anywhere project that currently connects 99 percent of the residents of Singapore to an ultra-high-speed network via cabling, as specified in the country’s iN2015 ICT master plan. The NBN is designed, according to iN2015, “to transform Singapore into an intelligent nation and a global city, powered by info-communications.” A network of private partners provides home- and business-based services..

Singapore’s Next-Gen NBN project is evidence of how the public and private sectors in Singapore work together toward innovation. First, the Singapore government pledged S\$250 million (roughly US\$200 million) for installation of the Next-Gen NBN infrastructure. Private providers assumed the remainder of the costs associated with installation and maintenance. Now complete, the infrastructure is entirely owned and managed by the private providers who installed it.

There were more than 550,000 Next-Gen NBN subscribers as of June 2014. The base has more than quintupled since January 2012, and there is a growing proportion of consumers on 100-Mbps plans or higher.

Transfer Speeds

The NBN provides download transfer speeds of up to 1 Gbps and upload speeds of up to 500 Mbps, with advertised speed capacities occurring 99 percent of the time. International download speeds also run up to 1 Gbps, with upload speeds up to 500 Mbps. It also has “an assured minimum international download speed of 30 Mbps during peak hours,” according to one provider. These speeds become critical for many industries in Singapore, and such high-speed data services are how Singapore helps maintain its competitive edge in developing its finance, software/ engineering, data center, and gaming industries.

Wireless Hotspots

In addition to the broadband network, the iN2015 National Infocomm Infrastructure initiative includes the establishment of wireless hotspots throughout the country. Known as Wireless@SG, this program offers Internet-based services in areas frequented by students, tourists, professionals, and business travelers with portable devices.

Providers

Wireless@SG service is offered by a federation of private service operators, allowing subscribers to use hotspots operated by different service providers seamlessly with the same credentials. Wireless access is granted upon registration. Registrations are available through online web pages and more recently via SIM Card authentication. Passwords are issued via SMS to mobile phones or through provider-operated customer service centers.

The IDA sees similar sensor infrastructure technology in the home as eventually expanding into energy-saving solutions or home health monitoring for chronic care patients with diabetes or heart disease.

Security

Upon registration, users can connect at any hotspot within the coverage area regardless of the operator network. Login methods include SIM-based authentication (EAP-SIM), Seamless and Secure Access (WPA2), and HTTP-based Login (Captive portal). Users are encouraged to take appropriate security measures, such as installing and activating a Virtual Private Network (VPN) or other encryption mechanism, a personal firewall, and anti-virus software.

Service Levels

The Wi-Fi initiative was subsidized by the Singapore government initially, and offered free wireless access of up to 512 Kbps. This has progressively increased over the years to 2 Mbps. Faster transfer speeds and connection options with higher-quality service are now reserved for those with paid subscriptions.

Sensing Technology

Singapore's Nationwide Broadband Network provides a robust foundation for the development of the Smart Nation Platform (SNP), which is currently being piloted in the Jurong Lake District. In this district, IDA is piloting an "aggregation-gateway box" (AG box), which extends power and connectivity to non-traditional locations such as street lamps and traffic lights. Sensors deployed near the AG box can then take advantage of high speed back-end connectivity.

This effort comes out of a need to create a shareable infrastructure that can be accessed by government in the public domain. AG boxes, therefore, are taking fiber – traditionally linked only to homes and businesses – into the street. The public infrastructure could be a traffic light intersection or a bus stop. The AG box brings the fiber to a point nearby, and then sensor gateways can be installed that relay their data back to the AG box and on to the main system. This makes it easy for different agencies to place their sensors nearby – whether they be cameras or weather sensors – without having to wrestle with multiple connection points. This common infrastructure will be a crucial step in helping to generate additional applications and create a data-driven anticipatory approach to government services.

The IDA sees similar sensor infrastructure technology in the home as eventually expanding into energy-saving solutions or home health monitoring for chronic care patients with diabetes or heart disease.

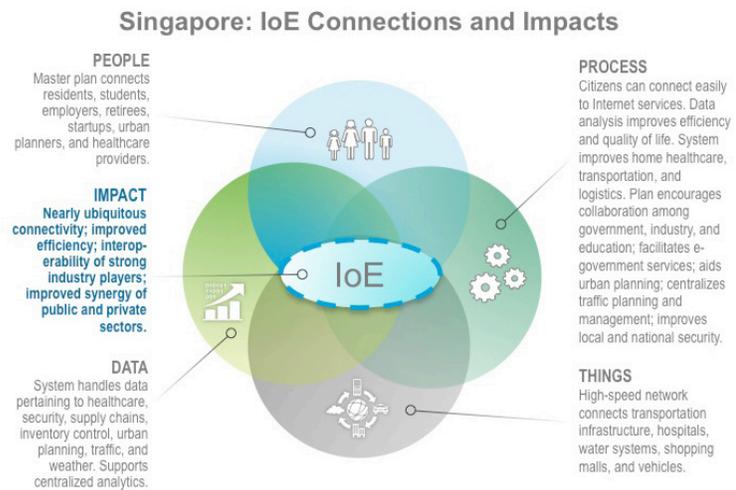
Businesses will also benefit from the growing opportunities for sensor technology to help optimize supply chains. This could make a difference for supply trucks, which sometimes sit for hours waiting to unload their goods at a busy mall. IoT technology would enable better information flow and subsequent resource allocation for truck movements and other parts of the logistics chain, ensuring better just-in-time planning – from shippers to freight forwarders to delivery. The same concept can apply to many elements in the public and private sectors.

IMM2025

Singapore's Ministry of Communication and Information is spearheading development of the country's next information and media master plan, IMM2025, which includes the vision of making Singapore the world's first Smart Nation. A key component of this plan is the Smart Nation Platform (SNP), which includes a mesh of sensors placed in the public transportation system, the roadway network, and other key locations. The platform will gather and analyze data to improve operations, quality of life, business, and government services throughout the country. National Broadband Network and wireless infrastructure provide an ideal foundation for this emerging sensor technology.

A key component of the 2025 plan is teaming with the private sector to meet objectives. A steering committee of various industry representatives, chaired by a renowned industry figure, provides critical private sector input.

Figure 1. Singapore: New and Better Connections.



Source: Cisco Consulting Services, 2014

Impact

Benefits from Singapore's infocomm planning process and the Nationwide Broadband Network and future Smart Nation Platform include enhanced efficiency, solution testing and marketing, interoperability of strong industry players, and synergy of the public and private sectors.

Connected Citizens

Singapore's widely adopted NBN demonstrates the success of IDA's program. Importantly, the government took measures to ensure its popularity and uptake. First, the government heavily subsidized installation costs and competition among the service providers. With monthly rates starting as low as S\$50 (US\$40) per month, the cost of broadband connectivity is among the lowest in the world. This low cost has been an important part of building the network's popularity, and has contributed

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to growth in the IT industry. The government also allows constituents to select their network provider.

Public-Private Collaboration and Innovation Test Bed

While the small size of the country may preclude competition in some large market arenas, the nation also considers it to be a strength. Singapore's size makes it an ideal test market for innovation that the global market can tap into. Using Singapore as a test bed enables IDA to prove certain concepts and, potentially, to scale and test solutions with the 600 million consumers in the ASEAN area – all within a four-hour flight from Singapore. This gives startups the right base from which to reach out to the rest of the world – a key area from which Singapore expects its economy will grow.

The Singapore Government's close alliance with industry helps create an ideal atmosphere for the nation as a test market. It's a collaboration that is intended to help startups succeed in an environment that enables rapid testing and prototyping.

The sensor deployment projects in the Jurong Lake District, for example, are watched closely by many parties, both internally and externally, to see if this solution can be replicated in other cities. The work has already attracted international interest from parties looking to build a common infrastructure that can cross several different domains. Whether they focus on sensors, networking, or apps, these players can come together first to collaborate in the Jurong Lake District, and then across the island to show proof-of-concept solutions can be rolled out nationwide later.

Growth in Singapore's IT industry is spurred in large part by the strong communication infrastructure. For example, Amazon and Google have both set up their own data centers in the nation. Additionally, Singapore's gaming and financial industries have grown in large part due to the nation's high-speed connections and communication infrastructure – creating jobs and economic activity.

Lessons Learned / Next Steps

Identifying New Technologies for Investment

The IDA studies various sectors – such as healthcare, logistics, energy, and sustainability – to identify technologies in which Singapore should invest. Nonetheless, the choices are often difficult to make. Singapore is currently evaluating how to incorporate technologies such as IoT, communications, cloud, Big Data, cognitive computing, robotics and more.

Aligning with Leading Standards

Alignment of technological development with internationally recognized standards gives Singapore's master plan an edge. However, it's a continuing challenge to determine the standards to which the country should align. The IDA works closely with industry to identify the standards that will have worldwide demand. Successfully implementing the Smart Nation vision depends on keeping a close eye on emerging standards and deciding which standards will be important in the long run, whether ISO or other sets of standards.

Next steps involve implementing analytics in multiple contexts, such as managing public transportation and urban planning.

Future Plans

In terms of future plans, effective data analysis is potentially the most transformative aspect of the Smart Nation plan. With a rich data platform enabled by the plan, analytics can play a larger role. IDA has created a special panel of data scientists to examine the issue.

Next steps involve implementing analytics in multiple contexts, such as managing public transportation and urban planning. For example, by studying data on how people travel from their homes to public transportation points, IDA can improve transportation planning. Analytics can address key issues such as whether enough buses are running at a given time, as well as making improvements to infrastructure such as covered walkways to bus stops (essential during Singapore's rainy season).

Analytics also enable cities to make small changes to the public transportation system to improve commutes. For instance, Singapore recently implemented a discounted fare for early-morning travelers. Commuter movement, how people pick fares, where they commonly stop, and when, are all different variables that had to be considered, and could only begin to be done with the rise of Big Data and analytics. These in turn help generate policies that can benefit the people.

More Information

For more information, visit <http://www.ida.gov.sg>



Americas Headquarters
Cisco Systems, Inc.
San Jose, CA

Asia Pacific Headquarters
Cisco Systems (USA) Pte. Ltd.
Singapore

Europe Headquarters
Cisco Systems International BV Amsterdam,
The Netherlands

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