

# City Cloud

City Cloud: Cloud Adoption for Asia's Cities

## A White Paper on Cloud Adoption for Asia's Cities



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## A summary of key findings

### Current Asia city cloud adoption

The majority of Asian cities do not use cloud computing to any great extent—at least not yet. Within the relatively short timeframe of three years the percentage of cities that expect to adopt cloud computing to a 'moderate' or 'extensive' degree almost doubles from 29% currently to 45.2%. Among the larger cities, defined as having >1,000 city staff using computers, more than half are already using cloud computing to a 'moderate' or 'extensive' degree.

### Security: the Dark Side of the Cloud

The perceived threat to data security and privacy is the disturbing side of the cloud. The reality is that organizations that have migrated to the cloud often discover that the security delivered by leading service providers actually improves upon their current security posture. The advanced security capabilities of cloud service providers (CSPs) have persuaded many government agencies, including the Department of Homeland Security in the US, to trust cloud service vendors with a widening array of data and applications.

### City cloud silver linings

Cities in Asia recognize the following benefits of cloud computing:

- Ability to adopt new technology faster
- Connect more easily and in more significant ways with city residents, external partners, suppliers, etc.
- More professional IT management
- A more flexible, scalable infrastructure for IT operations
- A catalyst for city Internet business ecosystem
- Improved disaster recovery
- Improved data security (access to advanced security technologies)
- More efficient deployment of e-Government applications
- Greener city footprint (lower power consumption and e-waste)
- Residents interact with city government departments more efficiently
- Higher labor efficiency by automating repetitive management tasks

### Business risk – help at hand

Any city eyeing a move to the cloud must appreciate the inherent business risks of cloud computing. Cloud service providers can help cities understand and address all business related risks.

### Cloud myths

Besides security anxieties, there are also concerns about the up-front cost of cloud computing. This is a misconception. The cloud operates on a utility pay-as-you-go model; migration to the cloud will reduce IT capital expenditure. Fears about legal/compliance issues can be easily managed and city concerns about insufficient internal IT capabilities are unwarranted: partnering with major cloud service providers brings with it their capabilities and should reduce the burden on in-house IT teams.

### City Case studies: growing proof of concept

The growing number of public sector cloud computing success stories is giving Asian cities the confidence to evaluate and implement their own cloud initiatives.

# INTRODUCTION

## Background & Objectives

Asia's urban population is now growing by more than 100,000 people per day, a reflection of the largest sustained population migration in the history of humanity. Already, more than half of Asia's urban population lives in cities of more than 1 million people. But as Asia's cities expand and merge to create urban settlements on a scale not seen before, Asia's city leaders face serious challenges. The ongoing and dramatic rise in city populations is increasing pressure on social infrastructure and essential services, including transportation, health care, education and public safety.

To revitalize the operating efficiency of city infrastructure and thereby improve the living environment for city residents, Asian city leaders are looking to the Smart City model of sustainable urban management. Cities of all sizes are turning to cloud computing as an answer to growing demands on public spending. Compared to traditional ICT systems deployed on-premises, the potential benefits of cloud computing for city municipalities appear profound. Using the cloud network as a 'fourth utility' (in addition to electricity, water, and natural gas), cities can integrate multiple systems to deliver on-demand services over an Internet-enabled cloud infrastructure supported by open innovation.

The corporate world is already convinced. IDC, an IT and telecoms research firm, recently estimated that globally companies will spend US\$100 billion on cloud computing in 2014. This is still a fraction of the US\$2 trillion that companies spend each year on IT worldwide and the potential for further rapid growth is self-evident. Take up has been rapid and is accelerating: Gartner, a leading American IT research and advisory firm, in early 2014 noted that, "CIOs are increasingly reconsidering data center build-out and instead are planning faster-than-expected moves to cloud computing."

*Cities in the Cloud - A White Paper on Cloud Computing for Asia's Cities* is jointly sponsored by Microsoft and CityNET. Using fact-based analysis and current case study examples it aims to answer the following questions:

- What are the potential benefits of cloud adoption for Asia's cities?
- How risky is migration to the cloud?
- What progress has been made—Asian cities' current and planned use of the cloud?
- What are the perceived barriers and knowledge gaps?
- What city cloud models and solutions are available?

Two appendices provide background information on cloud computing and Microsoft solutions:

Appendix A. City Cloud Defined

Appendix B. Microsoft Cloud Solutions

# CITY CLOUD BUSINESS CASE

## The potential benefits versus risks of cloud computing

The business case for any city cloud should articulate a clear path to an attractive return on investment. The returns can take many forms. Migration to the cloud can reduce a city's costs and lower its debt requirement—as the need for major ICT investment is diminished—while at the same time delivering improved revenue collection (see Cloud Case Studies). Internally, cities can benefit from better business focus and agility and accelerated innovation. Externally, cloud computing can revolutionise public engagement, catalyse the local IT ecosystem and bolster urban competitiveness as the city becomes 'smarter'.

Ultimately, the aim of any city cloud initiative should be to provide a higher quality of life for city residents, through the intelligent management of the available resources. Although concerns around privacy, security and data sovereignty are legitimate reasons for caution, the value proposition of moving to the cloud appears compelling.

This chapter examines the direct and indirect commercial and social benefits of moving to the cloud as well as the potential risks involved.

### Cloud benefits

Cloud computing benefits cities in many ways: financially, administratively and managerially.



- 1 Citizen engagement
- 2 Enhanced revenue streams
- 3 Better city administration
- 4 ICT ecosystem development
- 5 Public education
- 6 Better focus and agility
- 7 Lower costs
- 8 Reduced debt burden

#### 1 Citizen engagement

By adopting cloud-enabled services, cities can expand their reach and improve citizen participation in municipal affairs. Using the cloud, online resources can provide citizens with virtually 'anytime, anywhere' access to information and services.

Cities can create a central online resource where residents can look up information about events and services, apply for permits or licences, pay bills and fines, or log reports and requests. City authorities can also provide access to relevant data such as the weather, traffic conditions, air quality, or local rates and taxes. Enabling city residents to access, as well as submit information around-the-clock through social media, promotes public engagement and participation. Internally, contact centre employees can have ready access to the information and tools needed to address phone, email, online, or in-person inquiries.

Seoul has established a social media centre that acts as a single contact point for receiving communications from citizens. In preparing its 20-year Sports Master Plan, the Singapore government turned to online crowdsourcing (the process of obtaining needed services, ideas, or content by soliciting contributions from a large population of people). The Philippines, Australia and Malaysia have all canvassed city resident opinions online.

■ Engagement Case Study

**Ehime Prefecture and Microsoft team up to promote cycling**

Ehime Prefecture in Japan (pop: 1.4m) and Microsoft have joined forces to revitalize local communities and improve information literacy among prefecture residents using innovative ICT cloud deployment.

The result: the Ehime Marugoto Cycling Roads website (<https://ehime-cycling.jp>), providing invaluable information for cyclists. Launched in April 2014, the site has attracted cyclists from within the prefecture as well as tourists, revitalizing local communities through the interactive user information service. The user information service automatically transmits feedback from cyclists and others to the prefecture's blogs, as well as several social media sites such as YouTube and Facebook. Microsoft uses its public cloud service Microsoft Azure for storing and managing posted information and photos/videos from smartphones, signing in to the service site, working with social services and the map service (Bing Maps) and displaying all information on the site. Microsoft Dynamics CRM provides tourist information—updated with fresh viewpoints from cyclists and local citizens—by maintaining and analyzing posted information from smartphones and PCs.

Besides their collaboration to promote cycling, Ehime Prefecture and Microsoft run three other initiatives as part of the Local Revitalization Program.

- A Support Program for Physically Challenged Persons: Designed for physically challenged persons and their supporters, this program helps physically challenged persons go to work by improving their ICT skills.
- A Foundation Reinforcement Program for NPOs: seminars and courses on how to use ICT for intermediary organizations and NPOs.
- A Highly Skilled HR Development Program: seminars and courses on cloud services and application development designed for engineers in SMEs.

**② Enhanced revenue streams**

Two of the cloud case studies presented in this document explore the potential for the cloud to generate revenue for the relevant city or agency. The City of Makassar in Indonesia is launching an e-payment system that will enable businesses to pay various types of taxes and fees easily. The mayor has predicted the system roll-out to increase tax revenues by 200%. Mexico's Tax Administration Service uses Microsoft Azure cloud computing to ensure it receives electronic tax invoices more securely and more reliably.

**③ Better city administration**

As municipal governments grapple with the challenges of higher resident service expectations and constrained financial resources, they need new tools to promote communication, interaction, collaboration and government responsiveness. Improved information sharing can facilitate better interaction and collaboration across departments

and functions, improving management, decision making and policy development. Innovation in services will naturally occur as cities take advantage of new cloud innovations without the need for investment in research themselves.

Streamlined communications and tools in the cloud can provide workers and constituents with 24/7 access to streamlined communications solutions and tools. Cloud computing can enable mobile access for civil servants so that case workers in the field can access relevant data, simplify their work, and focus on the task at hand. Contact centre staff members can easily route requests to appropriate departments whether working remotely or onsite, from a laptop or a mobile device.

#### **Cloud computing as Smart City enabler**

All city administrations have numerous departments dedicated to the management of a variety of metropolitan services. Typically, these departments offer services independently of one another, and as the city expands, duplicated effort and inefficiencies emerge.

To attain smart city status, it is better to think of cities as complex systems with departments as subsystems sharing resources and assets. For example<sup>1</sup>, a typical department of transportation models traffic patterns in order to plan new roads or align traffic lights for optimum mobility. In a more systemic approach, city streets are a shared resource requiring a new perspective:

- The education department contributes to peak traffic according to school schedules;
- the sanitation department influences traffic with low speed vehicles collecting garbage; and
- the environmental department estimates pollution levels via the density of traffic

The smart city as the inevitable next phase of urbanization remains dependent on the use of ICT/cloud infrastructure, but accents the role of human capital and education, social and relational capital and environmental awareness.

#### **4 ICT ecosystem development**

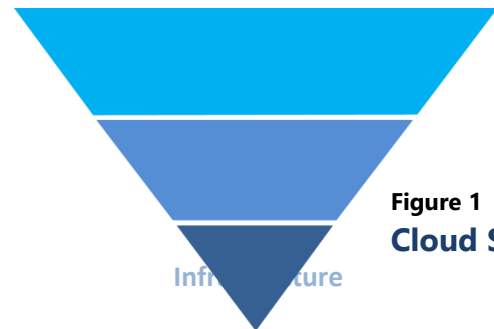
Cities often look to their own technology initiatives as catalysts for innovation and new digital industry development in the local economy and the communities they serve. The cloud is not only seen as a lever for better and more efficient public service delivery, but also as a platform upon which to build a more robust "New Economy" ecosystem.

A strong city commitment to a cloud-first strategy can generate many opportunities for a city's local ICT eco-system. This can be achieved by:

- Providing differentiated cloud and managed service offerings;
- partnering with cloud service providers to resell or bundle valued-added services;
- helping with cloud opportunity analysis and business case development;
- providing local support, implementation, migration and training services;
- assisting with business process rationalization, re-engineering and re-modelling;
- helping to transform and modernize legacy applications and data to a cloud stack; and
- developing and localizing innovative cloud applications.

<sup>1</sup> <http://www.cloudcomputing-news.net/news/2014/jul/16/cloud-computing-as-an-important-component-of-the-physical-infrastructure-for-smart-cities/>

Most cities are rightly focusing on application services to develop the local ICT ecosystem (see adjacent figure). By using crowd sourcing and investing in local developers, cities can generate greater value and local impact for their precious funds. A focus on infrastructure, the base of the stack, is really only appropriate for IT-advance economies such as Singapore or Hong Kong.



**Figure 1**  
**Cloud Stack**

### 5 Public education

Cities offer young people with higher levels of education, greater career and learning opportunities. And education, especially for females, is a key driver in accessing the opportunities that come with urban life.<sup>2</sup>

Cities will want to nurture a cloud-educated workforce to readily consume, and more importantly, exploit new cloud capabilities and value sources. Such is importance of the cloud that persisting with traditional ICT practices and mindsets may impede the agility, innovation and cost-saving benefits delivered by cloud computing.

Korea is taking education to the cloud in a big way. The country is revamping its entire education system: both the curriculum and the delivery of educational material. By 2015, the country will digitise all textbooks, have them hosted in the cloud and allow education to be customised by the individual.

#### ■ Cloud Learning Case Study

##### **Janison Cloud Learning System**

Janison Cloud Learning System (CLS)<sup>3</sup>, based in Coffs Harbour in the Australian state of NSW, is a new type of learning and assessment platform that leverages the power of Windows Azure to provide a robust, scalable and multi-tenanted solution for clients' online learning needs. It enables clients in many different fields—government, health education and corporate—to easily ensure full compliance by providing visibility and tracking of key data. CLS provides end-to-end management of a learner's journey for all leading learning providers. Key benefits of Janison CLS:

- End-to-end management of a learner's journey
- Workforce compliance - real-time tracking of mandatory training of employees
- Social applications for effective collaboration - rich discussion forums enable collaborative learning
- Access anytime, from anywhere - users can access from any device, including mobile devices and any supported browser, anytime, anywhere
- Easily created dynamic, cost-effective and engaging content
- Complete control over accessibility and security
- Streamlined course management, which results in reduced costs for managing and providing online courses.

<sup>2</sup> State of the Urban Youth 2010/1011: Levelling the Playing Field, ADB

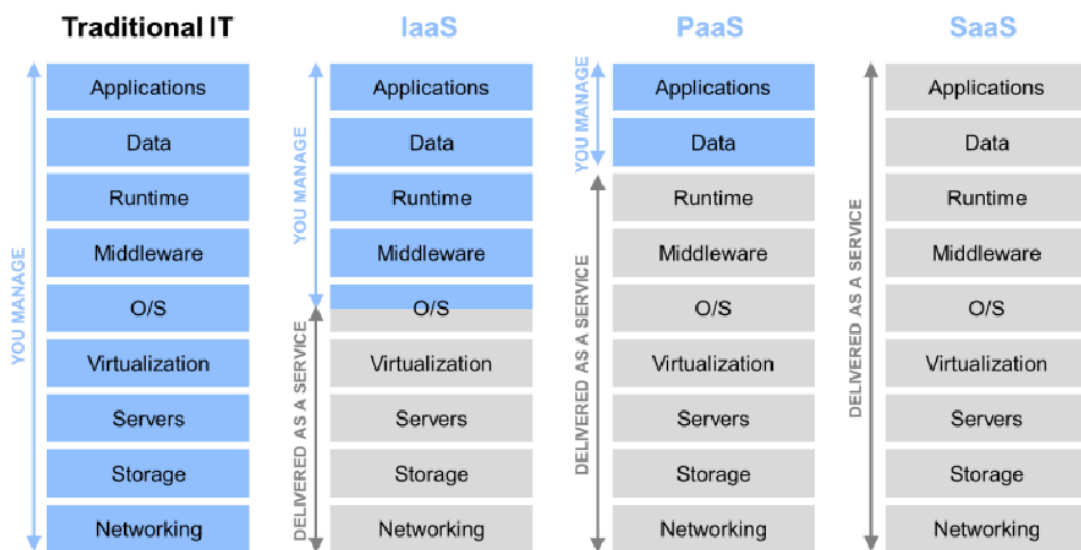
<sup>3</sup> Janison was the recipient of the Microsoft Windows Azure Partner of the Year in recognition of its expertise in building innovative software applications.



### 6 Better focus and agility

Additionally, cloud computing can free city administrations from the burden of more commoditized ICT functions. By consuming ready-made ICT services from the cloud, cities can better focus on their core missions and responsibilities. In general, cities should not build internal ICT services when these are available as generic commodity solutions from the industry, a conclusion reached by the Queensland government. The figure below reveals the lighter ICT management burden that results from cloud services such as IaaS, PaaS and SaaS.<sup>4</sup>

**Figure 2**  
**Capturing Cloud Benefits**



Source: Microsoft

Cloud computing represents a convergence of two major trends in information technology, one is IT efficiency and the other business agility. With cloud solutions, cities are able to respond more quickly to changing business needs and priorities as ICT services can be provisioned, scaled up or scaled down in very short timeframes. Moreover, lifecycle management becomes the responsibility of the service provider.

### 7 Lower costs

Cloud solutions must demonstrate a clear value for money proposition, meaning lower total cost of ownership, reduced capex (capital investment) and a lower ongoing cost of computer services. Cloud computing allows organizations to lease storage and processing capacity from expert providers such as Microsoft, thereby saving themselves the expense and bother of having to buy and maintain their own servers or data centers. The cloud's on-demand model means that cities only buy/own the IT infrastructure and software services that are needed, and from a highly competitive marketplace.

The job of conducting the business case assessment will usually fall to the ICT department or at the very least will involve significant ICT involvement and input. While the role of ICT will be dramatically enhanced, the cost of ICT management should diminish. The reconfiguration

<sup>4</sup> See Appendix A. City Cloud Defined for definitions.

of a city's ICT environment as it shifts into the cloud should present a slew of impressive benefits (see following Table: Cloud City State ICT Environment: Future Promise).

**Table 1**  
**Cloud City State ICT Environment: Future Promise**

Current State	Future Cloud City State
<b>High-cost, custom-built ICT</b>	Standardized and configurable shared services that evolve and innovate based upon the needs of a large and diverse customer base, and that are paid for by many customers
<b>Ever aging technology in need of continual upgrade</b>	An 'evergreen' scenario where lifecycle management is the responsibility of the service provider (e.g. Microsoft, AWS), and quality improvements and cost reductions are driven by competitive market forces
<b>Security limited by resource and funding constraints</b>	Enhanced information security from mature cloud services providers that hold extensive security accreditations and implement proven security management processes, including regular external audit
<b>Long, complex and risky infrastructure projects</b>	Rapid business value derived through the consumption of ready-made ICT services which are available for near immediate use (excluding organisational change and business transition)
<b>Rigid and/or inflexible systems</b>	Flexible, responsive and innovative cloud computing services, designed to be enduring and adaptive to changing business needs
<b>Resource intensive ICT management</b>	Agile, self-service ICT using automated just-in-time fulfilment and without the need for human intervention by the service supplier
<b>Long lead times to lift ICT capacity</b>	On-demand changes in ICT capacity are always available
<b>Low utilisation of assets</b>	Greater sharing of resources, improved economies of scale and the ability to closely match allocated resources to demand
<b>Capex intensive investment</b>	A more financially sustainable Opex model on pay-for-what-you consume basis

This is not to suggest that cloud providers do not charge for their services. They do. However, even in relation to these contractual fees, the business case for cities should improve as cloud pricing continues to fall. Leading providers and fierce competitors Google, Amazon and Microsoft all sharply reduced their pricing during 2014.<sup>5</sup> These lower prices will no doubt boost adoption among companies and municipalities alike, further supporting the underlying cloud computing principle of shared cost.

### ⑧ Reduced debt burden

<sup>5</sup> In 2014, Google claimed that hardware costs for cloud providers such as itself have been dropping by 20-30% a year.

Moving to a fee-for-service based model reduces future capital costs and hence the borrowing requirement for any city, large or small. With cloud solutions, high-cost, custom-built ICT projects are no longer needed to the same extent and cities can forgo the traditional large, risky ICT projects.



## Cloud risks

Some cities have delayed their final ascent into the cloud, concerned not only about the associated costs, but also wary of entrusting sensitive information to another organization's servers. The risk of cloud service options must be carefully reviewed and considered relative to the current in-house delivery of ICT systems. Help is available: cloud service providers, such as Microsoft, work closely with cities on their cybersecurity strategies (see Appendix B: Microsoft Technology Cloud Solutions).

While organizations are intrigued about the efficiency and cost benefits of cloud computing, IT professionals worry that migrating resources into cloud environments, especially public clouds, brings significant risk. Some safeguards and data security controls in existing networks today may not be present in cloud provider environments, or may not have the same features that security teams employ currently. Additionally, there may be a lack of control over, and visibility into, the security tools and controls in the cloud provider's infrastructure.

Below, three classes of risk, all of which are manageable, are briefly reviewed.

### Privacy & Security Risks

Cities need to appraise the potential for damage to their reputation and loss of public confidence due to a privacy or security breach. The issue should be covered in the vendor agreement, but in the event of a breach, the financial penalties are unlikely to offset the political fallout and loss of public confidence.

The perceived threats to data security and privacy have always been the supposed 'dark side of the cloud' and yet as organizations adopt cloud computing, many are finding that security delivered by leading service providers improves their current security environment posture. Only the less informed persist in believing that servers sitting under the desk afford more security than a professionally managed cloud service.

One recent study<sup>6</sup> found that 54% of companies that have implemented cloud computing report that the technology has actually improved security. Advanced security capabilities implemented by service providers have persuaded corporations, non-profit organizations, and municipal governments to entrust cloud service vendors with a widening array of data and applications.

One confirmation of this newfound trust is the US government's adoption of cloud-based solutions for several cabinet-level agencies, including the Department of Homeland Security, an agency that is pursuing both public and private cloud solutions. In discussing their plans for cloud computing, government officials cite cost savings of up to 10% and fast scalability of the cloud model, but they also acknowledge the

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<sup>6</sup> PwC's 2012 Global State of Information Security Survey

enhanced security of the cloud. And all the while, standards organizations (e.g. NIST and the Cloud Security Alliance) continue to strengthen cloud security standards.

### Financial Risks

The 'pay-as-you-go' model for cloud services is almost always cost effective for commodity workloads. However, there may be instances where it is more cost-effective to retain the traditional IT model. Areas of concern may include existing software investments, cloud usage restrictions and lock-in or lock-out practices. Cities also need to be confident that the solutions offered are sufficiently mature with proven track records.

Municipalities are wary of being straight jacketed by long-dated service contracts and high upfront investments in customized systems and worry that the cloud might present similar problems. Cities need to be able to change service providers easily and reduce 'lock ins' to long contracts. The need to migrate to an alternate provider in the event that a cloud service provider goes out of business (highly unlikely in the case of a major multinational CSP) is a possibility.

### Operational Risks

Cloud solutions should meet or exceed the business continuity and disaster recovery plans requirements for maintaining services and protecting data. In relation to the service performance of cloud providers, issues such as internet connectivity should be fully explored if not within the control of the service provider. The service provider should respond to incidents (security or otherwise) in an effective and timely manner.

#### ■ Checklist

#### **Assessing Cloud Providers' Security Controls<sup>7</sup>**

Data governance: The nature of the cloud could potentially mean that information could reside, or transition through, multiple different locations, legal jurisdictions and could also be co-located on infrastructure with other cloud customers. Ask your service providers what they intend to do with your information. For example do they routinely scan your data and documents for non-security purposes, such as profiling and advertising?

Contractual agreements: It's your data, so understand what rights and recourse you have for security breaches or incidents. Because users have no control over the cloud provider's infrastructure, SLAs, contract requirements and provider documentation are more important than in traditional IT environments.

Access controls: The cloud provider should prove that it has implemented and enforces administrative controls to limit employee and partner access to your information.

Certification and third-party audits: Verify that the provider has some form of accepted third-party review of security (Statement on Standards for Attestation Engagements 16 or ISO 27001 certification, for instance).

Compliance requirements: Determine whether the supplier meets compliance needs. A critical factor will be the geographic locations of the provider's servers.

Availability, reliability, and resilience: Agree on measurable availability and reliability service levels.

<sup>7</sup> Based upon tips provided by PwC in Navigating Security in the Cloud, 2012.

Backup and recovery: In the event of disaster, document recovery requirements are in writing; understand a provider's capabilities before you engage it.

Decommissioning: Agree that data will be securely deleted once it is no longer needed. Also make certain that virtual machines or processes are securely decommissioned.

Portability: Determine whether it is easy to move data and applications to another cloud provider or migrate data and applications back to an on-premises environment, if necessary. Before selecting a cloud provider, make sure that it does not use specialized or proprietary technologies that would create vendor lock in.

ICT personnel will need to be trained for the new cloud paradigm, with new skills and thinking required to be able to fully leverage the cloud's capabilities. Experienced, cloud-savvy ICT personnel should be able to: appreciate and manage cloud-optimised solutions, integrate cloud services and legacy on-premise ICT systems (using web-based driven integration technologies), engage with the consumer and provider communities in translating requirements and capabilities for both groups and analyse cloud-based services financial benefits to prove business cases.

# CITY CLOUD SURVEY

## Insights from a CityNET member survey

To understand the current state of play with cloud adoption in the Asian city, CityNET surveyed 38 of its city members on the current and potential role of cloud computing in the administration of their respective municipalities.

The survey examined:

- ▶ Current and Planned Use of the Cloud
- ▶ Perceived Risks & Benefits
- ▶ Cloud solution providers
- ▶ Confidence in Decision Making for the Cloud
- ▶ Senior Level Commitment to the Cloud

### Survey demographics

A total of 37 individual cities participated in the survey organized by CityNET, representing a diversity of cities in terms of geographic location (from Ulanbaator in the north to Java in the South), size (from Mumbai with its huge population of over 20m to small cities in Nepal with little more than 100,000 residents), and level of development (Japan and South Korea contrasting with Bangladesh and Cambodia).

The data below presents the type of city respondents captured in the survey.

#### 1. RESPONDENTS BY LOCATION

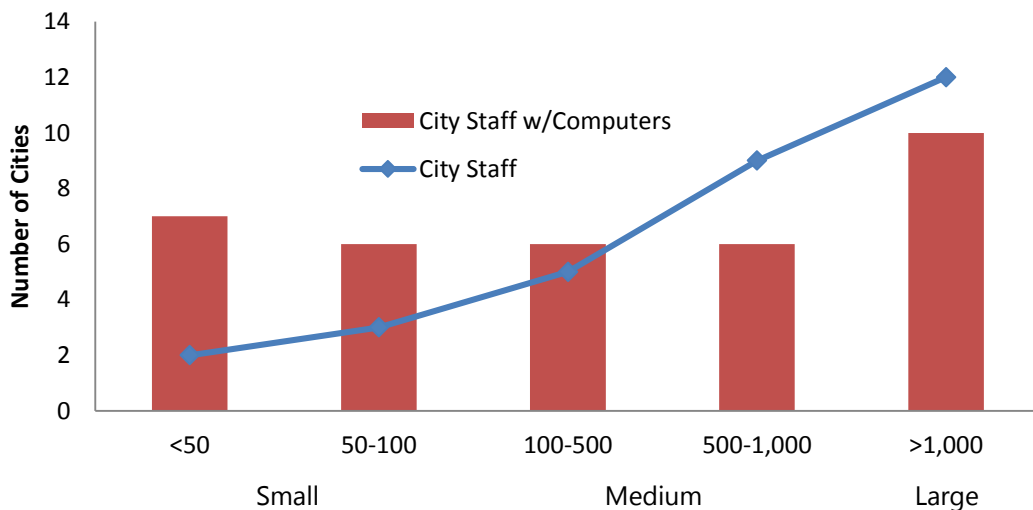


2. RESPONDENT POSITIONS IT Management – 50.0% (n=19)  
 Senior Management – 23.7% (n=9)  
 Other – 18.4% (n=7)  
 Not disclosed – 7.9% (n=3)

The 'Other' respondents included those in planning and engineering departments.

3. RESPONDENT CITY SIZE (No. of city staff)

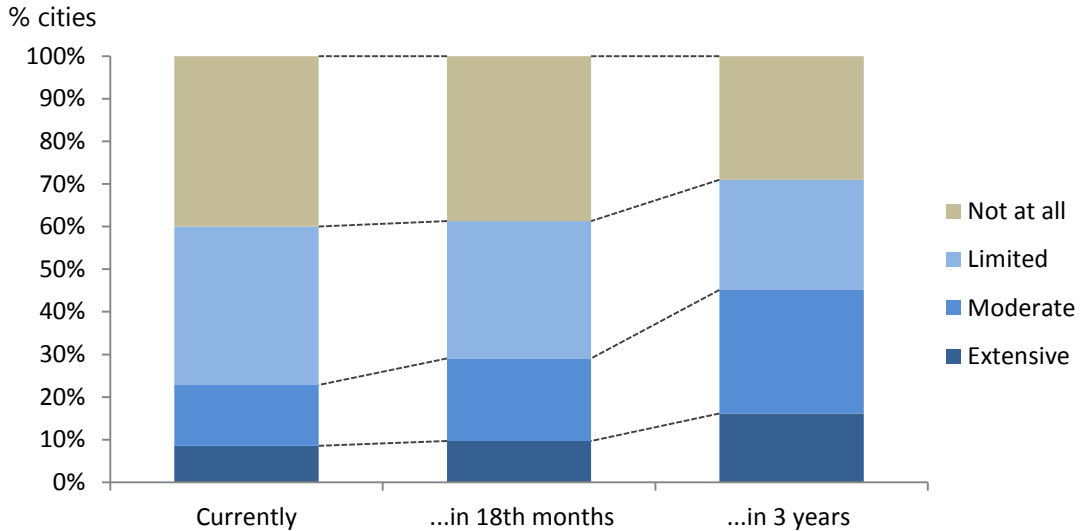
A significant proportion of the cities can be categorized as 'large', having more than 1,000 employees that use computers (total staff for these cities would be at least at least 5,000). The survey also included a number of mid-sized cities (100-1,000 staff using computers) and some quite small cities (<100 employees using computers).



**Current cloud usage**

The large majority of cities included in the survey do not use cloud computing to any great extent currently. However, within the relatively short timeframe of 3 years the percentage of cities that expect to adopt cloud computing to a 'moderate' or 'extensive' degree almost doubles, from 23.5% to 43.4% (see Figure 3 below). Among the larger cities (defined as having >1,000 city staff using computers), more than half are already using cloud computing to a moderate or extensive degree.

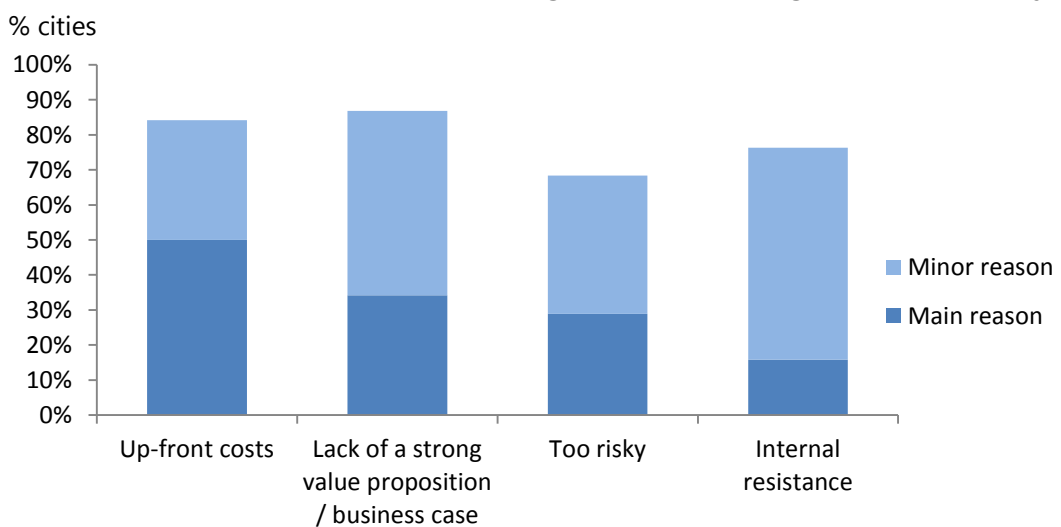
**Figure 3**  
**To what extent is your city using cloud computing?**



**Cloud concerns and barriers**

Asia's cities still harbor some concerns about virtualizing their IT, apprehensions that could slow the speed and scale of cloud transformation. Not all are justified. One of the leading concerns was the up-front cost of cloud computing. This is a misconception. Low up-front cost is one of the advantages of the cloud (see Benefits 7 & 8, lower costs and lower debt, described above). More reasonably, the lack of a convincing value proposition and perceived risks were also cited as barriers. While internal resistance to change was cited as an impediment by a good majority of cities, it was typically of secondary importance.

**Figure 4**  
**What are the main reasons for not using cloud computing more extensively?**

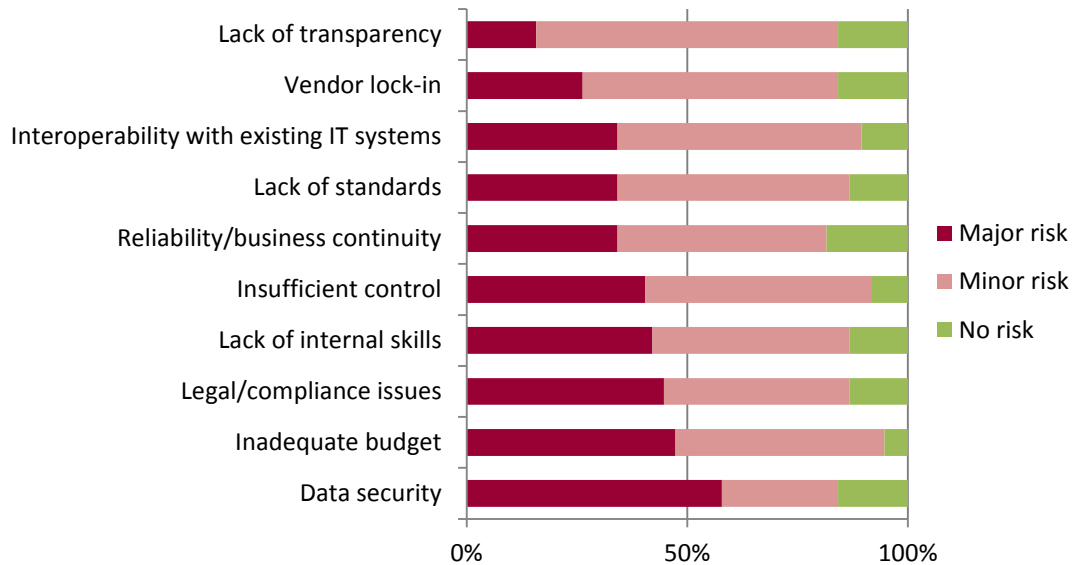


Other issues may also slow the adoption of cloud computing. Besides budget and security anxieties there are also fears about legal/compliance issues, insufficient internal IT capabilities to manage the transition to the cloud and a loss of control—with negative repercussions for business continuity. The biggest challenges around the city's modernization efforts has been "the constant change in political administration affecting the continuity of



the project plan, as well as the government officials' and citizens' resistance to change," commented one Indonesian city mayor.

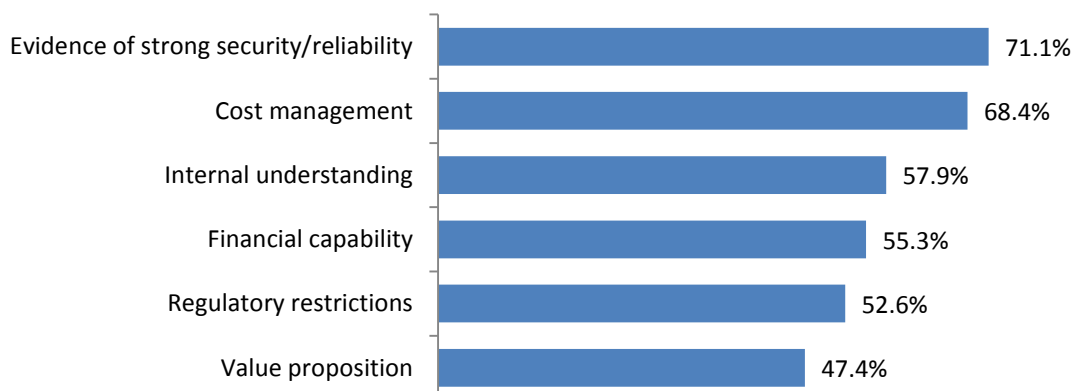
**Figure 5**  
**What are the biggest perceived barriers or risks of cloud computing?**  
 % cities



### Cloud support required

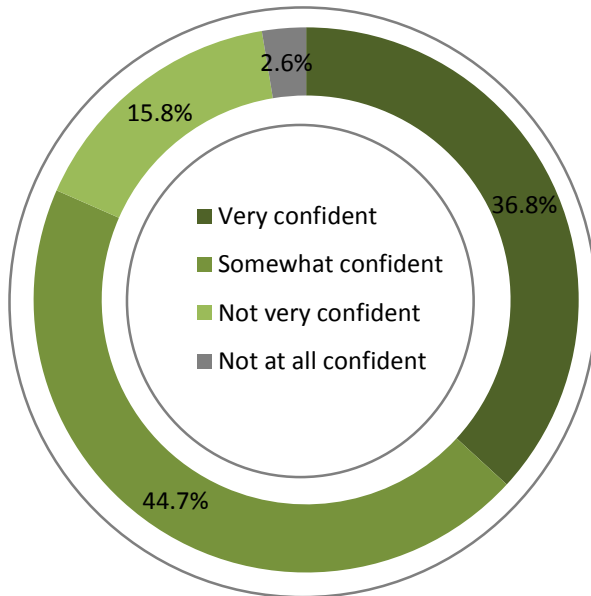
To help cities overcome the perceived obstacles and risks relating to the cloud, vendors need to : (1) demonstrate cloud computing's superior security and reliability; (2) better communicate the cost advantages of cloud computing; and (3) educate key constituents for a better understanding of cloud computing.

**Figure 6**  
**What would prompt you to move/move further into the cloud?**  
 % cities



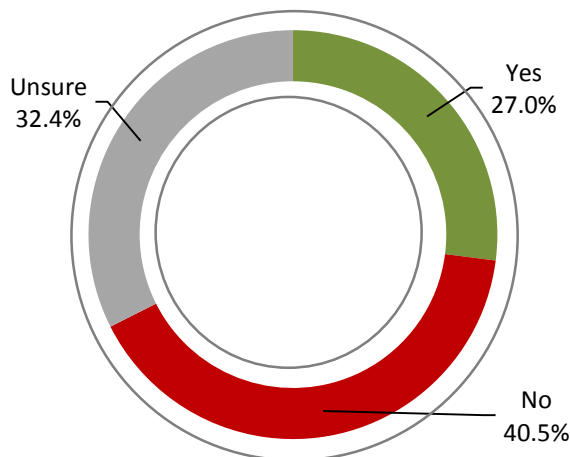
Only slightly more than one third of respondents were 'very confident' that they have all the right information to make sound decisions when it comes to cloud computing.

**Figure 7**  
**How confident are you that you have the right information to make sound decisions when it comes to cloud computing?**  
% cities



Top level leadership is sometimes lacking. Only a little over a quarter of the respondent cities surveyed were aware that their mayor (or another senior city official) had made public pronouncements or public commitments about using the cloud to become a Smart City.

**Figure 8**  
**Has the Mayor (or other senior city officials) made public pronouncements or public commitments about using the Cloud to become a Smart City?**  
% cities



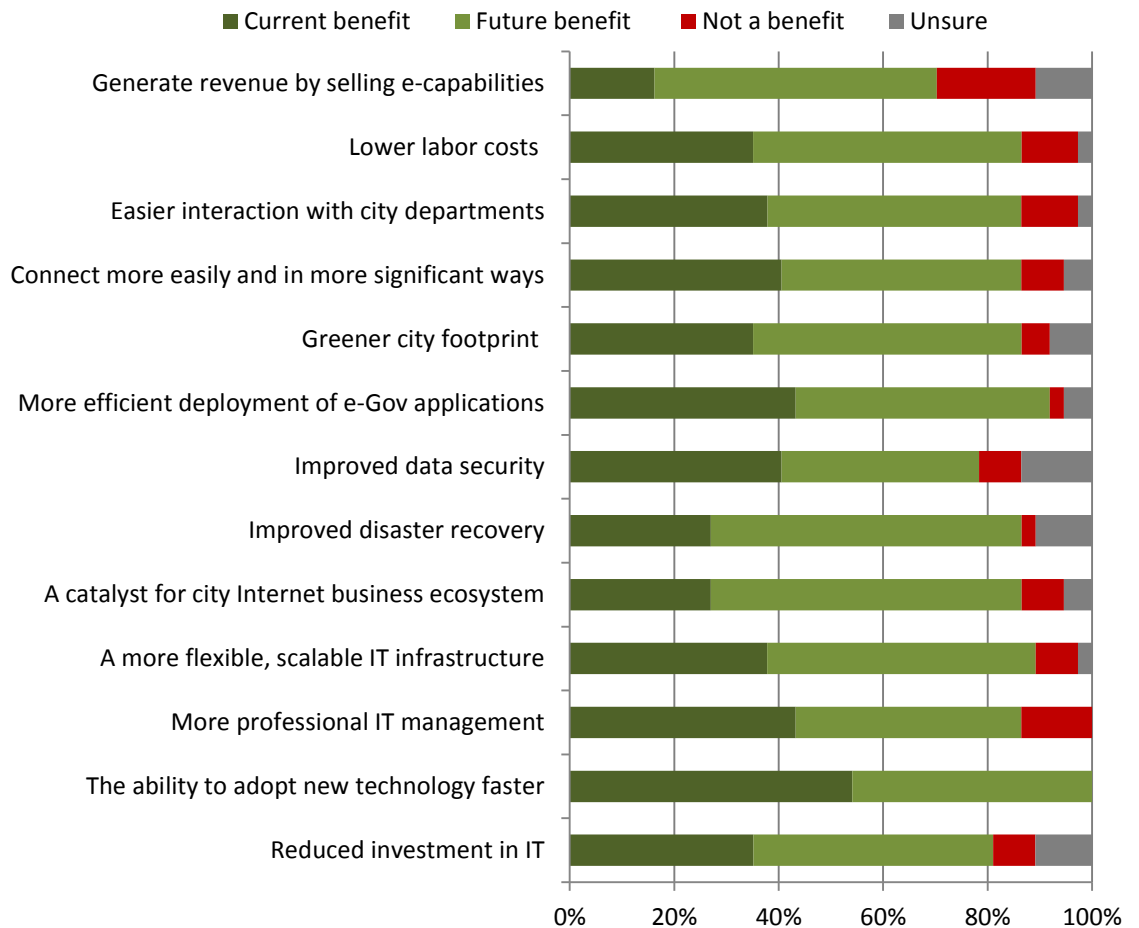
### Cloud benefits

There is widespread acknowledgement that cloud computing can deliver an array of important benefits for Asia's cities, now or at some point in the future. In particular, it is widely believed that the cloud can raise the ability of municipalities to adopt new technology faster and efficiently deploy new e-Government applications. The only areas of any

significant dissent, and these were relatively minor, relate to improved data security as a benefit and the ability of the cloud to deliver revenue generating opportunities.

**Figure 9**  
**What are the benefits of using cloud computing for a city?**

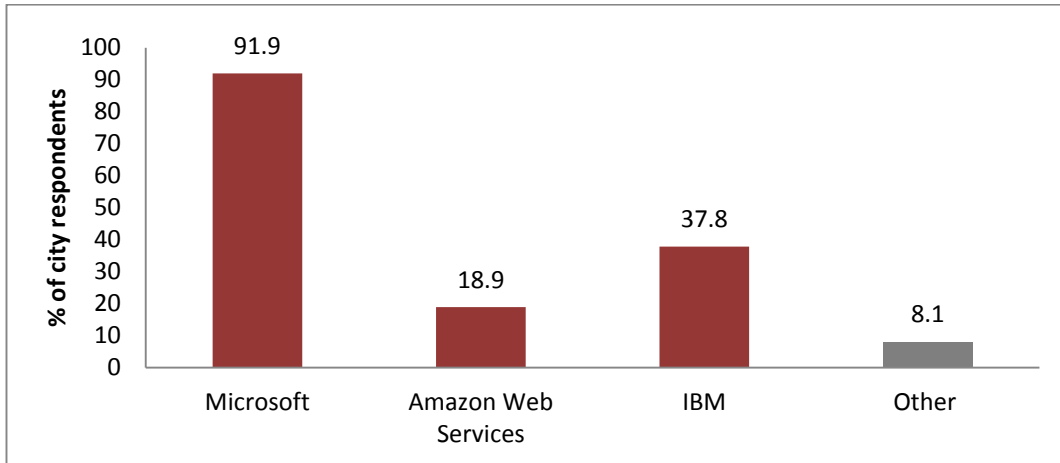
% cities



### Cloud favorites

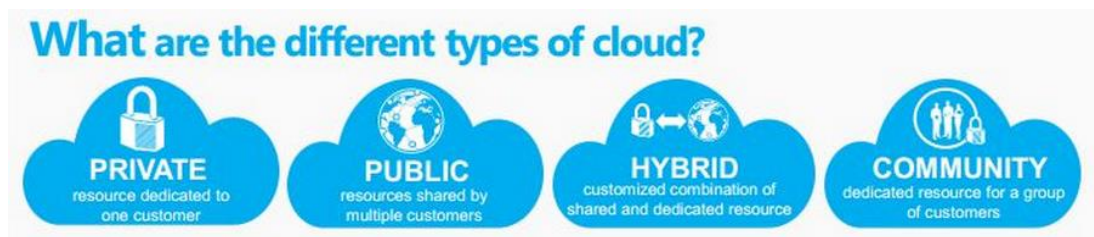
Microsoft was the overwhelming favorite among all city respondents. This was also true for those cities that currently use cloud computing. Other suppliers included domestic suppliers (e.g. local telcos) as well as Google and Apple.

**Figure 10**  
**Which of the following have you or would you consider for cloud solutions?**  
% cities



## CITY CLOUD MODELS FOR ASIA

Cloud computing for cities comes in three basic flavors, each with its own advantages and disadvantages: Public, Private and Hybrid. The trade-off is fundamentally a choice between maximizing shared economies of scale and retaining control through governance security and compliance. Cost is also a factor: private clouds can come with a significant cost premium in comparison to a public cloud, for the same unit of service, due to the combined effects of scale, demand diversification and multi-tenancy.



### The public cloud

The public cloud is an accumulation of hardware, networking, storage, services and applications and interfaces owned and operated by a third party CSP. Using highly scalable data centers, including literally hundreds of thousands of servers, these public clouds often manage relatively straightforward or repetitive workloads (e.g. email). The most open type of public cloud environment is an open community cloud, one which has no requirement for joining other than signing up and creating a password. These environments may be privately or publicly owned and would include social networking environments such as Facebook, LinkedIn, and Twitter. There are also open community sites that enable individuals with a common interest to participate in online discussions and share information (see example of cycling enthusiasts in Ehime Prefecture in Japan).

### The private cloud

The private cloud is a tightly controlled environment, one that is not open to the public. A private cloud can be created by a third party provider for the exclusive use of a single state or city authority. The private cloud is highly automated and has a strong focus on governance security and compliance. In this way, organisational rules and processes can be implemented using software so that the environment becomes more predictable and manageable. Private cloud infrastructure exists on the premises of the cloud provider. For cities with a small installed base of servers (<100), private clouds may be prohibitively expensive compared to public cloud.

### The hybrid solution

Cities should initially use the public cloud as much as possible, leaving the only most sensitive information to on-premises ICT leveraging existing in-house applications and servers. In spite of tight and improving security, cities remain wary of committing all their computing needs to a third party. Hence the popularity of so-called hybrid cloud computing. This involves running some software applications on a service such as Azure while keeping others on its own servers. In coming years, hybrid solutions may well dominate City clouds.

## CLOUD CASE STUDIES

The increasing excitement about cloud computing is prompting governments city, state and federal governments to assess and then implement the new delivery model. This growing number of public sector cloud computing success stories is giving Asian cities the confidence to evaluate and implement their own cloud initiatives.

This final section presents three case studies of cities/states that have taken the plunge.

- The City of Makassar stresses the ability of the cloud to raise the quality of education by making technology more accessible while at the same time energising Makassar's developing software ecosystem.
- In Mexico, the experience of the SAT (Tax Administration Service) demonstrates the dramatic positive impact that cloud adoption can have upon revenue generation, and demonstrates that, through cloud adoption, developing countries can steal a march on the more affluent countries.
- The Queensland Government has devised and implemented a comprehensive cloud strategy to reduce its ICT costs and ensure access to the latest technology. It advises careful consideration of a checklist of internal and external implications, the development of a comprehensive implementation roadmap and an incremental and iterative approach to cloud adoption.

To complement the case studies, this chapter reviews recent and ongoing cloud city initiatives, as publicly available, by governments across Asia Pacific.

### 1 Makassar

#### A future icon of efficiency

Makassar, the provincial capital of the province of South Sulawesi, is Indonesia's 6<sup>th</sup> largest city (population 1.5m) and the biggest metropolis in east Indonesia. Centrally located in the Indonesian archipelago, Makassar is a busy air hub, connecting Sumatra, Java, Bali and Kalimantan in the west with Sulawesi, the Moluccas, Papua and all points east. The city is not a major industrial conurbation and its economy relies heavily on services industries such as tourism, transportation, trading and finance. It is, however, more Internet-enabled than the average Indonesia city. Based on a 2012 study by the Indonesian Internet Service Provider Association (APJII), Internet penetration in the city of Makassar is among the highest in the country at 32.3%<sup>8</sup>, only slightly less than major centers such as Jakarta, Denpasar and Yogyakarta. Makassar City, according to its mayor has the one of Indonesia's highest city economic growth rates, consistently 2-3% above the national average.

In May 2014, Microsoft and the Indonesian city of Makassar signed a memorandum of understanding (MoU) for a strategic partnership to leverage the cloud platform and cloud

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<sup>8</sup> Survey of Internet Users, Indonesian Internet Service Provider Association (APJII)

services, the ultimate aim being to address the demands of the city's economic development and population growth. The agreement's ambitious objectives are to:

- create more effective citizen participation
- improve government efficiency
- develop the local software ecosystem

Under the new cloud agreement, Microsoft and Makassar city government are combining resources to raise the quality of education by making technology more accessible. The new initiative will inject vibrancy into Makassar's developing software ecosystem and help local government streamline operations and introduce more efficient services. The partnership heralds the beginning of a closer alignment of the city of Makassar and Microsoft CityNext solutions and reflects a shared vision, one that recognizes the importance of technology as a driver of the economy as well as a pillar of city competitiveness.

A key objective of the partnership is to reduce the Makassar's digital gap, providing educational institutions access to the Office 365 service, as well as a variety of skills training. The partnership also aims to foster new businesses and innovators, with the resources and support of Microsoft's BizSpark program.<sup>9</sup>

Ir. H. Mohammad Ramdhan Pomanto, Mayor of Makassar: *"We welcome this partnership [with Microsoft], and we believe this collaboration will help transform Makassar into an icon of efficiency and interconnectivity in Indonesia."*

The forward-looking mayor of Makassar has a highly mobile and well connected smart city vision. Mobile applications will provide real-time data that help residents plan their day and improve the ease of communicating and transacting with businesses and government agencies. Digital accessibility will be cast as wide as possible. Surveillance cameras will go up around the city to improve safety and traffic management and Mayor Pomanto wants to leverage the cloud to transform the way in which the city administration of 18,000 employees is managed. The city also plans to launch e-payment systems that will enable businesses to easily pay all types of taxes and fees. Mayor Pomanto expects the roll-out to increase tax revenue by as much as 200% (see following case study on Mexico also).

## ② Mexico

### Taxman and taxpayers benefit from cloud adoption

Tax collection is perhaps not an area in which one would expect Mexico to be an early adopter of technology—and yet it is. Mandatory e-invoicing—forcing buyers and sellers to register invoices with the tax authorities electronically whenever a transaction occurs—was enacted for all of Mexico on April 1st, 2014.

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<sup>9</sup> Started in 2008, BizSpark gives start-ups access to software development tools, industry connections and marketing visibility. Users gain access to Windows Azure, a cloud platform for the creation of web applications and services. (BizSpark startups must develop software, be privately owned, less than five years old, and generate less US\$1m dollars in annual revenue. There is also no cost to join.

The main purpose of e-invoicing is to combat tax evasion through the use of fake invoices, but there are other rewards too. In Mexico, the SAT (Tax Administration Service) has estimated that processing each individual paper invoice costs as much as US\$12.50, including printing, shipping, verification and years of storage. It used to take forests of trees to print paper invoices and acres of warehouses to store them.

Since 2013, Mexico's SAT has used Microsoft Azure cloud computing to ensure it receives electronic documents more securely and more reliably. Specifically, the elasticity of the cloud helps Mexico:

- issue huge numbers of electronic invoices (more than 16m daily on average)
- let SAT customers (taxpayers) check, cancel or download electronic invoices from the tax portal
- provide support to more than 85 authorized certification providers with filing-related services

For the country's 2013 annual tax returns, a version of DeclaraSAT (online tax declaration) was designed in the open and flexible Microsoft Azure cloud platform to facilitate the timely and efficient completion of annual tax returns.

Implementation of the Azure cloud solution helped the tax agency record an 8.2% increase in tax returns year on year. The Ministry of Finance and Public Credit reported that at the end of the April 2014 financial year, it had received the largest number of individual statements ever recorded.

*"Since we started using Microsoft Azure services with the SAT, we have processed close to 4 billion documents with the peace of mind that Microsoft Azure helps keep the information secure, which is fundamental for the organization."*

Juan Manuel Galarza, general administrator for communications, SAT

Alongside the goal of continuing to improve the services offered to Mexican taxpayers, Microsoft cloud computing has enabled a variety of system benefits:

- Microsoft Azure allows the agency to process daily spikes of up to 34m electronic invoices
- external connectivity is assured 99.95% of the time
- absolute security in the management of processed information
- automatic software updates
- network load balancing and high availability

And the benefits cut both ways. While no one likes doing their tax returns—it adds insult to injury when the tax system is slow and inefficient. Reducing the administrative burden of taxation not only benefits the taxpayers but also the economy as a whole. Taxation equity is improved, with the dishonest no longer being subsidised by honest taxpayers.

### ③ Queensland

## Aiming to provide the best public service



The Queensland government has partnered with Microsoft to move public sector staff to cloud-based technology, which will allow employees to access government information across all departments. A new 3-year contract with Microsoft, valued at A\$26.5m, was struck in early 2014. The Queensland government is keen to use the cloud-based technology to replace what it has called "cumbersome IT services" that delivered "little value for money."

Hailing the deal as a milestone, the Queensland government is touting agreement as the "first whole-of-government" cloud software contract in Australia that provides flexibility to move between computer and cloud-based software. The practical implication is that, for the first time, all government departments can discard their out-of-date and incompatible software systems and instead have access to the same technologies, ones that will allow for better sharing and collaboration.

The deal should also provide significant financial value to the state government, which has been working to reduce administration headcount and costs. Queensland Minister for Information Technology, Ian Walker, has high expectations of the new cloud contact, which he believes will let the government attain the ambitious goal of "having the best public service in Australia." Access to the most up-to-date IT services and world class innovations will further enhance the services that Queenslanders can expect.

*"We are moving from a government owned and operated model to one that uses world-class solutions to deliver the flexibility that drives innovation and transformation. It [the agreement with Microsoft] will improve the government's capabilities for us to engage with Queenslanders in new and innovative channels and offer more opportunities to local business and industry," Ian Walker, Queensland Minister for Information Technology said.*

**Implementation roadmap**

The most daunting aspect of cloud adoption is the implementation. Here, the example of the *Queensland Government Cloud Computing Implementation Model (May 2014)* is instrumental. Based on its observations of other early cloud adopters, the government concluded that, "The most successful cloud implementations were achieved by those organisations that adopt an incremental and iterative approach to cloud adoption." Further, "The greatest successes to date have come from small, sharply-focused cloud projects, where business stakeholders and ICT staff worked co-operatively to drive business cases to success."

Consequently, the Queensland Government is progressively implementing five cloud work streams, recognising that the right foundations must be in place to ensure successful and speedy adoption of cloud services (see table below).

**Table 2**

**■ City Cloud Work Streams**



Work stream	Outcomes
<b>Cloud ready</b>	Government agencies are informed regarding best practice procurement and management for cloud services, and are positioned to successfully use cloud services to cost-effectively meet their business requirements.

<b>Cloud foundations</b>	The key foundational building blocks are in place to consume cloud services and manage the use, performance and synchronised delivery of a multi-provider cloud ecosystem.
<b>Cloud engagement</b>	Through a shared vision and a coordinated approach, the Government and its ICT providers will be best positioned to leverage and realise the benefits of cloud-based services.
<b>Cloud accelerate</b>	The government has reformed its ICT service delivery model by adopting a cloud-first enterprise strategy, through the use of accredited cloud service arrangements for common and commodity ICT services.
<b>Cloud governance</b>	The implementation of a range of effective governance measures to ensure successful cloud adoption and continued alignment with the cloud-first enterprise vision.

Source: Queensland Government Cloud Computing Implementation Model, May 2014.

### Cloud considerations: a checklist

Queensland concludes that while the potential benefits of cloud-based services are significant, adoption must be carefully considered and the cloud model brings with it a number of challenges that need to be considered, including:

Organisational change management

The adoption of cloud services will involve significant business and cultural change to agency business practice, business operations, people and processes. Staff skill sets, roles and responsibilities, contractual and financial operating models will need to be considered.

Business practice and processes

The transitioning of ICT functions to cloud solutions will impact agency business process and practices. ICT systems are inherently linked to agency service delivery and support internal processes and practice.

Workforce capability

The adoption of cloud services will require new skills and capabilities. In particular, contract negotiation and management, and supplier performance management.

Impact on local ICT industry

The shift to cloud services may have an impact on the local ICT industry, prompting a reduction in capital investment state/city on-premise ICT infrastructure and applications.

Information, data and records management

Depending on the current policies in place, the following issues should be considered: (a) data classification, (b) data location/retrieval—data should be portable and stored in agreed locations, (c) data ownership and protection, (d) privacy, confidentiality and retention of data stored, (e) data integrity and authenticity, (f) data deletion/retirement, and (g) legislation and regulation

Security management

Security models will need to be adapted to suit cloud environments and consider end-to-end security as governance, compliance and risk management responsibilities are shared between the customer and cloud service provider.

Service integration

Using services from the cloud could present challenges to agencies when those services need to integrate with agency systems that are not in the cloud, or alternatively when data integration/migration is required between multiple services from different cloud providers.

Service level/performance management

Ensuring adequate service performance and reliability needs to be considered.

Financial and fiscal management

As a city/state moves to a more pay-as-you-go service model, utilising a cloud-based service delivery more, a proportion of capital expenditure (Capex) will need to be translated into operational expenditure (Opex).

Existing investments

Existing investment in ICT applications and infrastructure will need to be considered as services are moved to the cloud, notably which infrastructure/applications should be maintained and leveraged; current contractual models (e.g. software licensing) may present a potential impediment to cloud services also.

Procurement and contractual management

A shift to pay-as-you-go cloud services introduces new contractual arrangements.

Other cloud city activity as made publicly available.

**Table 3**

**■ City Cloud Ambitions**

Compilation of Announced City Cloud Activity

City	Objectives
<b>Ho Chi Minh City, Vietnam</b> (2014)	<p><u>Aim:</u> to realize the municipality's development as a smart city.</p> <p><u>Key elements:</u></p> <p>Under a 2014 MOU between the city and Microsoft, both parties will focus on developing:</p> <ul style="list-style-type: none"> <li>• IT Infrastructure for Smart City status</li> <li>• Information Security</li> <li>• Cloud Apps Development</li> <li>• Training for IT Resources</li> <li>• e-government &amp; e-Health Development</li> <li>• High-tech and Electronic Information Technology Industries</li> <li>• IPR implementation</li> </ul>
<b>Seoul, South Korea</b> (by 2016)	<p><u>Aim:</u> South Korea's capital city is developing a cloud platform to better connect its government agencies.</p> <p><u>Key elements:</u></p> <ul style="list-style-type: none"> <li>• The platform will improve interoperability of systems and data portability between agencies</li> <li>• Increased communication and collaboration between government officials.</li> <li>• Involvement of small and medium enterprises which specialise in cloud services</li> </ul>
<b>Pasay, Philippines</b> (2014-15)	<p><u>Aim:</u> Move city data into the cloud and invest in Big Data to improve citizen services and virtualize servers.</p> <p><u>Key elements:</u></p> <ul style="list-style-type: none"> <li>• Cost-effective solution for our expanding database</li> <li>• The City Government of Pasay (Pasay pop: &gt;400,000) to centralise government processes across agencies to allow data sharing for analytics</li> <li>• Standardised/automated systems have already increased the city's income from P800m (US\$18m) to nearly P4bn (US\$90m) within five years</li> </ul>
<b>Tamil Nadu, India</b> (2014)	<p><u>Aim:</u> Delivery of cloud-based solutions to state wide departments.</p> <p><u>Key elements:</u></p> <ul style="list-style-type: none"> <li>• No longer dependent on departmental-dedicated infrastructure</li> <li>• With the deployment of cloud, the Tamil Nadu Government expects online applications to be able to better handle heavy user traffic</li> <li>• Cost advantages for maintaining digital services</li> </ul>

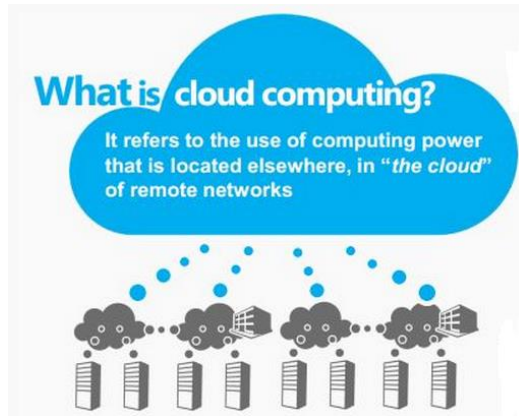
City Cloud: Cloud Adoption for Asia's Cities

<p><b>Hong Kong,</b> (2013)</p>	<p><u>Aim:</u> a Government Cloud Platform (GovCloud) to support the hosting of common e-government services for shared use by government bureaus and departments.</p> <p><u>Key elements:</u></p> <ul style="list-style-type: none"> <li>• HK's first major private cloud computing initiative</li> <li>• GovCloud's facilities are dedicated for government use.</li> <li>• Robust and resilient infrastructure enables GovCloud to provide a stable and reliable environment for agencies to develop and host e-government services.</li> <li>• Adopting cloud computing provide benefits of cost and time saving, and enhances agility in meeting the growing demands of bureaus and departments on IT resources, expediting expedite development and delivery of e-government services.</li> </ul>
<p><b>Dongying, China</b> (2009)</p>	<p><u>Aim:</u> Help transform the city of Dongying from a manufacturing-based economy to a high-tech services oriented economy.</p> <p><u>Key elements:</u></p> <ul style="list-style-type: none"> <li>• Cloud-based platform for the local petroleum industry to develop more innovative application services</li> <li>• Software development and test resources, through the Internet, for start-ups and other companies that establish their presence in the city</li> <li>• eGovernment Services Platform for Dongying Economic Development Zone</li> <li>• Solutions for "Smart Roads" and a "Smart Airport" based on data analytics</li> <li>• Healthcare services in the cloud as part of the plan to centralize patients' records and make them available to doctors online.</li> </ul>
<p><b>Wuxi, China</b> (2009)</p>	<p><u>Aim:</u> establish a 'Cloud Services Factory' to provide adequate computing resources to the enterprises (mainly start-ups) located in a software park.</p> <p><u>Key elements/outcomes:</u></p> <ul style="list-style-type: none"> <li>• Higher financial bandwidth to acquire the required IT assets to compete effectively.</li> <li>• Attraction of more enterprises to the city</li> </ul>
<p><b>Pekalongan, Indonesia</b> (2013)</p>	<p><u>Aim:</u> Develop a 'smart city system' covering health, education security and transportation</p> <p><u>Key elements/outcomes:</u></p> <ul style="list-style-type: none"> <li>• Improved administration efficiency</li> <li>• Higher citizenry satisfaction</li> <li>• Benchmark for information based city development</li> </ul>
<p><b>Jammu &amp; Kashmir, India</b></p>	<p><u>Aim:</u> More efficient and expansive e-Government services (The Jammu &amp; Kashmir state government was the first India to adopt cloud computing for eGovernance services, using Microsoft cloud computing solution.)</p> <p><u>Key elements/outcomes:</u></p> <ul style="list-style-type: none"> <li>• Issuing cloud based ration cards, birth/death certificates</li> <li>• Recruitment services for citizens</li> </ul> <p>In order to roll out these services in just 60 days, the spare infrastructure from the data centers in Madhya Pradesh was used.</p>

Sources: [www.futuregov.asia/](http://www.futuregov.asia/), general news sources

## Appendix A

# City Cloud Defined



### What is The Cloud?

The US National Institute of Standards and Technology (NIST) definition of cloud computing is most commonly used throughout the ICT industry:

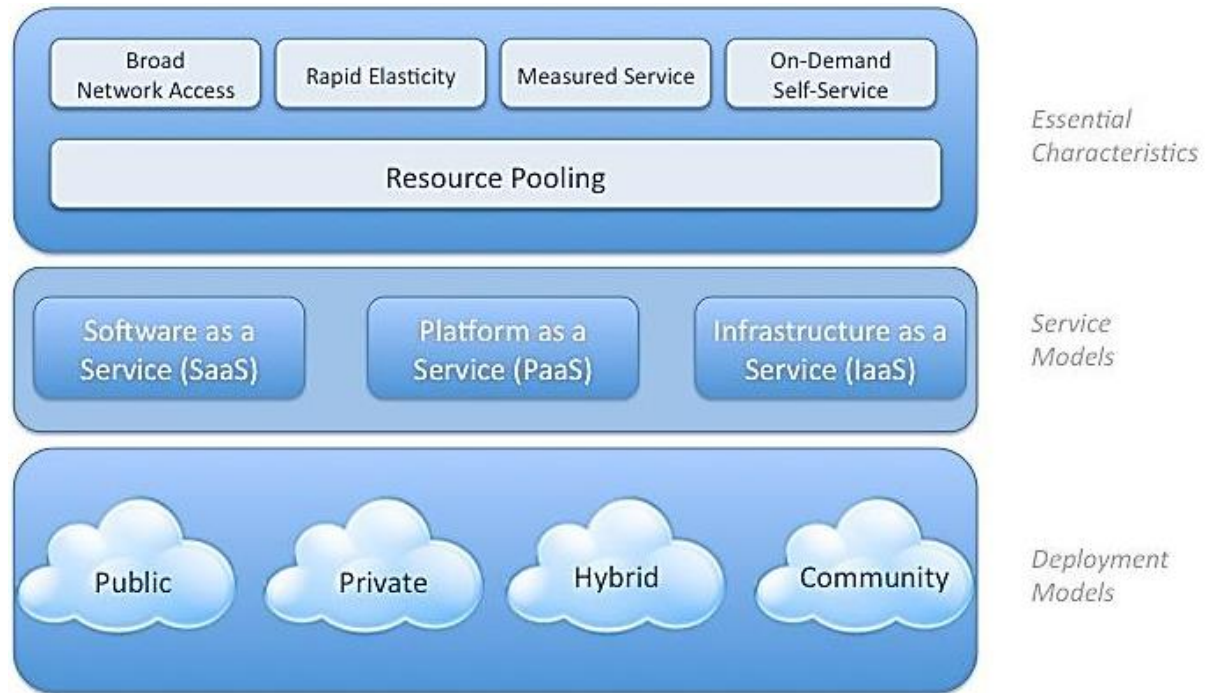
*Cloud computing is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g. networks, servers, storage, applications and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction.*

Essentially, the cloud provides a new economic model of computing. Instead of having to own, manage and maintain a self-contained data center, cloud computing lets organizations lease storage and processing capacity from expert providers such as Microsoft, saving themselves the expense and bother of having to buy and maintain their own servers and data centers.

The emergence of cloud services is fundamentally changing the economics of IT. Cloud technology standardizes and pools IT resources and automates many of the maintenance tasks done manually today. Cloud architectures facilitate elastic consumption, self-service and pay-as-you-go pricing.

The cloud model is composed of: (a) five essential characteristics, (b) three service models, and (c) four deployment models as depicted and described below.

**Figure 11**  
**NIST Definition of Cloud Computing**



Source: National Institute of Standards & Technology, US Dept. of Commerce

**(a) Five Essential Cloud characteristics**

Broad network access: Access via many standard devices (e.g. mobile phones, tablets, laptops, and workstations).

Rapid elasticity: Automatic scalability (outward and inward) corresponding to demand, which to the user appears unlimited.

Measured service: Cloud systems automatically control and optimize resource use by using a metering capability.

On-demand self-service: Access to computing capabilities, such as server time and network storage, as needed automatically without requiring human interaction with each service provider.

Resource pooling: Computing resources are pooled to serve multiple consumers with different physical and virtual resources dynamically assigned according to consumer demand (resources can include storage, processing, memory, and network bandwidth).

**(b) Three Cloud Service Models**

Cloud computing technologies offer a good solution for cities to consolidate their physical infrastructure. Cloud technologies provide different levels of services such as IaaS (infrastructure as a service), PaaS (platform as a service) and SaaS (software as a service) for efficiency, quality of service on demand and green infrastructure.

## What are the different cloud services?

	SOFTWARE-AS-A-SERVICE		PLATFORM-AS-A-SERVICE		INFRASTRUCTURE-AS-A-SERVICE
It enables a user to be able to use an application without installing it on a computer or other type of device.	It allows third parties to build applications without buying hardware or maintaining software.	It provides hardware capacities as demanded by users, to run their own software services.			

Software as a service (SaaS): The city uses the provider's applications running on a cloud infrastructure. The applications are accessible from various client devices through either a thin client interface, such as a web browser (e.g. web-based email) or a program interface. The city does not manage or control the underlying cloud infrastructure including network, servers, operating systems, storage or even individual application capabilities, with the possible exception of limited user-specific application configuration settings.

Platform as a service (PaaS): The capability provided to the city is to deploy onto the cloud infrastructure consumer-created or acquired applications created using programming languages, libraries, services and tools supported by the provider (e.g. for media services). The city does not manage or control the underlying cloud infrastructure, including network, servers, operating systems, or storage, but has control over the deployed applications and possibly configuration settings for the application-hosting environment.

Infrastructure as a service (IaaS): The capability provided to the city is to provision processing, storage, networks, and other fundamental computing resources where the consumer is able to deploy and run arbitrary software, which can include operating systems and applications. The consumer does not manage or control the underlying cloud infrastructure but has control over operating systems, storage, and deployed applications; and possibly limited control of select networking components (e.g. host firewalls).

### (c) Four Cloud Deployment Models

Public cloud: This cloud infrastructure is provisioned for open use by the general public. It may be owned, managed and operated by a business, academic or government organization, or some combination of them. It exists on the premises of the cloud provider.

Private cloud: This cloud infrastructure is provisioned for exclusive use by a single city comprising multiple consumers (e.g. administrative departments). It may be owned, managed, and operated by the city, a third party, or some combination of them, and it may exist on or off premises.

Hybrid cloud: This cloud infrastructure is a composition of two or more distinct cloud infrastructures (private, community, or public) that remain unique entities, but are bound together by standardized or proprietary technology that enables data and application portability (e.g. cloud bursting for load balancing between clouds).

Community cloud: This cloud infrastructure is provisioned for exclusive use by a specific community of consumers from organizations that have shared concerns (e.g. mission, security requirements, policy, and compliance considerations). It may be owned, managed, and operated by one or more of the organizations in the community, a third party, or some combination of them, and it may exist on or off premises.

## Appendix B

# Microsoft Technology Cloud Solutions

Microsoft has been in the forefront of the cloud revolution for more than a decade. Today, the company's cloud includes top global enterprises—energy companies, telecom firms, banks, and pharmaceutical giants—in addition to more than 500 state and local governments, including, many in Asia (see case studies for Queensland and Makassar).

### Microsoft's Trustworthy Cloud Initiative

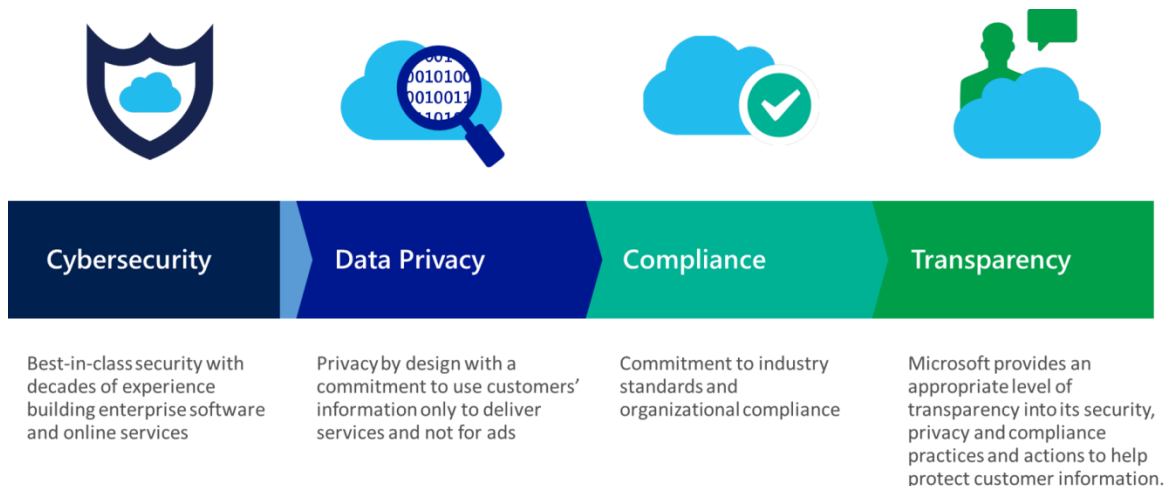
When it comes to choosing a cloud provider, how do cities decide who to trust with their most sensitive information? Cities naturally want reassurance that their cloud service provider has the right capabilities to keep their data secure and private. They want a provider that has deep awareness of the cybersecurity landscape, one that is able to respond immediately to any threats. Ultimately, cities want to be confident that their provider will deliver a secure and a regulatory compliant cloud solution.

Five questions a cloud service provider must answer to earn customers' trust

1. Who has access to my data?
2. Where is my data?
3. What are you doing to protect my data?
4. How do I know you are doing what you say you are doing?
5. Why should I trust you with my data?

Microsoft, with its strict operational policies and transparent procedures for protecting customer information will answer these questions. It utilizes the Operational Security Assurance (OSA) framework, which details an optimal approach to security controls such as vulnerability scanning, patch management, encryption and much more. It is a framework designed to continually evolve and refine operational security practices in the cloud to keep pace with any changes in the threat landscape.

More than this, to deliver a truly Trustworthy Cloud, Microsoft provides built-in capabilities and customer controls for organizations.





## Meeting security concerns

Microsoft is committed to making its own products safe. To address product vulnerabilities, Microsoft uses its Security Development Lifecycle, a security assurance process for new products. Microsoft uses a patch management system that enhances operational security through standard, predictable, and regular releases of software patches. Cities can take advantage of Privacy by Design at Microsoft, which describes not only how it builds products, but how the company is organized as an accountable technology leader.

Microsoft draws on years of experience in dealing with cyber threats around the world to help cities develop cybersecurity strategies. Each month, it receives threat information from more than 600m systems in more than 100 countries and regions. Microsoft also works closely with governments, city leaders, organizations, and individuals to get a first-hand view of how risks within their environments are managed.

## Assessing compliance & risk for cloud computing

Microsoft has developed a set of tools to help organisations to objectively identify, analyse, assess and determine potential risk treatment alternatives for many risks related to their proposed cloud strategy. The framework adds value to the decision-making process using a practical process to help cities design and implement cloud strategies, the purpose of which is to assess the potential for a city to leverage a particular IT capability through the use of a cloud-delivered IT service via a third party vendor.

Microsoft would apply the following five step analysis to address compliance requirements and evaluate risk for a cloud-services candidate city.



Source: Assessing Compliance & Risk for Cloud Computing Deployments, Microsoft

### Microsoft's solutions

Microsoft recognises that for cities, a "one size fits all" strategy for cloud adoption is not helpful. A holistic appreciation of city capabilities across different scenarios (Private, Public, Hybrid) is needed and any solution should provide consistent user experience for the different audiences (End Users, Developers, ICT Managers).

	Public	Private
<b>SaaS</b>	Microsoft Office 365 (Office, Exchange, Lync, Sharepoint) Dynamics CRM online	<a href="#">Microsoft Office</a> <a href="#">Microsoft Exchange (secure email)</a> <a href="#">Microsoft Lync</a> <a href="#">Microsoft Sharepoint</a> <a href="#">Microsoft Dynamics CRM</a>
<b>PaaS</b>	Microsoft Azure Microsoft Dynamics CRM Microsoft Visual Studio Online	<a href="#">Cloud Platform System</a> <a href="#">Visual Studio Team Foundation Server</a>



<b>IaaS</b>	<a href="#">Microsoft Azure</a> <a href="#">Microsoft Intune</a> <a href="#">Microsoft Enterprise Mobility Suite (hybrid)</a>	<a href="#">Microsoft Windows Server</a> <a href="#">System Center Server</a> <a href="#">Cloud Platform System</a>
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