

ANNEX A

Brief Description on the Nine Technology Themes Identified

1. **Big Data**

Big Data refers to datasets whose size is beyond the ability of typical database software tools to capture, store, manage and analyse. It gives rise to an ecosystem of new software and hardware products that enable users to analyse the huge data sets to produce more detail and new insights. Driven by the rapid increase in number of people and devices connected to the Internet, data is growing at a phenomenal rate. The amassed data pool contains hidden insights which give governments and enterprises the opportunity to understand the behaviours and opinions of their targeted interest groups. New technologies have to be adopted to manage the data deluge and extract these insights before more effective business models and policies can be formulated.

2. **Cloud Computing**

Cloud computing is an orchestration of various technologies enabling, but not limited to, multitenancy, automated provisioning and usage accounting, the Internet and other connectivity technologies like richer Web browsers to realise the vision of computing delivered as a public utility. Cloud elasticity affects an organisation's bottom line by improving efficiency and influences the topline of the business by allowing low-risk experimentation, innovation, and improving turnaround time. In the long term, IT agility enabled by cloud computing will transform the business landscape. On-demand delivery of software, platforms or infrastructure as a service lends itself well to today's challenges of shrinking IT budgets and the metamorphosis of IT from a cost centre to a driver for business growth. Cloud computing can lower the cost of operations by consolidating supply, aggregating demand and improving efficiency through multi-tenancy. IT can leverage on Cloud to improve agility and align itself to create strategic value for business.

3. **Cyber Security**

Cyber security is such a critical concern that it is projected to be among the fastest growing segments of the infocomm technology in the next three to five years. In cyberspace, everything and everyone are interconnected digitally. Today, these attacks are systematically orchestrated and commercialised to achieve greater impact and damage, with less effort and sophistication. A proactive and coordinated cyber security system is necessary to minimise the adverse effects caused by cyber attacks from people or organisations with malicious intent. With cyber attacks becoming better orchestrated and more sophisticated globally, continuous innovation is necessary to provide a secure environment for individuals and enterprises to operate in. To understand the rapidly evolving landscape of Cyber Security, we must understand potential threats and the emergence and evolution of security technologies.

4. **Internet of Things**

The boundary between the physical and the digital worlds is blurring with the prevalence of the Internet of Things (IoT) where the physical, digital and virtual worlds converge in a networked environment. IoT refers to the pervasive connectivity of physical objects, often using the same Internet Protocol (IP) that connects the Internet, to enable communication, interactions and controls. The pervasive connectivity of these physical objects enables multiple interactions that spur the creation of new intelligent services, improvement in information exchange and enhancement of quality of life. IoT is poised to bring tremendous value and impact - helping people decide the best route to work and choose a favourite restaurant, and ensuring that our health is constantly being monitored. For enterprises, IoT will create tangible business benefits ranging from improved management and tracking of assets to new business models and cost savings achieved through optimization of equipment and resources.

5. **Sustainability**

Sustainability has emerged as a result of concerns about the unintended social, economic and environmental consequences of rapid urbanisation and economic growth, as well as growing resource constraints. Our actions today will have an impact on the current environment and that of future generations to come. ICT can play an active role in enabling innovations to tackle various sustainability challenges. An example is smart building technology which can optimise energy consumption using installed building systems to improve energy efficiency. However, the ICT sector will also need to take actions to minimize its own social and environmental impact.

6. **Communications of the Future**

Convergence is bringing various technologies together, and enabling us to do things beyond our imagination. Communication is no longer confined to traditional voice or data. Mobile devices are empowering individuals to connect anytime, anywhere. The bandwidth of communication networks is also increasing to keep pace with data traffic growth. Today, the movement from basic fixed telephony to wireless mobile connectivity is changing the way we communicate, work and entertain ourselves. Singapore has one of world's highest mobile penetration rates, indicating a trend that has implications for future development of applications and services. The popularity of smartphones, tablets and other Web-enabled, connected devices further fuels social media and networking activities. This "always on" connectivity has given rise to a world where the Internet of Things (IoT) influences business and public services as well as our digital lifestyle. We can expect more new machine-to-machine(M2M) / IoT applications to crowd the landscape. To cope with the scale and elastic demand, cloud-based infrastructure that offers more flexibility will become an attractive proposition.

7. **Social Media**

Social media essentially comprises networks that democratise the landscape of engagement. The public is increasingly self-organising events and campaigns, and coordinating them through social media. The effectiveness of this kind of engagement was most evident during the major earthquakes in Haiti and Japan. A good understanding of the opportunities that arise from the evolution of social media will help organisations to engage the community more effectively and gain useful insights to improve their services or business models. It is thus essential for organisations to learn to tap on and manage interactions on various social media platforms so they will be in better stead to leverage the power of the masses to extend their influence.

8. **New Digital Economy**

With the widespread adoption of social media and mobile technologies, the digital economy has entered a new phase of development, presenting unprecedented opportunities for future growth. These include the provision of direct access to mass consumer markets via mobile devices and the promotion of proactive consumer feedback to improve technology products. It will profoundly transform consumer-enterprise interactions, particularly the conduct of purchases in sectors such as retail and entertainment. Mobile is fast becoming the primary window to the Internet for most consumers. The adoption of smart mobile devices has empowered a new era of infocomm-enabled business models that can potentially either disrupt traditional businesses or be leveraged for unprecedented growth and opportunities. Apps on handheld devices are gaining more consumer "face time" and social networking sites are becoming consumers' first site of visit on the Web, replacing "Search." Even in emerging markets, because of the millions of new mobile customers, new business models are emerging continuously and may even be applied back in reverse to developed markets.

9. **User Interface**

User interface and interaction technologies provide users with new ways to interact with data, systems and the environments in which we work, live and play. The paradigm shift in the concept of user interface, of which the user is now the new interface, is fundamentally about multiple user interface technologies and enablers converging to provide a more holistic and immersive user experience.