



Smart Cities Seoul: a case study

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Rapid urbanization is exerting growing pressure on cities' traditional infrastructures, and information and communication technologies (ICTs) present very viable means of updating these infrastructures to reflect the demands of 21st century societies. This ITU-T Technology Watch Report analyses Seoul's implementation of its "Smart Seoul 2015" project, providing a best-practice guide to the construction and operation of a smart city. The report investigates the conceptual underpinnings of Smart Seoul, the use of smart technologies and mobile-web applications to provide citizen-centric services, and the role of technical standards as the precondition for smart city functionality.



The rapid evolution of the telecommunication/information and communication technology (ICT) environment requires related technology foresight and immediate action in order to propose ITU T standardization activities as early as possible.

ITU-T Technology Watch surveys the ICT landscape to capture new topics for standardization activities. Technology Watch Reports assess new technologies with regard to existing standards inside and outside ITU-T and their likely impact on future standardization.

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The opinions expressed in this report are those of the authors and do not necessarily reflect the views of the International Telecommunication Union or its membership.

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Smart Cities

1 Introduction to Smart Cities

1.1 What is a Smart City?

Many of the world's major cities have embarked on smart city projects, including Seoul, New York, Tokyo, Shanghai, Singapore, Amsterdam, Cairo, Dubai, Kochi and Malaga. Smart cities may still be viewed as cities of the future, but considering today's rate of innovation it is highly likely that smart city models will over the coming decade become very feasible and certainly very popular strategies for cities' development.

A smart city has been defined as a 'knowledge', 'digital', 'cyber' or 'eco' city¹; representing a concept open to a variety of interpretations, depending on the goals set out by a smart city's planners. We might refer to a smart city as an improvement on today's city both functionally and structurally, using information and communication technology (ICT) as an infrastructure.

The concept of a smart city is evolving and the work of defining and conceptualizing the term is in progress. Some of the earlier outcomes of this activities included:

- *"A city well performing in a forward-looking way in [economy, people, governance, mobility, environment, and living] built on the smart combination of endowments and activities of self-decisive, independent and aware citizens."*²
- *"A city that monitors and integrates conditions of all of its critical infrastructures including roads, bridges, tunnels, rails, subways, airports, sea-ports, communications, water, power, even major buildings, can better optimize its resources, plan its preventive maintenance activities, and monitor security aspects while maximizing services to its citizens."*³

Smart cities demand careful planning and, at an early stage, it is essential that national and municipal governments, citizens and all other stakeholders agree on the smart city definition they aim to fulfill. A clear definition or strategy must address two key factors: the city's desired 'functions' and 'purposes', with its 'functions' referring to the appearance and operation of a city, and its 'purposes' to the benefits promised by a smart city model.

Looking at its functions as well as its purposes, a smart city can perhaps be defined as "a city that strategically utilizes many smart factors such as Information and Communication Technology to increase the city's sustainable growth and strengthen city functions, while guaranteeing citizens' happiness and wellness."⁴

A human-centric smart city thus relies on an advanced ICT infrastructure and continued urban development, always taking environmental and economic sustainability into account (Figure 1).

¹ A. Murray, M. Minevich, and A. Abdoullaev, "Being smart about smart cities," KM World, October 2011.

² R. Griffinger et al., "Smart cities - Ranking of European medium-sized cities," October 2007, http://www.smart-cities.eu/download/smart_cities_final_report.pdf.

³ R. Hall, "The vision of a smart city," September 2000, <http://www.osti.gov/bridge/purl.cover.jsp?url=/773961-oyxp82/>.

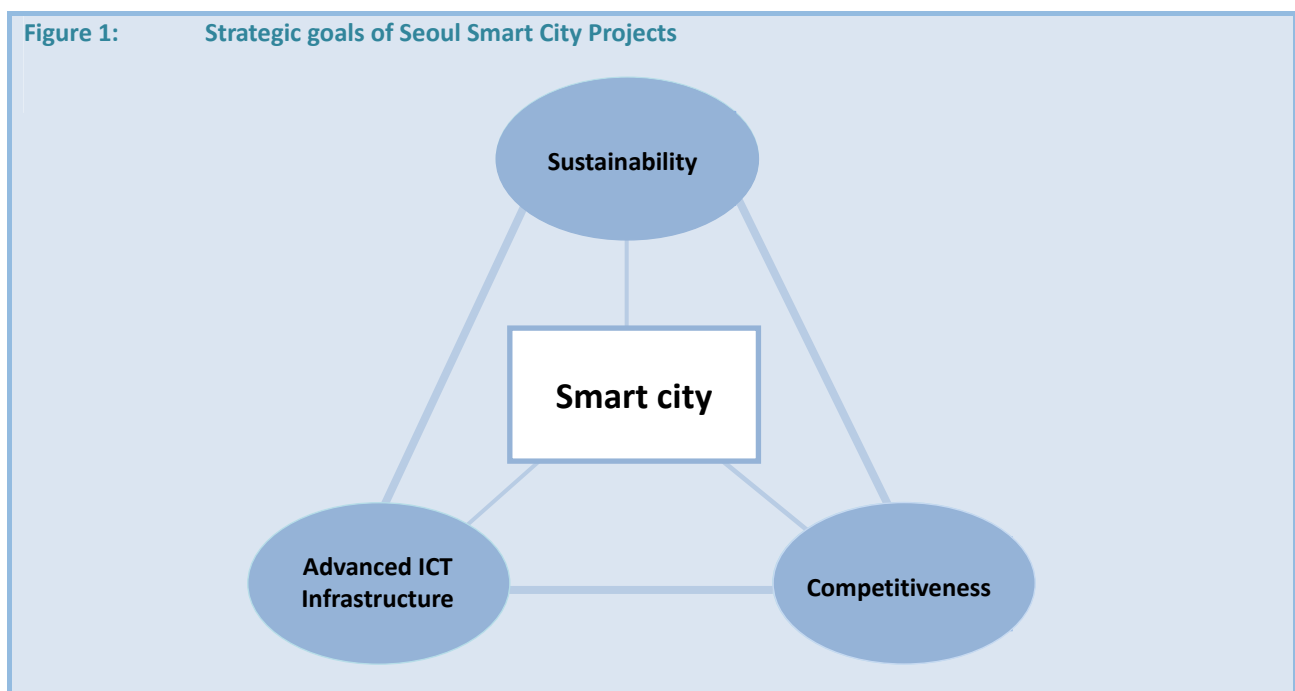
⁴ UN, "Our Common Future, Chapter 1: A Threatened Future," Clause 49 from <http://www.un-documents.net/ocf-01.htm#1>

1.2 Smart Cities' ICT Infrastructure

ICT is the basic infrastructure of a smart city, used not only in cyber space, but also as communicating elements of physical infrastructure, transmitting real-time data on a city's status by way of sensors and processors applied within real-world infrastructure. A diverse range of city functions and services rely on this ICT infrastructure, and this brings about a convergence of processes that enables a smart city to function as a giant, independent intelligence unit.

Structurally, a smart city is a system of systems. Many individual, independent systems are combined to form meta-systems which in turn become sub-systems. This interoperation of countless independent systems demands that openness and standardization be adhered to as the key principles in smart city construction. At the subsystems level, a lack of openness limits the scope of a smart city, and a lack of standardization increases the costs of a city's construction. Without openness and standardization, a smart city project quickly becomes cumbersome and expensive.

As a consequence of its service-driven ICT infrastructure, a smart city's relationship with its citizens is what distinguishes it most from a traditional city. The ICT-supported services of traditional cities cannot respond to changing economic, cultural and social contexts in the way that smart-city services can, and one could say that smart cities are relatively more considerate of people; responding attentively to individuals' tastes and preferences, and relying on the city's inhabitants to pinpoint the most needed improvements to city services. A smart city is above all a human-centric city, adapting its behavior in response to that of its citizens – the ICT users constantly interacting with city infrastructure and services.



1.3 The Evolution of a Smart City

One may generally classify smart cities in three types:

1. New cities, built *smart from the start*: these cities are designed to attract businesses and residents with a master plan that uses ICT to deliver efficient citizen benefit services.
2. Existing cities made smart, *smartization*: This partial approach (step by step; with retrofits and upgrades) is followed by most cities.
3. Purpose-driven cities: These are cities established with special purposes, e.g., industrial cities, science towns, etc.

Seoul would qualify for class 2 and has applied three broad phases to the evolution of a smart city:

- The **First Phase**, or the individual service level, applies ICT to improve individual city operations such as transportation, safety, environment and culture. The majority of 2012's smart city projects lie in this phase, an example being the addition of real-time bus schedule information to public transportation services, or using closed-circuit television (CCTV) to a greater extent in maintaining public safety.
- The **Second Phase**, or the vertical service level, integrates related processes and services by smart technology within major sectors of a city, enabling the provision of more advanced services. Taking the transportation sector as an example, citizens are offered information on the public transportation system's real-time activity as well as emergencies, road conditions, road repairs and subsequent detours. Smart city services are not yet integrated across sectors, but people will experience leaps forward in the quality of service provided by each sector.
- The **Third Phase**, or the horizontal service level, is the point of smart city development at which there is no longer a distinction between different service areas, with all parts now seamlessly integrated within an efficient smart city ecosystem.

The Second Phase, and especially the Third Phase, will see the creation of many new B2B (business-to-business) and B2C (business-to-customer) models making use of smart-city infrastructures to provide improved services (See Figure 10 Virtual Store as an example).

1.4 Smart Cities around the World

Many of the world's major cities are attempting smart city projects, aided by multinational corporations such as IBM which provides smart technology solutions through their "Smarter Planet"⁵ initiative, and benefiting from research undertaken by the likes of the Massachusetts Institute of Technology (MIT), an institution keenly involved in the study of "smart cities"⁶.

Many international and industry organizations are advancing the smart city agenda:

International Organizations:

- UN-HABITAT: Sustainable Cities Programme⁷
- The World Bank: Eco2-Cities (Ecological, Economical)⁸
- APEC: Low Carbon Model Town⁹
- EU: Smart Cities and Communities Initiative¹⁰

Industry players:

- Siemens: Green Cities¹¹
- IBM: Smarter Planet
- GE: Masdar Smart City¹²
- Toshiba: Smart Community¹³

⁵ Smart Planet, IBM, http://www.ibm.com/smarterplanet/us/en/?ca=v_smarterplanet

⁶ Smart Cities, MIT, <http://smartcities.media.mit.edu/>

⁷ <http://www2.unhabitat.org/programmes/sustainablecities/>

⁸ <https://openknowledge.worldbank.org/handle/10986/2453>

⁹ http://publications.apec.org/publication-detail.php?pub_id=1225

¹⁰ http://ec.europa.eu/energy/technology/initiatives/smart_cities_en.htm

¹¹ <http://www.siemens.com/entry/cc/en/greencityindex.htm>

¹² <http://www.ge.com/innovation/masdar/index.html>

- Cisco: Smart Connected Communities¹⁴
- LG-CNS: Smart Green City¹⁵

Looking at the world's various smart city projects one might be surprised to discover more differences than similarities among them:

- Dubai's application of the concept focuses on enhancing urban development, and it leads a *Smart-City* project¹⁶ which aims to build a smart city network with Malta and Kochi. New cities added to this network are immediately associated with the *Smart-City* brand, attracting knowledge-intensive businesses to cities known to offer cutting-edge urban and ICT infrastructure.
- Amsterdam's approach is to achieve greater environmental sustainability through smarter operations, employing numerous state-of-the-art technologies in efforts to reduce its emissions and use energy more efficiently.

Other cities aim for the *smartization* of a broad range of city functions, with ubiquitous smart technology playing a role in all aspects of citizens' lives. Two examples of this strategy are Korea's "Ubiquitous City (u-City)"¹⁷ launched in 2004, and Deutsche Telekom's "T-City"¹⁸ in Germany launched in 2006.

The "Smart Seoul" in this case study follows a balanced approach, focusing initially on a number of well-balanced smart factors, and ultimately on much smarter city management and a better quality of life for Seoul's citizens.

Mayors of cities around the world have formed alliances and networks to discuss issues related to Smart Cities, urbanization and environmental challenges. Some of those initiatives are listed below.

- The World Cities Summit Mayors Forum¹⁹. Established by the Centre for Liveable Cities and Urban Redevelopment Authority, The World Cities Summit Mayors Forum is a platform for mayors and governors to discuss city challenges, share best practices on urban solutions and form partnerships on innovative projects.
- The Global Mayors' Forum (GMF)²⁰ is an international conference on the topic of urban development, held annually by the GMF Council. The forum focuses on issues related to sustainable development but also covers such things as international cooperation, modern development practices, public relations, and other topics in the fields of urban planning, economics and international relations.
- C40 Cities Climate Leadership Group²¹, launched in London, October 2005. C40 is a network of the world's megacities to reduce greenhouse gas emissions. It is committed to implement meaningful and sustainable actions for climate change related locally and that will help address climate change globally.

¹³ <http://www.toshiba-smartcommunity.com/EN/>

¹⁴ http://www.cisco.com/web/strategy/smart_connected_communities/overview.html

¹⁵ <http://www.lgcns.com/>

¹⁶ Dubai, Smart city project, <http://gulfnews.com/business/general/dubai-signs-lease-agreement-for-smart-city-project-1.767167>

¹⁷ <http://www.ucta.or.kr/en/ucity/background.php>

¹⁸ <http://www.telekom.com/media/management-to-the-point/120314>

¹⁹ The World Cities Summit (WCS) Mayors Forum, <http://www.worldcities.com.sg/aboutus.php>

²⁰ The Global Mayors' Forum, <http://www.globalmayorsforum.org/>

²¹ C40 Cities Climate Leadership Group, <http://www.c40cities.org/partners>

- In Europe, the Covenant of Mayors²² is the first European Commission initiative directly calling on local authorities and citizens to take the lead in the fight against global warming. All Covenant of Mayors signatories make a voluntary and unilateral commitment to go beyond EU objectives regarding the reduction of greenhouse gas emissions.
- World e-Governments Organization of Cities and Local Governments (WeGO)²³ is an international organization committed to accomplishing three goals. It seeks to share and disseminate the knowledge and practices of e-governments around the world; to achieve “green growth” utilizing ICTs, to bridge the digital divide by providing ICT support to cities in developing countries, and to improve citizens’ quality of life through greater administrative efficiency and transparency.
- World Mayors Council on Climate Change (WMCCC)²⁴, launched in Kyoto, December 2005. The WMCC is an alliance of committed local government leaders concerned about climate change. They advocate for enhanced engagement of local governments as governmental stakeholders in multilateral efforts addressing climate change and related issues of global sustainability.
- Asian Mayors Forum²⁵ is aiming to achieve more cooperation and integrity among Asian metropolises, urban development and higher standards of life for all citizens. Some of the goals of the Forum include: elevation of the levels of cooperation and partnerships among municipalities, creating better environments for balanced urban developments, cultural and social integrity and offering better solutions for resource allocation towards optimization of urban development.

²² Covenant of Mayors; <http://www.eumayors.eu/>

²³ WeGO, <http://www.we-gov.org/>

²⁴ World Mayors Council, World Mayors Council on Climate, <http://www.worldmayorscouncil.org/>

²⁵ Asian Mayors Forum, <http://www.asianmayors.org/>

2 Smart Seoul

Officially “Seoul Special City”, Seoul is the capital of South Korea and the country’s largest metropolis with a population of over 10 million people. Having hosted the Olympic Games, the FIFA World Cup, and 2010’s G-20 summit, Seoul is world renowned as both a highly-advanced economy and leading tourist destination.

Seoul is however best known as one of the most tech-savvy cities in the world, retaining its No.1 ranking in the UN e-Government Survey since 2003²⁶, and creating a true world-first in the PC-gaming equivalent of the Olympic Games, The World Cyber Games²⁷.

Smart Seoul 2015²⁸ was announced in June 2011 to uphold Seoul’s reputation as a global ICT leader by boosting its sustainability and competitiveness through smart technologies.

Strictly speaking, Smart Seoul is not Korea’s first attempt to incorporate ICT in city-development strategies. In 2004, Korea initiated the u-City project whereby ubiquitous computing technologies were applied to strengthen cities’ competitiveness²⁹.

The smart city achievable today differs fundamentally however, in that today there are ways to simultaneously enhance a city’s sustainability, competitiveness and citizen happiness. A smart city emphasizes the continued maintenance, protection, reinforcement and regeneration of its attractiveness in the future no less than it prioritizes its short-term competitive edge.

Smart Seoul 2015 was adopted to overcome the limitations of u-Seoul which applied ICTs only to existing ‘traditional’ city infrastructure. u-Seoul improved the delivery of services such as transportation and safety, but failed to produce material improvements in the quality of life enjoyed by Seoul’s citizens.

Smart Seoul 2015 is a more people-oriented or human-centric project; and Seoul now aims to implement as many smart technologies as possible, but also to create a more collaborative relationship between the city and its citizens.

The three pillars of Smart Seoul

Cities set out their own unique priorities when planning a smart city, but all smart cities must display three essential traits:

- **ICT Infrastructure:** Securing next-generation ICT infrastructure is critical to the success of emerging smart-city services. Efforts to develop ICT infrastructure must anticipate future service demands, rather than respond only to those most apparent.
- **Integrated City-management Framework:** A well-defined ‘integrated city-management framework’ is essential. The many integrated subsystems, meta-systems and individual, building-block systems of a smart city will work in harmony only through the strictest adherence to common standards.
- **Smart Users:** ICTs are the tools to enable a smart city, but are of no use without smart-tech users able to interact with smart services. Increasing access to smart devices and education on their use, across income levels and age groups, must remain one of a smart city’s highest priorities.

²⁶ UN-PAP, UN E-Government survey 2012, http://www2.unpan.org/egovkb/global_reports/12report.htm

²⁷ World Cyber Games, <http://www.wcg.com>

²⁸ Smart Seoul 2015, http://english.seoul.go.kr/gtk/cg/policy_view.php?idx=1&cPage=1&

²⁹ Also see ITU-T Technology Watch report “Ubiquitous sensor networks,” February 2008, <http://www.itu.int/oth/T2301000004/en>

Box 1: A word from Park Won-soon, Mayor of Seoul

Human civilization has continued to advance through the centuries as a result of certain core engines of growth, including technical development and sophisticated social values. The world of today is being driven forward largely by advances in information technology.

Unlike previous technologies, information technology is having a powerful impact on a countless number of industries, creating new values and dramatically changing our way of life. It is leading us towards a new type of society, a smart society, bringing about revolutionary changes in many aspects of human society.

In fact, advanced societies have already begun to enter the age of the smart society, moving beyond the age of the information and knowledge society. The key to becoming a smart society is 'communication' on a totally different level. A smart city, for instance, involves communication between person and person, people and agencies, and citizens and municipal spaces, with human beings always taking the central position in everything.

A smart city is also characterized by its unprecedented level of 'sharing.' A city inherently calls for the sharing of many things such as the urban infrastructure of the 20th century, which includes the grid for water, power and transportation services. However, 'sharing' in a smart city of the 21st century means much more than that. A smart city must, on the basis of mutual trust, facilitate the sharing of knowledge, information, experiences - you name it - among all of its constituents.

Therefore, the heroes of a smart city must be its citizens, rather than anyone or anything else. Furthermore, a smart city can develop only through full-fledged communication among all its constituent parties. The smart city to which we aspire is a space for the sharing of an incredibly diverse range of things, and this can only be made possible by fostering solid trust among all its members and by making constant advances in information technology, the new growth engine of the 21st century.



3 Smart Seoul Infrastructure

Smart Seoul Infrastructure refers to the functional ICT framework essential to the provision of Smart Seoul's services. The development of Smart Seoul's services has to date been led by Seoul's Metropolitan Government, and Seoul is currently transferring a larger portion of this task to its citizens through the publication of the city's administrative information and the creation of open-source app-development models. Please see the digital version of this report at <http://itu.int/techwatch/> which provides a list of apps available to Seoul's residents.

3.1 Smart Devices for All

A smart city relies on an inclusive network of smart device users, with the city's inhabitants demanding or creating the services they most value. The inclusive network in Seoul encompasses high-speed broadband optical wire and wireless networks (including Wi-Fi, NFC technology, etc.). All citizens' voices should be heard in this effort, and a key pillar of Smart Seoul 2015 is to increase access to smart devices and to educate new users on their operation (see Box 2).

Box 2: Free public Wi-Fi

- By February 2012, the number of Koreans using smart devices had exceeded 25 million (50% of Korea's population; 78% of Seoul's)
- Seoul is installing a free Wi-Fi network accessible in parks, squares and other public places (project to be completed by 2015)
- Public-private partnership used as the mechanism to ensure the high-speed Internet is required in a smart city context
- Seoul is attracting private investment for Wi-Fi on subways, trains and buses. As of March 2012, Wi-Fi is available on all of Seoul's subway trains
- In addition, the metropolitan government's "administrative" Wi-Fi network is freely accessible to citizens visiting its public buildings



Source: Seoul Metropolitan Government

3.1.1 Device Donation

In 2012, Seoul began distributing second-hand smart devices to low-income families and others in need. The ICT market moves rapidly and typical smart device users buy new products well within the useful lives of the devices they are replacing. Citizens are encouraged to donate their old devices when buying new ones, and after these donated devices have been inspected and repaired by manufacturers they are distributed free of charge to vulnerable populations, such as beneficiaries of Korea's National Basic Living Security. Smart devices donators are incentivized by tax deduction in the range of USD 50 to USD 100 per device donated.

3.1.2 Smart Capability for All

Smart devices have the potential to give voice to vulnerable groups, whether impaired financially, physically, or by the effects of ageing.

Dialing 120 reaches “120 Dasan Call Center”³⁰ which consolidates the call centers of 25 district offices. Those with hearing impairments are able to call the call center through a video-call system which is today available as a mobile device application.

Seoul has been providing education courses on smart ICTs since 2009, offering both city-run lectures and city-funded smart ICT classes through private education institutions. Aimed at immigrants, low-income individuals and elderly people using smart devices for the first time, these classes attracted over 47,000 people over 2009-2011. Although still addressing the basics of smart technology’s use, these classes will in the future teach more advanced skills, giving more citizens the tools to improve Smart Seoul’s services.

3.2 u-Seoul Net

Establishing a communication network dedicated to smart services has been a priority to Smart Seoul. An administrative optical network called “e-Seoul Net” was established in 2003, embedding fibre-optic cable along Seoul’s subway tunnels to connect the city’s main public buildings, its affiliated offices and municipalities.

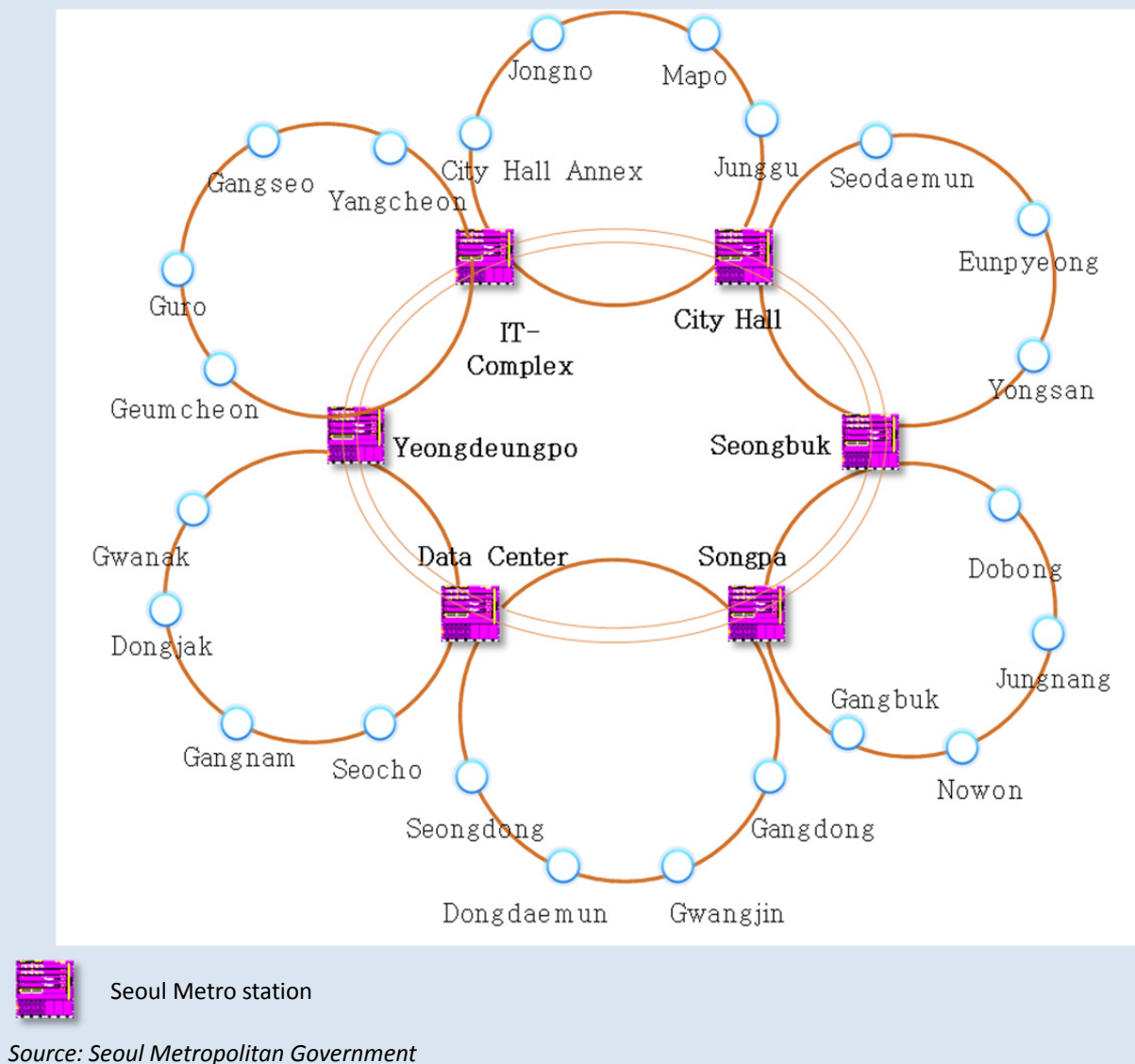
However, e-Seoul Net is not equipped to support new smart services, as it was specifically designed to connect only public offices in the interest of administrative data exchange. Citizens have no access to this network at all, and it is not equipped to support the massive volumes of data flowing over a smart-city network. Completed in 2011, the 192-kilometre “u-Seoul Net” (see Figure 2) overcomes these restrictions, providing citizens with free Wi-Fi service and full access to public web sites and enabling metropolitan government to handle huge amount of data generated from variety of smart devices. With u-Seoul Net citizens have access to administrative services anytime, anywhere.

u-Seoul Net is divided into three communications sub-networks: a Wi-Fi network used to serve administrative functions; a CCTV network enabling the exchange of video data generated by Seoul’s 30,000 CCTV installations; and the u-service network, which connects the websites of all the public offices under the Seoul Metropolitan Government, allowing citizens to bypass internet service-provider networks, and instead access u-Seoul Net for free information on city services.

In the future, Seoul plans to utilize u-Seoul Net in areas such as children’s safety and vehicle-emissions control systems able to reduce the city’s energy costs.

³⁰ Seoul, 120 Dasan Call Center, http://www.visitkorea.or.kr/enu/FU/FU_EN_15.jsp?cid=880985

Figure 2: u-Seoul network diagram



3.3 Smart Work Center

Seoul Metropolitan Government is piloting a “Smart Work Center”³¹ project, allowing the government’s employees to work from 10 offices – Smart Work Centers – located much closer to their homes (Figure 3). As employees check-in to a Smart Work Center for their shifts they are permitted access to sophisticated groupware and teleconferencing systems, ensuring their absence from City Hall in no way impedes their job performance.

The project has attracted the interest of the international community, and Seoul plans to offer Smart Work to 30 per cent of its government employees by 2015. The first Smart Work Centers opened in August 2011, and by the end of that year, 2,792 employees had made use of Smart Work (available to all government employees on request). Moreover, a Metropolitan Government survey found that 79 per cent of its employees believed this service was valuable, and 91 per cent expressed interest in working from a Smart Work Center in the future.

³¹ Seoul, Smart Work Center, <http://www.smart2020.org/case-studies/smart-work-center/>

Figure 3: Smart Work Center



Source: Seoul Metropolitan Government

3.4 Community Mapping

Seoul's open governance model seeks to extend citizens the opportunity to participate in the administration of the city, and "Community Mapping"³² was born with this pursuit in mind. Using ICTs such as geographical-information systems, the m.Seoul platform and social networks, citizens will be able to raise the issues of greatest concern to their neighborhood or community.

Community Mapping relies on P2P (peer-to-peer) communication among citizens and is a big step up from the one-way communication of road-repair requests on the city website's FixMyStreet board. It was very successful in its initial application, where physically disabled people marked streets or shopping malls without wheelchair access on a map shared by a community of smart device users. Seoul sees great potential in the system and is focusing on applying Community Mapping to a wider range of citizens' concerns, empowering citizens to develop solutions to these concerns in collaboration with their peers.

3.5 Smart Metering Project

Seoul's Smart Metering Project aims to reduce the city's total energy use by 10 per cent, and in 2012, Seoul is piloting a program installing smart meters in 1,000 households.

Smart meters provide home, office and factory owners with real-time reports of their electricity, water and gas consumption. This information is presented in monetary units, and is accompanied by detailed information on a household's energy-consumption patterns and means of adjusting those patterns to reduce energy costs.

³² Seoul, Community Mapping, <http://epd372.blogspot.ch/2012/03/community-mapping-in-seoul.html>

A national smart-metering pilot was completed in 2008, and Korea is currently replacing homes' meters with more sophisticated equipment. The Integrated Automatic Meter-Reading Pilot Program found that 84 per cent of the participants checked their energy information status once a day or more; 60 per cent reported that the Pilot Program was helpful in reducing their energy use; and 71 per cent expressed a willingness to participate in similar projects in the future.

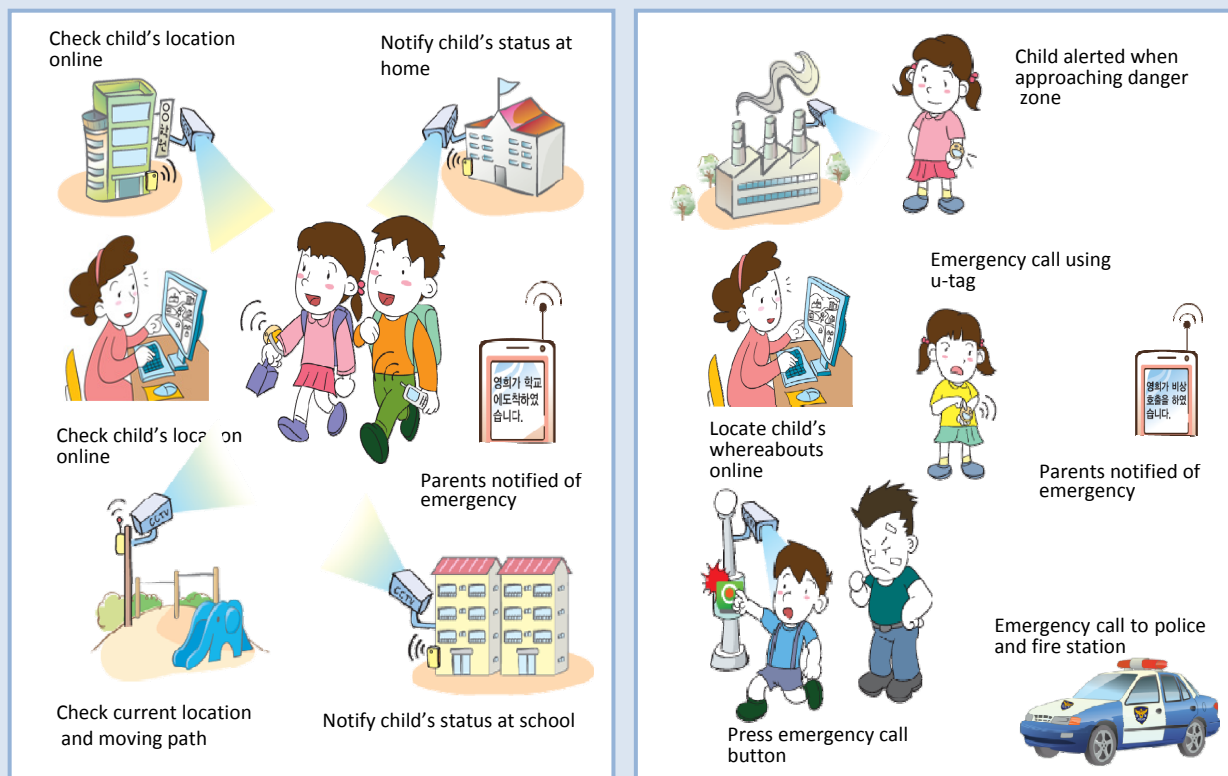
3.6 u-Seoul Safety Service

u-Seoul Safety Service has been in operation since April 2008, utilizing state-of-the-art Location Based Services and CCTV technologies to notify authorities and family members of emergencies involving children, the disabled, the elderly, and those suffering from Alzheimer's disease. Seoul has developed a smart device dedicated to this purpose and when its holder leaves a designated safe zone or pushes its emergency button, an emergency alert is sent to guardians, police, fire departments and CCTV Control Centers.

To make use of the u-Seoul Safety Service, citizens are required to register with mobile carriers specifically designed for this purpose. Supporting low-income households and especially vulnerable groups, Seoul often provides emergency-alert devices free of charge or at significant discounts, aiming to reach 50,000 registered users by 2014.

"U-Children Safety System"³³ (see Figure 4) provides 'children safety zones' using a multiple-input and multiple-output (MIMO) wireless infrastructure mesh network. Real-time CCTV networks and children's smart devices allow Seoul to make use of wireless networks in locating missing children as quickly as possible.

Figure 4: u-Children Safety System



Source: Seoul Metropolitan Government

³³

Seoul, U-Children Safety System, <http://eesc.sitebuilder.ios21.co.kr/app/board/view.asp?board=89&idx=218>

4 Government/Municipal-developed Services

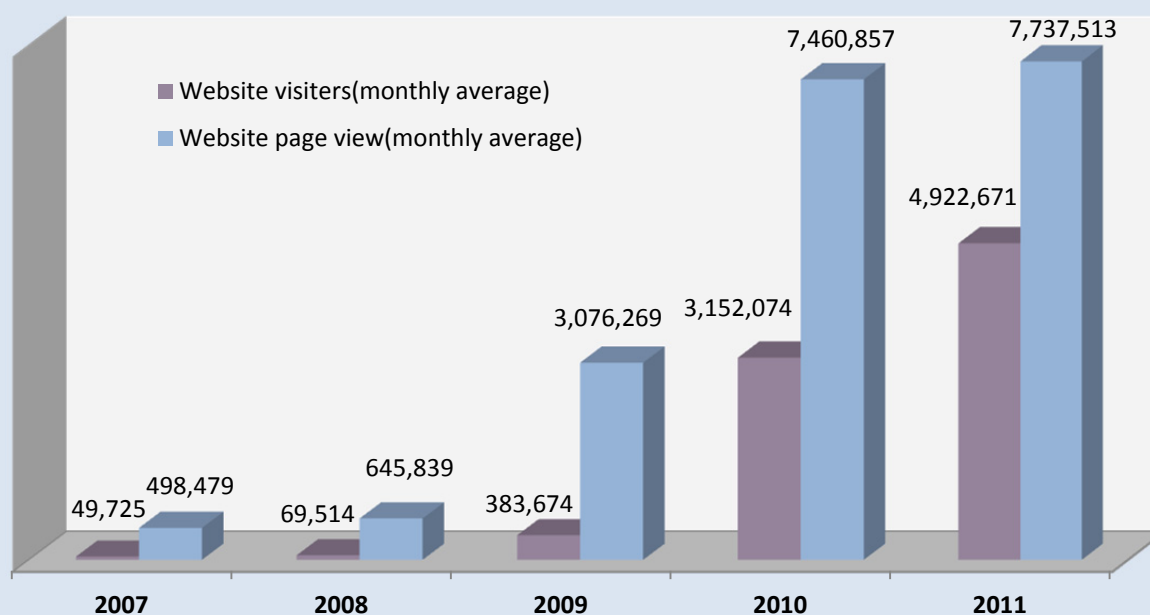
4.1 Mobile Seoul (m.Seoul)

Mobile Seoul (m.Seoul) makes use of Mobile Web technology and mobile applications to provide Seoul's citizens with 62 unique services over 11 types of mobile device. A wide range of public information is available over the Mobile Web, but the inconvenience of navigating is averted by mobile apps concentrating on the provision of the most commonly-demanded information (see Box 3. A list of services is available at <http://itu.int/techwatch/>).

m.Seoul apps support location-based services pinpointing nearby public offices, restrooms, hospitals, supermarkets or bus stations. Other services include live real-estate listings, daily job-search updates, and notifications of free cultural events. Apps also enable citizens to suggest actions to improve the city, participate in yes/no votes, and freely exchange city information over social networks; and another service, "Staying Safe in Seoul", alerts citizens of emergency situations brought on by heavy rain, snow, typhoons or fires.

Box 3: m.Seoul

Launched in 2007, m.Seoul's user-base continues to expand; and by 2011, Mobile Seoul was being accessed by an average of five million people each month.



Source: Seoul Metropolitan Government

4.1 CMS-based Homepage

In March 2012, the website of Seoul Metropolitan Government³⁴ completed its migration to a state-of-the-art content management system (CMS), more openly sharing public information and strengthening the city-citizen relationship. The new website consolidates over 70 specialized websites previously maintained by

³⁴ Seoul Metropolitan Government website, <http://english.seoul.go.kr/>

government branches, offering a single platform through which citizens can access information on all possible public services – information easily scrapbooked to users’ websites or social networks. Citizen interaction with the CMS website provides detailed data on individuals’ search patterns, and the metropolitan government is developing an intelligent service able to provide citizens with important personalized information even before it is requested.

4.3 Promoting Open Governance 2.0

The importance of sharing government information with the private sector cannot be emphasized enough. The public information made available to the private sector enables it to produce innovative solutions to basic public needs, with a familiar example being the disclosure of a city’s bus schedule or road-condition information leading to privately-developed mobile-navigation apps.

Recognizing the socioeconomic value of public information, Seoul aims to make all administrative information available to its citizens. In line with similar *Government 2.0* strategies of Europe or the USA, Seoul’s open governance 2.0 strategy³⁵ encourages transparent city governance and open communication between the city’s government and its citizens. Information Open Square, added to Seoul’s website in April 2012, is a mechanism through which Seoul discloses administrative documents, including work still in progress. Citizens and the private sector are consequently encouraged to make use of the city’s administrative information to uncover new job and business opportunities.

Disclosing Public Data

Seoul Open Data Square³⁶ is a key building block to the Information Open Square. Opened in April 2012, the website discloses public information under ten categories:

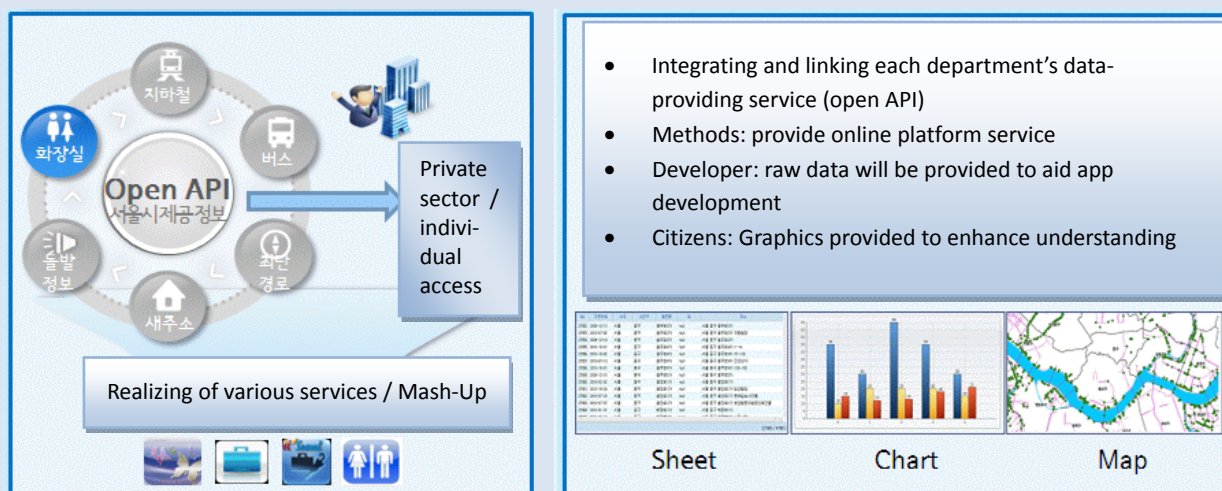
- 1) General administrative work;
- 2) Welfare, culture and tourism;
- 3) City management;
- 4) Environment;
- 5) Safety/security;
- 6) Education;
- 7) Health;
- 8) Industry;
- 9) Economy; and
- 10) Transportation.

Within these categories, 33 public information systems and 880 different datasets provide information on child-care services, public-transportation routes, bus arrival times, parking availability, weather conditions by region, and Seoul’s recommended restaurants; all accompanied by maps, internet links, graphs or statistics.

The Metropolitan Government plans to add another 150 public information systems to Open Data Square, initially aiming to increase the number of systems from 60 in 2012, to 100 in 2013. With the exception of citizens’ personal information, Seoul Open Data Square shares almost all information in its original form – giving citizens and businesses the raw data they need to develop apps enhancing the quality and efficiency of public services.

³⁵ Seoul’s open governance 2.0, http://iacconference.org/documents/WS_113_Ahn_Final_Paperdoc.pdf

³⁶ Seoul Open Data Square, <http://data.seoul.go.kr/index.jsp>

Box 4: Disclosing Public Data

Classification	2011	2012	2013	2014
Accumulated number of databases	20	60	100	150
Proportion of total (150 DBs are expected to be disclosed)	15%	40%	70%	100%

Source: Seoul Metropolitan Government

4.4 Developing Public Applications and Its Current Status

More than 75 per cent of Seoul's mobile phone users are smart device users, and Seoul aims to profit from the innovation of the competitive private sector, as well as leverage users' brand loyalties to accelerate the adoption of public apps.

Seoul Metropolitan Government discloses all its administrative information and rewards the best private-sector or citizen use of this information in a Public Application Contest, which began in 2010. The contest's best applications – eight in 2010 and nine in 2011 – are today freely available on Seoul's App Market.

Seoul City offers 37 public applications developed by Seoul or in partnership with the private sector, and Seoul's Public Application Management System monitors the number of people using each app, identifies overlaps in app functionality and ensures app content remain up-to-date. The popular "Seoul Bus'app"³⁷ provides precise bus schedules updated in real-time and is an excellent example of an app developed by the private sector using public information. Another is "iTour"³⁸, an app turning one's smart-device into Seoul's most knowledgeable tour guide.

³⁷ Seoul Bus'app, <http://itunes.apple.com/us/app/seoul-bus-2-metropolitan-bus/id340701877?mt=8>

³⁸ Seoul, iTour, <http://itunes.apple.com/us/app/i-tour-seoul/id360156429?mt=8>

4.5 Online Reservation System for Public Services

Seoul's next-generation online reservation system allows citizens to search for, book and pay for public services instantly. The one-stop, integrated reservation system³⁹ lists over 150 services under categories such as education, infrastructure, cultural tourism, commodities and medical treatment.

Seoul Metropolitan Government and its affiliates offer over 30,000 public services, from education courses to reserving public sporting or cultural facilities, using gymnasiums or registering at day-care centers. Of these 30,000-plus services, 17,000 offer online reservation. However, around 1,500 core services are linked to the integrated reservation system, and Seoul plans to complete the inclusion of all 30,000 by the close of 2012.

4.6 Eun-pyeong u-City

Eun-pyeong is a district of Seoul, and Eun-pyeong u-City, a project beginning in 2006, was completed in March 2011 and now houses 45,000 people on land covering 3.49 million m² (862.3 acres).

Eun-pyeong's residents do not require private Internet access or smart devices to make use of city services, and instead receive practical information via smart devices on their living room walls. In the interests of residents' safety, intelligent CCTV cameras installed on every street corner automatically detect people trespassing on private premises.

If a disabled or elderly person carrying a Location Detecting Device leaves Eun-pyeong or pushes an emergency bell on the device, their location is automatically sent to their guardians via text message. The city's high-tech "Complex Street Lamps" reduce energy use, and also broadcast audio and provide residents with wireless internet access. The Media Board, which is set up in the New Town, is a digital newsletter providing news, the bus schedule and other practical information to residents and visitors. Finally, the city's u-Green service represents a network of sensors assessing factors such as water and air quality, transmitting this information directly to the Media Board and the devices in citizen's living rooms. The Seoul Metropolitan Government runs a u-City Consolidated Operation Center which oversees the web of ICTs composing Eun-pyeong u-City; managing its ubiquitous ICT networks, and collecting and archiving vital city information.

4.7 3-Dimensional Spatial Information

Since 2001, Seoul Metropolitan Government has been increasing the capabilities of its 3-dimensional (3D) spatial information system⁴⁰: a mapping application providing 3D street information and enabling the provision of new smart services.

In April 2008, the system supported the launch of three new services:

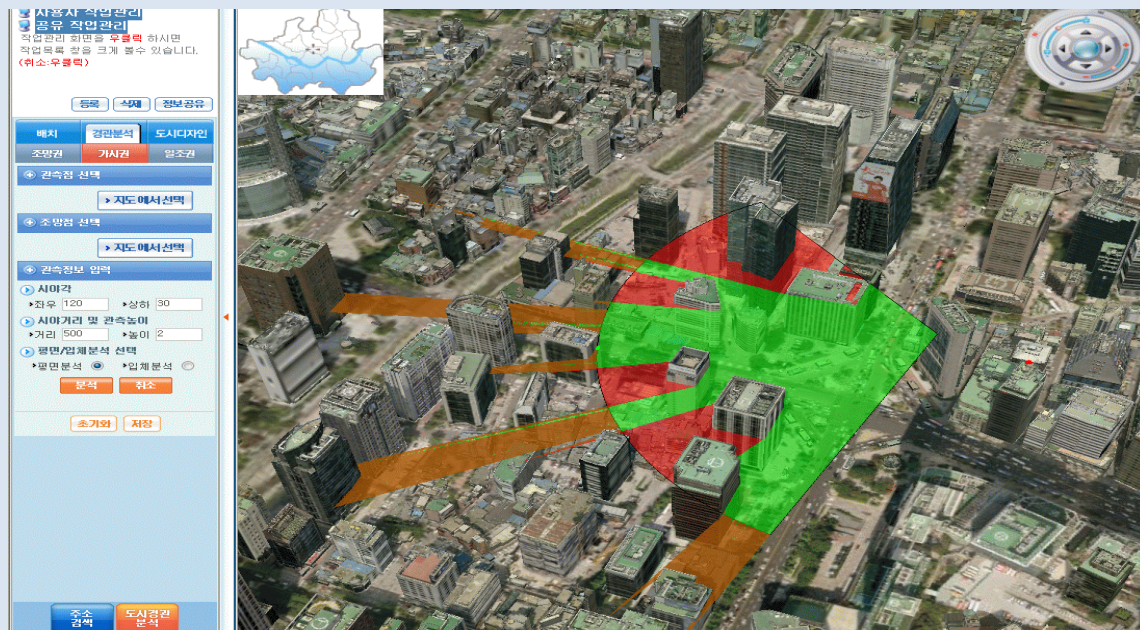
- 1) "Geographical Information", which allows users to view streets as if standing upon them;
- 2) "Tour with a Theme Information", which highlights tourist attractions, offering its users a virtual tour of Seoul; and
- 3) "Urban Planning", an application allowing city planners to simulate infrastructure development or renovation (see Figure 5).

Improved further by high-quality photographs and video clips in 2009, 3D spatial information will be very useful in monitoring the environment, preventing disasters and constructing disaster-resilient infrastructure. For example, flood simulations developed in 2012 aid in predicting which areas will be worst affected by floods, thereby enabling the development of preemptive flood-response mechanisms.

³⁹ Seoul, one-stop, integrated reservation system, <http://yeyak.seoul.go.kr/english/main.web>

⁴⁰ Seoul, 3-dimensional spatial information system, http://3dgis.seoul.go.kr/SearchMap_3D/

Figure 5: 3D spatial information system to analyze and predict visibility

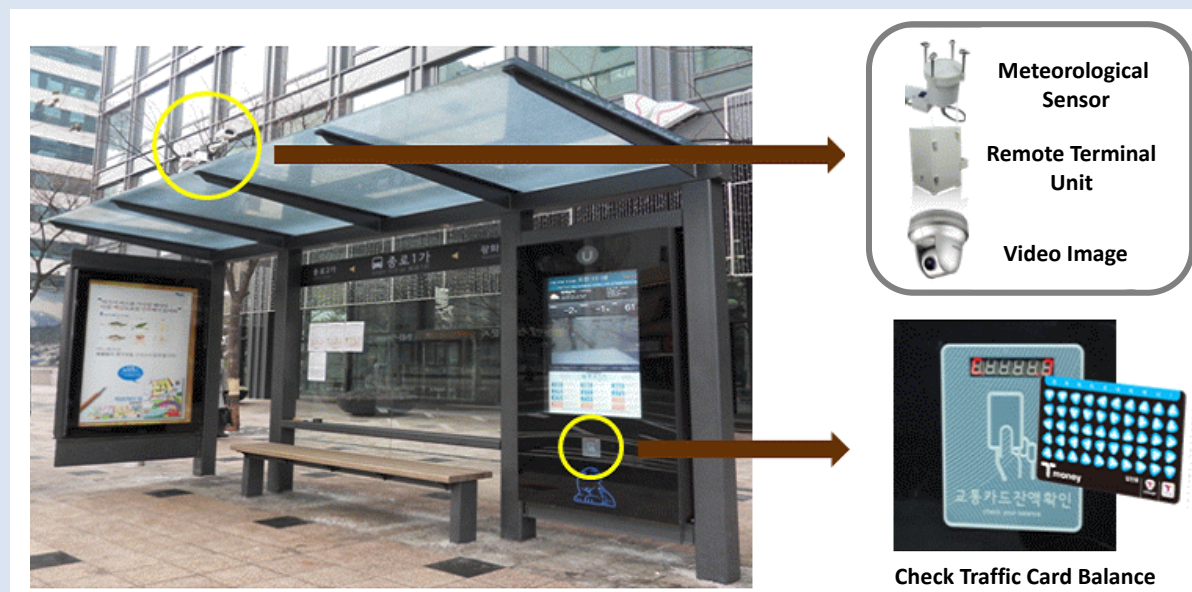


Source: Seoul Metropolitan Government

4.8 u-Shelter: State-of-the-art Bus Stops

Introduced in 2009, Seoul's u-Shelter bus stops incorporate state-of-the-art ICTs to offer citizens a variety of smart services (see Figure 6). In 2011, each u-Shelter interacted with an average of 2,518 people each day—with Bus Route Guide the most-frequently used service at 1,427 times per day, followed by Digital Map (764), Destination Search (135), Traffic Broadcasting Station (65) and Weather Forecast (59).

Figure 6: Detail view of u-Shelter



Source: Seoul Metropolitan Government

5 Citizen-developed Services

5.1 NFC-based Mobile Payment

The NFC (near field communication)-based Mobile Payment system is a product of public-private collaboration, and is a service accessible to anyone with a smart device or mobile card. People making a purchase at a store select credit-card payment or mobile-card payment, and pay for their purchase simply by touching their smart phones to a specialized reader capturing information essential to the transaction.

Seoul's citizens today possess roughly 7 million smart phones with built-in NFC chips, and Mobile Payment services are currently available in over 22,000 stores including super markets, convenience stores, gas stations, coffee shops and department stores.

An illustration of the system's application:

- Download mobile coupons, and receive discounts on movie tickets booked through NFC-based Mobile Payment. Touching a smart phone to a poster advertising an upcoming film provides movie trailers, cast information and plot summaries; and purchasing tickets to that film is completed by the touch of a button. Touching a smart phone to a reader opens the movie-theatre's door; and smart phone is automatically set to 'vibrate mode' as its' user enters the movie theatre.
- A coffee shop stages a promotion encouraging customers to download coupons when in range of the shop's Wi-Fi: downloaded coupons are used to order and purchase by touching a smart device to items on the menu.

An NFC-based P2P payment system enables money transfers from one smart device user to another. Users touch the smart devices to one another, and once the transferring party has entered their PIN number, the transaction is complete.

5.2 Virtual Store

Virtual Store is an example of B2B and B2C utilization of smart devices and social networks.

Virtual Stores are found on street billboards, with each item possessing a unique barcode or Quick Response (QR) code. A smart phone's barcode or QR code reader allows consumers to purchase goods while on the move, receiving delivery at their homes later that day.

The HomePlus Application facilitates transactions at HomePlus Virtual Stores. The application combines traditional and virtual shopping experiences, allowing customers to purchase goods using a smart-phone app able to read product barcodes or QR codes. With purchased items delivered to customers' homes, citizens can shop for groceries and other goods without the inconvenience of carrying shopping bags.

HomePlus' first Virtual Store opened in August 2011, and more were added to bus stops near universities in October that same year. 65 per cent of these stores' total sales were accounted for by customers in the 20 to 30 year-old age bracket, and 21 more virtual stores have thus been positioned in areas frequented by young people; at subway stations or bus stops in towns such as Deahak-ro, Shinchon and Gangnam.

Figure 7: Bus stop outside Seoul City Hall, HomePlus Tesco Virtual Store



Source: Tesco

5.3 School Newsletter Application

The citizen-developed School Newsletter Application connects schools with pupils' parents, instantly notifying parents of changes in academic schedules or the items students are required to bring to school for the following day's lessons. This is achieved by way of an online 'school board' alerting parents of changes to its content whenever it is updated. 100 elementary schools currently make use of this service, and more are encouraged to do so via "I am school"⁴¹.

⁴¹ I am school, School application, <http://www.iamschool.net/>

6 Smart City Standardization and Conclusion

The concept of the smart city as the next stage in the process of urbanization is high on the political agenda throughout the world. Smart Cities are underpinned by an ICT infrastructure and its integration with the services that a city delivers. Weather information could be combined with traffic sensors to anticipate congestion and keep traffic moving. Leaks in water networks would be detected automatically; pumping stations would adapt flexibly to patterns of use detected by smart meters, reducing energy consumption and costs to the consumer. This will call for new ICT standards, infrastructure and solutions to ensure that this vision becomes a reality.

Some areas where standardization activities are currently focusing are:

- The definitions and blueprints of smart city infrastructure.
- Building the architectural ICT framework to enable the harmonized operation of a smart city's constituent technologies: high-speed optical, sensor, wired and wireless networks necessary to enable Intelligent Transport Systems (ITS), Smart Grid, Home Networking, etc.
- Best-practice methodologies for national and municipal smart city planning.
- Evaluation mechanisms to assess the health and success of a smart city; through statistical feedback on the use and value of smart services deployed within a city.
 - Remove complexity of smart factors
 - Open evaluation methodology for smart factors

The International Standardization Organization (ISO) is looking at smart city standards through a group focused on “Smart Community infrastructures metrics” (ISO, TC 268/SC 1).

ITU-T has established a new Focus Group on Smart Sustainable Cities⁴² to assess the standardization requirements of cities aiming to boost their social, economic and environmental sustainability through the integration of ICTs in their infrastructures and operations.

ITU-T Study Group 5 – Environment and climate change⁴³ – agreed the formation of the new Focus Group at its meeting in Geneva, 29 January to 7 February 2013.

The creation of the Focus Group answers a Call to Action⁴⁴ proposed in September 2012 at ITU's 2nd Green Standards Week in Paris. “Smart Sustainable Cities” is also the theme of ITU's 3rd Green ICT Application Challenge⁴⁵.

The Focus Group will act as an open platform for smart city stakeholders – such as municipalities; academic and research institutes; non-governmental organizations (NGOs); and ICT organizations, industry forums and consortia – to exchange knowledge in the interests of identifying the standardized frameworks needed to support the integration of ICT services in smart cities.

⁴² ITU-T, <http://itu.int/en/ITU-T/focusgroups/ssc/>

⁴³ ITU-T, <http://itu.int/en/ITU-T/studygroups/2013-2016/05/>

⁴⁴ ITU, http://itu.int/dms_pub/itu-t/oth/4B/04/T4B040000180001PDFE.pdf

⁴⁵ ITU, <http://itu.int/en/ITU-T/climatechange/greenict/2013/>

ITU-T Technology Watch surveys the ICT landscape to capture new topics for standardization activities. Technology Watch Reports assess new technologies with regard to existing standards inside and outside ITU-T and their likely impact on future standardization.

Previous reports in the series include:

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