

Seoul TOPIS Center Harnesses IoE Capabilities to Improve Service, Efficiency, and Customer Satisfaction



EXECUTIVE SUMMARY

Objective

- Efficiently provide public transportation services to all citizens based on use of Internet and technological data-gathering devices
- Improve customer satisfaction and increase usage of public transportation

Strategy

- Transform bus system into a quasi-public operation
- Upgrade system to manage not only buses, but also all other transit-related systems (excluding traffic signals)

Solution

- TOPIS Center manages and gathers information from all public transportation in Seoul
- Center's success derives from establishing scientific transportation policies based on collected data

Impact

- Data collection allows Seoul City to conduct new analysis that wasn't possible before
- Bus companies benefit from establishment of fair and transparent competition system
- One-unit integrated fare program improves service by allowing bus and subway riders to use all transit systems with only one card
- Satisfaction rate for public transportation has grown from less than 50 percent to 85-90 percent

Background

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

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

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

When public transportation companies in crisis were not able to provide good service for users, more citizens took to the streets in small cars – worsening the situation. As streets became increasingly congested and bus companies continued to suffer, Seoul City decided to transform the bus system into a quasi-public operation.

About Seoul TOPIS Center

Seoul, South Korea, seeks to efficiently provide public transportation services to all citizens based on the use of Internet and technological data-gathering devices. Through the establishment of the Bus Management System (BMS) in 2004, Seoul transformed its financially struggling bus service into a thriving backbone of the city's public transport. Cash fares evolved into the integrated one-fare card, which simplified fees for customers, and returned transparent usage and revenue data to officials for fair distribution of government subsidies. By installing sensors and global positioning systems (GPS) on buses, BMS can post accurate schedule and arrival times for riders via Internet applications.

With this success, BMS was upgraded to the Seoul City Transportation Information Center (known as TOPIS Center), which is responsible managing and gathering information from all public transportation in Seoul, excluding traffic signals. Already recognized worldwide for its achievement in reducing traffic congestion and connecting passengers with real-time information, TOPIS Center credits its success to establishing scientific transportation policies based on collected data. Customer satisfaction with public transportation in Seoul has risen dramatically, not only because service has improved, but also because TOPIS Center diligently strives to share relevant data with riders.

TOPIS Center Director Kyung Soon Lee is responsible for managing all aspects of the Center, including systems and manpower for transportation and IT projects. Before moving into operational management, Ms. Lee was a team leader during TOPIS Center's planning stage.

Ms. Lee holds a doctorate degree in computer science, and is certified as both an information processing technician and a transport engineering technician. Before joining Seoul City 20 years ago, she spent 10 years working in an IT environment at a large corporation.

Objectives

According to Ms. Lee, TOPIS Center was born as a result of Seoul City using technology to improve the public transportation system.

"In 2004, Seoul City was planning bus system reform," Ms. Lee explained. "This was the beginning of Seoul City's transportation system renovation process. As a known problem worldwide, public transportation had been ignored due to the emergence of passenger vehicles. Consequently, public transportation companies suffered from managerial and financial crises."

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Strategy

To make this transition, Seoul City assumed control of bus-route management from the bus companies. To encourage greater use of public transportation by citizens, the city increased the number of buses in operation and improved services. As citizen use of public transportation grew, revenue rose for the bus companies, allowing them to offer better service. “I think Seoul’s bus companies needed this type of official systematic support to maximize operational efficiency – now passengers don’t wait too long at the bus stops, and they know the time when the bus is arriving. Bus riders must know the bus schedules before they come to bus stops so they can plan their times. We created this management system to control all of these elements,” Ms. Lee explained. TOPIS Center was soon upgraded to manage not only the bus systems, but also all other transit-related systems (excluding traffic signals).

“When there is an emergency, our Center moves the quickest. For example, if heavy snow, heavy rain, or a landslide is reported to the EM Center, this information gets passed to the TOPIS Center immediately so we can take action, such as announcing closed routes in real time, or which area to avoid. You can call it a fusion of systems or cooperation.”

Kyung Soon Lee,
Director,
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Seoul City is the key stakeholder in this project. “As of now, Seoul is the first city that has implemented or executed the quasi-public system,” Ms. Lee said. “Other local governments consider it a benchmark, and they copy this system with the help of the central government.” According to Ms. Lee, TOPIS Center is under the auspices of Seoul City’s mayor because it was constructed by the city government, not by the central government.

According to Ms. Lee, all funding came from the city itself: “Seoul built this system autonomously,” she asserted. “There was no joint venture effort or public-private partnership. Seoul City government didn’t receive any funding from the central government.” However, officials were able to use the Seoul City government budget to fund bus companies by supplementing their revenues.

The ability to track bus revenues and ridership has been crucial in understanding the operating success of each of the bus companies. Characterizing the information as a check on their performance, Ms. Lee indicated that TOPIS has allowed the city government to verify the efficacy of their transportation subsidy dollars.

In 2013, TOPIS began integrating with Seoul Emergency Management Center. Integration of operational areas is in process, and integration of software applications is yet to come. Both Centers now share the same location, which makes sense because they can collaborate to resolve problems and communicate with transit customers. “The physical integration already works in favor of all of us,” Ms. Lee explained. “When there is an emergency, our Center moves the quickest. For example, if heavy snow, heavy rain, or a landslide is reported to the EM Center, this information gets passed to the TOPIS Center immediately so we can take action, such as announcing closed routes in real time, or which area to avoid. You can call it a fusion of systems or cooperation.”

Enormous amounts of data from road and video sensors, GPS, taxi cab credit card readers, citizen and driver reports, Wi-Fi networks, CCTV, and unattended surveillance devices are processed by the Center's databases. This real-time information is then distributed to citizens via smartphone apps, signboards at bus stops, and a web portal.

Solution

In terms of structure, this project involved gathering data from a number of sources – streets, buses, taxis, and citizens – using GPS devices, loop detectors (under-pavement vehicle detection), road sensors, video, CCTV, and reports from drivers and riders. “The information collected from these devices gets transmitted to our Center [via Wi-Fi and data networks],” Ms. Lee explained. “The Center utilizes various algorithms and analyses to disseminate bus-arrival times for all buses, which are posted on a smartphone app, bulletin board terminals at each bus stop, and on the web portal. All information is offered to citizens via all means possible.” Riders have access to data that helps them schedule their routes and choose which buses to ride 24 hours a day.

This data also facilitates the city's decision-making and enforcement of transit rules. “Within the Center, we create modeling utilizing received data from riders or drivers and any transit-related sources,” Ms. Lee said. “This is used to make decisions regarding transportation-related policies, and to prioritize work orders for route changes and improvements.” Using unattended surveillance, officials can issue citations for parking and driving violations. As integrated transit fare cards replace cash fares, bus companies and transit officials can also track passenger usage and allocate revenue to specific companies. Passengers can use a single card to complete their journeys, thereby avoiding being charged for transferring from buses to subways, for example. In this way, TOPIS Center data not only improves service for public-transit users, but it also provides transparency for officials who can issue violations using unattended surveillance, monitor passenger usage, and determine funding subsidies for bus companies.

The initial public transportation management and data flows are already in place and working successfully. TOPIS Center is beginning to identify bus-load capacity. “As riders scan their bus cards and bus location, information is received from BMS,” Ms. Lee explained. “Utilizing these two pieces of information, we create one new process to provide citizens with information about how crowded specific buses are, so riders can choose their buses accordingly.” This aspect of the project is currently in process.

In a public transportation system where citizen engagement was once minimal, Seoul City public transit now offers excellent methods for communication between riders and officials. Ms. Lee says that citizens are encouraged to communicate with TOPIS Center via Internet and smartphone applications, and via telephone by calling 1-2-0. “This is the main number that belongs to Seoul City. People can call from anywhere or anytime. We resolve issues immediately,” Ms. Lee explained.

Enormous amounts of data from road and video sensors, GPS, taxi cab credit card readers, citizen and driver reports, Wi-Fi networks, CCTV, and unattended surveillance devices are processed by the Center's databases. This real-time information is then distributed to citizens via smartphone apps, signboards at bus stops, and a web portal. Riders can plan efficient routes based on traffic information, locate parking spots, and learn when buses will be arriving. This information also benefits city officials, who use it to inform policies, plan route improvements, clear up road congestion, and issue violation notifications.

System Architecture and Design

According to Ms. Lee, system architecture and design is divided into three parts: 1) the field area, 2) the Center itself, and 3) citizen services.

First, the field area includes sensors mounted on the road, OBU (on-board units) installed in the vehicles, Wi-Fi systems transmitting data from those devices, and the CCTV video system and its control system. These devices help gather and transmit relevant data from roads and vehicles to the Center for processing.

Second, at TOPIS Center, “main servers have database management systems. Main servers operate in dual system for nonstop operation,” Ms. Lee explained. The Center is the hub for analyzing and organizing data using several web servers and databases, and then disseminating it for official and citizen use.

Third, in terms of citizen services, this project enables riders to access data using smartphones or Internet devices, or at bus stops. “We built our server in open API to allow the general public or businesspeople to download necessary data,” Ms. Lee explained. “An example of direct (immediate) service to citizens is the Bus Information Terminal (BIT), which is installed at each stop and displays the arrival times of buses. We also installed Variable Message Signs (VMS) along the roadways so drivers can obtain necessary traffic information.”

“Citizens are connected to TOPIS Center via three applications. Additionally, both citizens and transit-related business organizations have access to our location information.”

Kyung Soon Lee,
Director,
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User Applications

After gathering and analyzing a wealth of data, TOPIS Center also connects Seoul residents with transportation data via three specific, Internet-based applications. First, a public transportation service application called SeoulPublicTransportation offers information in real time regarding any form of public transit – such as buses, subways, or railroads – that passes through Seoul City. “The app shows the location of all transportation means, and users can locate the one they need,” Ms. Lee explained. “For example, let’s say a citizen needs to be somewhere after midnight. She or he can search for available transit in real time. Recently, we opened a 24-hour bus service and it became our most popular program.” This app helps riders locate buses that pass every 40 minutes after midnight and plan their schedules to minimize wait time. Since this app meets an important and previously unmet public need, it has generated significant support for TOPIS.

Second, a relatively new app called Seoulppaleungil (translated as “Seoul’s fastest way”) delivers traffic information in real time for main highways around Seoul’s central business district areas, including all city routes. Ms. Lee describes Seoulppaleungil as “popular because it shows the fastest route for getting from place to place.” Since traffic conditions are constantly in flux, this app makes a difference minute by minute.

Third, the Seoul traffic portal site not only combines the functions of the two applications described above, but also allows users to search in real time for parking spots, public-use bicycle areas, and car-sharing spots.

Ms. Lee summarized the combined effect of this technology: “Citizens are connected to TOPIS Center via three applications. Additionally, both citizens and transit-related business organizations have access to our location information.”

These three main benefits show up in the creation of data-based transportation policies, the establishment of fair and transparent competition for bus companies, and the reduction of citizen traffic complaints.

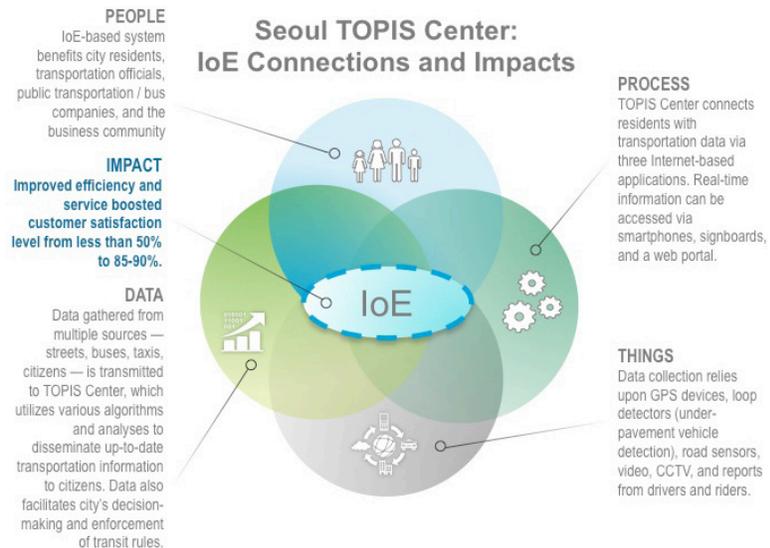
These three applications promote positive public relations, and they increase citizen and business awareness of the Center’s efforts.

User experience has changed substantially as a result. Now, riders can plan routes faster and more accurately than before. Beyond the roadway, the citizen services aspect of system architecture also includes the construction of specific link servers designed to connect with other servers to download necessary information.

Surveillance

Technology also advances the process of surveillance. For example, Ms. Lee explained, “we have two bus lanes: median lane and curbside lane. If any other vehicles enter those lanes, it constitutes a violation. Usually drivers follow the rules very well, but we established a surveillance system to crack down on offenders. First, CCTV is installed to videotape the violation. Then, our Center uses filtering functions to single out the offending vehicle according to individual plate number, which is stored in the system.” After TOPIS Center uses technology to catch the offense and identify the offender, it connects with servers in another facility, which imposes the fine, and a third facility notifies the citizen of the ticket.

Figure 1. Seoul TOPIS: New and Better Connections.



Source: Cisco Consulting Services, 2014

Impact

Ms. Lee notes that public satisfaction with TOPIS has been very high, and she credits this in part to the added transparency and information that is available to Seoul residents and those who utilize the transportation system.

“There is a saying in Korea that means, loosely, ‘We caught three bunnies at once.’ This is definitely the case here,” Ms. Lee explained. These three main benefits show up in the creation of data-based transportation policies, the establishment of fair and transparent competition for bus companies, and the reduction of citizen traffic complaints.

“So, it is a *win-win-win* situation, not win-win. I think our system satisfies the citizen, public sector, and bus companies.”

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First, gathering data allows Seoul City to conduct new analysis that wasn't possible before the public sector established scientific transportation policies. For example, Ms. Lee explained how the Center analyzes Big Data collected from credit-card readers in taxis: “Our system receives credit-card data from 30,000 taxis every 10 seconds,” she said. “We are talking about 7.6 billion data points collected per year. We can produce Seoul City's transportation information deliverables (i.e., planning and analysis documents) using those 7.6 billion Big Data points collected from taxis As for the future transit system, we want to be able to forecast by utilizing this accumulated past data. To do this, we are in process of making an arrangement with the central government's R&D team.” Validating current and future policies with data increases the city's ability to provide for citizens' transit needs, and minimizes room for corruption.

Next, Seoul's bus companies benefit from the establishment of a fair and transparent competition system. One of the biggest issues that city officials and the bus companies had to solve was related to bus revenues and government subsidies. Before TOPIS Center, riders used cash to pay bus fares, and the drivers provided change when needed. “Since the revenues were in cash,” Ms. Lee explained, “it was very difficult to figure out how bus-fare revenues should be allocated for each company.” When Seoul City began giving out financial assistance to companies with low revenues, the government needed data to evaluate recipients of this subsidy impartially. In the past, according to Ms. Lee, there had been some cozy relations between government officials and business organizations, but, with the 2004 transportation system innovation, data collection facilitated policy without corruption.

To establish a transparent revenue system, TOPIS Center created the one-unit integrated fare program, in which bus and subway riders can use all transit systems throughout the city with only one card. This improved citizen services because riders don't pay extra fees when transferring between subways and buses on the way to their purchased destination. These fare cards also provide tangible data regarding bus company revenue, thereby supporting the fair distribution of government funds (Oil Price Subsidy) available to bus companies. “The transparent fare system and high-quality services enabled the government and the bus companies to work together to manage bus transit, drivers, and fares,” Ms. Lee said.

Finally, as transit operation increases in efficiency, customer satisfaction also rises. “Scientific operation of transit affairs has reduced citizen traffic/transit complaints dramatically, compared with the past, when more than 90 percent of civil complaints were about transportation,” Ms. Lee reported. “Now not many complaints are received, and the satisfaction rate for public transportation has grown from less than 50 percent to 85–90 percent.” The Seoul transportation system has achieved global recognition, and TOPIS Center has become a benchmark for other public sectors. “So, it is a *win-win-win* situation, not win-win,” Ms. Lee stated. “I think our system satisfies the citizen, public sector, and bus companies.”

“We’d like to be a leader in transit management systems. So, we love to support other countries, such as underdeveloped countries or jurisdictions that need help sorting out transit problems. If there is an opportunity to share our expertise and experiences with others, we welcome it.”

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Lessons Learned / Next Steps

Every project has a learning curve, and Seoul City’s transportation upgrade is no different. In the process of implementing such extensive innovation in the transit system, TOPIS Center has overcome many challenges. “In establishing our TOPIS Center, we had numerous cases of trial and error,” Ms. Lee explained. “For instance, one sensor that we’d selected was not the best fit for our system technologically. Sometimes policies were against us, and we didn’t have the right technical environment. For TOPIS Center to be this sophisticated, we went through many hurdles.”

Some of these obstacles involved negotiating with bus companies toward fair and transparent management practices, revenue allocation, and fund distribution. Others related to mapping out specific projects and devising new software applications to fit. Often, Ms. Lee faces a shortage of IT manpower – Seoul City wants to implement various projects but cannot supply sufficient, qualified workers.

In terms of future plans, Ms. Lee affirms TOPIS Center’s interest in supporting other countries in building effective transit systems. “We’d like to be a leader in transit management systems,” she said. So, we love to support other countries, such as underdeveloped countries or jurisdictions that need help sorting out transit problems. If there is an opportunity to share our expertise and experiences with others, we welcome it.”

Currently, TOPIS is collaborating with the World Bank and ADB (Asia Development Bank) to support other Asian jurisdictions and countries that want to visit the Center. Current projects are advancing along the trend of collecting and analyzing Big Data to inform future policies and improvements, and Seoul is making arrangements with the central government for assistance with research and development.



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