

ICT Policy History and Development in Korea: Local and Central e-Governance Toward Smart Nation

2019. Sep.

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<Education Background>

- Ph.D., Information Systems, University of Missouri – St. Louis, Missouri, U.S.A.
- MA, Economics, University of Illinois at Urbana-Champaign, Illinois, U.S.A.
- BA, Economics, Hanyang University, Korea

<Research/Services/Publications> (selected)

- KOICA, EDCF expert advisor on ICT area and Smart City expert for local governments in Korea
- Korean National ID and resident registration system expert
- Joo Yeon Lee and Sang-Baek Chris Kang, "Korea Fusion Industry", in Korea Future Report, (International Future Society, EDs.), KYOBO Publishing, Dec., 2015 (ISBN 979-11-5909-007-3).
- Project Manager for World Bank Consulting Project "E-Government Technical Advisory and Consulting for Municipalities: Cairo Governorate and Egypt Initiative" (2018)
- Program Supervisor of KLID-UNDP International Workshop for Afghanistan, (2017).

Agenda

- I. The e-Government of Korea Initiatives: history and blueprint**
- II. Introduction of Korean local e-Government Services**
 - 1. GOV 24 Introduction
 - 2. Information Network Village (INVIL)
- III. Smart City Initiatives**
 - 1. Multi-Modal Transportation with T-Money Card
 - 2. Night Bus based on Big-Data Analysis
 - 3. Open Transport Data and Application
 - 4. IoT Platform Deployment for Smart City
- IV. Discussions**



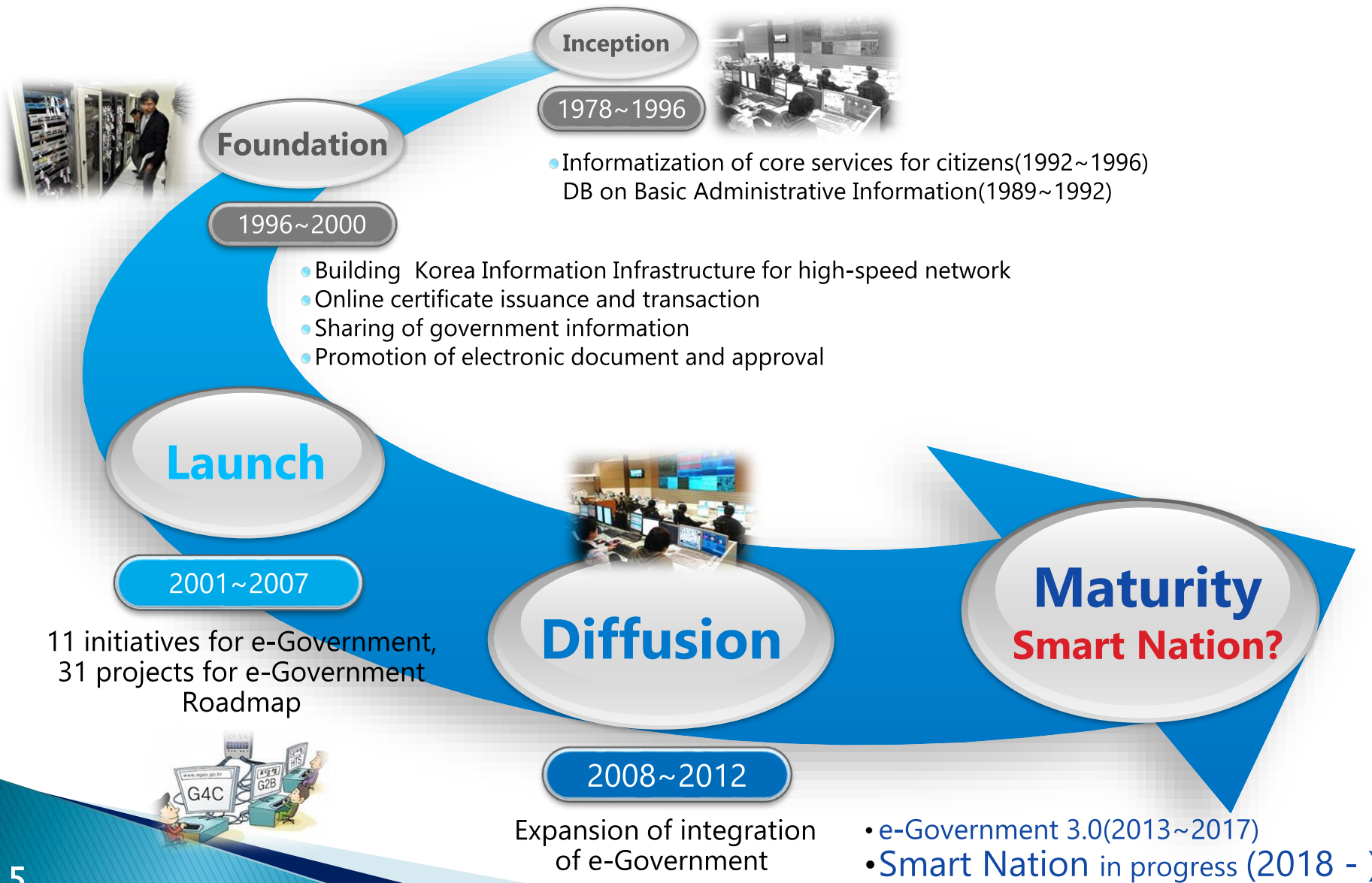
I. The e-Government of Korea

Initiatives: history and blueprint



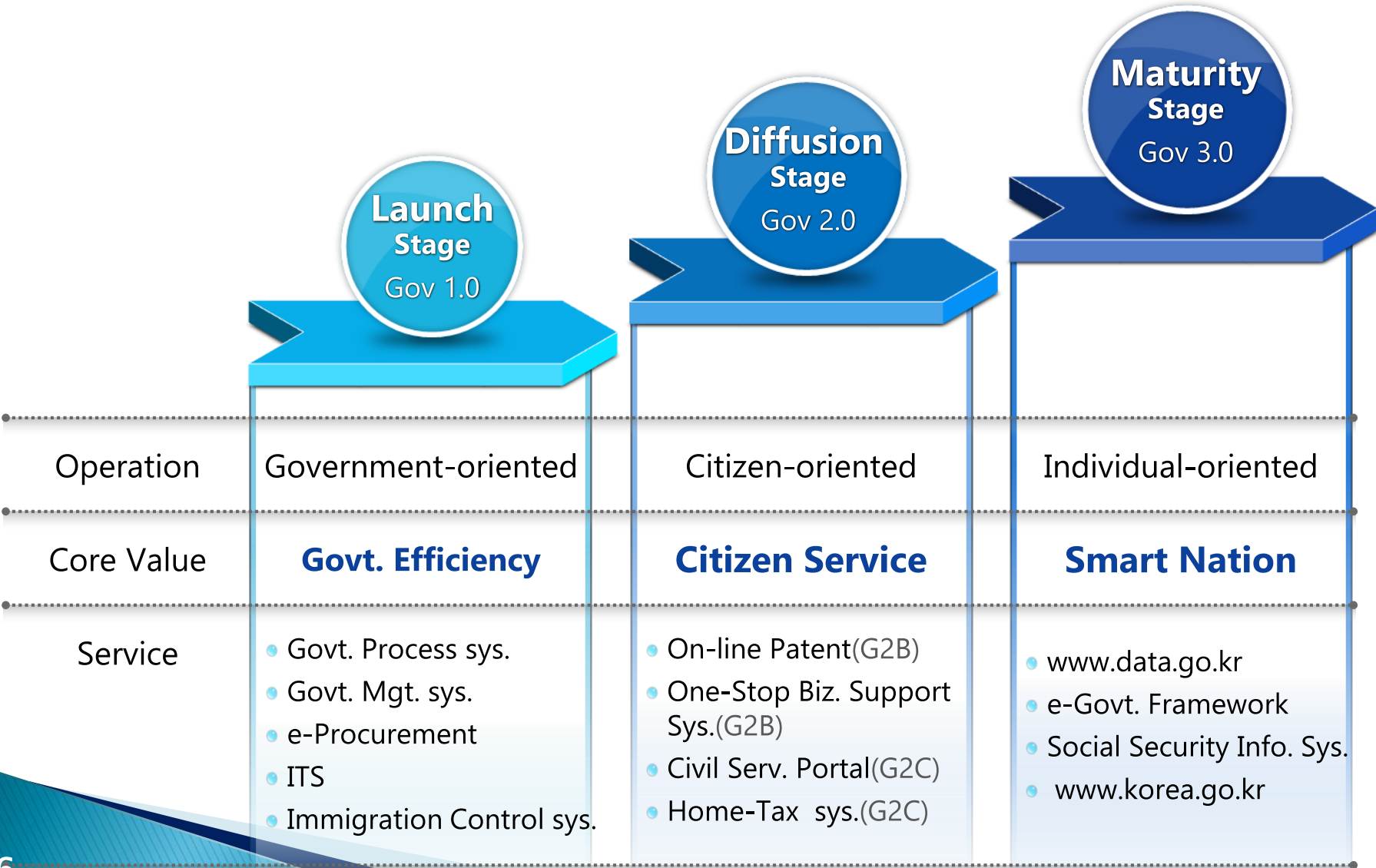
1. History of Korea's e-Government

I. The e-Government of Korea Initiatives: history and blueprint



2. The evolution of e-Government

I. The e-Government of Korea Initiatives: history and blueprint



II. Introduction of Korean local e-Government Services

- 1. GOV 24 Introduction**
- 2. Information Network Village (INVIL)**



1. GOV 24 Introduction (1)

□ e-Government – a lifecycle care for citizens



1. GOV 24 Introduction (2)

Screen Capture from Minwon24 – Main

The screenshot shows the main interface of the Minwon24 website. At the top, there's a search bar and navigation links. The main content area is divided into sections for popular services, a life information banner, and frequently asked questions. A yellow arrow points to the '주민등록표등본 (초본)' service icon. Another yellow arrow points to the '생활정보 42종 전체보기' button in the banner. A third yellow arrow points to the '신규 서비스' (New Services) section at the bottom.

<http://www.minwon.go.kr> -> <http://www.gov.kr> (after Nov 24 2017)

1. GOV 24 Introduction (3)

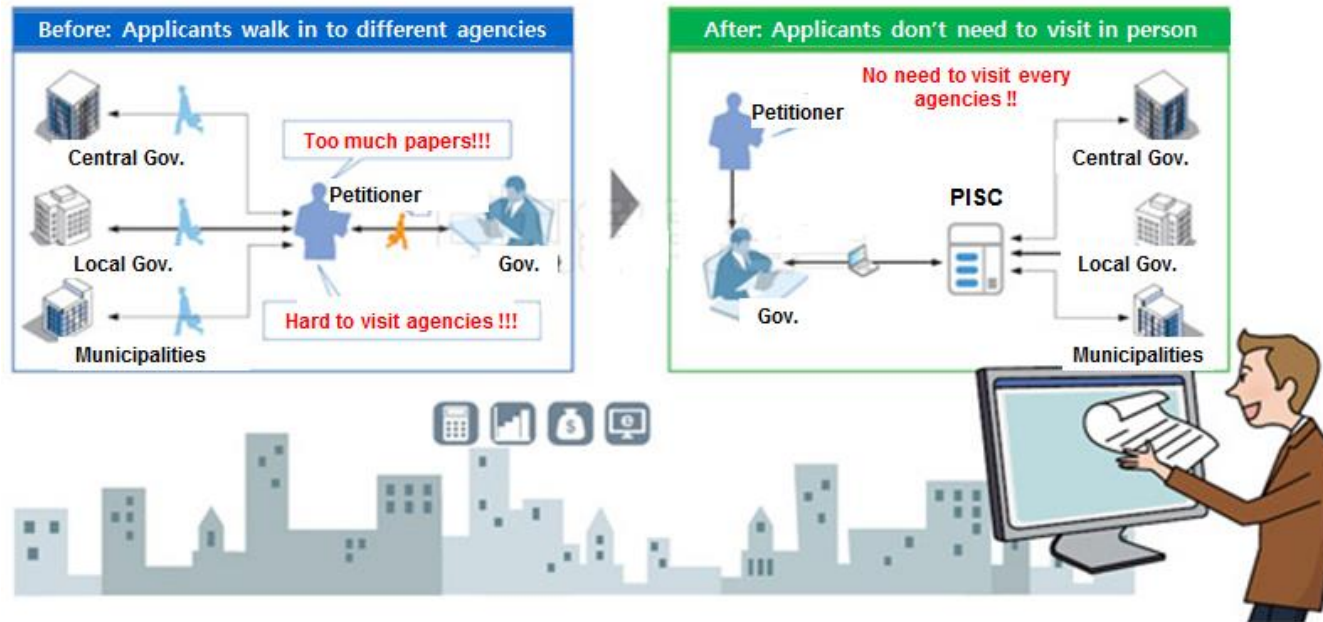
가족/건강 (총 6종) 	건강검진 및 예방접종과 관련된 생활 정보를 확인할 수 있습니다. ▶ 일반 건강검진일 ▶ 생애전환기 건강진단일 ▶ 암 검진일 ▶ 영유아검진일 ▶ 예방접종일 ▶ 영아8주간접종일	세금/미환금 (총 8종) 	납부해야 할 세금과 관련된 생활 정보를 확인할 수 있습니다. ▶ 종합소득세 신고안내 ▶ 재산세 ▶ 주민세 ▶ 자동차세 ▶ 등록면허세 ▶ 미환금 ▶ 휴면예금 ▶ 휴면보험금
연금 (총 3종) 	향후에 받게 될 연금 생활 정보를 확인할 수 있습니다. ▶ 국민연금 예상액 ▶ 사회연금 예상액 ▶ 공무원연금 예상액	병역 (총 4종) 	입영, 민방위 교육 훈련일 등 병역과 관련된 생활 정보를 확인할 수 있습니다. ▶ 병역판정검사일 ▶ 입영일/병역소집일 ▶ 병역동원훈련일 ▶ 민방위교육훈련일
법칙금/과태료 (총 2종) 	법칙금·과태료 등의 생활 정보를 확인할 수 있습니다. ▶ 교통법칙금과태료 ▶ 주차차위반 과태료	자동차 (총 4종) 	운전면허 갱신·정지 기간 등 자동차와 관련된 생활 정보를 확인할 수 있습니다. ▶ 운전면허 ▶ 자동차 검사기간 ▶ 자동차 압류정보 ▶ 고속도로 미납통행료
생활금융 (총 9종) 	주택연금 잔액, 학자금 대출 등 생활 금융과 관련된 생활 정보를 확인할 수 있습니다. ▶ 든든 학자금 대출 ▶ 일반상환 학자금 대출 ▶ 농어촌대학생 학자금 대출 ▶ 공무원연금 대여학자금 ▶ 다담돌 대출 ▶ U-보금자리론 대출 ▶ 아낌e 대출 ▶ 주택연금 잔액 ▶ 노후긴급자금(실버론) 지원(대출잔액)	주택/복지 (총 5종) 	예비 입주자 순위, 장려금 등 주택·복지와 관련된 생활 정보를 확인할 수 있습니다. ▶ 근로장려금 대상자 ▶ 자녀장려금 대상자 ▶ 여권만료일 ▶ 예비입주자 순위 ▶ 건축물에너지 사용량 등급

Screen Capture from Minwon24

- SSO based citizen portal with digital certificates.
- Resident Registration System has been the basis of citizen portal services.
- Now citizen portal (Minwon24) offers 42 types of “Daily-life Information Service” which is an extended services of customized citizen services based on the integration of agency data.
- Family/health, Taxation, Pension, Military Services, Penalty information, Vehicles, Finance Support, Housing/welfare are the major categories of Daily-life information service.
- Without strong resident registration service over ESB structure, these services are not available.

1. GOV 24 Introduction (4)

■ Before and After of PISC service



443 Million paper certificates needed for transactions per year

Personal Cert.	Real-estate Cert.	Vehicle Cert.	Etc. Cert.
222 Million	190 Million	26 Million	5 Million
Resident Registration, Registered Stamp, Family Registration, etc.	Real-estate registration	Vehicle registration, motorcycle registration, etc.	Bidding, company registration, etc.

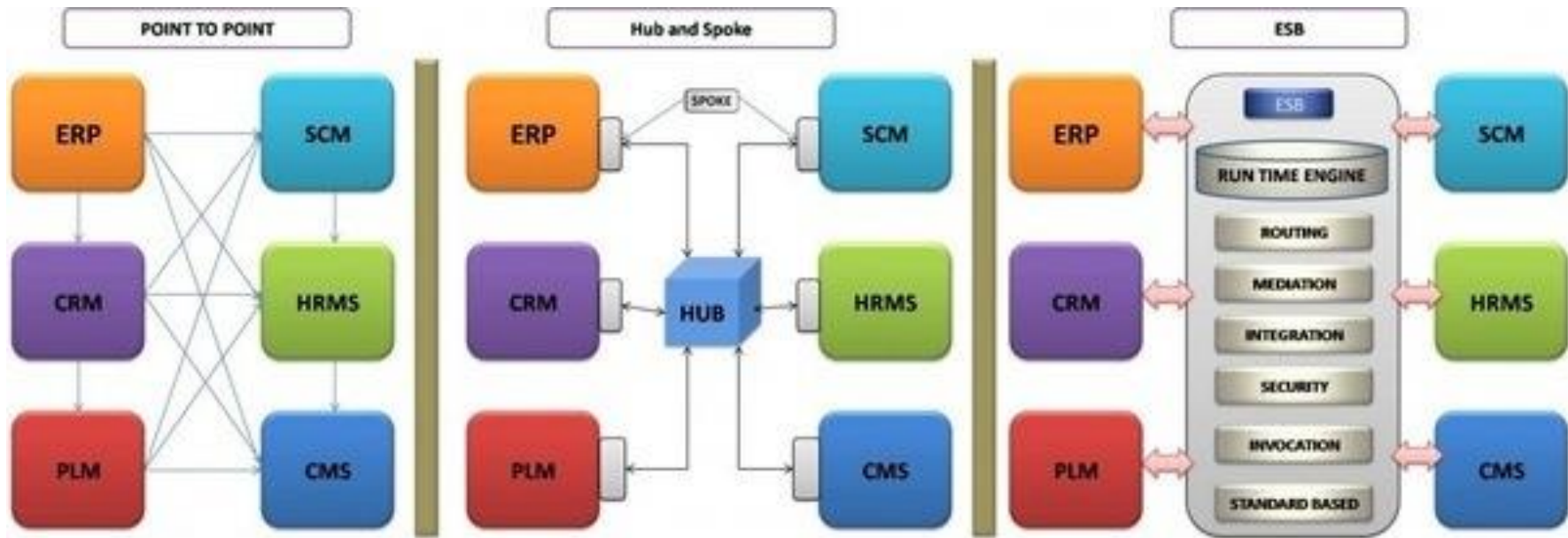
1. GOV 24 Introduction (5)

■ ESB and SOA – the basis of Korean PISC

- An ESB's primary function is to provide the connections between communicating applications – acting much like a router to control the data.
- It is commonly used in enterprise application integration (EAI) or service-oriented architecture (SOA) principles.
- The interaction and communication between components are across the bus, which has a similar function to the physical computer bus to handle data transfer or message exchange between services, without writing any actual code.
- ESB as an infrastructure software service-oriented model works as a managed message system that provides routing, data transformation, translation upon a client's request and event-interpretation.
- It is often needed to transform messages into a format that the application can interpret. ESB is also used to change data content or execute services via a rule engine.
- SOA is way of building the next generation of applications from 'Lego Blocks' called Services whereas ESB is a piece of infrastructure software that provides APIs for developers to create services and send messages between services.

1. GOV 24 Introduction (6)

PISC in Korea is based on ESB integration



- Simple structure
- System maintenance cost increases with increasing number of systems
- Flexibility/extensibilities are low



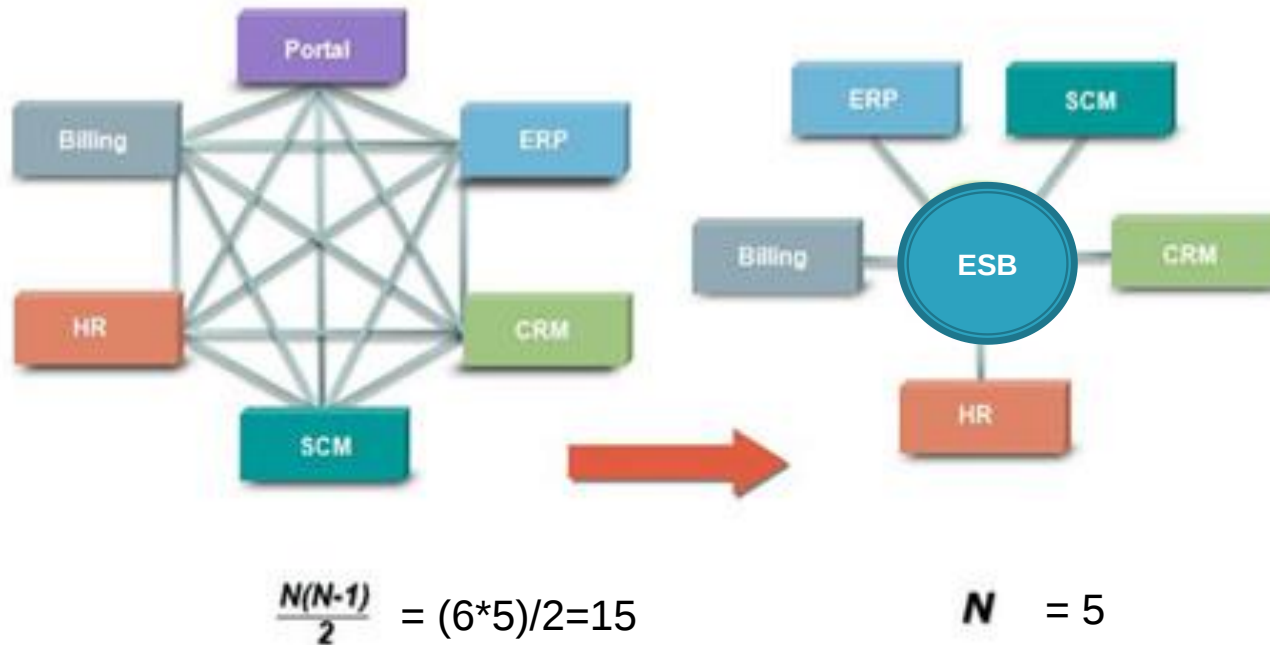
- By middleware, business logic is used to integrated applications
- 1:N structure
- Vendor specific
- Central hub system is the single point of failure
- New application adoption is easy by same vendor



- By middleware, service oriented integration
- EAI+SOA concept
- Web service, XML based standardized integration environment
- Mutli-protocol supports
- BUS structure
- Reusable components
- High cost for initial investment

1. GOV 24 Introduction (7)

■ PISC features and Searching Cost



- Compared to Point-to-Point integration, ESB has much lower level of searching cost

2. INVIL – portal

II. Introduction of Korean e-Government Services

인빌쇼핑

인빌체험

로그인 | 회원가입

한국어

이동

행정자치부 지정

정보화마을

www.invil.org

정보화마을 소개

인빌뉴스

인빌배움터

정보화마을 찾기

이벤트

ALL MENU

알파고도
선택하기
어려운 결정

바다 갯벌체험 VS 계곡 송어잡기

여러분의 선택은??

2/4

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||

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인빌쇼핑

인빌체험

인빌배움터

정보화마을찾기

인빌웹진

인빌메신저

화상대화

고객센터

홍보동영상

2. INVIL – Shopping (1)

II. Introduction of Korean e-Government Services

정보화마을 | 인빌뉴스 | 인빌체험 | **요청사항**

로그인 | 회원가입 | 장바구니 | 주문/배송조회 | 고객센터 | 즐겨찾기

행정자치부 지정
정보화마을
www.invil.org

인빌쇼핑

자두 | 매실 | 옥수수 | 복분자 | 감자

이벤트 | 기획전 | 지금이 제맛 | 베스트 상품 | 친환경 농산물 | 대량구매

인빌특가

전체보기

농산물 | 수산물 | 축산물 | 가공식품 | 건강식품 | 화훼/특화상품

인빌체험
바라가기

아이삼
홍삼쿠키&캔디
아이들 영양간식

무농약
농산물

우리 농산물 사랑 캠페인, 정보화마을이 함께 합니다!

김천 포도

예약판매 이벤트

예약기간 : 6월 23일(목) ~ 7월 15일(금)

베리 베리 베리~ 굿

김천포도 예약이벤트

컬러푸드 2탄

춘천 맛 그대로~국내산 재료
춘천 닭갈비 2kg

10%↓ ₩31,500→ **28,500**

(인빌푸드)녹차골(꼬마)토마토 [5kg]



상품번호 : PRD20160302000002510 [URL 주소복사](#)



[이미지 크게보기 >](#) [동영상 보기 >](#)

판매가	14,000원
이벤트가	10,000원

인빌머니 ?	100원 (회원등급별 최대 0.5%까지 추가 적립)
생산마을	전남 보성 벌교부농마을 마을탐방
생산단체	벌교부농회 상세정보
원산지	국내산 (전남 보성군)

배송료	무료
배송기간	결제일로부터 3일 (산지 사정에 따라 1~2일 추가 소요)
반품여부 ?	반품불가
생산자선택	

구매수량	1	10,000원
총 상품금액(수량)	10,000원 (1개)	

상품평 (총 2건)

7.8 점

★★★★★

조아요조아요조아요조아요~

[상품평더보기](#)

[✓ 바로 구매하기](#) [장바구니 담기](#) [♥ 관심상품](#)

바람의 라이더(ATV)-험로코스



이미지 크게보기 >

예약가능여부 예약접수중
이용기간 개별여행
상품유형 인원

담당자 이선헌
마을명 강원 평창 의야지바람마을
위치 의야지바람마을체험장
연락처 010-4822-5876
휴대전화 010-4822-5876

상품가격
[개별] 성인 30,000원, 어린이 30,000원
[단체] 성인 30,000원, 어린이 30,000원
[단체기준] 20 명

보험 * 개별 보험적용 상품 * 보험
정보화마을 인빌체험 보험적용 상품 보험

문의하기

상품평쓰기

선택하세요

예약가능 체험일정
2016-06-27 ~ 2016-10-01
체험일 선택 (예약/정원)P

신청수량
성인
어린이

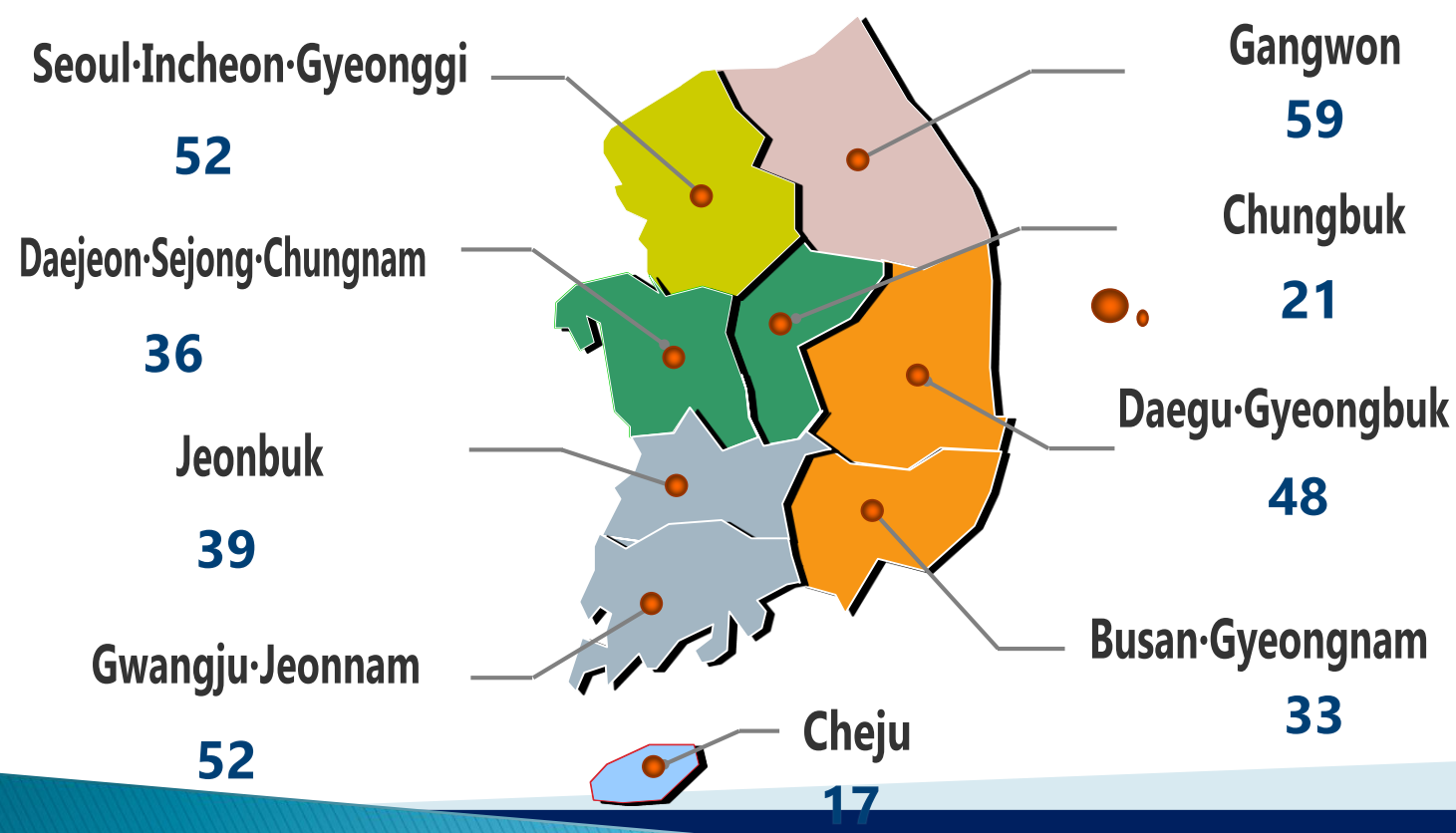
총 결제금액

0원

관심상품>

장바구니 >

예약하기 >



As of 2015, 358 INVILs are in operation all over the country

2. INVIL – Marketing Logos



기본형



기본형 + 정보화마을 로고



기본형 정면



정좌측면



정우측면



안전행정부 지정
정보화마을
www.invil.org



영월 삼굿마을

2. INVIL – Achievements (1)

MOU WITH COUPANG (APR, 2015)



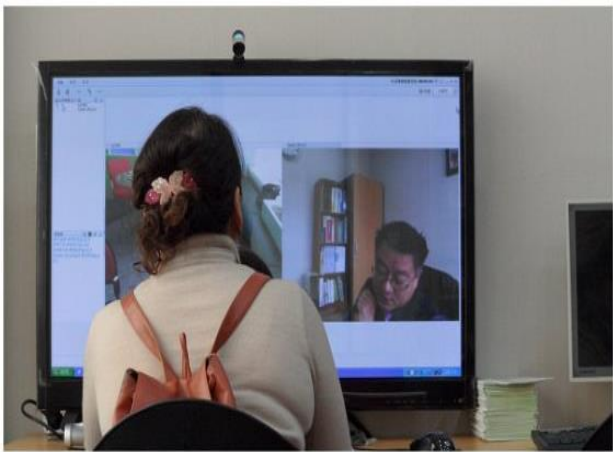
E-commerce through tablet pc



1st Smart-INVIL , Gyeonggi(Mar, 2012)



Medical / legal consultation



2. INVIL – Achievements (2)

II. Introduction of Korean e-Government Services



World e-Gov Forum
(Oct. 2006)



Visit INVIL from UNDESA
(May. Oct. 2006)



Visiting INVIL
3,256 persons from 165 Countries
(2002 ~ 2015)



PSA Award of the Year 2011 Best Practice
(June 2011)



III. Smart City Initiatives

1. Multi-Modal Transportation with T-Money Card
2. Night Bus based on Big-Data Analysis
3. Open Transport Data and Application
4. IoT Platform Deployment for Smart City



1. Smart Transportation in the Public Sector

□ T-Money Card for Multi-Modal Transportation in Korea



1.Multi-Modal Transportation with T-Money Card

T-Money Card charge at the subway station kiosk



T-Money Card tagging when taking buses



Mobile T-Money Card tagging with a Smartphone



Mobile T-Money Card payment with a wearable device



1. Multi-Modal Transportation with T-Money Card

- ☐ T-Money Card for taxi fare payment



1. Multi-Modal Transportation with T-Money Card

☐ T-Money Card can be used in various service outlets

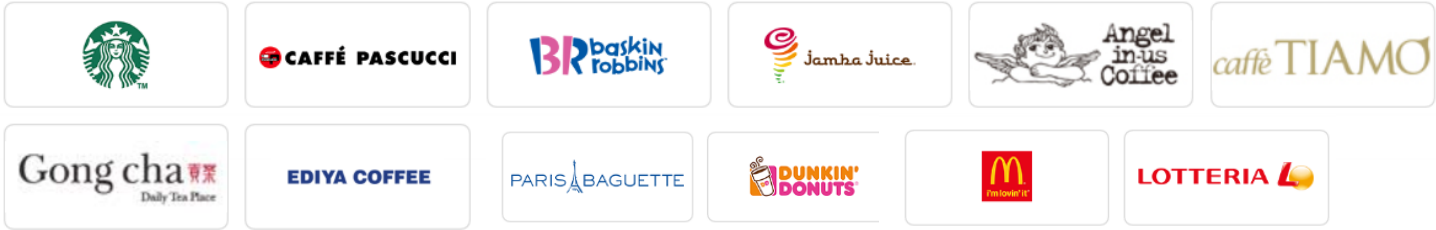
Convenient Stores



Mega Stores



Coffee-shops and food stores



1. Multi-Modal Transportation with T-Money Card

□ Seoul Transportation Fare Information (Transportation Card vs. Cash)

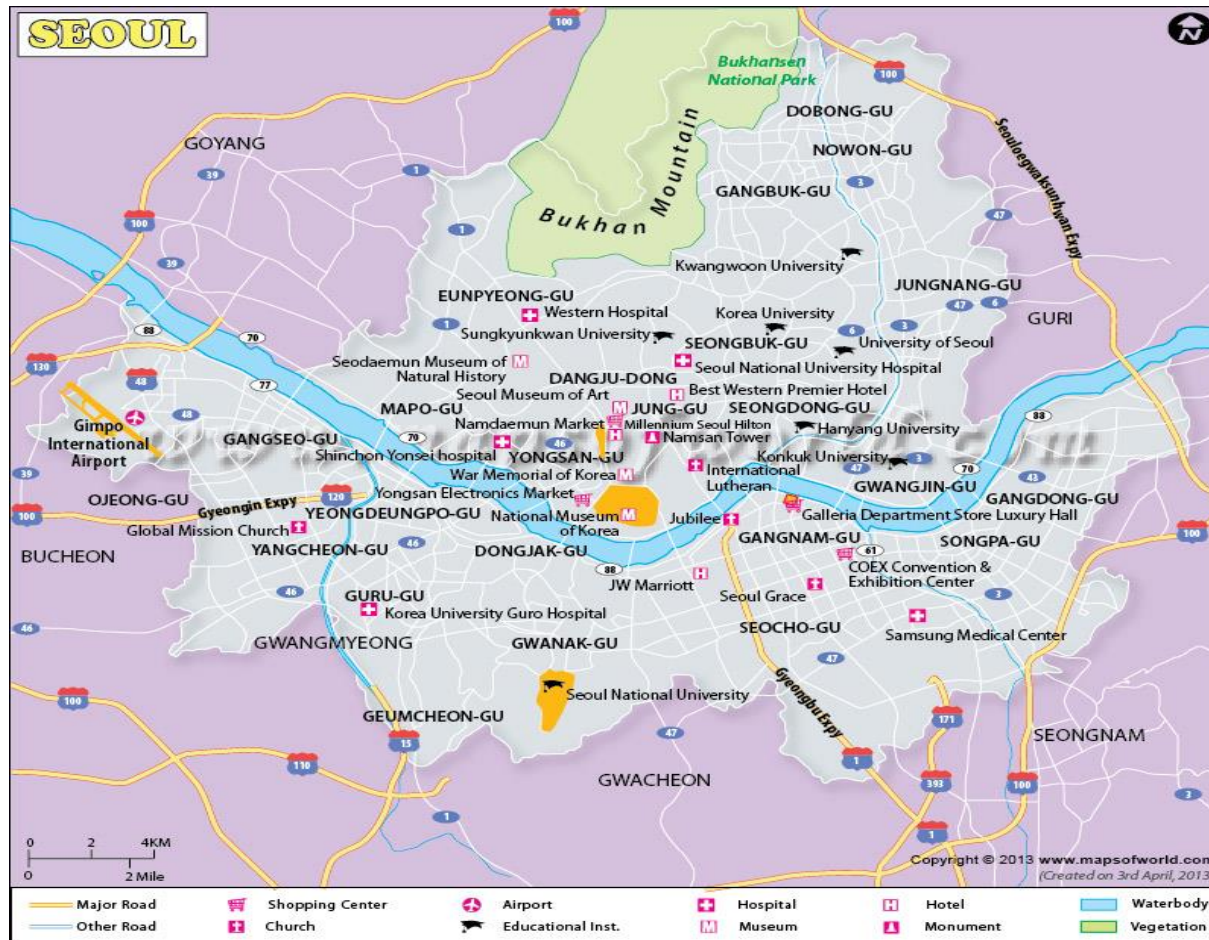
Seoul Transportation Fare Information			
Transportation	Age group	T-money	Cash
Subway	Adults	1,250 won	1,350 won
	Youth	720 won	1,350 won
	Children	450 won	450 won
Blue Bus / Green Bus (4-digit number)	Adults	1,200 won	1,300 won
	Youth	720 won	1,000 won
	Children	450 won	450 won
Green Village Buses (2-digit number)	Adults	900 won	1,000 won
	Youth	480 won	550 won
	Children	300 won	300 won
Yellow Bus (circular route bus)	Adults	1,100 won	1,200 won
	Youth	560 won	800 won
	Children	350 won	350 won
Red Bus (express bus)	Adults	2,300 won	2,400 won
	Youth	1,360 won	1,800 won
	Children	1,200 won	1,200 won
Night Bus	Adults	2,150 won	2,250 won
	Youth	1,360 won	1,800 won
	Children	1,200 won	1,200 won

1,000Won=1USD

□ Transfer Discount Policy for T-Money Card usage (cont'd)

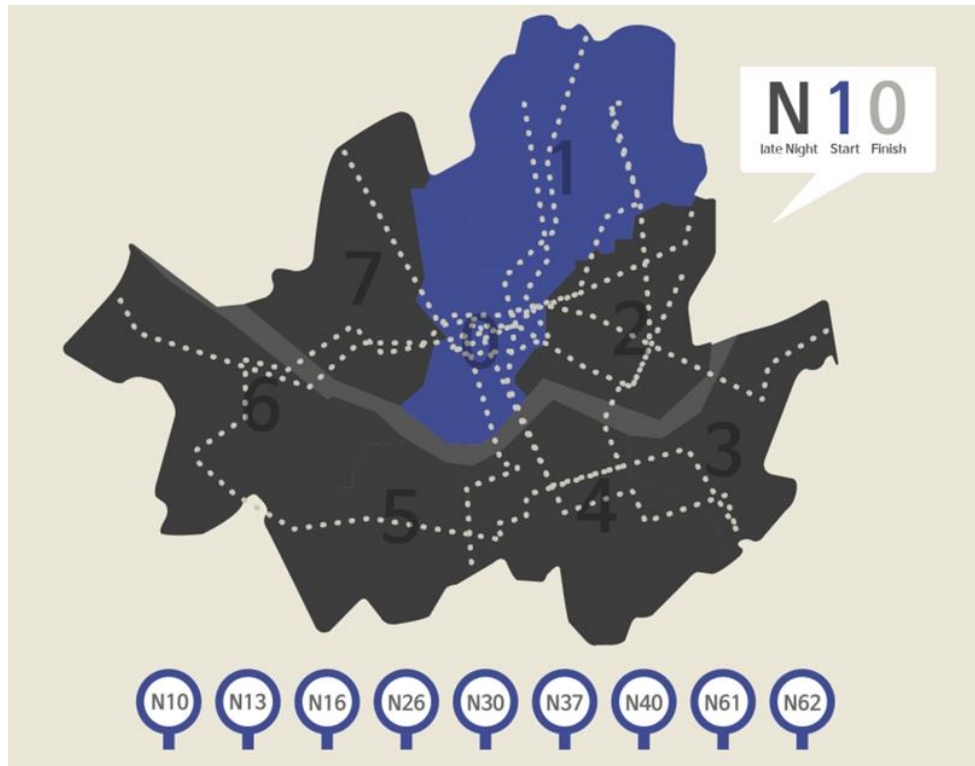
- Transfer discounts are applicable for up to 4 times a day, within a transfer time limit of 30 minutes (up to 1 hour from 9pm to 7am next day).
- However, if a customer does not tap the card on the sensors as he/she gets off the bus or exit the subway, he/she will not benefit from the transfer discounts and may be charged double the base fare at the next time.
- Therefore, it is important to ensure to tap the card at all times when getting off the bus or exiting the subway.

☐ City of Seoul map



2. Night Bus based on Big-Data Analysis

□ City of Seoul and night bus line number naming convention



- Including the data from ①Taxi (location of entry/exit of 5 Million customers) ②Mobile phone base station traffic data ③Routes of daily bus lines
- The size of 1km of hexagon of 1,250 cells were identified
- 2013 September, the service is launched
- After the first three months of launching, on the average 6,079 passengers were using the service per one night
- Overall 300,000 passengers used the service for first three months

2. Night Bus based on Big-Data Analysis

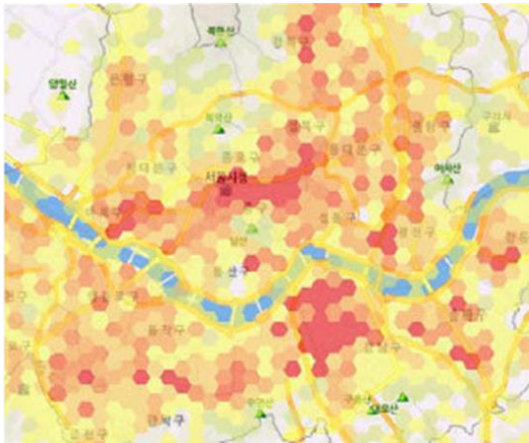
☐ Night bus in Seoul



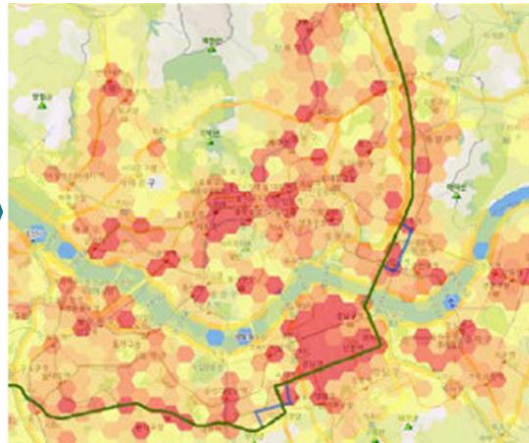
2. Night Bus based on Big-Data Analysis

□ Big-Data analysis process of night bus lines

Identifying population density



Identifying optimized routes



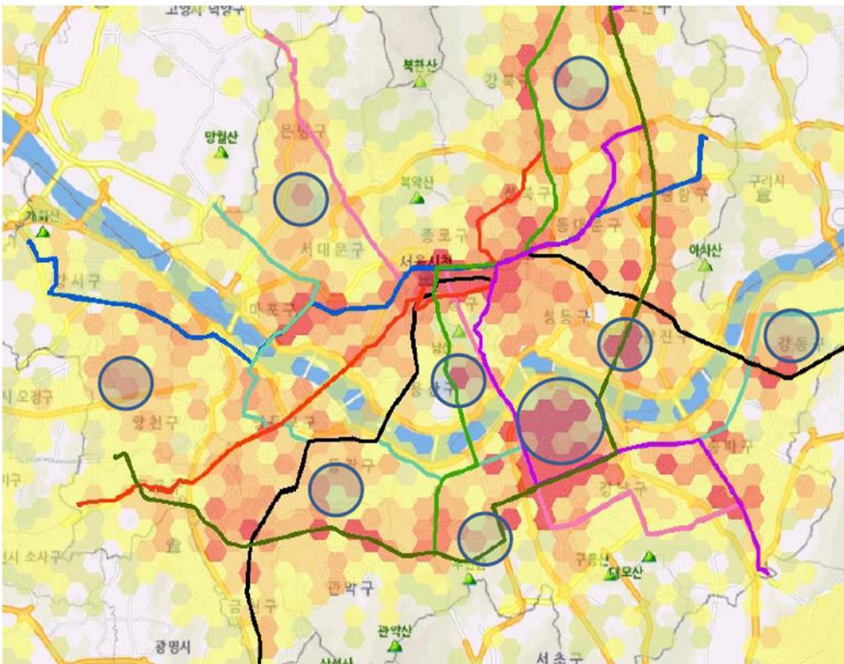
Set time interval of busses



- First, based on mobile phone base station and billing addresses of 300,000 customers, 3 billion data of March of 2013 were analyzed for identifying the patterns of foot traffic (population density of a hexagon cell)
- Next, identifying the patterns of population density and adjust time intervals of bus routes reflecting timely, daily variance weights

2. Night Bus based on Big-Data Analysis

□ Final routes by big-data analysis

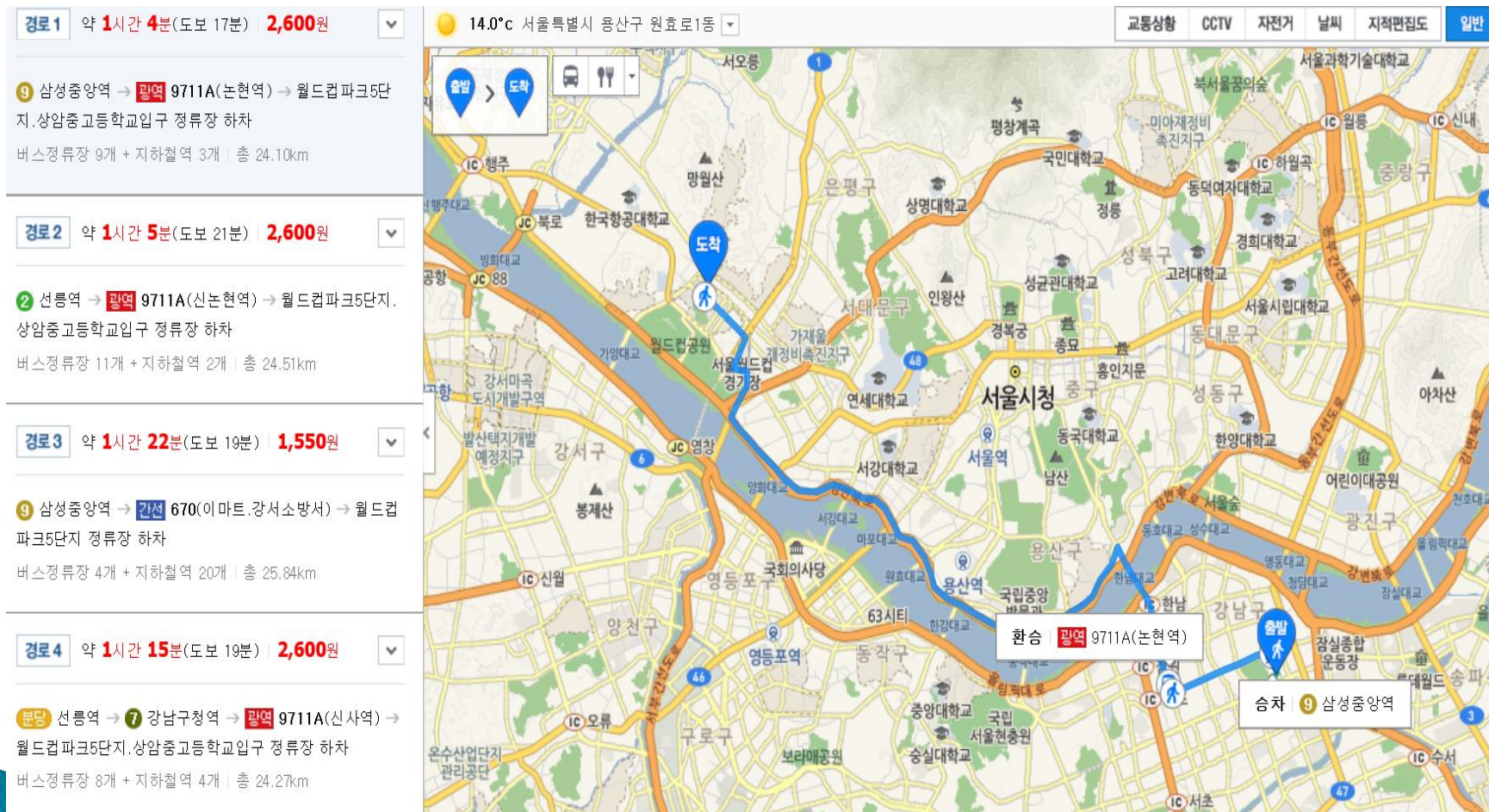


3. Open Transport Data and Application

☐ Seoul Traffic Information Center (TOPIS)



Public bus route suggestions with real-time traffic data

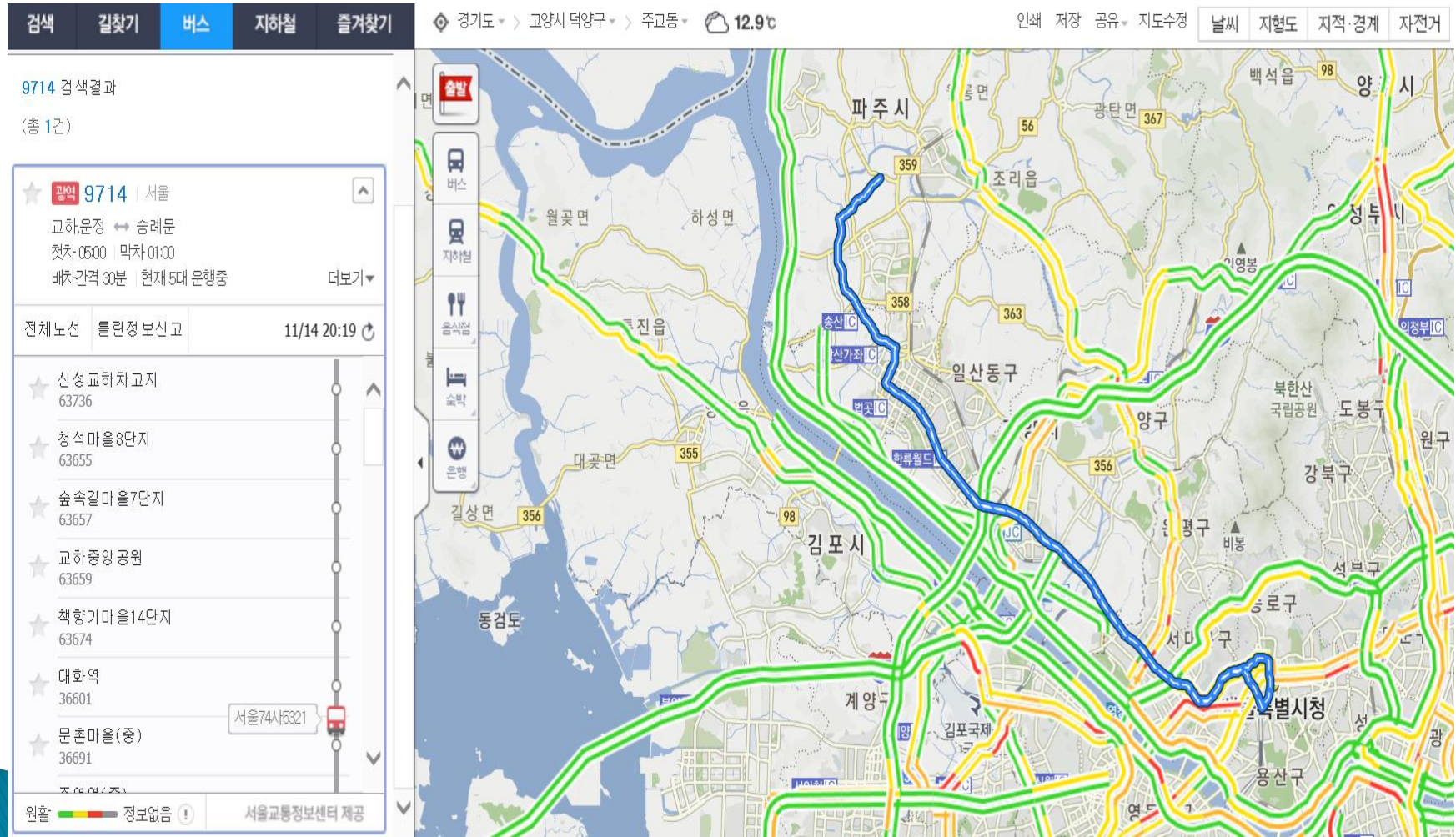


3. Open Transport Data and Application

□ Open API example (XML)

```
<?xml version="1.0" encoding="UTF-8" standalone="true"?>
- <SpotInfo>
  <list_total_count>5</list_total_count>
  - <RESULT>
    <CODE>INFO-000</CODE>
    <MESSAGE>정상 처리되었습니다</MESSAGE>
  </RESULT>
  - <row>
    <spot_num>A-10</spot_num>
    <spot_nm>동호로(장충체육관)</spot_nm>
    <grs80tm_x>200633.487975</grs80tm_x>
    <grs80tm_y>451010.051429</grs80tm_y>
  </row>
  - <row>
    <spot_num>B-06</spot_num>
    <spot_nm>화랑로(조선왕릉)</spot_nm>
    <grs80tm_x>208764</grs80tm_x>
    <grs80tm_y>459019</grs80tm_y>
  </row>
  - <row>
    <spot_num>B-29</spot_num>
    <spot_nm>경인로(유한광고)</spot_nm>
    <grs80tm_x>184313.594374</grs80tm_x>
    <grs80tm_y>443266.257648</grs80tm_y>
  </row>
  - <row>
    <spot_num>D-13</spot_num>
    <spot_nm>동일로(노원역)</spot_nm>
    <grs80tm_x>205351.935482</grs80tm_x>
    <grs80tm_y>461419.376043</grs80tm_y>
  </row>
  - <row>
    <spot_num>D-36</spot_num>
    <spot_nm>사평대로(고속터미널역)</spot_nm>
    <grs80tm_x>200691.392481</grs80tm_x>
    <grs80tm_y>444896.469303</grs80tm_y>
  </row>
</SpotInfo>
```

- Real-time Traffic Open Data example and 9714 bus line route



3. Open Transport Data and Application

- Open Data example
 - number of passengers by bus stops (cont'd)



Station Name	Entry	Exit
Digital Media City Station (A)	1763	209
Digital Media City Station (B)	290	1788
Kyoha Parking Lot (A)	189	8
Kyoha Parking Lot (B)	0	151
Madoo Station	743	496
Central Park (A)	1	1504
Central Park (B)	1115	9
Woori Bank	51	4042
Triple Medical Town	4359	46
Chungsok 8 th Village	5	1182
Chungsok Village	3089	16
Sungraymoon	1786	1099
Haengsin Elementary School	1053	359
Almee Park	319	267
Jooyeop Station(A)	475	363
Jooyeop Station (B)	854	475
Ilsan East Office (A)	860	1325
Ilsan East Office (B)	1028	798
Koyang Police (A)	540	554
Koyang Police (B)	535	454
Hansindong (A)	663	277
Hangsindong (B)	377	687
Seojeong Vill (A)	308	108
Seojeong Vill (B)	134	503
Moonchon Vill (A)	227	271
Moonchon Vill (B)	131	306
Kangsun Vill (A)	416	585
Kangsun Vill (B)	331	543
Madoo Station (A)	860	972
Baeksuk Station	433	687
Soman Vill (A)	519	123
Soman Vill (B)	184	544
Yonsei University (A)	2787	90
Yonsei University (B)	139	1995
Seodaemoon Police	479	184
Daewha Station (A)	2679	1049
Daewha Station (B)	716	2965
Chekhyanggi Vill (A)	1701	14
Chekhyanggi Vill (B)	8	2895
Gwanwhamoon Building	2076	2931
Shinhan Bank HQ	1519	1481

3. Open Transport Data and Application

□ Open Transport Data by Seoul Metropolitan Government (Example)

검색

길찾기

버스

지하철

즐거찾기

서울 종로구 삼청동

2016년 09월

틀린정보 신고

★즐거찾기

공유

전체

장소

주소

버스

모두지우기

'삼청터널' 검색결과

'삼청' 주변 '터널' (으)로 재검색 ▶

장소 (2건)

정확도순

인기도순

삼청터널

터널

서울 성북구 대사관로 1

지번> 성북동 산 25-1

★★★★★ 0건 | 리뷰 0 | 상세보기

출발

도착

숙정문

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08238

서울 성북구 성북동

지선

오픈API | 검색등록 | 광고신청 | 고객센터 | 법적공지

출발

버스

지하철

스토어뷰

음식점

주차장

지도

스카이뷰

Kakao

Samchung Tunnel

2015/12 Traffic Volume Data

북동

3. Open Transport Data and Application

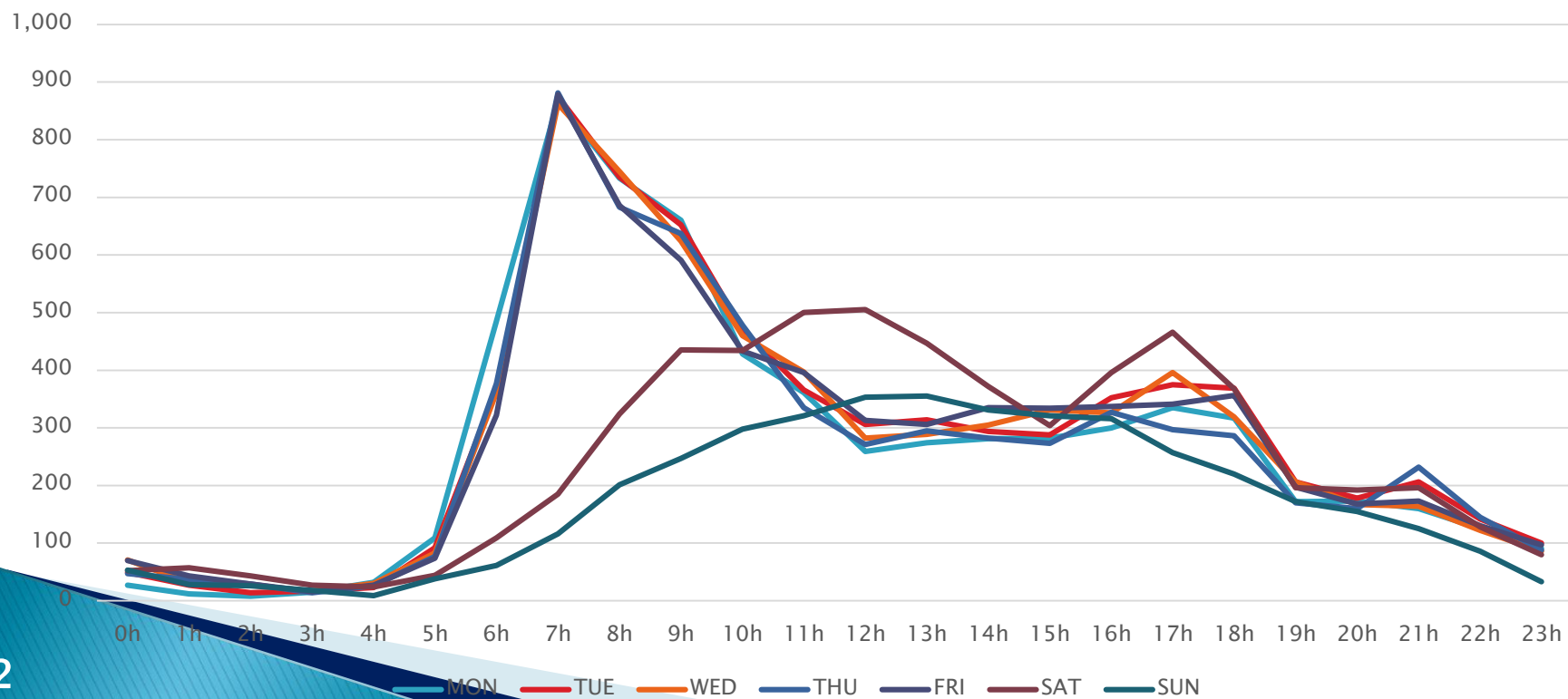
□ Monthly number of cars at a place (by hour, month of December, 2015)

Date	Enter/Exit	0h	1h	2h	3h	4h	5h	6h	7h	8h	9h	10h	11h	12h	13h	14h	15h	16h	17h	18h	19h	20h	21h	22h	23h
20151201	Enter	72	40	13	16	29	93	355	856	748	716	475	352	279	328	276	299	298	327	301	183	177	186	130	86
20151202	Enter	63	38	19	17	29	97	385	846	730	719	541	403	312	283	256	272	296	277	275	176	193	156	125	67
20151203	Enter	45	45	18	10	32	71	309	884	669	587	325	352	196	221	239	240	248	266	196	169	135	133	114	90
20151204	Enter	47	32	18	13	22	75	312	890	744	624	471	344	304	305	307	317	331	372	339	181	160	218	148	95
20151205	Enter	66	42	42	19	28	42	121	189	298	413	391	419	393	322	259	262	256	262	220	178	142	166	120	63
20151206	Enter	52	34	26	8	12	22	54	120	184	251	283	306	312	329	346	305	257	233	211	188	153	118	67	42
20151207	Enter	27	12	8	15	32	109	485	867	733	660	428	361	259	274	281	282	300	335	317	172	173	160	125	91
20151208	Enter	49	27	14	17	23	92	367	875	735	652	471	366	306	314	294	288	352	375	369	206	178	206	142	100
20151209	Enter	71	31	27	17	30	83	361	862	745	624	460	397	282	289	305	331	326	396	319	206	167	164	122	86
20151210	Enter	47	37	29	14	26	77	377	881	683	637	478	335	271	295	282	273	327	297	286	170	160	232	145	88
20151211	Enter	70	43	29	16	27	74	322	878	686	591	433	396	313	306	335	334	337	341	356	197	168	173	130	97
20151212	Enter	52	57	43	27	24	44	109	185	324	435	434	500	505	447	372	304	396	466	368	196	192	196	128	80
20151213	Enter	53	28	26	18	9	38	61	116	201	247	298	321	353	355	331	321	316	257	220	172	155	125	86	33
20151214	Enter	17	9	9	14	24	97	479	936	667	687	455	324	272	281	270	245	248	279	238	157	138	150	108	69
20151215	Enter	57	21	18	13	21	79	358	850	715	611	469	346	304	305	317	266	294	284	281	178	163	160	179	100
20151216	Enter	62	50	18	19	25	92	349	908	713	584	453	398	291	275	281	311	294	308	269	164	153	161	134	88
20151217	Enter	68	42	23	16	16	93	333	901	724	678	510	391	306	303	291	290	294	345	265	204	179	196	163	91
20151218	Enter	63	43	27	14	25	88	361	835	728	602	497	414	296	308	310	333	330	334	361	233	176	169	147	114
20151219	Enter	74	47	32	27	23	50	126	176	326	402	418	477	481	577	397	337	365	285	269	173	180	155	115	69
20151220	Enter	65	21	22	14	16	31	66	114	204	289	321	330	334	338	316	282	291	258	202	154	151	154	95	45
20151221	Enter	33	9	14	12	32	107	461	828	667	787	607	436	280	274	263	284	287	313	254	172	146	159	132	89
20151222	Enter	61	38	18	21	19	77	339	859	722	617	542	407	276	333	311	323	327	360	324	213	196	164	153	75
20151223	Enter	61	49	23	14	20	85	364	822	708	605	515	389	286	320	269	273	283	335	322	179	161	180	140	107
20151224	Enter	82	53	27	20	19	68	334	808	689	614	467	397	291	313	290	291	320	317	288	244	203	220	167	108
20151226	Enter	36	19	14	11	12	37	76	125	208	320	314	331	338	308	327	325	295	300	240	168	179	143	120	85
20151227	Enter	43	36	30	11	12	21	60	99	189	231	271	288	342	365	353	349	307	233	157	159	146	121	71	37
20151228	Enter	15	14	8	13	24	85	449	891	710	606	510	373	274	327	262	267	295	285	252	180	153	154	119	76
20151229	Enter	51	33	15	13	22	79	324	834	674	598	491	362	329	293	304	266	323	317	282	173	186	177	130	91
20151230	Enter	56	54	29	18	25	71	337	807	680	541	441	386	299	321	315	265	312	276	261	166	156	144	123	56
20151231	Enter	53	33	28	22	21	59	255	691	678	483	471	361	285	297	301	258	303	286	276	207	180	173	177	115
20151201	Exit	137	52	35	13	21	29	63	168	233	242	225	307	258	286	273	318	438	593	703	654	428	429	380	186
20151202	Exit	124	65	25	27	25	28	62	183	222	234	240	246	242	286	320	325	406	509	683	679	432	425	334	181
20151203	Exit	94	60	34	26	17	28	79	159	206	211	145		214	212	248	270	332	415	574	528	341	304	293	173
20151204	Exit	94	63	33	20	22	32	67	165	214	221	242	275	261	278	332	379	451	574	678	699	488	406	388	252
20151205	Exit	117	98	48	28	29	28	48	82	135	225	242	277	280	266	301	253	299	411	516	544	350	299	207	132
20151206	Exit	78	47	42	20	17	14	25	47	107	131	217	185	204	295	388	411	398	439	305	338	282	238	166	90
20151207	Exit	63	24	15	13	13	27	62	157	215	241	259	256	243	249	298	318	403	519	679	608	453	404	322	181
20151208	Exit	101	59	24	25	24	22	64	160	202	217	228	270	285	283	328	387	447	565	754	707	499	468	381	182
20151209	Exit	103	55	35	19	34	27	76	165	248	212	222	269	261	281	315	416	466	570	650	667	465	437	353	181
20151210	Exit	122	79	43	21	24	32	63	156	215	240	272	274	309	306	348	377	430	491	658	642	458	398	345	223
20151211	Exit	122	53	32	32	27	25	59	160	226	253	270	246	278	309	381	382	427	564	699	676	491	429	411	225
20151212	Exit	115	79	62	42	27	36	47	91	95	197	215	261	306	354	355	469	440	504	484	395	359	359	276	166
20151213	Exit	111	59	37	30	23	26	23	51	95	161	187	221	249	299	327	413	463	430	394	290	357	248	162	99
20151214	Exit	38	26	20	13	12	27	62	169	226	209	213	241	252	246	257	299	338	502	597	629	450	375	354	163
20151215	Exit	71	53	31	24	18	29	62	147	199	208	235	246	269	261	333	354	409	548	634	572	457	403	394	196
20151216	Exit	100	67	40	26	24	39	73	136	206	219	283	249	272	287	302	361	483	528	666	615	446	412	353	207
20151217	Exit	119	64	36	28	22	21	64	161	219	222	200	244	262	318	321	346	430	559	653	633	487	466	400	222
20151218	Exit	116	78	37	32	22	28	48	153	200	229	265	284	302	273	307	377	454	606	631	584	468	434	432	269
20151219	Exit	155	76	72	44	22	30	52	82	101	183	193	242	297	338	336	391	431	485	568	486	367	293	276	144
20151220	Exit	93	69	46	34	24	13	39	49	87	155	232	238	275	288	333	369	410	415	346	275	307	257	195	81
20151221	Exit	51	33	17	11	20	21	61	152	191	189	201	199	237	276	277	335	375	518	608	538	412	428	362	184
20151222	Exit	109	75	36	24	20	28	46	157	236	241	218	271	315	272	310	383	462	506	674	626	472	397	365	208
20151223	Exit	112	81	48	29	25	25	48	143	191	217	205	243	270	280	286	372	381	565	628	598	431	413	373	216
20151224	Exit	114	74	40	31	21	29	58	148	184	208	197	279	285	289	356	361	454	626	644	635	540	484	371	271
20151226	Exit	77	43	24	12	16	20	39	46	112	170	150	202	246	280	384	391	418	435	411	319	332	321	251	134
20151227	Exit	76	55	37	22	13	14	23	56	72	143	185	191	251	312	332	377	423	399	331	248	293	234	150	100
20151228	Exit	42	37	12	17	8	25	55	150	219	223	221	241	242	260	286	327	383	516	579	579	451	415	375	203
20151229	Exit	106	51	41	23	13	26	62	121	205	209	216	275	260	294	297	353	427	575	643	606	426</			

3. Open Transport Data and Application

□ Weekly Traffic Volume Open Data at *Samchung* Tunnel

DATES	DAY	0h	1h	2h	3h	4h	5h	6h	7h	8h	9h	10h	11h	12h	13h	14h	15h	16h	17h	18h	19h	20h	21h	22h	23h
20151207	MON	27	12	8	15	32	109	485	867	733	660	428	361	259	274	281	282	300	335	317	172	173	160	125	91
20151208	TUE	49	27	14	17	23	92	367	875	735	652	471	366	306	314	294	288	352	375	369	206	178	206	142	100
20151209	WED	71	31	27	17	30	83	361	862	745	624	460	397	282	289	305	331	326	396	319	206	167	164	122	86
20151210	THU	47	37	29	14	26	77	377	881	683	637	478	335	271	295	282	273	327	297	286	170	160	232	145	88
20151211	FRI	70	43	29	16	27	74	322	878	686	591	433	396	313	306	335	334	337	341	356	197	168	173	130	97
20151212	SAT	52	57	43	27	24	44	109	185	324	435	434	500	505	447	372	304	396	466	368	196	192	196	128	80
20151213	SUN	53	28	26	18	9	38	61	116	201	247	298	321	353	355	331	321	316	257	220	172	155	125	86	33



□ Calculating the speed of a road link

Total Distance Driven $tot(tacho_l) = \sum_{i=1}^n tacho_{li}$

Total Driven Hours (sec) $tot(tick_l) = \sum_{i=1}^n tick_{li}$

Calculating Velocity $v_l = \frac{tot(tacho_l)}{tot(tick_l)} \times 3.6$

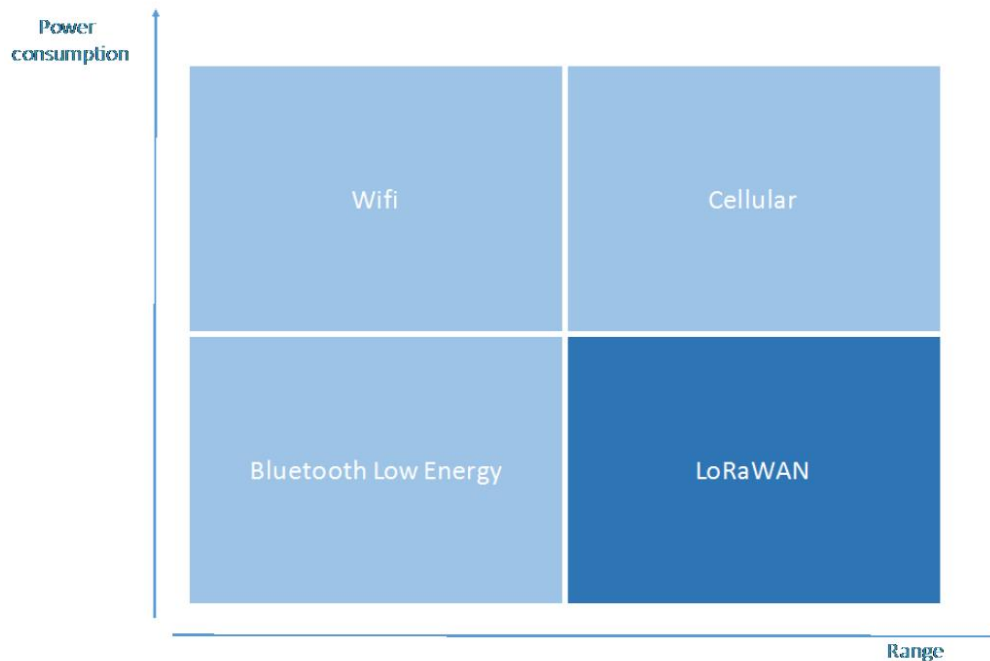
- Velocity of each 5 minutes will be averaged for an hourly basis

$$v_r^{avg} = \frac{(v_r^{00:05} + v_r^{00:10} + v_r^{00:15} + \dots + v_r^{00:50} + v_r^{00:55} + v_r^{00:60})}{n^t}$$

- Tick : Total time of duration from start to end of a road link (in terms of seconds)
- Tacho : Real distance of a Taxi from start to end of a rod link (in terms of meter)

4. IoT Platform Deployment for Smart City

□ IoT (Internet of Things) Specialized network (2)



- LPWAN (Low Power Wide Area Network) such as LoRa Network includes applications for Smart Cities such as;
 - smart parking,
 - intelligent street lighting,
 - supply chain management with asset tracking & condition monitoring,
 - smart grids with electricity,
 - water & gas metering,
 - smart agriculture with land condition monitoring
 - animal tracking
 - geo-fencing, etc.

■ IoT Importance

- IoT offers **16 Billion connected devices** by the year 2020, which will average out to six devices per person on earth.
- Existing sensors may not have direct internet access but IoT devices are able to **connect to the Internet directly**.
- **IoT data will be more democratic than SCADA** data. Historically, SCADA data has been locked away in somebody's process control network. With IoT, this one aspect is revolutionizing business models and allowing businesses to enhance their services in real time.
- The terms **IoT and M2M** communications are interchangeably used.
- **AI, robots and autonomous driving** can be associated with strong IoT architecture supports.
- **IoT networks and infrastructure** can be the foundation of smart city and future citizen friendly services.

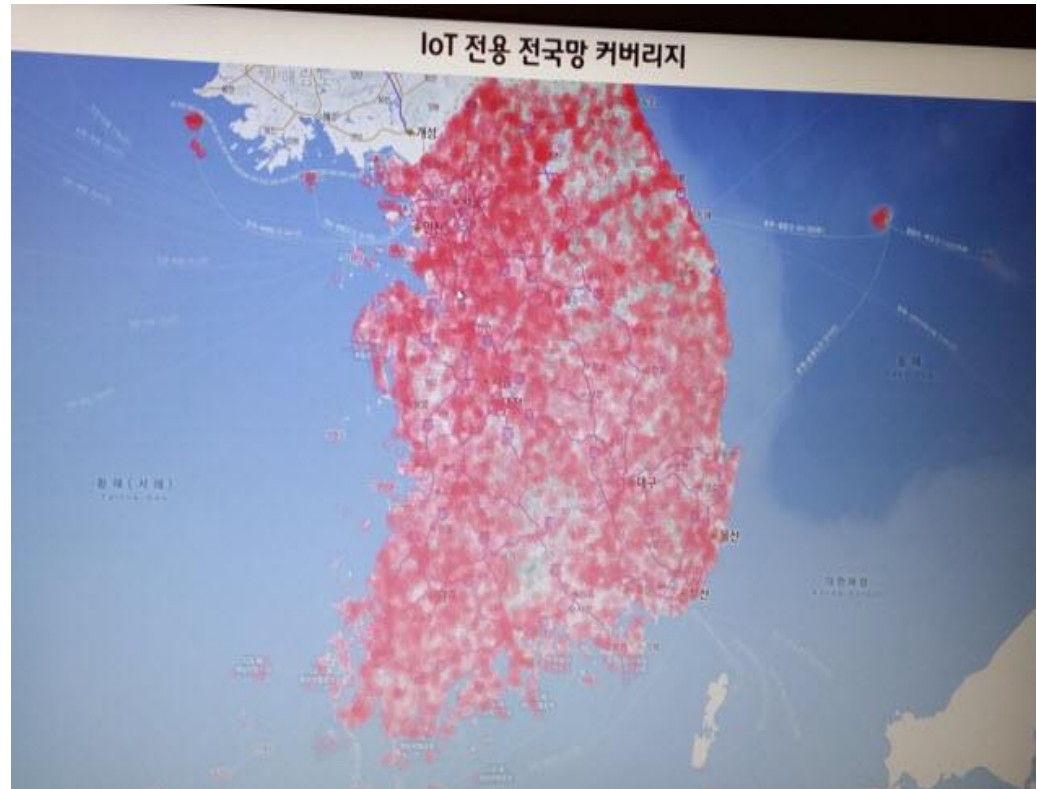
4. IoT Platform Deployment for Smart City

- SK Telecom had implemented nationwide LORA IoT network in Korea

LoRa Base Stations



SK LoRa network coverage of Korean Peninsula



4. IoT Platform Deployment for Smart City

□ SK Telecom’s Monthly Amounts for IoT Services

Unit : 1,000 Won = 1 USD

Data	Monthly Base Amounts	Services	Etc.
100KB (1time per 1 hour)	35 cents	Gas/Water AMI and Monitoring	- Discount 2 year contract (5%), 5 year contract (20%), Multi-lines (500, 2%) - Additional data rate 0.05cents/0.5KB
500KB (1 time per 10 minutes)	50 cents	Monitoring of facilities	
3 MB (1 time per 1 Minute)	70 cents	Asset management (public bicycles, etc.)	
10 MB	1 dollar	Safe watch for humans	
50 MB	1.5 dollars	Movable assets	
100 MB	2 dollars	Construction sites security management, Electricity AMI, etc.	

Source: SK Telecom, IoT homepage, 2016

* The amount of new IoT fixed monthly fee is 1/3~1/10 of the current IoT fee rates

4. IoT Platform Deployment for Smart City

□ Examples of IoT services through LoRa network



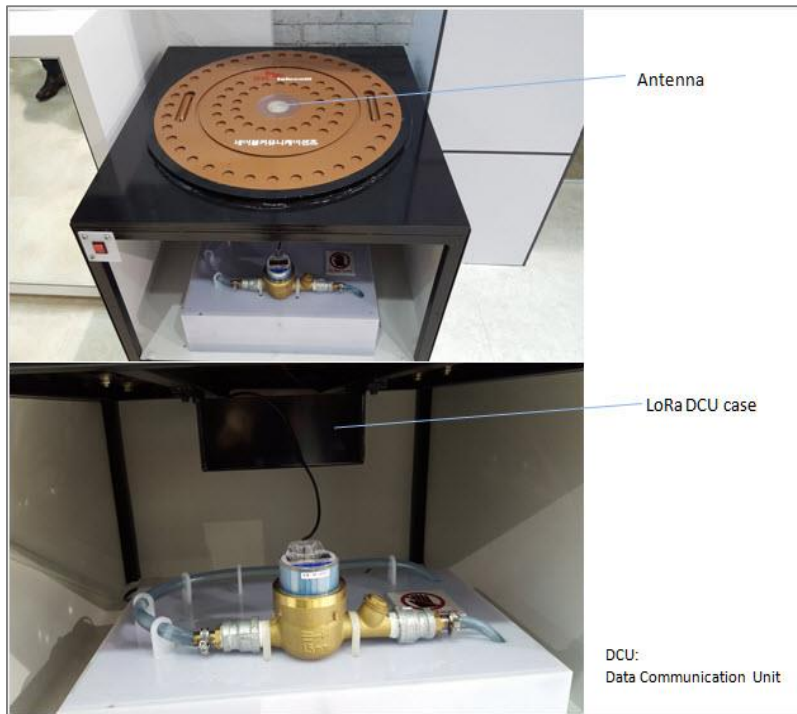
IoT Meteorological Sensors



IoT based Gas detectors

4. IoT Platform Deployment for Smart City

□ Examples of IoT services through LoRa network



IoT based manhole cover



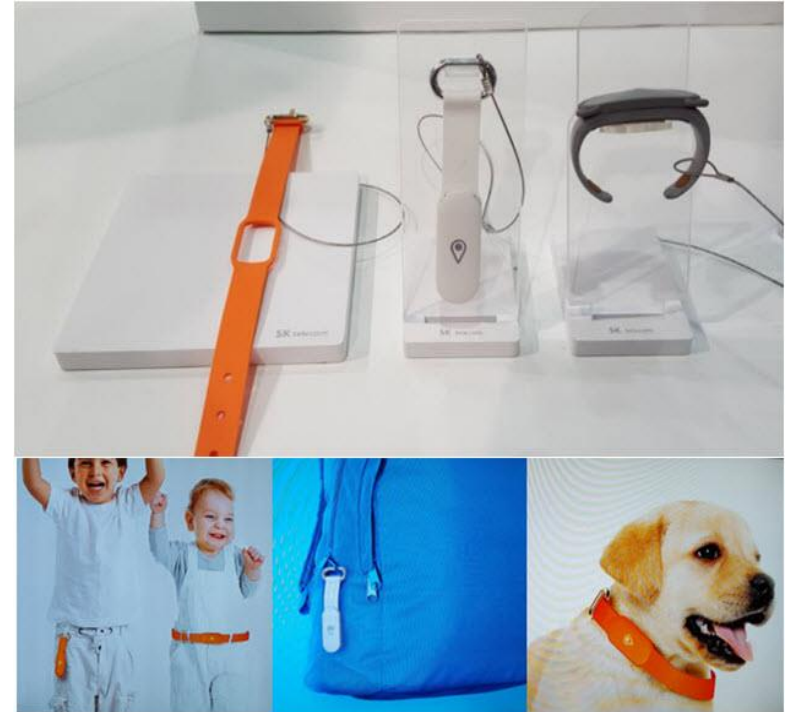
IoT based tracking device

4. IoT Platform Deployment for Smart City

□ Examples of IoT services through LoRa network



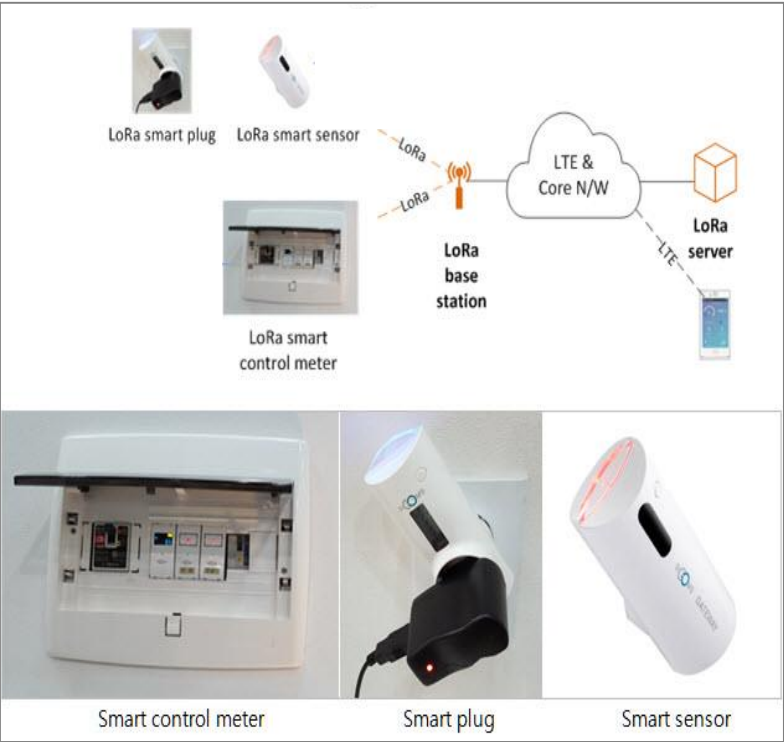
IoT based wearable watches



IoT based GPS tracker for babies and animals

4. IoT Platform Deployment for Smart City

□ Examples of IoT services through LoRa network



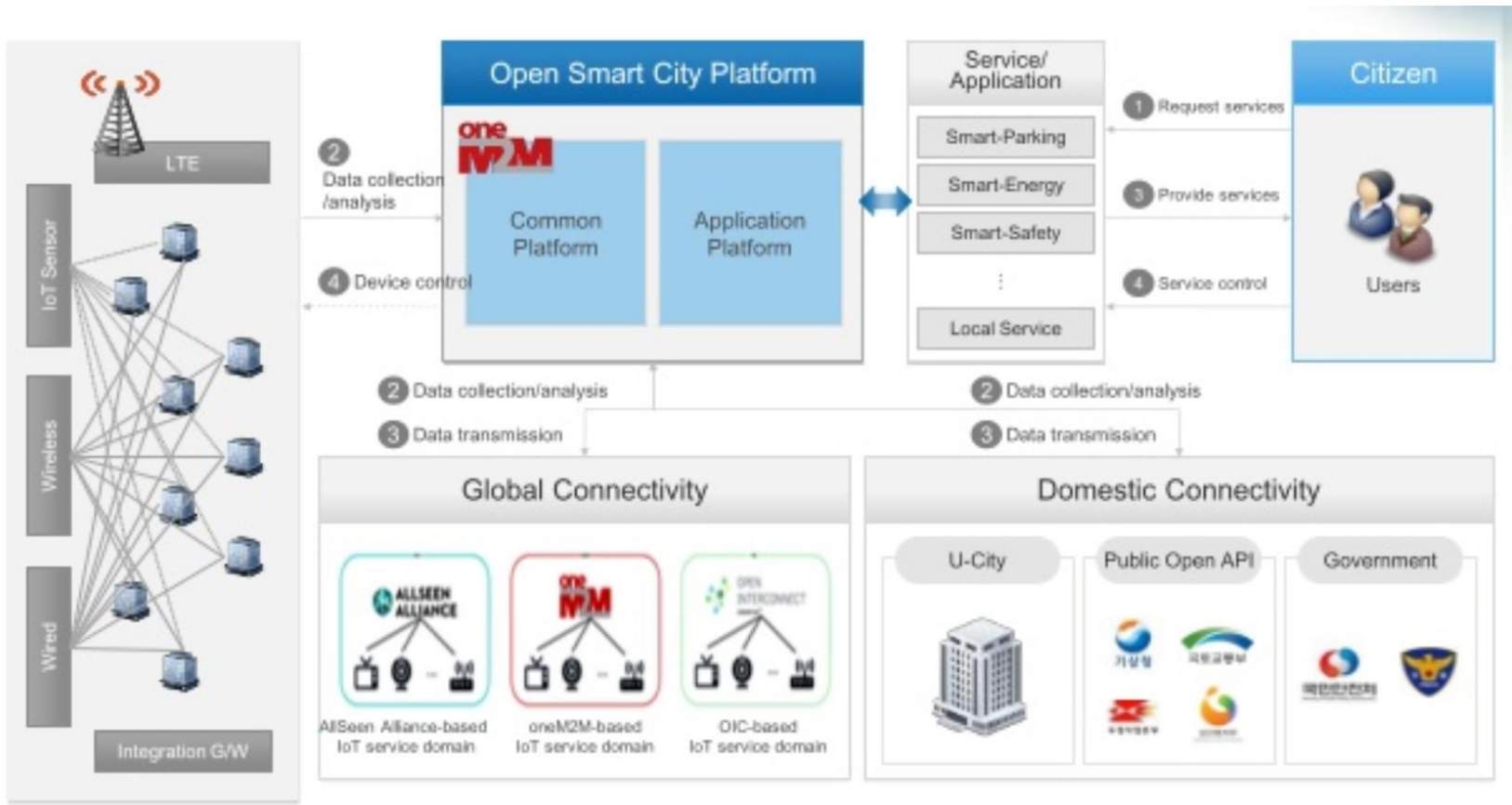
IoT based smart plugs and sensors



IoT based Security Devices

4. IoT Platform Deployment for Smart City

□ OneM2M based Smart City Platform named Mobius in Busan, Korea



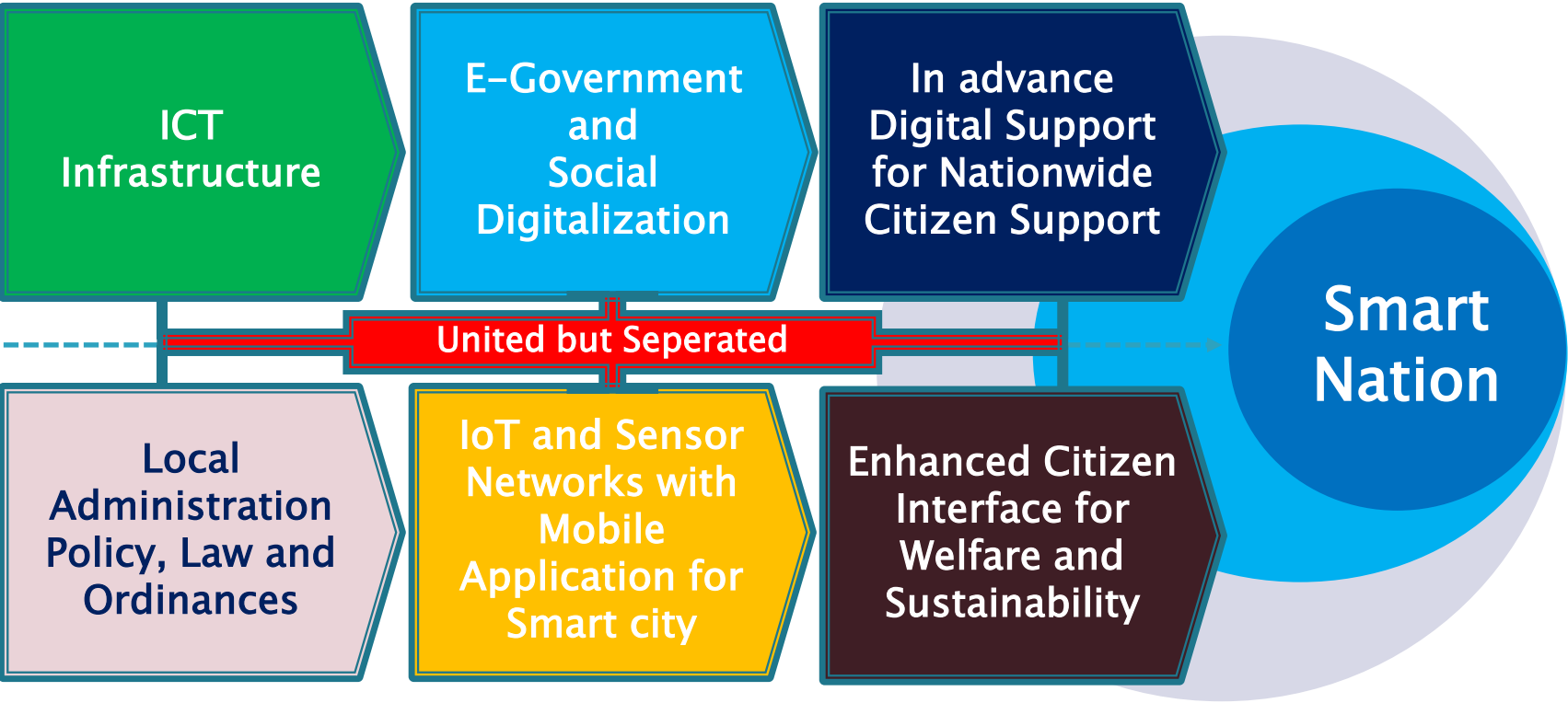
Source: Busan city, 2015

IV. Discussions



Transformation into Smart Nation – A **Two Track** Approach

Central Government ➡ Smart Nation



Local Government ➡ Smart City

Thank You!

Questions and Comments

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