

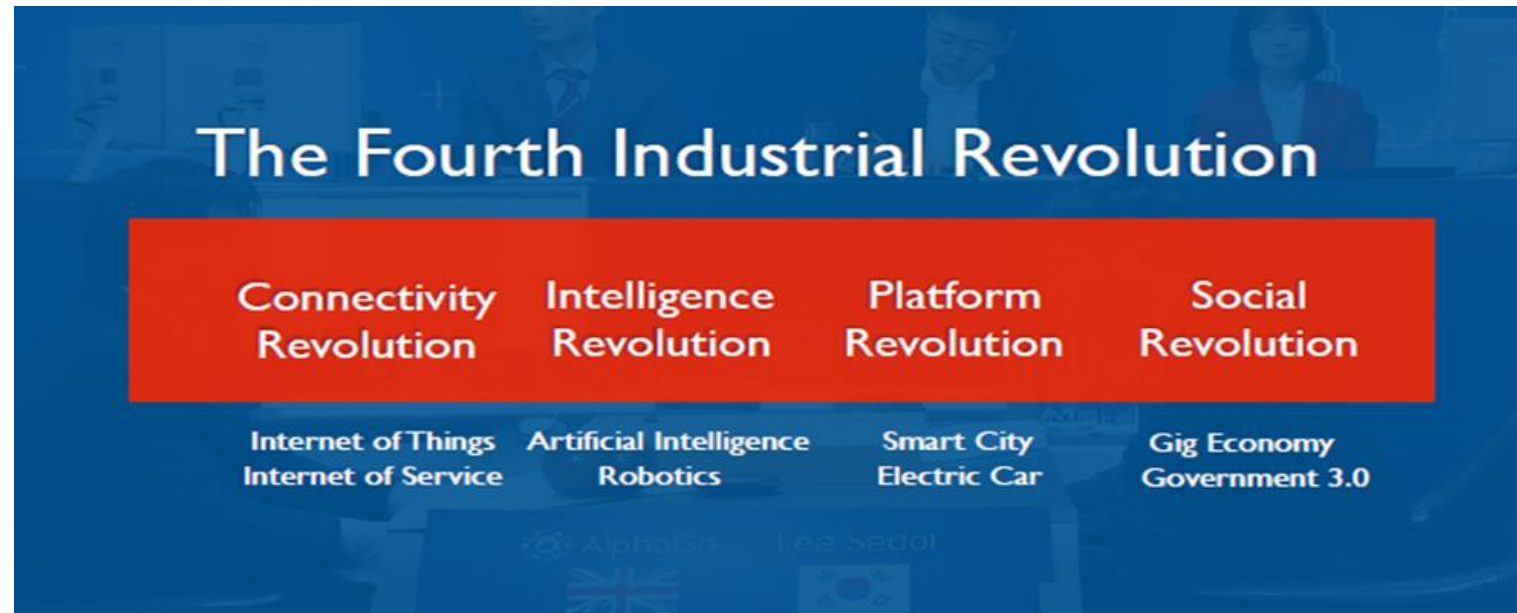


Industrial Revolution 4.0 & Disaster Management

Dr Azman Ali
Telekom Malaysia

Industrial Revolution 4.0 and Disaster Management

- IR 4.0 - Introduction
- Opportunity & Challenges
 - Connectivity Revolution
 - Intelligence Revolution
 - Platform Revolution
 - Social Revolution
- Summary



The Fourth Industrial Revolution

**Connectivity
Revolution**

Internet of Things
Internet of Service

**Intelligence
Revolution**

Artificial Intelligence
Robotics

**Platform
Revolution**

Smart City
Electric Car

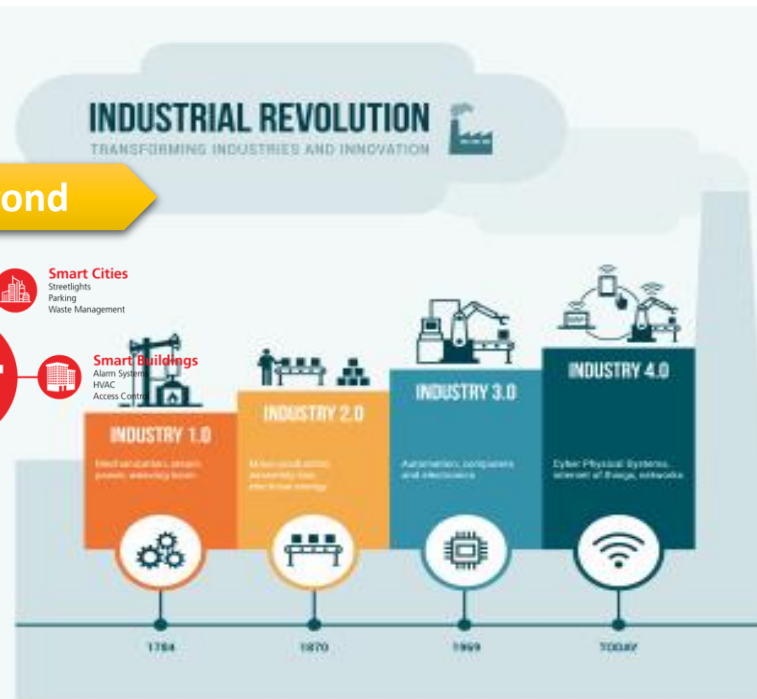
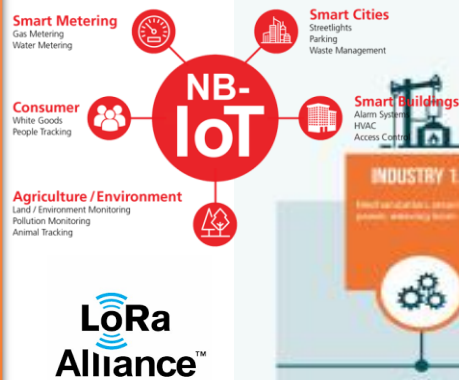
**Social
Revolution**

Gig Economy
Government 3.0

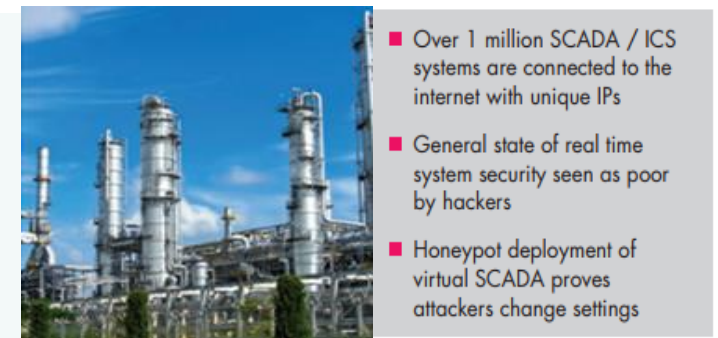
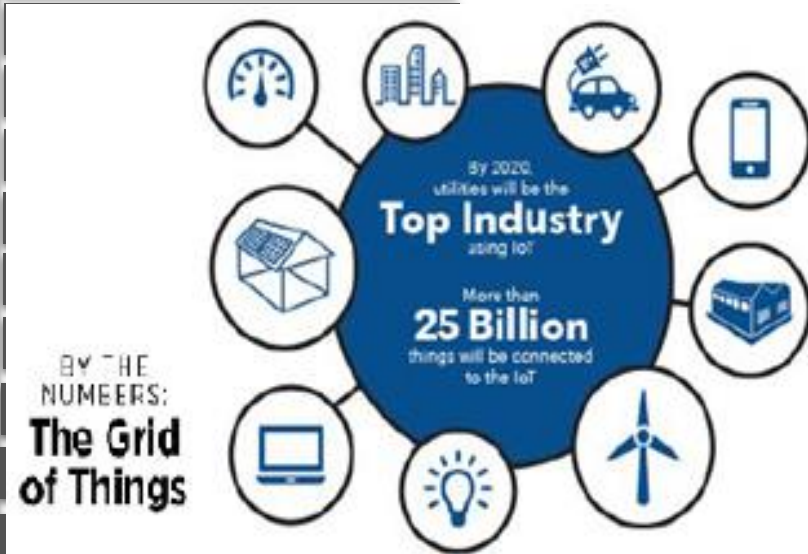
IR4.0 where IT meet OT



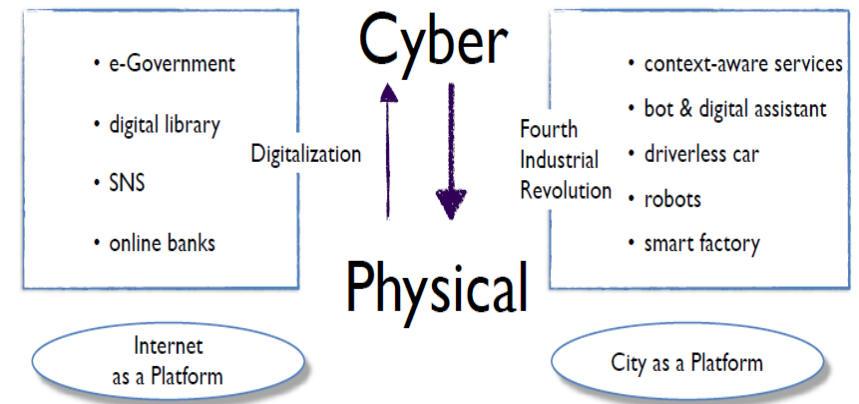
2020 and Beyond



Critical Infrastructure Security



INCREASED VULNERABILITY TO THREATS



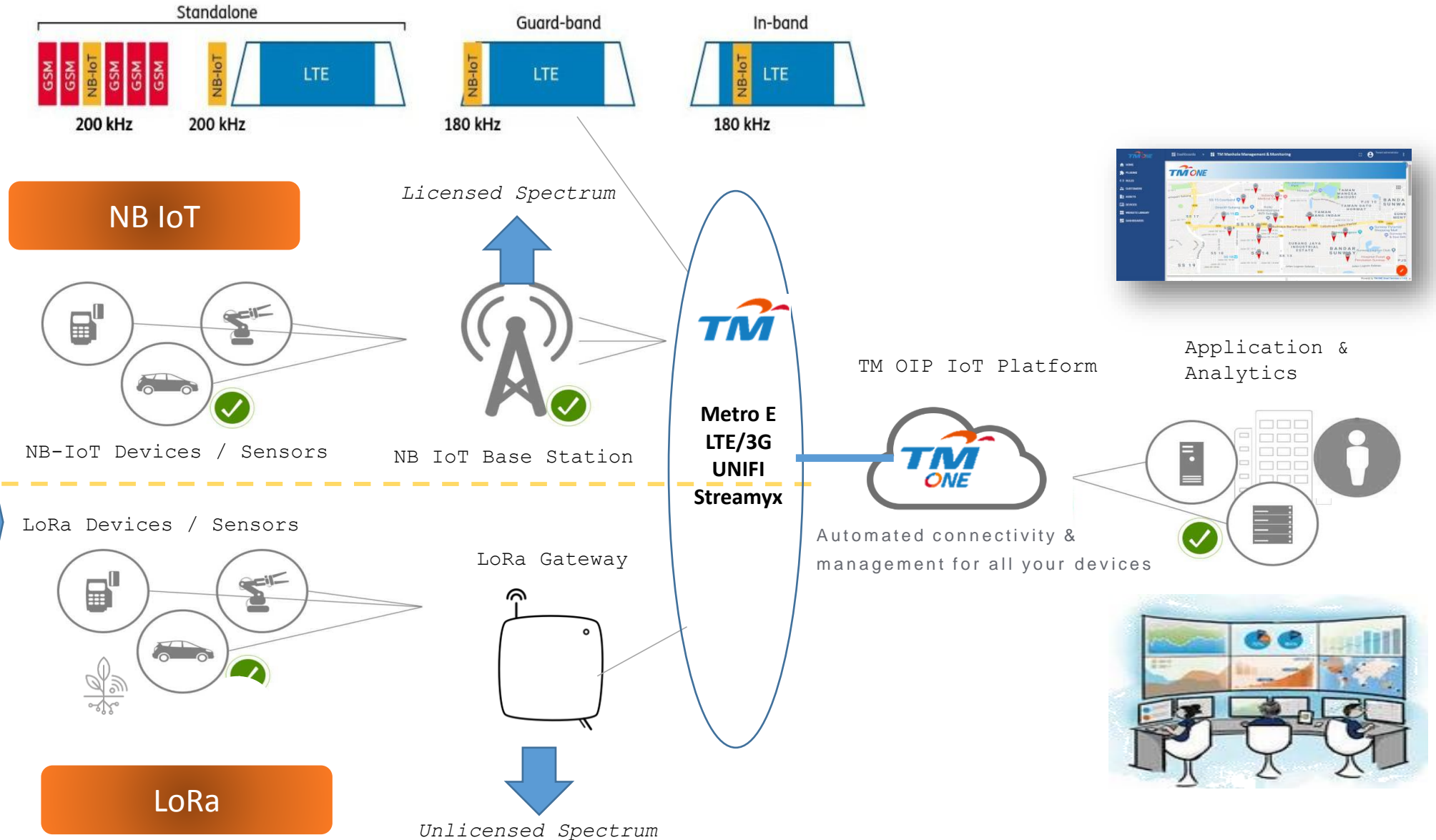
Connecting Critical Infrastructure (IoT Innovation)

Use Cases

Smart Grid
(SCADA PLC/RTU generated)

IoT Sensors
(Leakage, crack, Tilt
Vibration, altitude,
Air & Water quality,
temp, humidity)
Smart detection
(movement, elevation,
Frequency, anomaly)

Smart Meter
(Energy, water –
Understand behavior)



Connected Critical Infrastructure (IoT Advantages)



Features	Current	IoT Benefit
Example Devices	Offline Meter & probe	IoT (Connected) Meter, Sensors
Systems	SCADA/PLC/ICS (protocol dependent)	SCADA + IoT Meter, IoT Sensor (protocol agnostic)
Energy Requirement	High Energy consumption	Battery up to 10-15 yrs
Communication	3G/Radio/Satellite	LPWAN (LoRA, NBIoT)
Data Transaction	Sim card, usage based, limited sensor	1:1000 ++ gateway:sensors; always on
Data Collected	Limited to Water Flow, Level, Quality and predefined SCADA features	Greater additional Range of sensors ecosystems
Example	Flow meter, pressure meter, water quality	Water pressure, flows, levels, Leaks, Tilt meter, gyro meter, volumes and usage, Crack Sensor, Humidity, Crack monitor, GPS, water/air quality
Application	Special built function	Customizable for Asset Management, Rescue Monitoring, workforce mgmt, Energy Saving, Smart Light, Smart Access, Security etc
Deployment Model	Built As part of Infra	Innovation, Retrofit

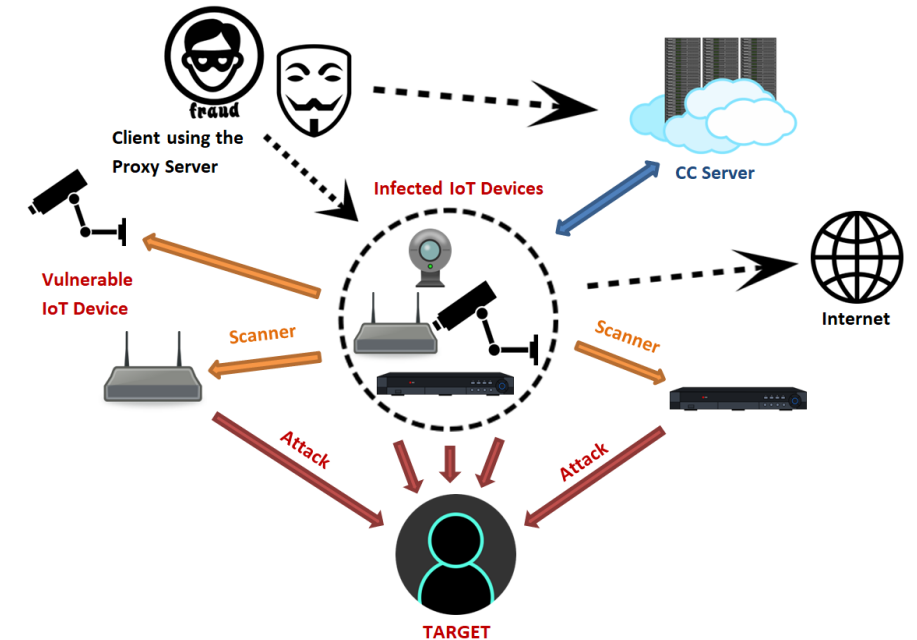
- ↑ Connectivity
- ↑ Reliability
- ↑ Data Granularity
- ↑ Scalability
- ↑ Data Varieties
- ↑ Smart Grid Application
- ↑ Support Innovation

Example 1 : CCTV monitoring vs connected motion sensor/gyro meter for water theft/intrusion

Example 2 : Existing flow meter vs vibration sensor and crack sensor.

Connectivity Revolution Challenges & Concerns

- State of Art Technology is available but **lack use cases/business drivers**
- **Economic of Scale** : Satisfying Regulatory-Technology-People
- Hard to **justify investment in** Disaster Management Infrastructure(ie financially)
- Cybersecurity concern – “Smart *Toasters*, *Smart light* and *Smart TVs* brought down the Internet” – Mirai Botnet Attack



The Fourth Industrial Revolution

Connectivity
Revolution

Internet of Things
Internet of Service

Intelligence
Revolution

Artificial Intelligence
Robotics

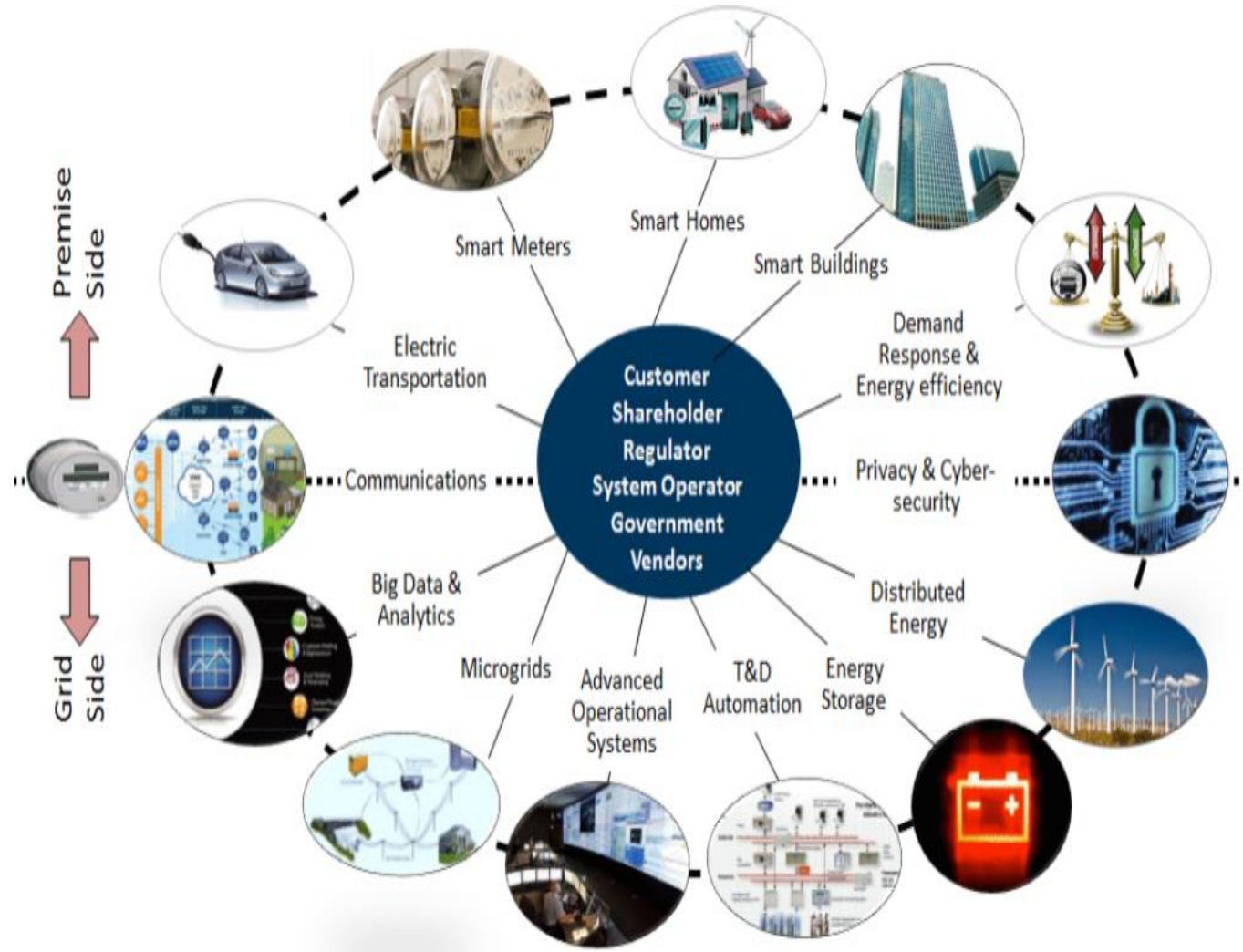
Platform
Revolution

Smart City
Electric Car

Social
Revolution

Gig Economy
Government 3.0

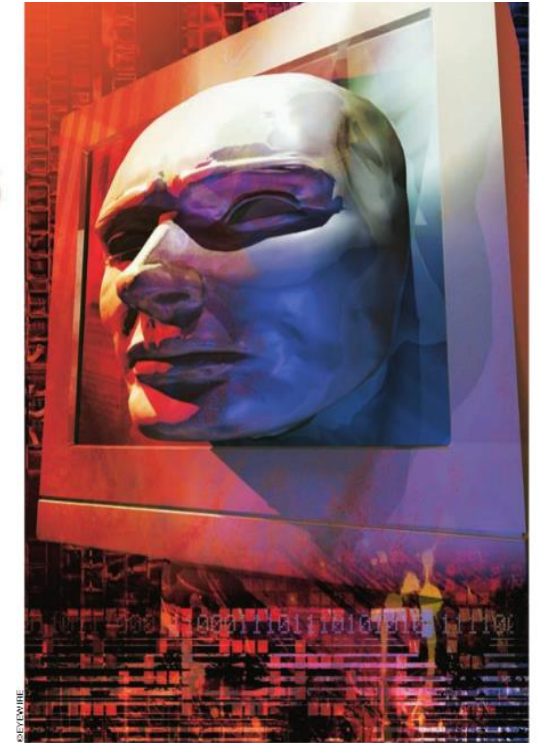
Intelligence Revolution : Smart Energy Grid



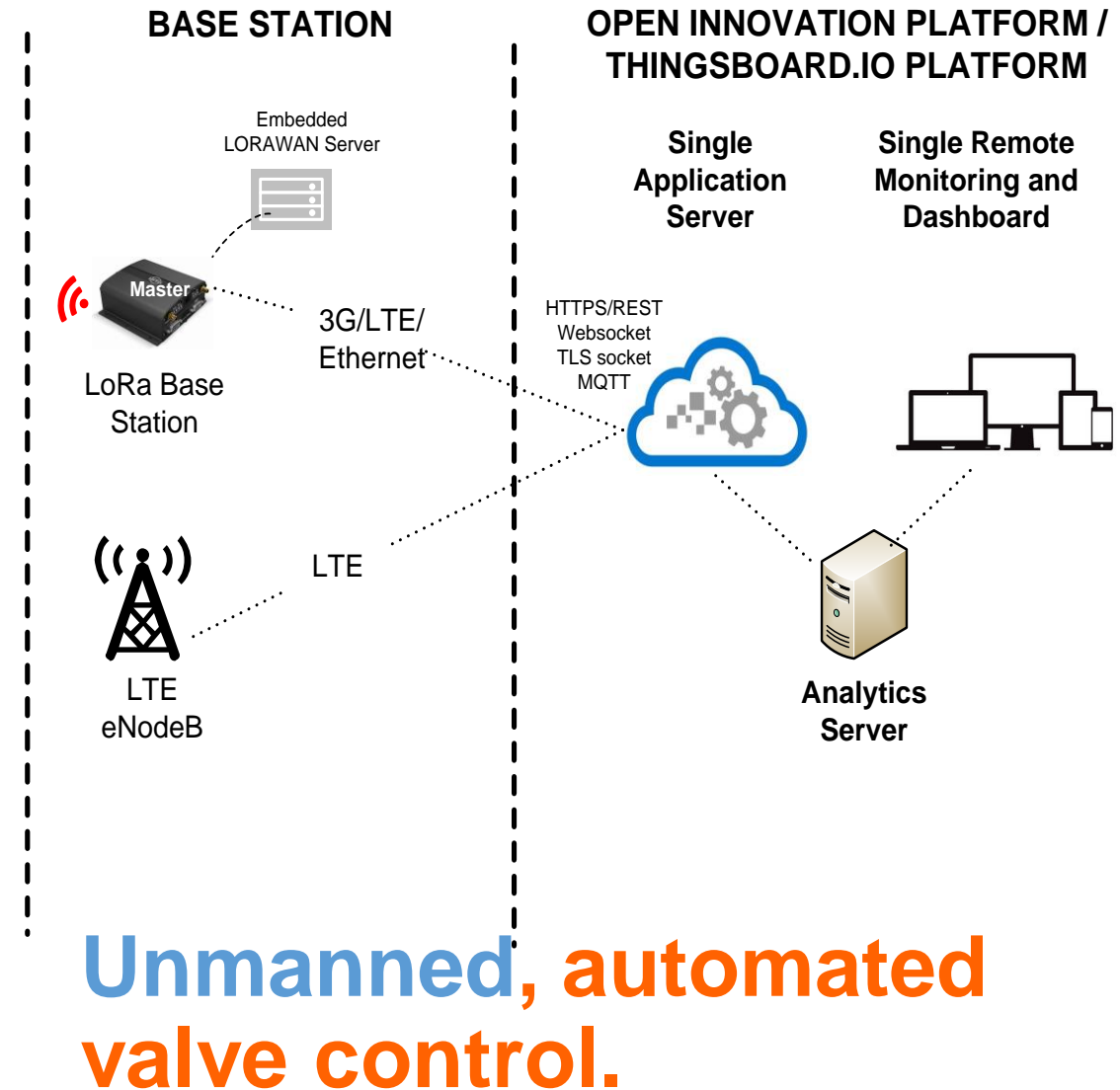
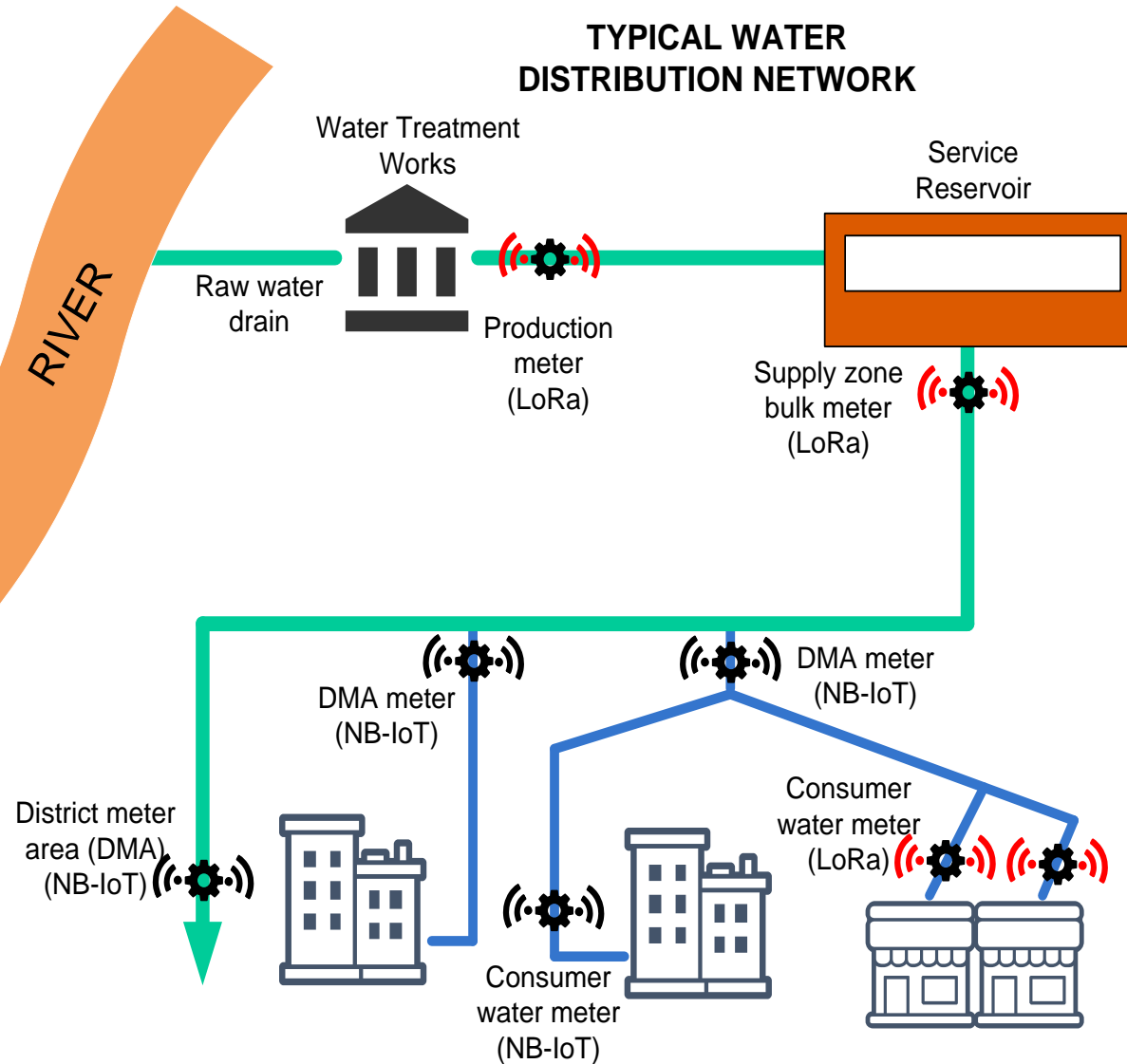
AI Automates Substation Control

Melvin Ayala S., Galdenoro Botura Jr., Oscar A. Maldonado A.

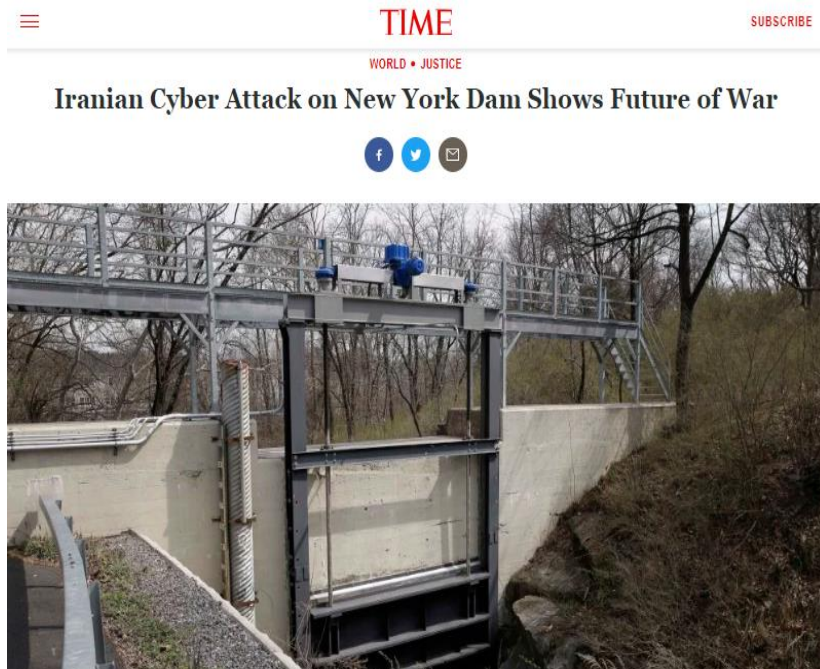
Controlling a substation by a fuzzy controller speeds up the response time and diminishes the possibility of risks normally related to human operations



Intelligent Water Grid (Internet of Water Infrastructure)



Intelligence Revolution's Concerns



Cyber Attack on the Power Grid ...
nbcnews.com



How Corporate America keeps huge hacks ...
money.cnn.com



energy grid hacks
money.cnn.com



US blames Russia for power grid ...
cnn.com



Russian threat to power grid ...
cnn.com



China could take down U.S. power grid ...

Other than security Challenges include

- **Skillset** Gap
- Lack of **Regulatory Framework**
- Social and **Job displacement**

The Fourth Industrial Revolution

Connectivity
Revolution

Internet of Things
Internet of Service

Intelligence
Revolution

Artificial Intelligence
Robotics

Platform
Revolution

Smart City
Electric Car

Social
Revolution

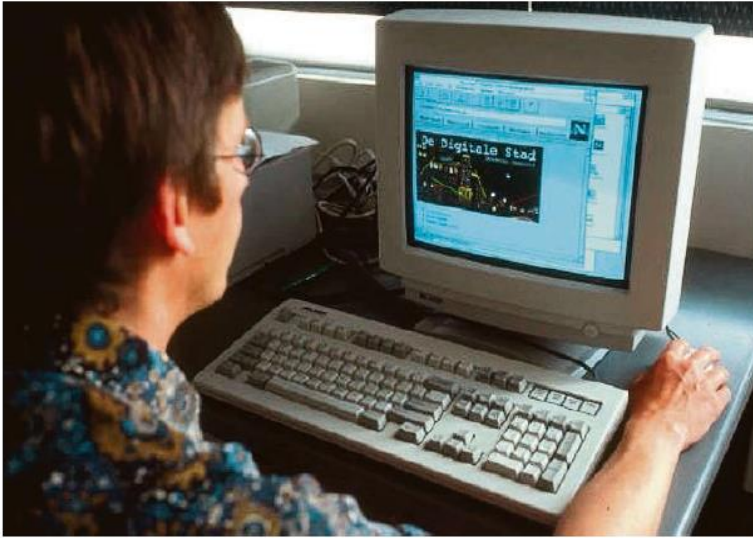
Gig Economy
Government 3.0

Smart City 1.0

Digital,
Amsterdam
(1994)

<Key Technology>

Internet



Smart City 2.0

Songdo Incheon
Busan
(2004)

<Key Technology>

Sensor
+
Internet



Smart City 3.0

Smart City
After 2012

<Key Technology>

Big Data
+
Sensor
+
Internet



Yinchuan, China

스마트시티 4.0

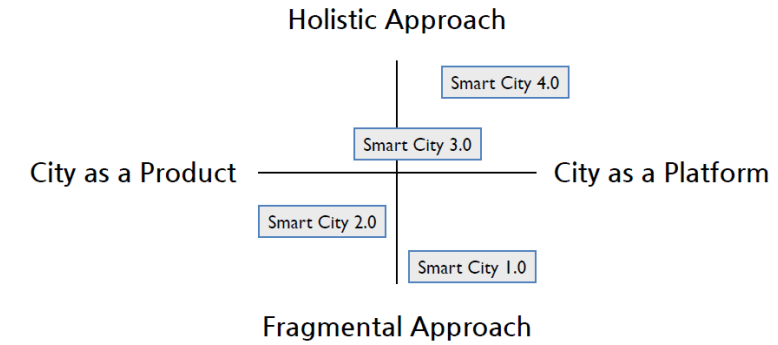
Singapore(2015)
Pittsburgh
Colombus(2016)

<Key Technology>

AI/Robot
+
Big Data
+
Sensor
+
Internet



Platform Revolution : City as Platform



Smart City as a Product

Perform its own Functions



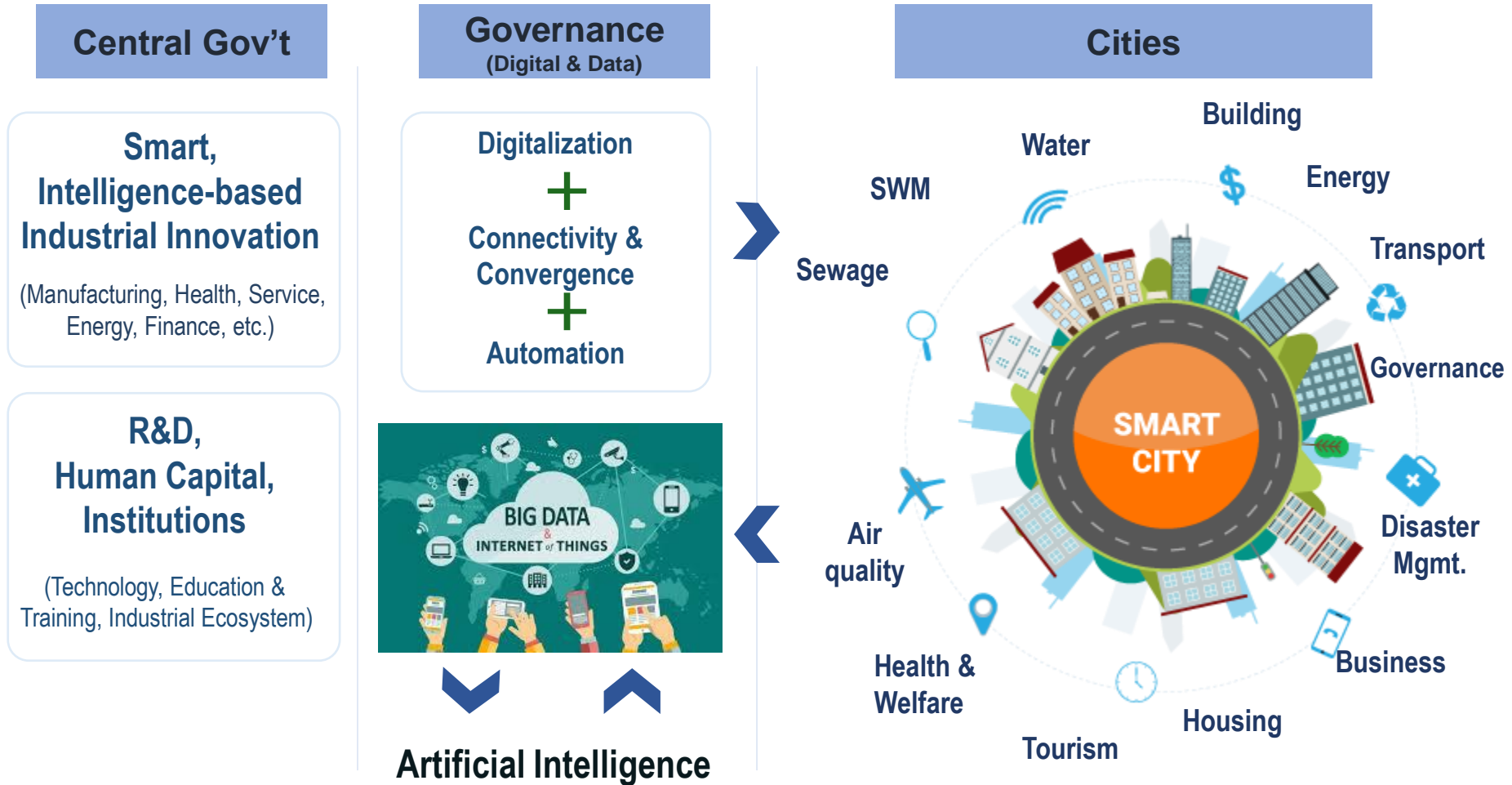
Smart City as a Platform

Support Innovations



Korea's Smart City Directions :

Driving social and economic innovations



Data Driven - Mobility

[Primary Analysis of Demand based on Taxi Ride Information]

Table

STIS_0318_GETOFF

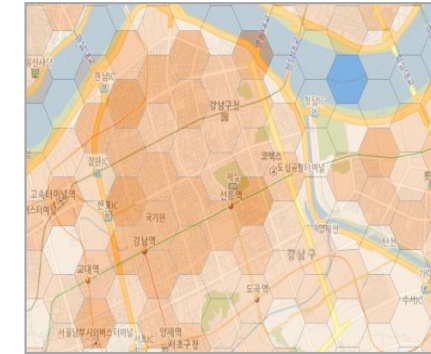
승차시간	하차시간	승차좌석	승차좌석_X	승차좌석_Y	하차좌석	하차좌석_X	하차좌석_Y
2013-09-17 08:11:51	2013-09-18	2916	126.98802	37.465508	414	126.982792	37.5
2013-09-17 08:11:56	2013-09-18	291	127.055955	37.500008	576	127.053007	37.5
2013-09-17 08:11:47	2013-09-18	7822	127.040149	37.500530	1700	127.067324	37.6
2013-09-17 08:11:44	2013-09-18	8949	126.943021	37.547	90	127.015343	37.5
2013-09-17 08:11:20	2013-09-18	25099	127.057333	37.544363	2437	126.768591	37.5
2013-09-17 08:11:54	2013-09-18	2349	126.962519	37.467972	1940	126.989329	37.5
2013-09-17 08:11:51	2013-09-18	1814	127.020121	37.57712	2878	127.01702	37.5
2013-09-17 08:11:45	2013-09-18	6910	126.888776	37.578363	4989	126.9136	37.5
2013-09-17 08:11:35	2013-09-18	15089	126.909598	37.518971	3623	126.834576	37.5
2013-09-17 08:11:50	2013-09-18	2741	127.071045	37.5404	4210	127.06727	37.5
2013-09-17 08:11:47	2013-09-18	7966	126.95531	37.467813	785	127.01897	37.5
2013-09-17 08:11:55	2013-09-18	2024	127.040441	37.54005	0	127.057786	37.5
2013-09-17 08:11:50	2013-09-18	3724	126.937986	37.5554	521	126.92515	37.5
2013-09-17 08:11:45	2013-09-18	8210	126.97849	37.55511	4719	126.913635	37.5
2013-09-17 08:11:47	2013-09-18	8360	126.841418	37.571606	5952	126.841418	37.5
2013-09-17 08:11:43	2013-09-18	9715	127.026955	37.624913	1176	127.069466	37.5
2013-09-17 08:11:58	2013-09-18	1010	126.974875	37.508165	1657	126.971958	37.5
2013-09-17 08:11:54	2013-09-18	2871	126.96732	37.578916	4944	127.000066	37.5
2013-09-17 08:11:54	2013-09-18	1890	127.011023	37.571861	421	127.002036	37.5
2013-09-17 08:11:28	2013-09-18	16439	126.918993	37.61552	135	127.002036	37.6
2013-09-17 08:11:47	2013-09-18	5164	127.000725	37.615735	730	127.003178	37.5



Table

TAXI_SATURDAY_Statistics

OBJECTID *	hexagonID *	DEMAND
1	2381	1
2	2752	1
3	2862	1
4	2962	2
5	3059	1
6	4510	1
7	4800	1
8	4999	1
9	5187	2
10	5188	1
11	5505	1
12	5575	2
13	5877	1



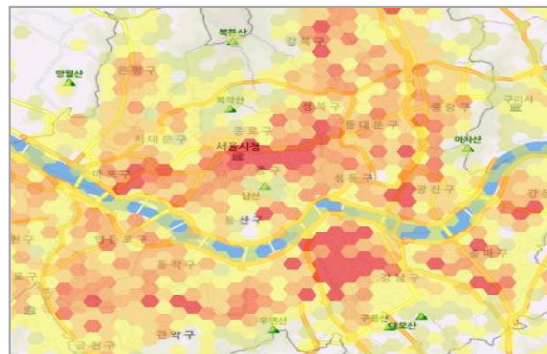
1 Taxi ride data by day of given week

2 Building layers based on taxi ride locations

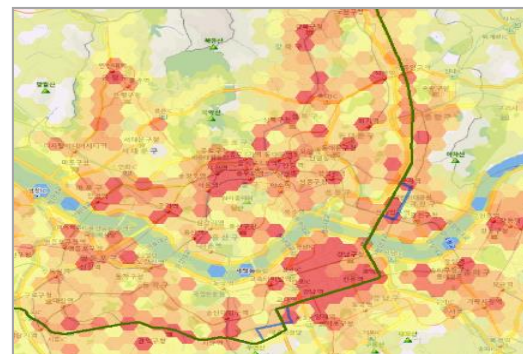
3 Summarized statistics on number of taxi ride

4 Mapping on hexagon
→ Used as Predicted Demand

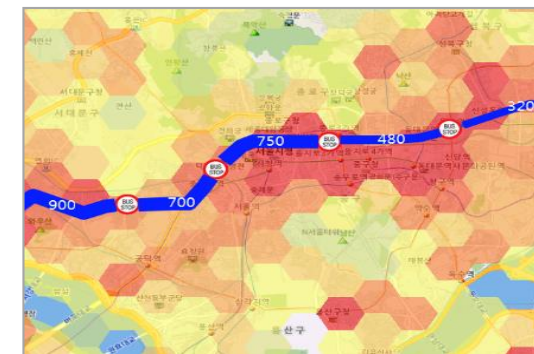
[Adjustment of Route and Dispatch Timetables by Floating Population Pattern Analysis]



Floating Population Density Analysis



Optimization of Routes based on Floating Population



Adjustment of Dispatch Timetable based on Floating Population

City as Platform : Data sources and Information

Connections that Generate Data

Category	Data Source	Types of Data	Usage
Solid Waste Management	Incineration facilities	Volume and type of waste generated, waste composition, energy generated	Efficient City Management <ul style="list-style-type: none"> Resource forecasting and planning Water/energy supply chain management Disaster management Early warning system Augment Policy Design <ul style="list-style-type: none"> Changes in existing policies Traffic light system rearrangements Public transportation (re)routing New Policy Introduction <ul style="list-style-type: none"> Based on enhanced understanding of pain points New, Convenient Citizen Applications <ul style="list-style-type: none"> Mobile ITS services Safer public spaces
Transportation	TOPIS (ITS)	Public transport, fleets, traffic speed	
	CCTV	Traffic, parking violations	
	Smart Card	No. of passengers, OD info., transfers, distance travelled	
Water Management	Water quality monitoring system	Source water quality, volume, substance	
	Water purification facilities	Water quality, volume, supply, production	
	Pipe leakage monitoring	Leaking pipes by region	
Energy	Energy meter	Production, supply, consumption	
e-Government	Voice of citizens captured via e-Government systems	Citizen needs, complaints, infrastructure issues	

Platform Revolution Challenges

- City is seen as **product** (hence lack innovation)
- **Priority** on revenue generation over resilience
- Lack coordination, **Disintegrated** data and structural issue
- Lack of **Political Leadership** in Resilience
- **Cybercrime**, cyberwar fear



The Fourth Industrial Revolution

Connectivity
Revolution

Internet of Things
Internet of Service

Intelligence
Revolution

Artificial Intelligence
Robotics

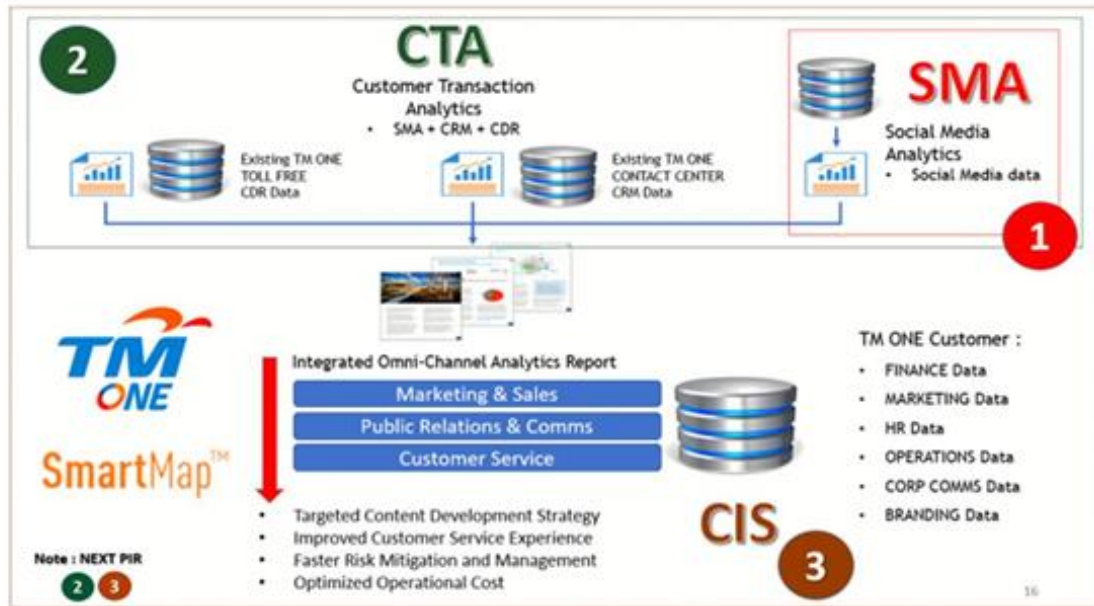
Platform
Revolution

Smart City
Electric Car

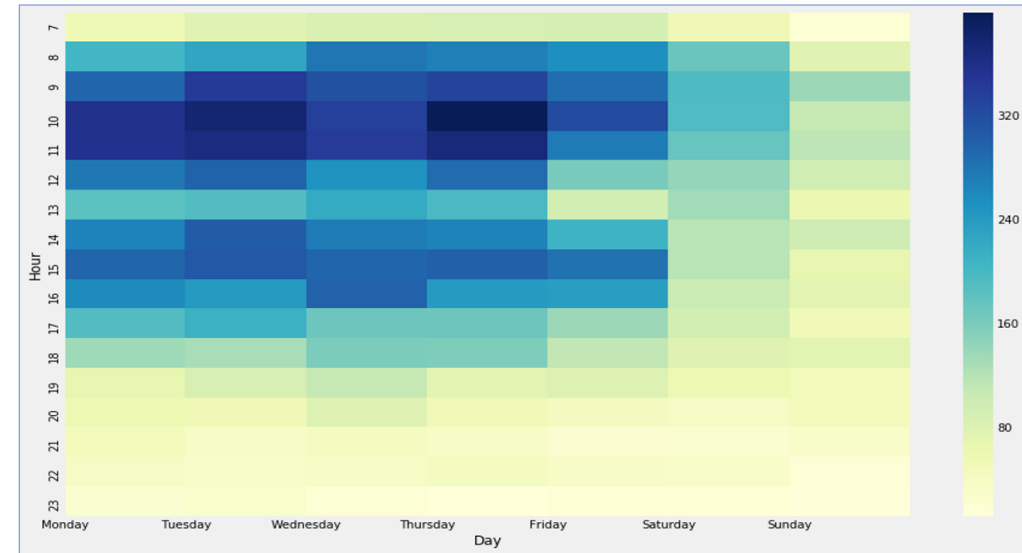
Social
Revolution

Gig Economy
Government 3.0

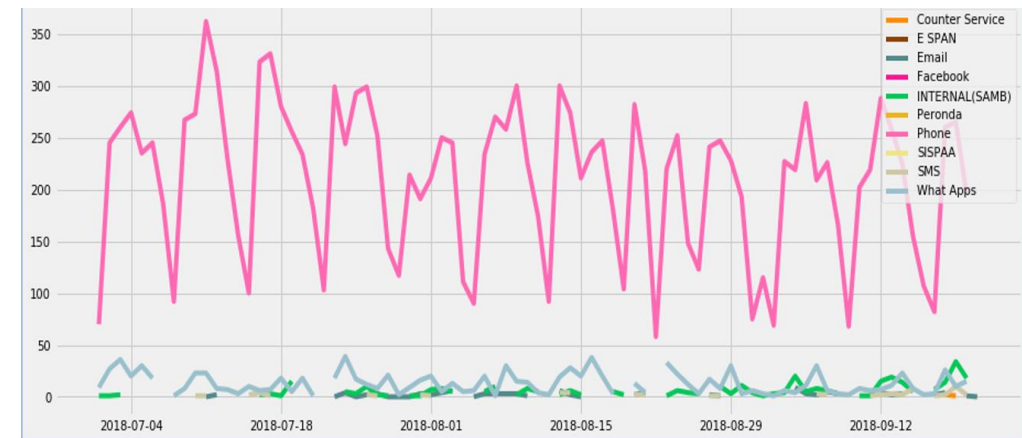
Urban Sensing : Water issue Analytic



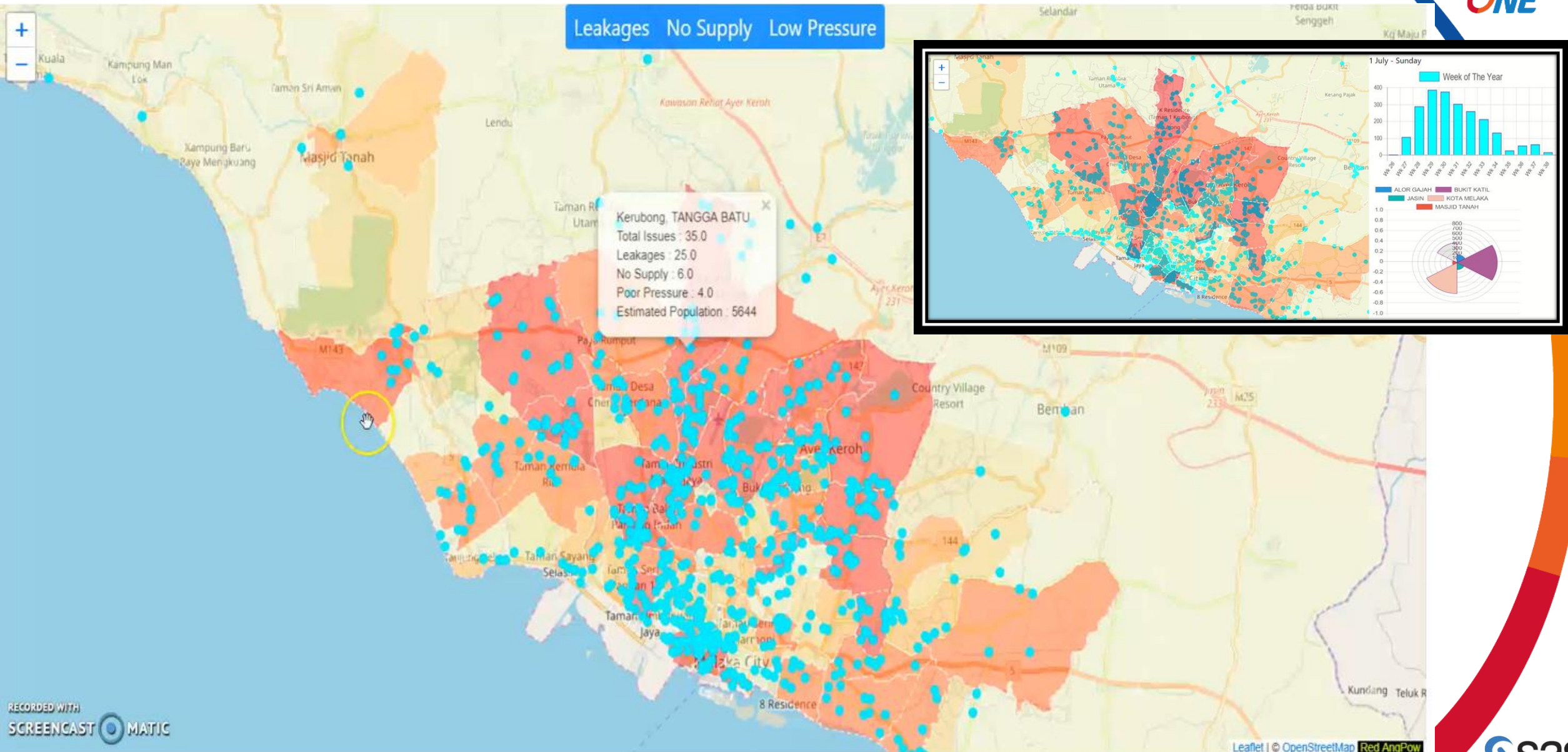
Complaint vs Time of the day



Complaint vs Channel



Urban Sensing : Water issue Analytic



Density of Issues mentioned in the problem description

Issues of Callers



Big Data and Behavior

- Human Behaviour is unique and unexplainable, sometimes irrational
- Following on the notion that people's behaviors may not follow rational rules, there is need to analyze data to discover more anomalies
 - Amazon shopping correlations
 - Lack urgency when reacting to disaster alarm
 - Opportunistic people.
- The advent of Big Data collection brings forth the possibility to find more evidence of behaviors that are not rational

Urban Behaviors

Perennial issues/problems of urban life result from human behaviors that often exhibit biases that may be less than civic-minded

- Density
- Resources
- Crowd mentality
- Waste
- Traffic



Example of the Big Data and Citizen's behavior

- Seoul has established the technological infrastructure for many Big Data enabled Smart City features
 - Ubiquitous CCTV
 - Linkage between citizens' behaviors: purchases, communications, travel
- Citizens are generally accepting of such “surveillance” and complicit with development goals
- New policies aimed at curbing negative externalities are open for enhanced implementation techniques

Social Revolution Challenges

- Data for Disaster Management available but **lack coordination**
- Lack User/Citizen political Awareness
- Unique '**irrational**' behaviors (cultural and background)
- Fear of Technology create **new disaster?**

Summary & Recommendation

- Framework to address issues and concerns
- Coordinated **Data Utility** infrastructure & governance – CD, APIs
- Develop **innovative Business-Government Operating Model** (PPP)
- **Promote Co-creation** & **Encourage** Innovation (social revolution, city as platform) – **Empower** more stakeholders/citizens
- Democratization of data (Open data – government data)
- **Innovative Policy** to build the case – Big data driven policy ie on climate change by Understand behavioral economic
- **Embed Cyber-physical resilience** at design stage

Thanks You

