



# From ETC to IoT & Smart City

**Peggy Liao, Manager, OBD**

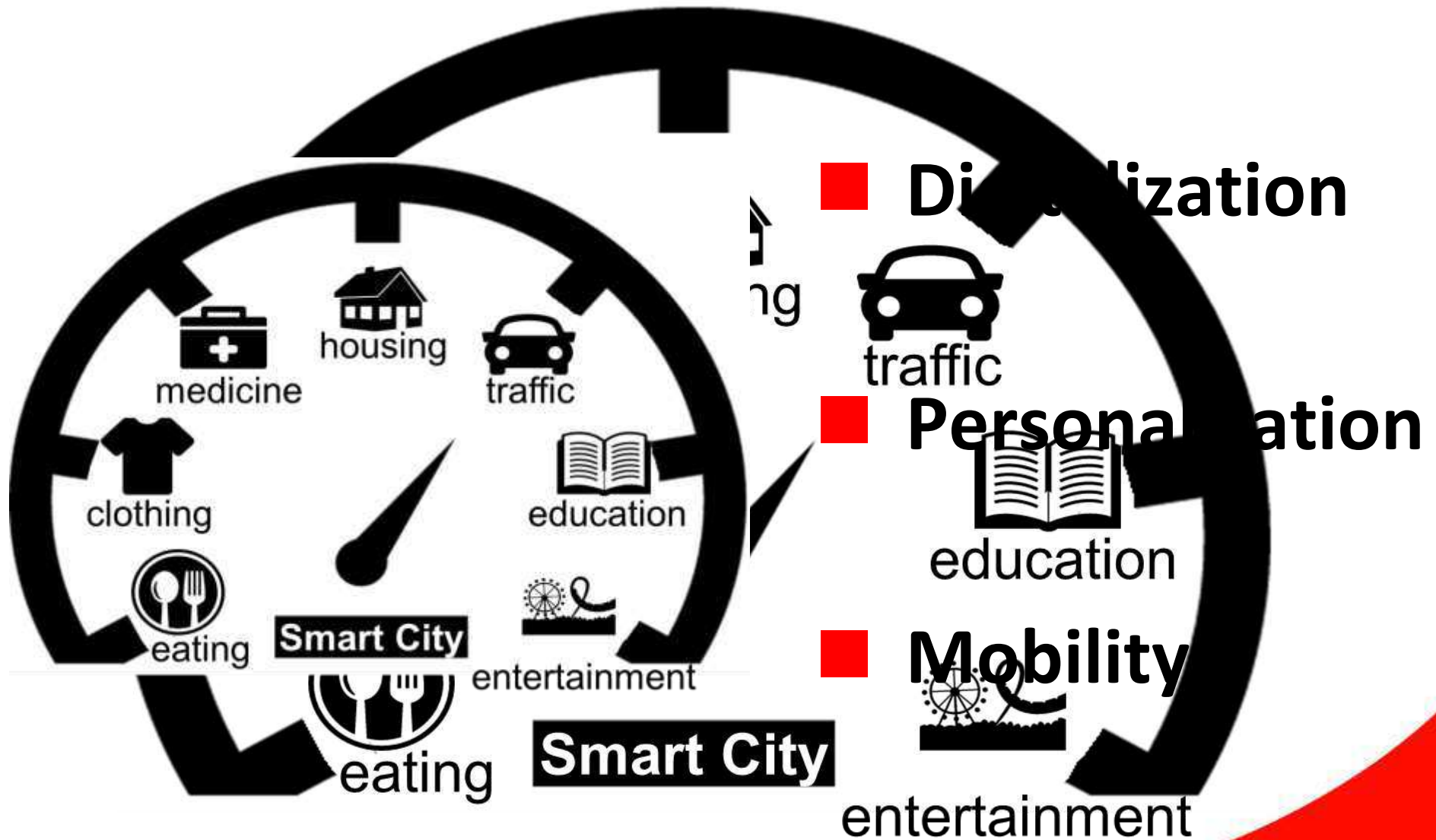
**4<sup>th</sup> April, 2016**

**Far Eastern Electronic Toll Collection Co.,Ltd.**

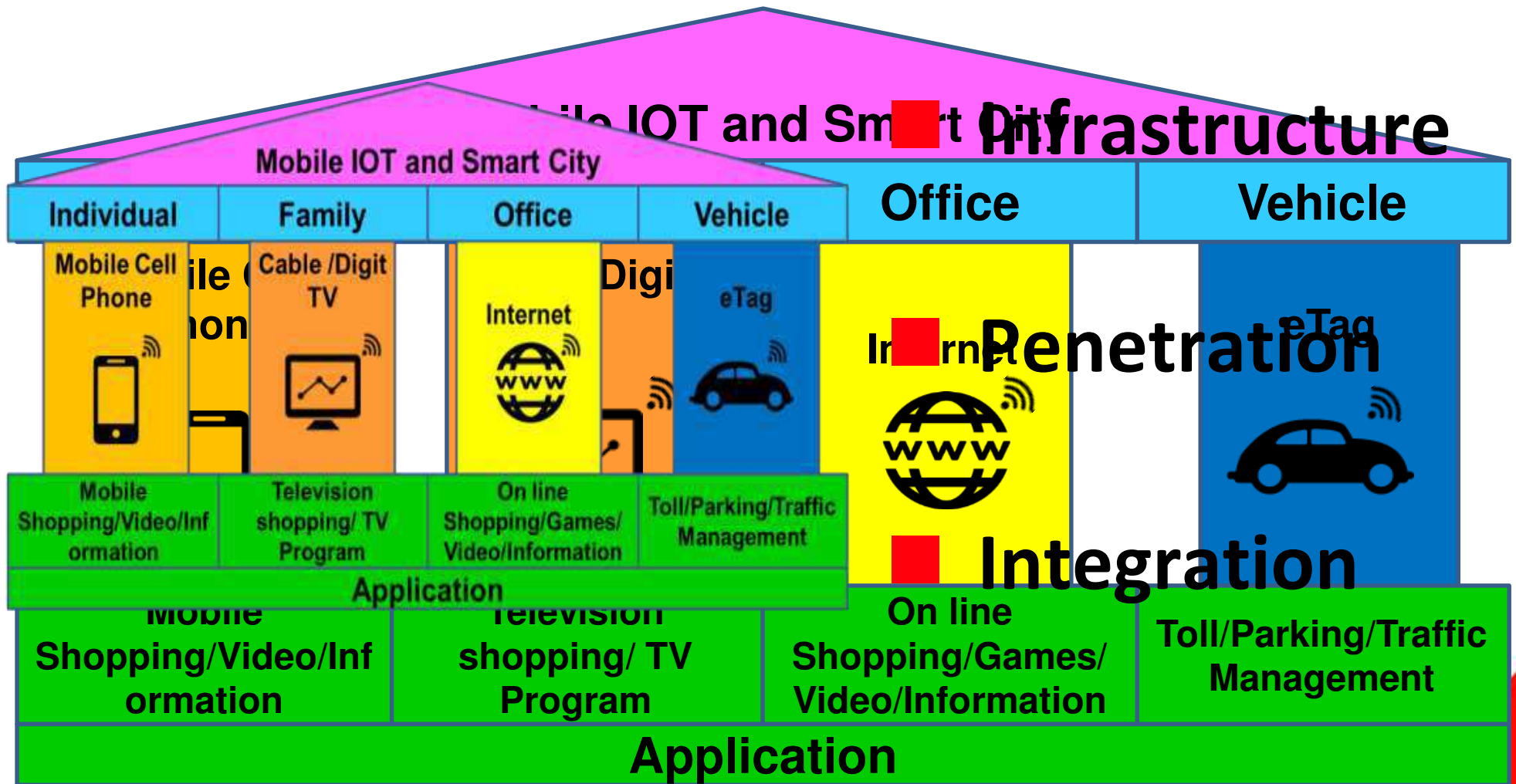
# Mobile IoT and Smart City



# Mobile IoT and Smart City



# Mobile IoT and Smart City



# Taiwan ETC Overview



# Taiwan ETC Overview



Area	36,192 Km <sup>2</sup>
Population	23 M
Registered Vehicle	7.1 M
Total Highway Distance	1,000 Km
Tolling Method	Distance-based
Tolling Infrastructure	327 free flow gantries
BOT Contract	The Taiwan Area National Freeway Bureau awarded 20 years of BOT concession to FETC from 2004

# Taiwan ETC Overview

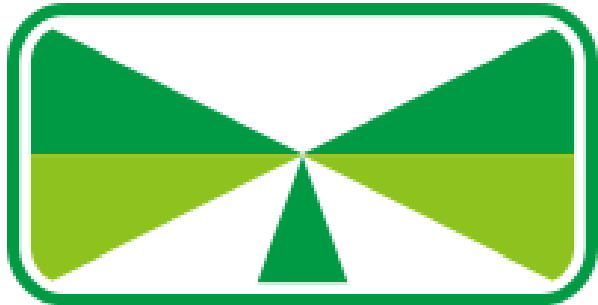
## Public-private partnership

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■ **Public: Taiwan Area  
National Freeway Bureau  
(TANFB)**

■ **Policy, Toll Rate**



■ **Private: Far Eastern Electronic  
Toll Collection Co, Ltd  
(FETC)**

■ **Design, Build, Operate**

■ **Duration: 2004-2025**



# Taiwan ETC Overview



## ▶ Manual toll



## ▶ Phase I: Y2006 SLFF ETC



## ▶ Phase II: Y2014 MLFF ETC



## Manual → Phase I

- ▶ Manual toll & ETC toll
- ▶ Extend ETC Lane by usage



## Phase I → Phase II

- ▶ Construct 319 new gantries
- ▶ Full ETC without manual toll



# Taiwan ETC Overview



## ■ IR DSRC OBU system started in Feb 2006

- IR OBU was paid by vehicle owner (\$40 USD)
- Only accumulated 1.2M of vehicles until 2012

## ■ Passive RFID system introduced in May 2012

- eTag (RFID) for free
- IR OBU and eTag co-exist operation
- Reach 5M of vehicles by only spending 16 months
- **100% eTag and full distance-based MLFF started from Jan, 2014**



+



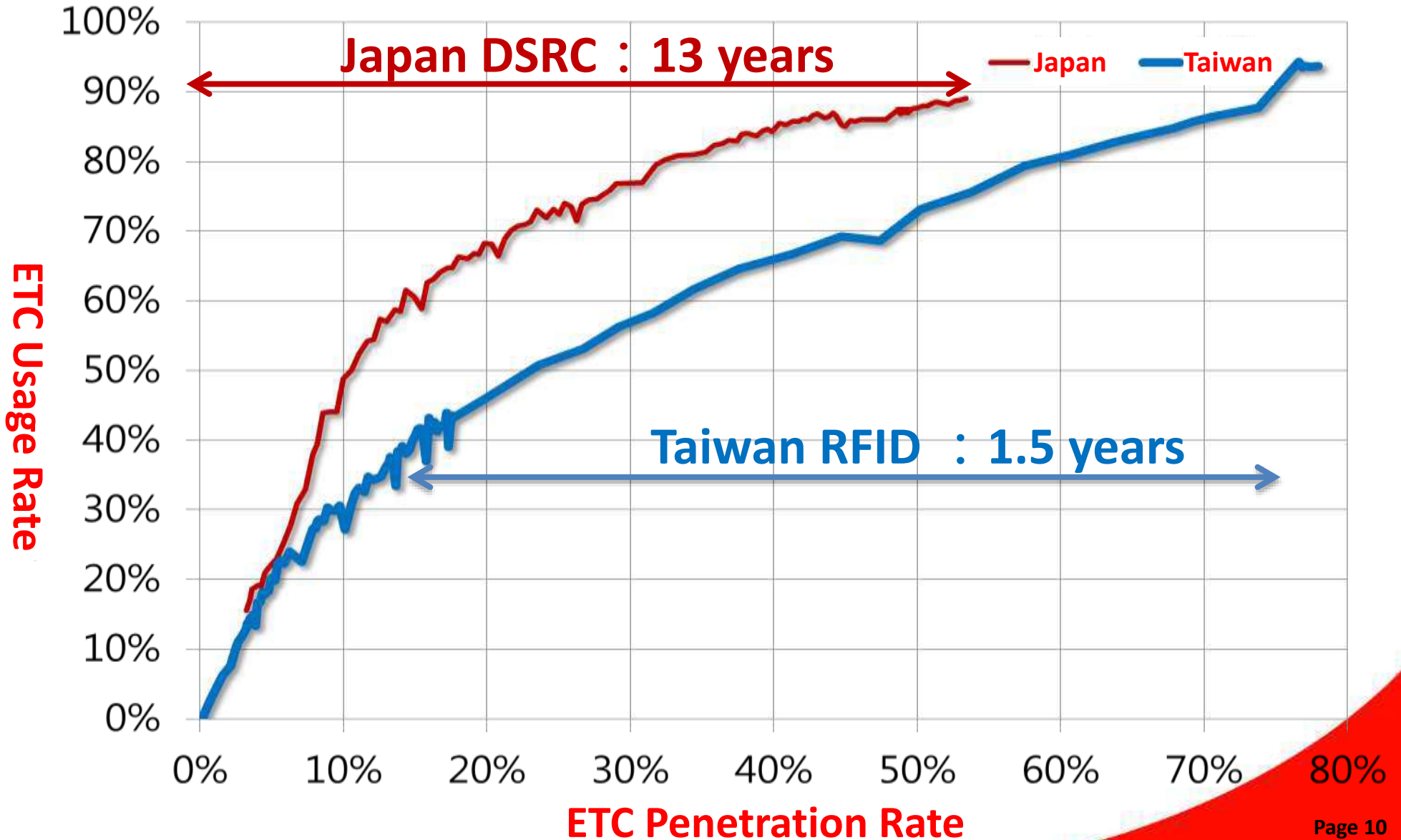
ETC Card + IR OBU



Virtual Account = License Plate + ID of Car Owner

Each eTag links to  
a Virtual Account

# Taiwan ETC Overview



# Taiwan ETC Overview



## THE FIRST COUNTRY

have implemented ETC on the entire national freeway system.

## THE FIRST COUNTRY

transformed from manual flat-rate toll plazas to distanced-based ETC.

## THE LONGEST ETC

The total ETC length reaches 926 kilometers.

# Taiwan ETC Overview



<b>ETC Customer</b>	<b>6.4 M</b>
<b>ETC Daily Transactions</b>	<b>Daily Average: 15 M Historical Daily High: 22.7 M</b>
<b>eTag Usage Rate</b>	<b>94%</b>
<b>ETC Usage Rate</b>	<b>100%</b>



- Audited by the third party and supervised by the government

Audit period (2014/02/01-2014/04/30 )	Audit result	Remark
Total Audit Transactions	4,805,610	
Tolling Accuracy Rate	99.9999%	only 7 cases
Vehicle Detection Accuracy Rate	99.9800%	KPI: 99%

# Taiwan ETC Overview

## Sustainable ITS Business Model



### Service Channel



(activation, top up,  
payment, inquiry)



pay\$



Quality Monitor &  
Enforcement

**Government (TANFB)**

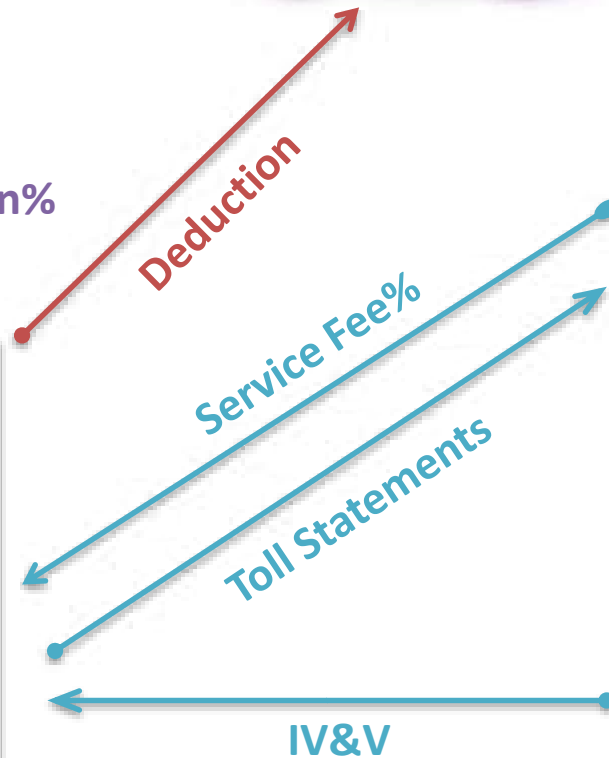
**3<sup>rd</sup> Party Auditor**

Account & Tag Mgmt.  
Cash\$  
Commission%

### Bank Account



### ETC Operator



# Taiwan ETC Overview

## 2015 IBTTA Toll Excellence Award



台灣ETC在美榮獲

2015年國際收費系統卓越大獎



### 2015 Toll Excellence Award Winners Customer Service & Marketing Outreach

**Taiwan Area National Freeway Bureau - Program for Transition from Manual Flat-rate Pay-Per-Use Toll Collection to Electronic Distance-based Toll Collection on Taiwan's Freeways.**

**The Taiwan Area National Freeway Bureau introduced its electronic, distance-based toll collection system to increase fairness and equity across the highway network, boost operational efficiency, streamline traffic flow through variable pricing, and deliver superior accuracy. The agency introduced manual and electronic tolling in February 2006, followed by an eTag system in May 2012, and now averages 14 million transactions per day with a tolling accuracy rate of 99.97% and detection accuracy of 99.9%, the world's highest. The new system consists of 319 single gantries that feature a modular design for rapid deployment. It took only 10 months to install all the gantries, with no on-the-job accidents or loss in quality.**

# Taiwan ETC Overview

## 2015 ITS Industry Award

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### Taiwan's ETC wins 2015 ITS World Congress

Taiwan's electronic toll collection (ETC) system developed by Taipei-based Far Eastern Electronic Toll Collection Co. (FETC) has won the 2015 Intelligent Transport System (ITS) World Congress Industry Award. The FETC is sending a representative to receive the award at the ITS World Congress to be held Oct. 5-9 in Bordeaux, France.

Combining services offered by the convenience stores around Taiwan and the smart phone app for adding value and responding to inquiries in an efficient manner, the FETC has made the ETC system a main pillar for the development of the intelligent transport system in the nation.



# Taiwan ETC Overview

## 2015 eASIA Awards

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### **Taiwan ETC, the first prize of 2015 eASIA Awards among eBusiness in private sector**

eASIA Award has announced by Asia Pacific Council for Trade Facilitation and Electronic Business (AFACT) every two years. For the 2015 contest held on 25th Dec in Tehran, FETC wins the first prize of eBusiness in Private Sector among strong competitors from Iran and Japan. Taiwan ETC system is well recognized by its sustainable business model and high level KPIs. Kenny Chen, the CIO of FETC, was the representative to present to the Evaluation Committee in Tehran. Total solutions, business planning, and service flow are critical to build up a successful ETC system, according to Chen. Technical issues and devices aren't key issues since information is fast-distributed nowadays, especially in those developed countries. What matters and need to be considered first is actually the overall strategic planning for user-friendly service.

# eTag Mobile IoT Application



# Mobile IoT and Smart City

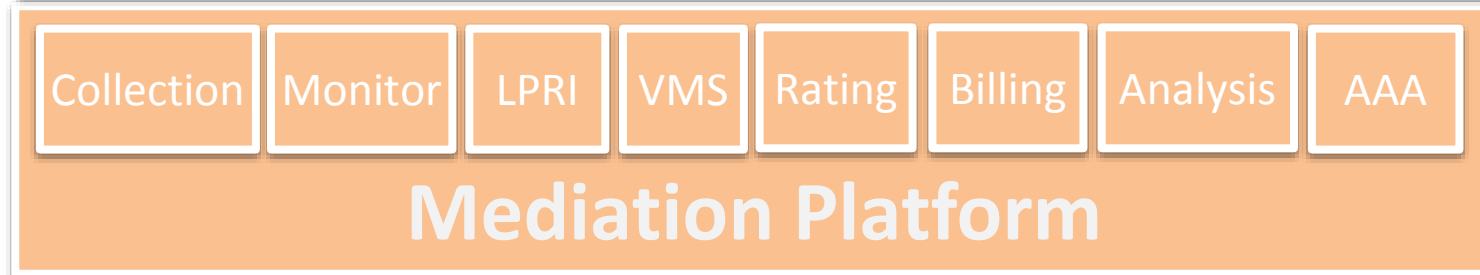
## eTag Service Architecture



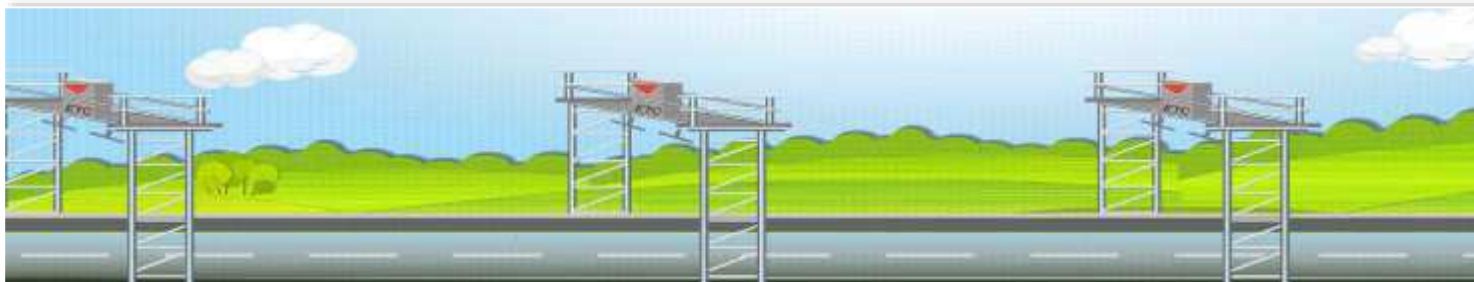
Applications  
Layer



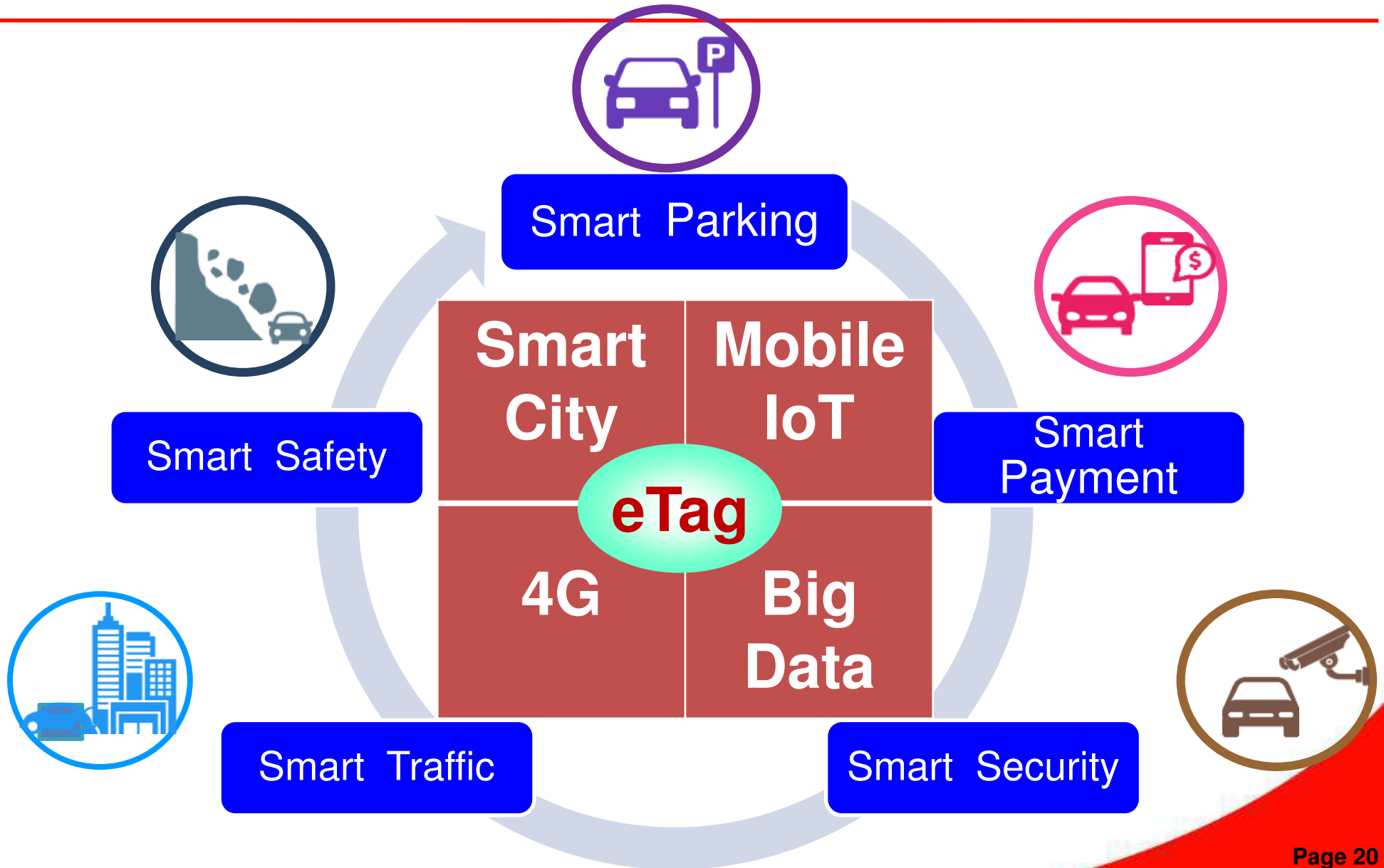
Network  
Platform



Sensor  
Layer



# eTag Mobile IoT Application

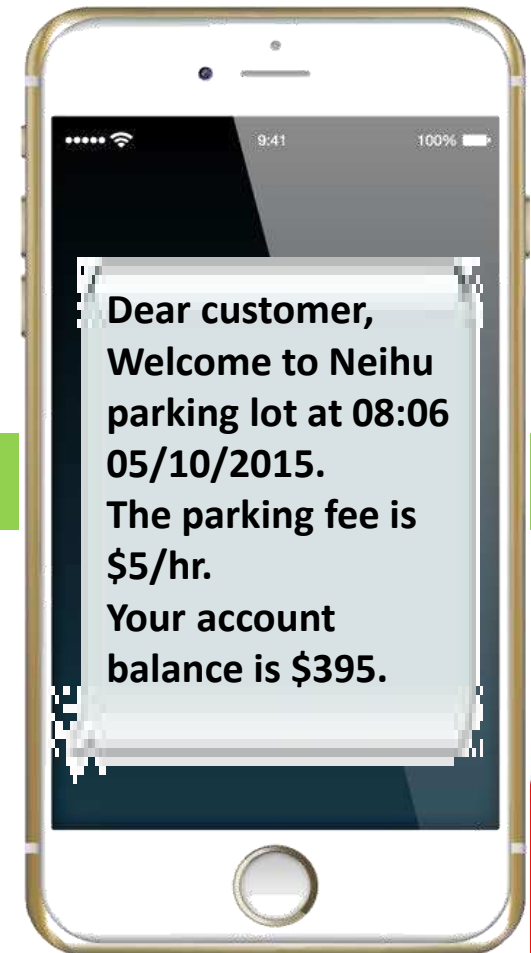
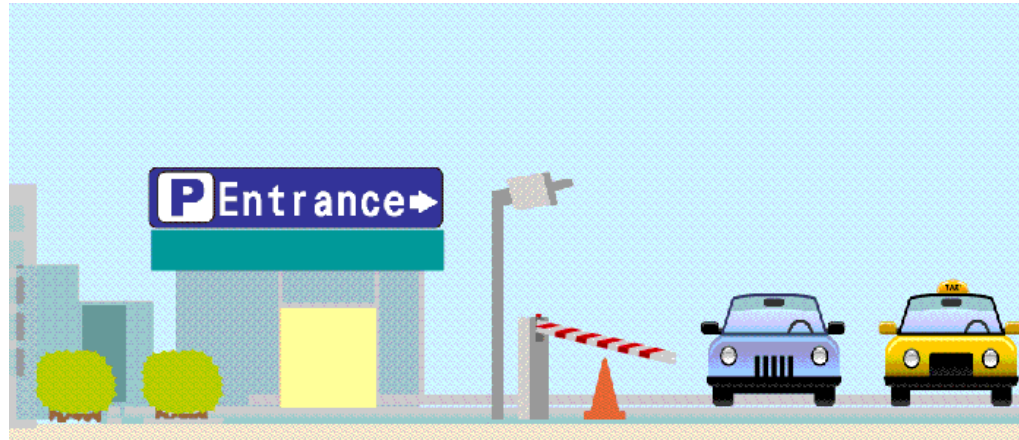


# eTag Mobile IoT Application

## Smart Parking



Entrance



Exit

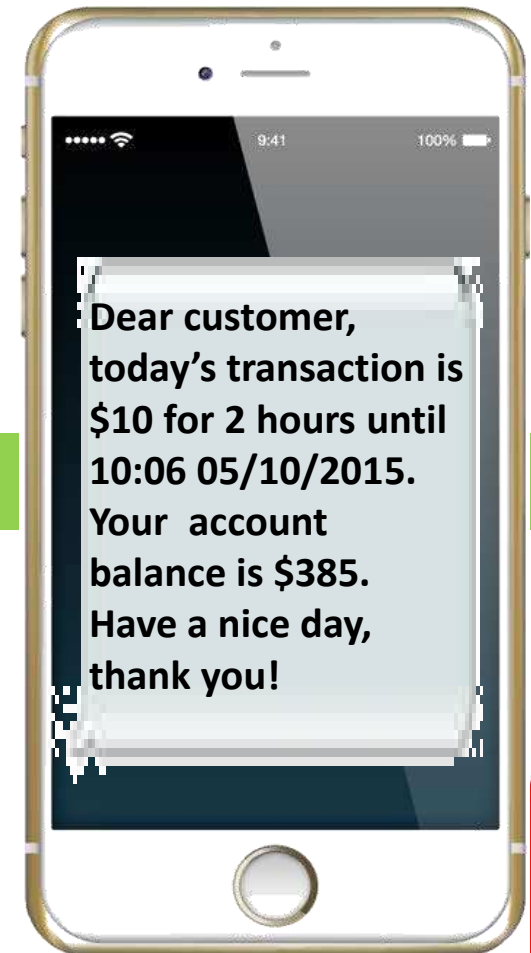


# eTag Mobile IoT Application

## Smart Parking



**Entrance**



**Exit**



# eTag Mobile IoT Application

## Smart Safety



# eTag Mobile IoT Application

## Smart Safety

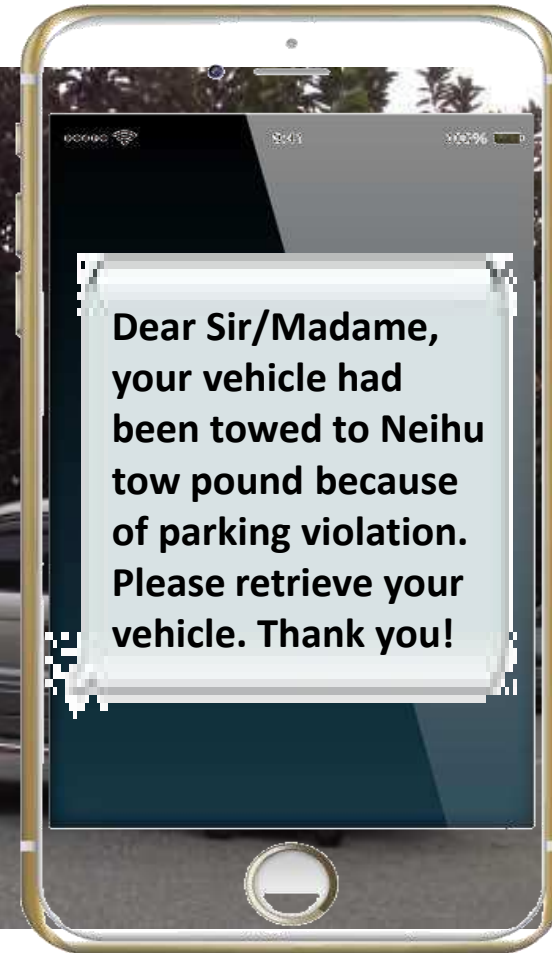


Dear Sir/Madame,  
typhoon is coming. The  
flood gate will be closed  
at 04:00 pm, please move  
your car out of the area  
before 03:00 pm.  
Thank you for your  
cooperation!



# eTag Mobile IoT Application

## Smart Safety



# eTag Mobile IoT Application

## Smart Traffic



# eTag Mobile IoT Application

## Smart Traffic

- a. Network interface
- b. Camera
- c. Microprocessor

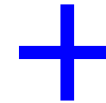
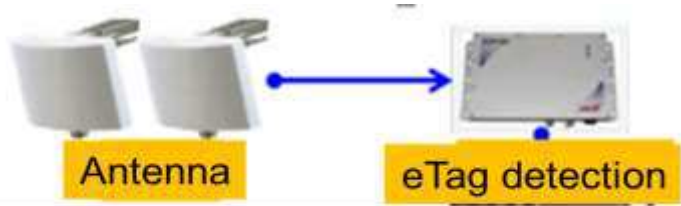


# eTag Mobile IoT Application

## Smart Traffic



# eTag Mobile IoT Application Smart Payment (ERP)



eTag Payment Platform

# Road to the Future



# Overseas Business Collaboration Progress



# Overseas Business Collaboration Progress



Country	Interest in Application
Vietnam	<ul style="list-style-type: none"><li>• Freeways ETC system and operation</li></ul>
Malaysia	<ul style="list-style-type: none"><li>• Freeways ETC system and operation</li></ul>
Indonesia	<ul style="list-style-type: none"><li>• Freeways ETC system and operation</li><li>• Urban road traffic congestion toll collection</li></ul>
Philippines	<ul style="list-style-type: none"><li>• Freeways ETC system and operation</li></ul>
India	<ul style="list-style-type: none"><li>• Freeways ETC system and operation</li><li>• Smart City application</li></ul>
Kuwait	<ul style="list-style-type: none"><li>• eParking</li></ul>
Italy	<ul style="list-style-type: none"><li>• Freeways ETC system and operation</li></ul>
Turkey	<ul style="list-style-type: none"><li>• Freeways ETC system and operation</li><li>• ETC system and operation of Marmaray Tunnel</li></ul>
Kazakhstan	<ul style="list-style-type: none"><li>• Freeways ETC system and operation</li></ul>
Thailand	<ul style="list-style-type: none"><li>• Freeways ETC system and operation</li></ul>
Iran	<ul style="list-style-type: none"><li>• Freeways ETC system and operation</li></ul>
Belarus	<ul style="list-style-type: none"><li>• Freeways ETC system and operation</li></ul>



Implementation of eTag, 4G, Cloud Computing, Big Data, IoT to **Smart City**

Embedded eTag to a **new business model**

Engaged eTag and smart city toward **productivity 4.0**

eTag based ETC is a **sustainable PPP model**



**Thank you**

[www.fetc.net.tw/en/](http://www.fetc.net.tw/en/)

# ETC 1.0 (Speed 0km)

Barrier	Toll Detection	Country/Application
yes	stop and go to pay tolls	Malaysia ETC, Taipei MRT (easycard)



# ETC 2.0 (Speed 20km)



Barrier	Toll Detection	Country/Application
yes	slow down to pay tolls	Japan, Korea, Hong Kong, China/ETC



# ETC 3.0 (Speed 70km)



Barrier	Toll Detection	Country/Application
no	single lane free flow	Taiwan per-entry-based ETC



# ETC 4.0 (Speed $\geq 110\text{km}$ )



Barrier	Toll Detection	Country/Application
no	multi-lane free flow	Taiwan distance-based ETC



# Basic Rule

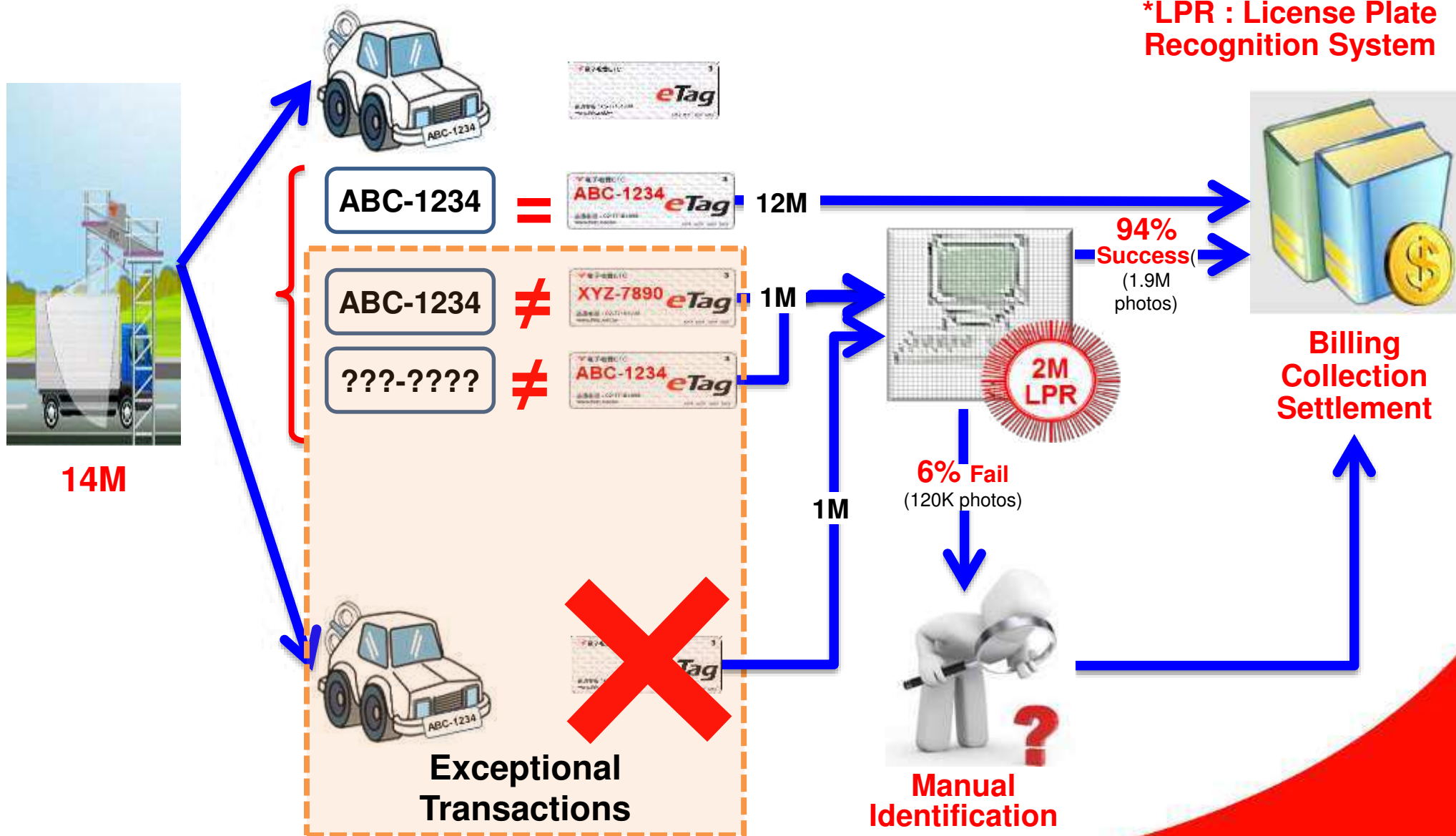


- eTag register ID = License Plate → Normal Case
- eTag register ID ≠ License Plate → Issue Case

# Toll Transaction Handling Process

Daily 14M Transactions, 0.8% need human intervention

\*LPR : License Plate Recognition System





# Taiwan ETC Overview

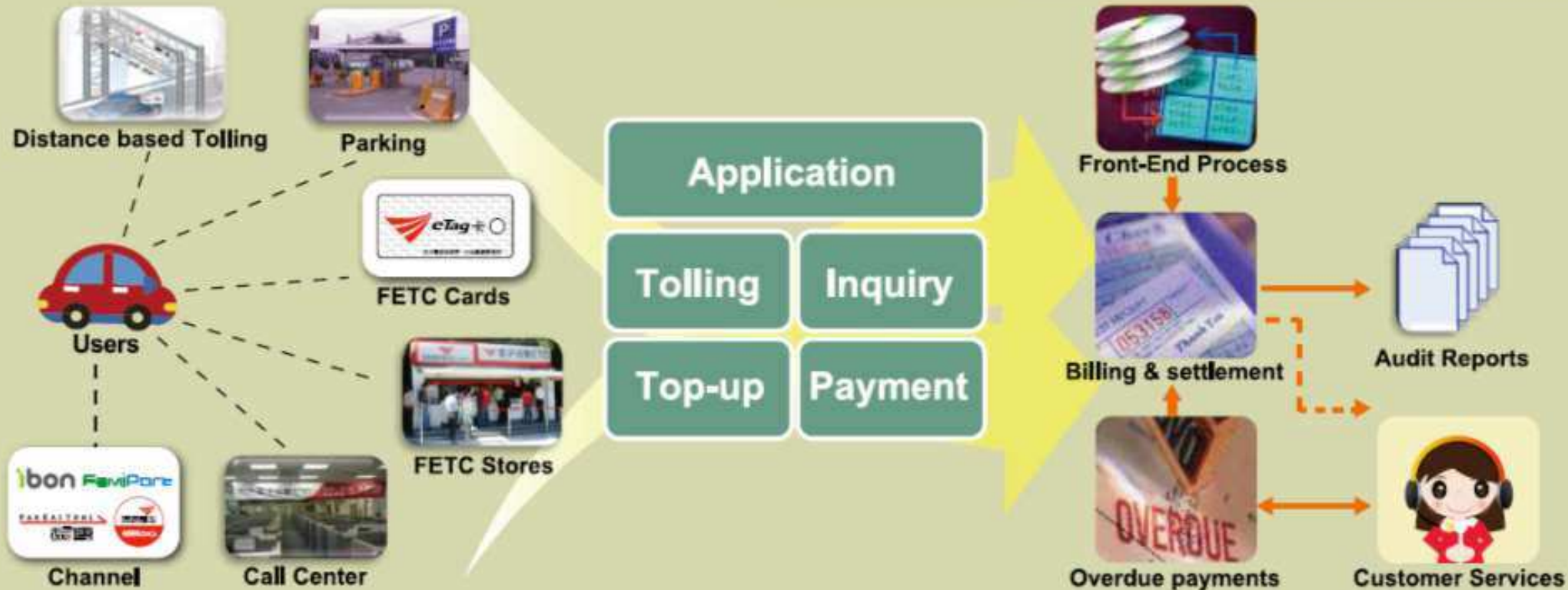
## Operation Service Model



Customer contact

Service contact

Tolls & BMS



# Taiwan ETC Overview

## Instant APP Service



- Real time balance within 0.5 hour
- Tolling fee calculation
- Detail list for the paths taken
- 2.3 Million mobile device downloads

FETC APP Service



### CN-571 通行明細

車號：CN-571 交易日期：2014年3月23日

列印

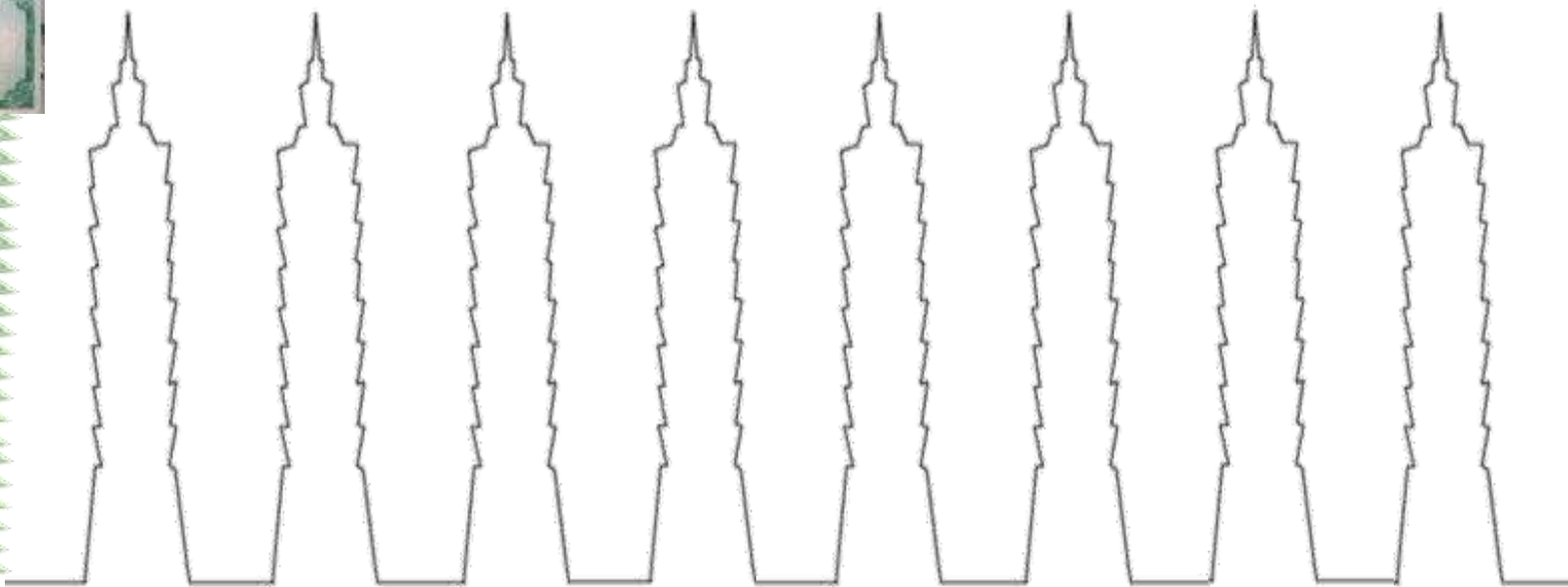
通行時間	通行方向	通行路段	里程(公里數)	門架牌價
15:08:07	國道一號北上	大雅-豐原	6.2	\$7.4
15:12:31	國道一號北上	豐原-台中系統	2.5	\$3.0
15:15:26	國道一號北上	台中系統-后里	4.7	\$5.6
15:18:21	國道一號北上	后里-三義	10.5	\$12.6
15:24:38	國道一號北上	三義-銅鑼	10	\$12.0
15:29:29	國道一號北上	銅鑼-苗栗	7.3	\$8.7
15:35:19	國道一號北上	苗栗-頭屋	7.4	\$8.8
15:48:20	國道一號北上	頭屋-頭份	15.1	\$18.1
15:57:50	國道一號北上	頭份-新竹系統	11	\$13.2
16:02:20	國道一號北上	新竹系統-新竹(科學工業園區)	2.8	\$3.3
16:04:17	國道一號北上	新竹(科學工業園區)-新竹(新竹-竹東)	2.5	\$3.0
16:09:45	國道一號北上	新竹(新竹-竹東)-竹北	3	\$3.6
16:13:14	國道一號北上	竹北-湖口	7.3	\$8.7
16:22:22	國道一號北上	湖口-楊梅	14.6	\$17.5
16:32:28	國道一號高架北上	楊梅-中壢	6.7	\$8.0
16:34:19	國道一號高架北上	中壢-機場系統	10.2	\$12.2
16:42:27	國道一號高架北上	機場系統-高公局	17.8	\$21.3
16:50:38	國道一號北上	高公局-五股	1.4	\$1.6
16:53:49	國道一號北上	五股-三重	5.9	\$7.0
16:56:29	國道一號北上	三重-台北	2	\$2.4

# Taiwan ETC Overview

## ETC Social Benefit (2013/12/30~)



 **Paper Ticket Reduced** equivalent to **2,075 Taipei 101s (508m)**




# Taiwan ETC Overview

## ETC Social Benefit (2013/12/30~)



 **Paper Ticket Reduced** equivalent to **2,075** Taipei 101s (508m)

 **Carbon Emissions** **430** thousand metric tons of CO<sub>2</sub> equivalent to the CO<sub>2</sub> captured by trees in **55** New York's Central Park



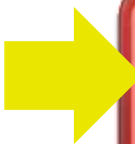
# Taiwan ETC Overview

## ETC Social Benefit (2013/12/30~)



 **Paper Ticket Reduced** equivalent to **2,075** Taipei 101s (508m)



 **Carbon Emissions** **430** thousand metric tons of CO<sub>2</sub> equivalent to the CO<sub>2</sub> captured by trees in **55** New York's Central Park

 **Fuel Saving** **180** million liters of fuel equivalent to **74** Olympic swimming pools



# Taiwan ETC Overview

## ETC Social Benefit

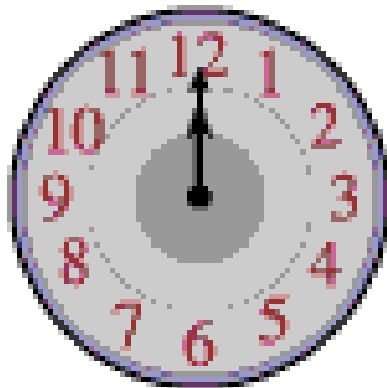


### Taiwan ETC

1.5 million car journeys per day x 15mins  
= **22.5 million minutes (42.8 years)**

### Taiwan HSR

150 thousand car journeys per day x 120mins  
= **18 million minutes (34.2 years)**



# Taiwan ETC Overview

## ETC Social Benefit

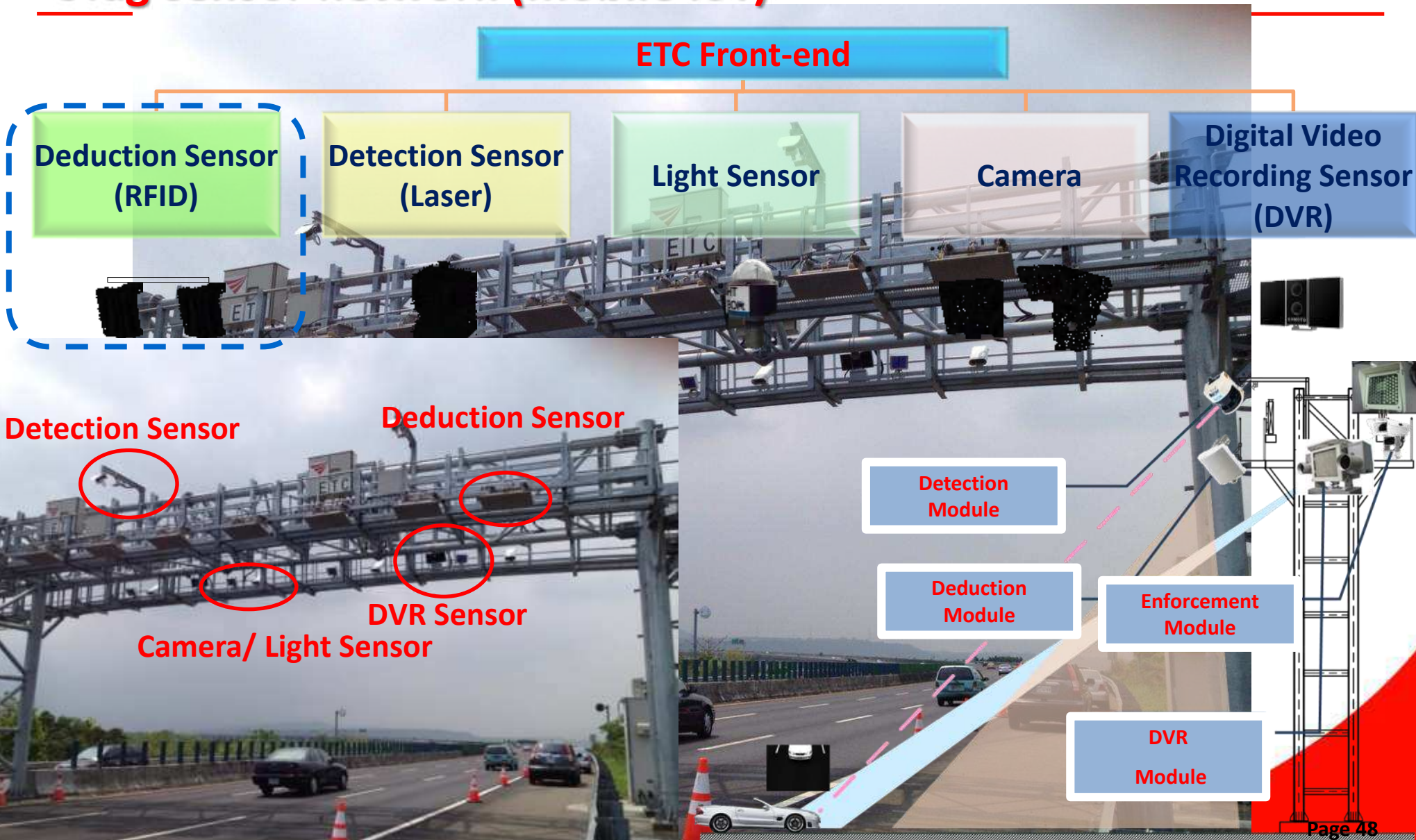


=

**USD 418 million**  
per year

# Mobile IoT and Smart City

## eTag sensor network (mobile IoT)





# Taiwan ETC Overview

## ETC Service Innovation



### ■ MLFF single-gantry solution



# Taiwan ETC Overview

## ETC Service Innovation



■ MLFF single-gantry solution

■ In-house development by operator



..... hundreds more vendors

# Taiwan ETC Overview

## ETC Service Innovation

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- MLFF single-gantry solution
- In-house development by operator
- Open Standard System (ISO 18000-6C)



# Taiwan ETC Overview

## ETC Service Innovation

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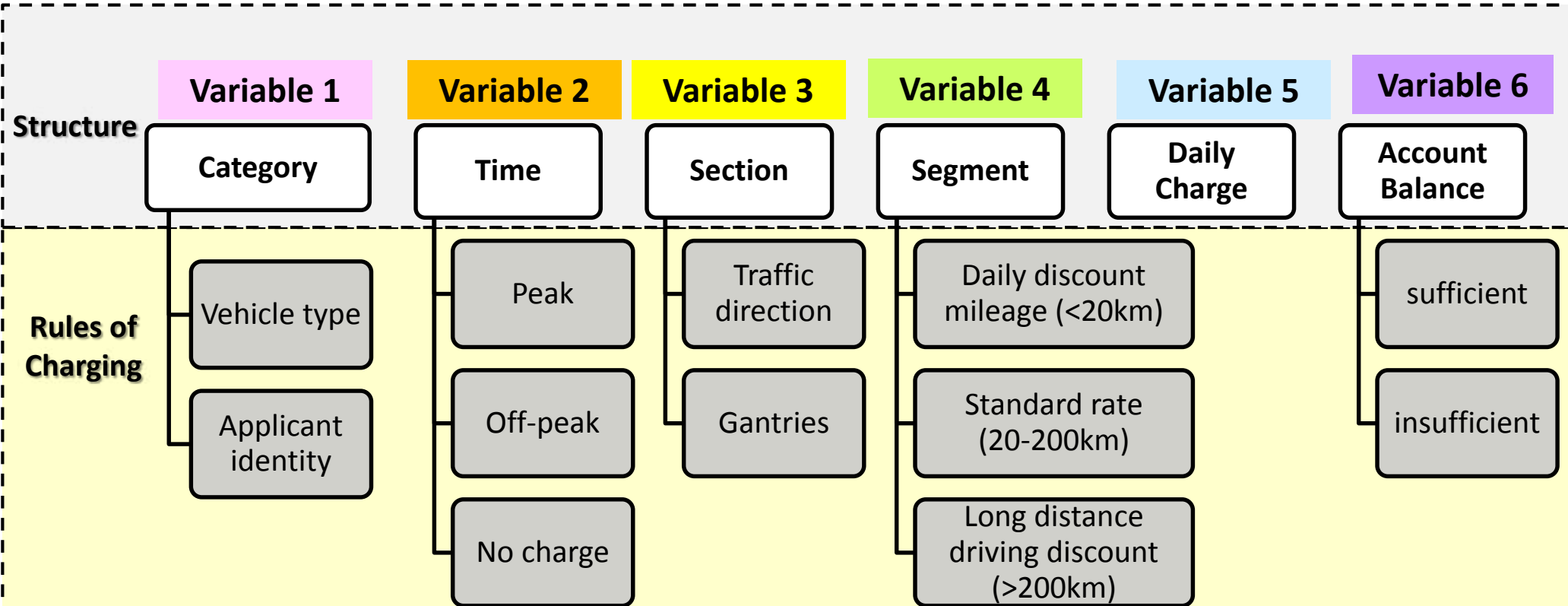
- MLFF single-gantry solution
- In-house development by operator
- Open Standard System ( ISO 18000-6C)
- Flexible toll charging capabilities

# Taiwan ETC Overview

## ETC Service Innovation



### Flexible toll charging capabilities



- |  |   |
|--|---|
| <u>Vehicle type</u>  | <u>Applicant identity</u>   |
| <ul style="list-style-type: none"> <li>compact car</li> <li>truck</li> <li>trailer</li> <li>Motorcycle (more than 500c.c)</li> </ul> | <ul style="list-style-type: none"> <li>eTag deposit account</li> <li>Non-eTag deposit account</li> <li>Non-eTag user</li> </ul> |

# Taiwan ETC Overview

## ETC Service Innovation

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- MLFF single-gantry solution
- In-house development by operator
- Open Standard System ( ISO 18000-6C)
- Flexible toll charging capabilities
- 24x7 continuous stable operation

# Taiwan ETC Overview

## ETC Service Innovation



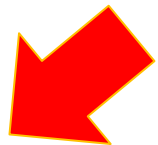
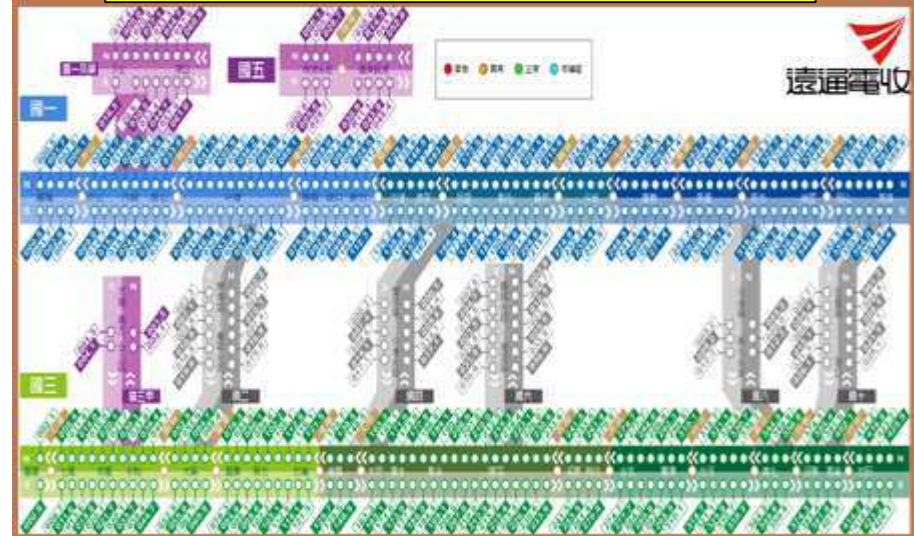
Front-end System Monitoring



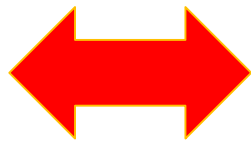
Dashboard



Back-end System Monitoring



Call Engineer



# eTag Mobile IoT Application Smart Payment (ERP)

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