



中華電信
Chunghwa Telecom

IoT Development in ChungHwa Telecom (CHT)

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Refresh your life



Outline

- IoT Policy in Taiwan
- IoT Opportunities and Challenges
- CHT IoT Platform & Applications
- Conclusion

Chunghwa Telecom Overview

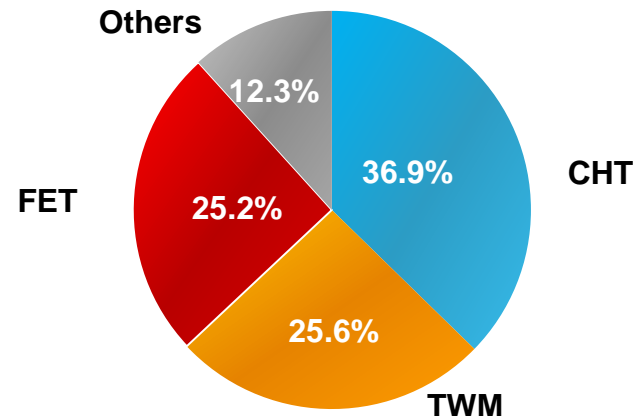
Strong Market Position

- Domestic Fixed
 - #1 Local
 - 93.4% share by subs (10.80M subs)
 - 84.1% share by minutes
 - #1 Broadband access
 - 73.8% share by subs (4.47M subs)
- Mobile
 - #1 Mobile subscribers
 - 36.9% market share (10.60M subs)
 - Usage 3.3 Hrs/per day (#1 worldwide)
 - (14 GB/per month about 182 K photos)
 - #1 Mobile revenue
 - 37.3% market share
- International Fixed
 - #1 ILD
 - 60.9% share by minutes

Operational Strategies

- Streamline services and strengthen profitability
- Capitalize and remain at the forefront of digital convergence trends
- Leverage governments' new southbound development policy
- Broaden corporate governance initiatives
- Continue to invest in talent, network construction and R&D

Mobile Subs Market Share



R&D Focus (1,300 Engineers)

Convergence Service

- Video Service System
- LBS System
- Payment and smart shop System
- 4G/IMS value-added services
- Cloud Assistant/Convergence Service System
- Intelligent Man-Machine Interactive Technique

Cloud/Big data/Information Security

- Hybrid Cloud Solution
- Big data Solution
- Multi-Card with unique identification and certification Solution
- APT Defense Solution
- Security Solution

Intelligent Broadband Network

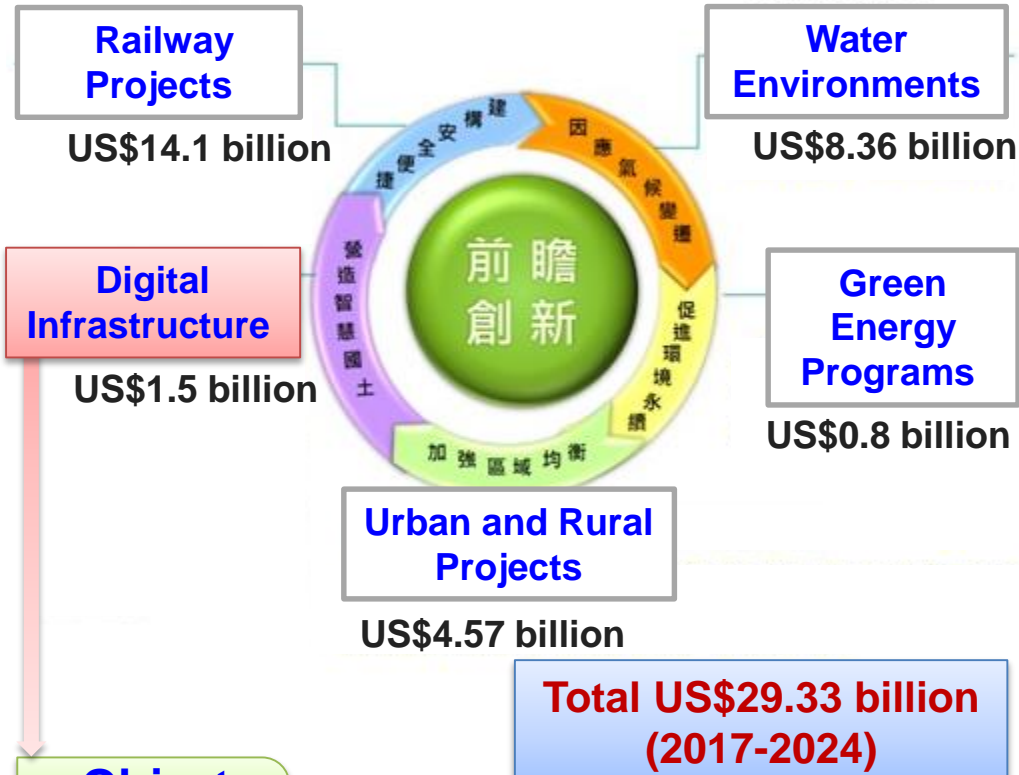
- B4G/5G Technique
- 4G network evolution and HetNet Technique
- G generation fixed network new Technique
- Network Detection and intelligent Technique
- SDN Technique and Application
- Fixed network Integration intelligent Technique
- Multi-Cloud management Technique

Internet of Things Application

- Intelligent Environment Solution
- Smart Building Solution
- Intelligent Transportation Solution
- Smart Healthcare Solution
- Intelligent Operation Center for Smart City
- IoT Platform

IoT Policy in Taiwan

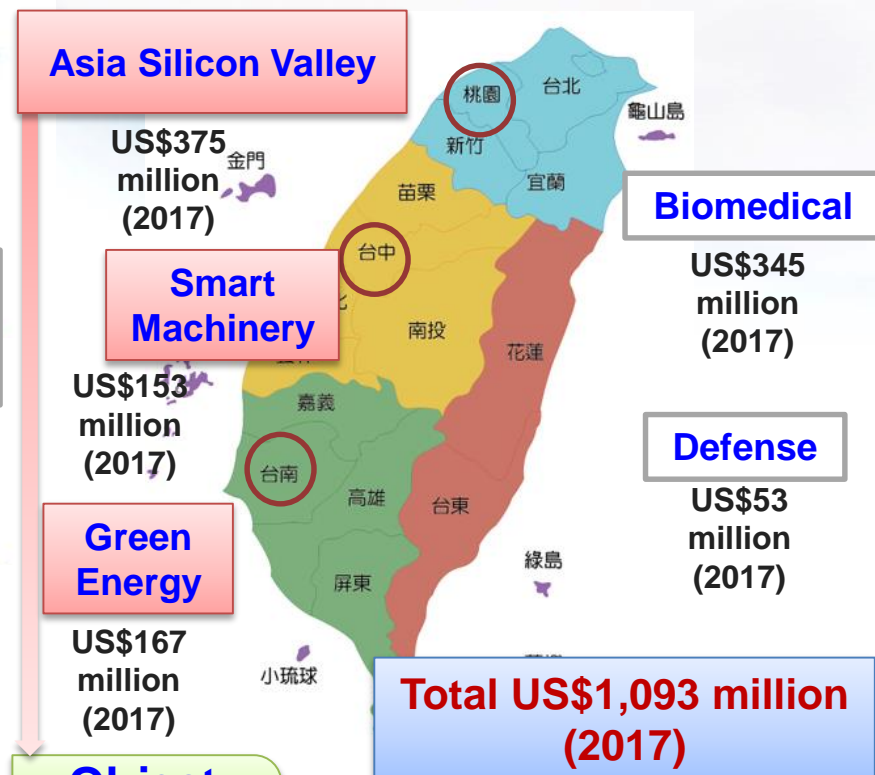
Forward-looking Infrastructure Development Program (2017-2024)



Object

Create IoT basic environment. Expect to start 5G mobile services in 2020, and build a complete low-power wide area (LPWA) network

Five Major Innovative Industries Policy (2016-2020)

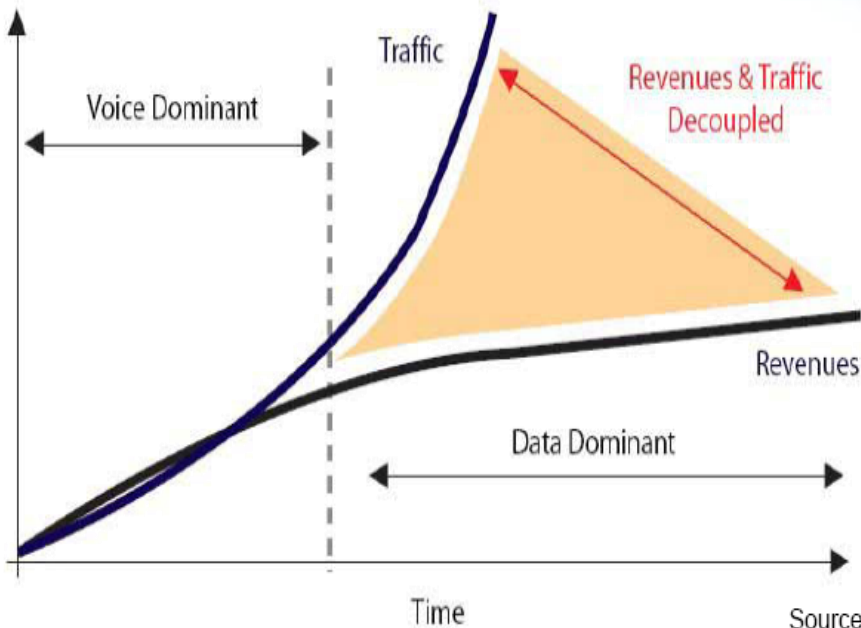


Object

Enhance Taiwan's IoT economic and business opportunities and account for **2%*** of the global market in 2020

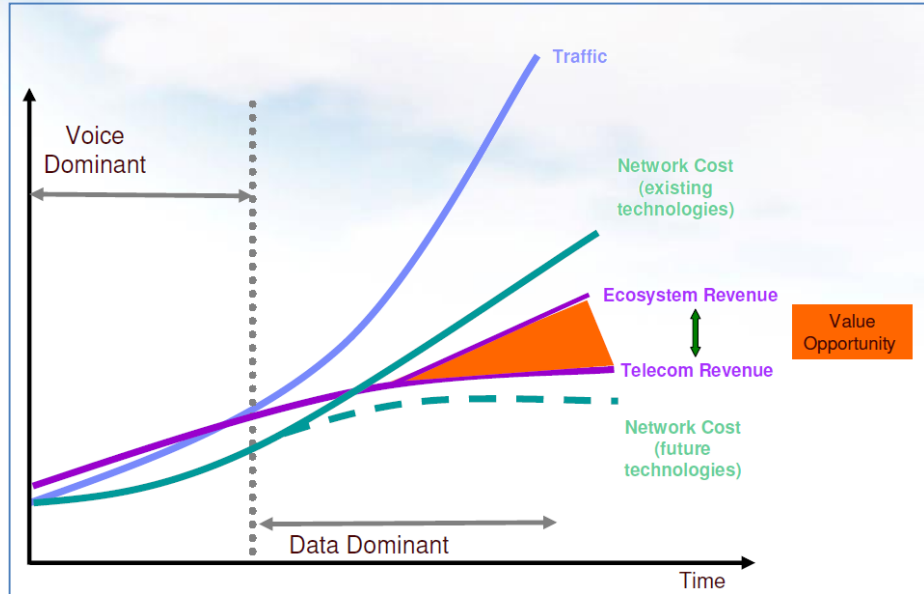
Reality Telecoms Are Facing

■ Scissors Effect



Source: Unstrung

Traffic Up vs. Revenue Down

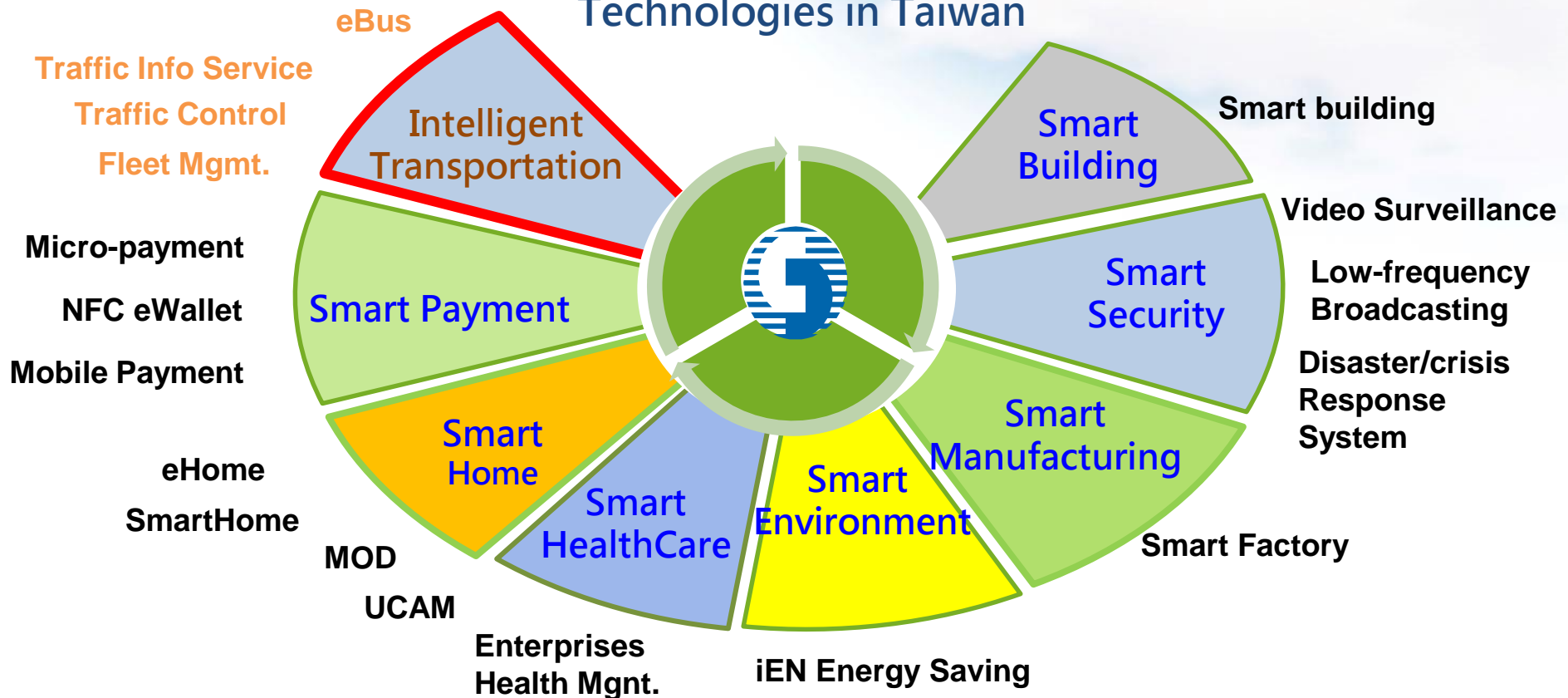


CAPEX Up vs. Revenue Down

- Blooming of the OTT Business
- Saturated Domestic Market

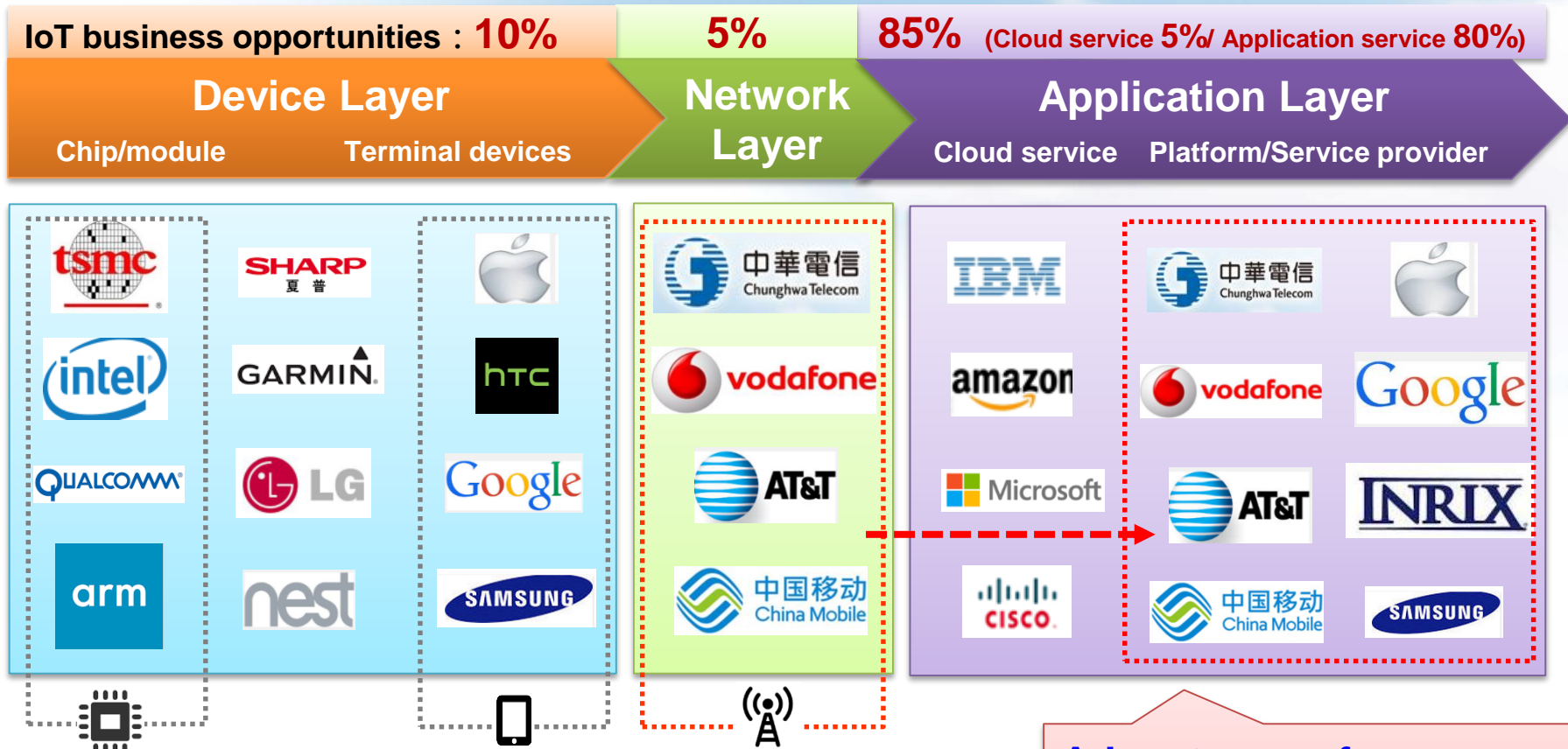
ICT Applications of CHT

Leading IoT Services and Technologies in Taiwan



IoT Ecosystem

Ref: Gartner



Advantages of telecom operators:

- Connectivity
- Data storage resources
- Billing system
- Hosting
- Customer relationship

Sensor technology

Low power consumption

Smartphone becomes the control Hub

MEMS technology
(Micro Electro Mechanical Systems)

Advanced packaging technology

- Internet access
- Display
- Monitor
- Sensing

Large coverage



Massive connection



Low-cost devices



Low power consumption



Telecom's IoT Opportunities

Opportunity 1

IoT Platform

Massive Devices

Gartner: IoT devices reach 20.4 billion in 2020

Information Exchange

Intel: IoT devices and applications services need information exchange

Rapid Development Applications

Digitimes: IoT Platform significantly accelerates service development time

Opportunity 2

Data Analysis

Massive Data

Amazon: a large number of devices will drive large data processing and analysis

Differentiation

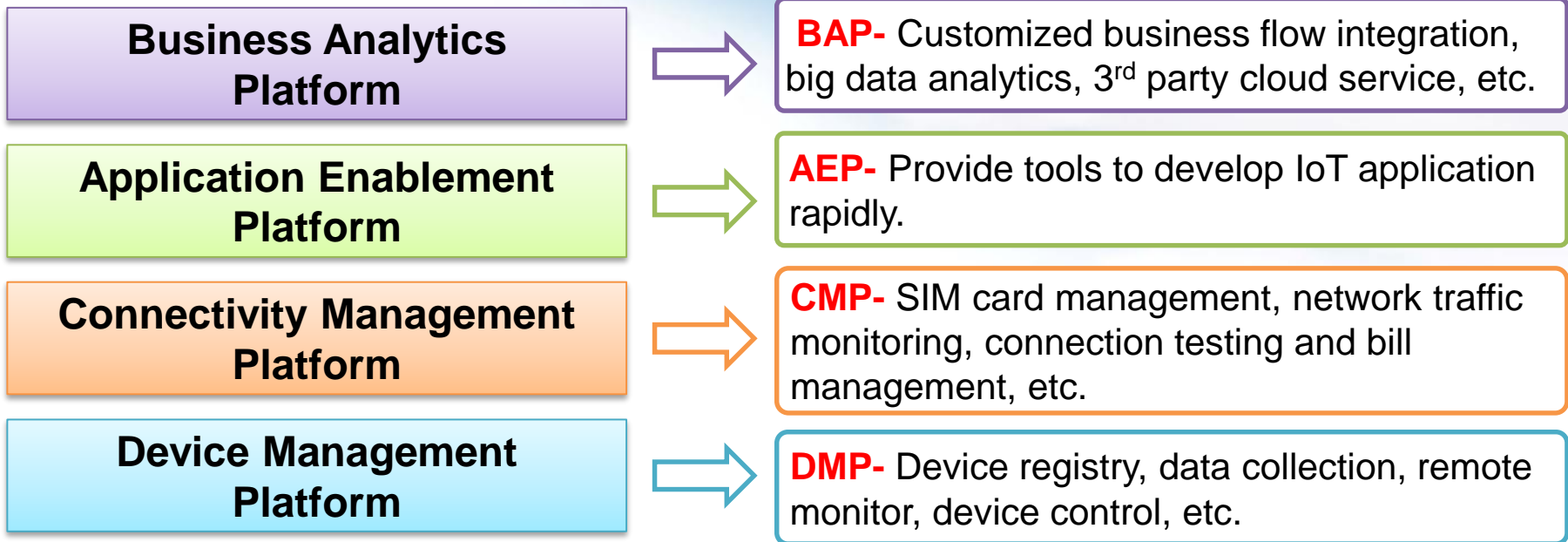
Ovum: data analysis is the most important to make IoT solution effective

Value-added Applications

Google: third parties need data analysis results to do value-added applications

Opportunity : IoT Platform

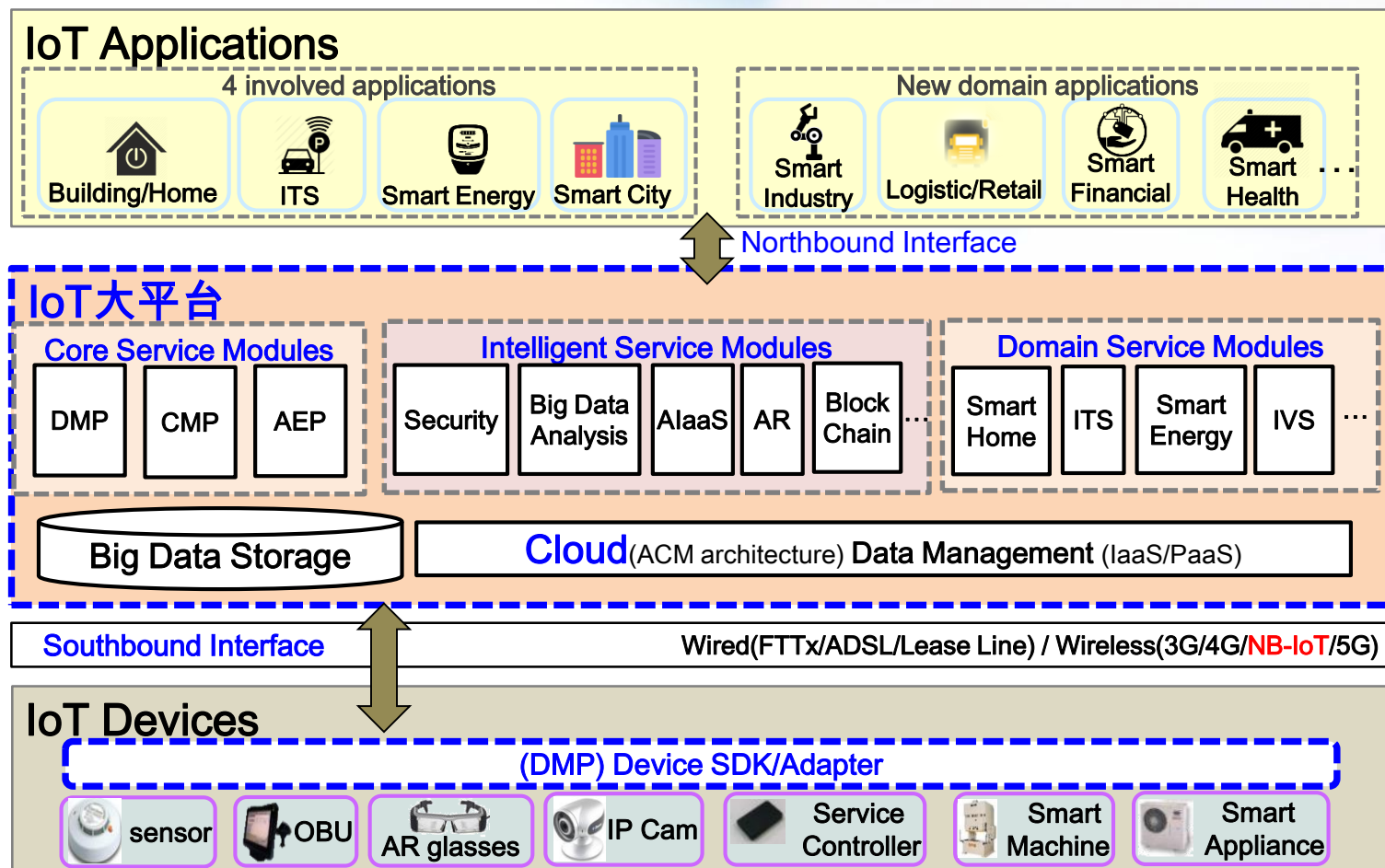
■ 4 Types of Global IoT Platform Development



	Ericsson	Cisco	PTC	IBM	AT&T
Platform product name	Ericsson DCP (2011/4)	Jasper Wireless (founded 2010/11) (acquired 2016/2)	ThingWorx (2009/03)	Watson IoT Platform (2015/11)	M2X (2015/11)
Features	DMP (devices lifecycle management) CMP	CMP (SIM card management 、 eSIM OTA setting) DMP	AEP (Graphical control toolkit) BAP DMP	BAP (Watson Analytics) AEP DMP	DMP CMP BMP AEP

CHT IoT Platform Architecture

- 1 Platform, 2 Interfaces, 3 Cores, 4+ Domains, 5 Intelligent



DMP : Device Management Platform

AEP : Application Enablement Platform

CMP : Connectivity Management Platform

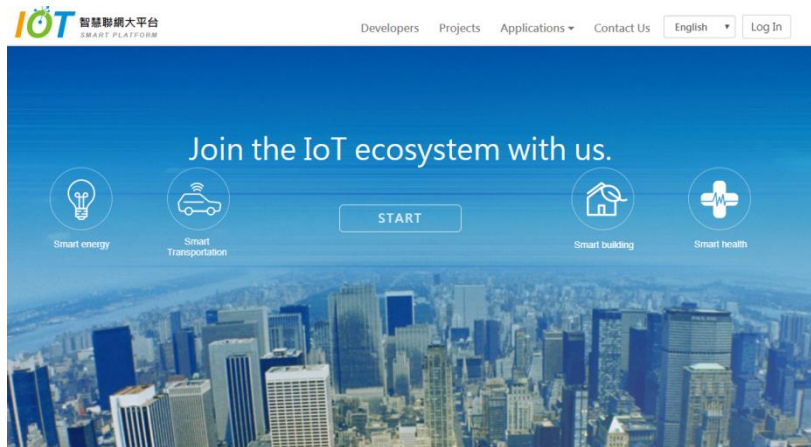
ACM : Application Container Management

Building Industry Ecosystem

2018/1 Free trial opening

2018/12 Formal commercialization

- URL : <https://iot.cht.com.tw> (login as CHT user)
 - Developer center: API document, related source(SDK, adapter, sample code)



News: 【英文版網頁上線】IoT智慧聯網平台英文版網頁上線，可從右上方多語系下拉選單中選取“Englis...

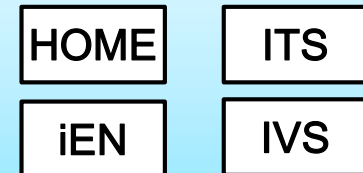


API
UI

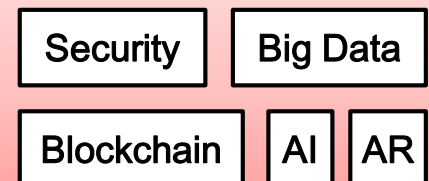
3 core module



4 domain module



5 intelligent module



Easy development of innovative application

Development of application

Node-RED

ThingWorx
A PTC Business

IoT APP
framework



Development tools for application:

Integration with ThingWorx, providing **IoT APP framework**, **Node-RED** graphic tool(Q2), easy development

(1 month learning ThingWorx, 3 days building visualization website)

Use of platform service



API document and sample codes:

The developer center on IoT platform web page provides complete manuals and sample codes to **guide users for a quick start**.

(including API documents, documents/codes for IoT development board, etc.)

Connection between devices and platform

CHT IoT
device protocol

Device SDK

Programmable
device

Adapter with Standard
industrial protocol

Devices with
standard protocol



Development tools for devices:

Providing multiple device SDK, Adapter, and **fast development for the connection between devices and the platform**.



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Opportunity : Data Analysis

■ Three levels of data analysis

Descriptive Analytic

Level 1

Find feature and rule from real-time and historical data



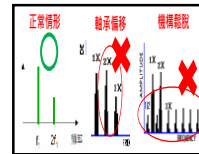
For example:

Use data to get real-time machine status

Predictive Analytic

Level 2

Historical data combine with conditions and factors to predict possible results



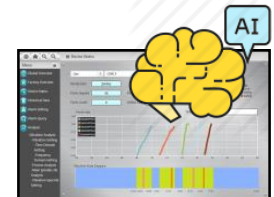
For example:

Predict equipment maintenance time and components life cycle

Prescriptive Analytic

Level 3

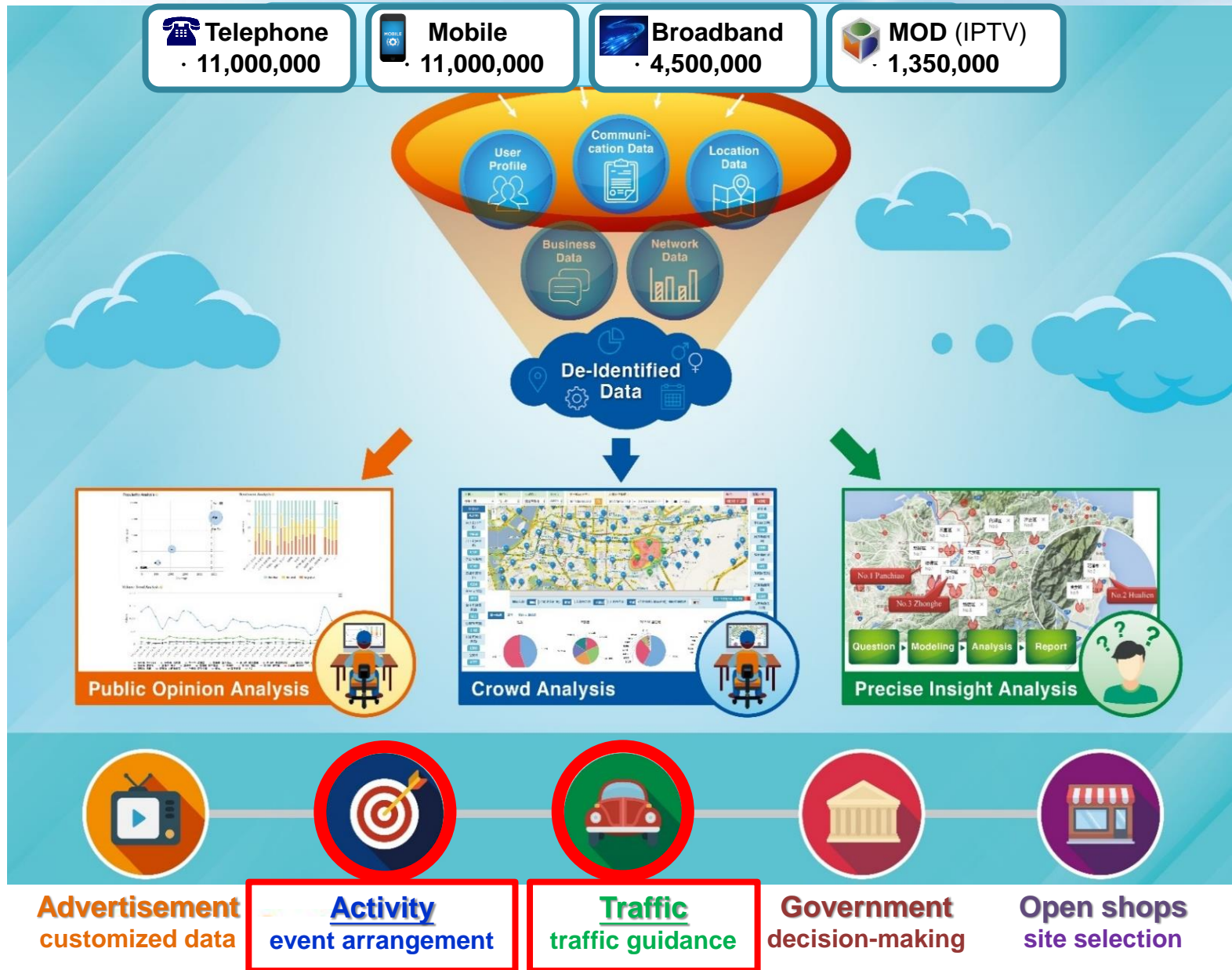
The machine finds data feature and rule by self-learning and adjusts the behavior according to the predictions results by self-adjustment



For example:

According to mechanical conditions to adjust the process parameters

CHT Data Analysis



Real-time Crowd Analysis

- After collecting **mobile network signal of users**, we help the government to know crowd density & profile of each site for **emergency response & decision making**

Feature 1: Analyze crowd of each site

Date: 2017/8/21 18:20

Total people: 5,644

Taipei 101

人 : 957

30°C

Taipei Gym

人 : 1337

30°C

Taipei Park

人 : 1573

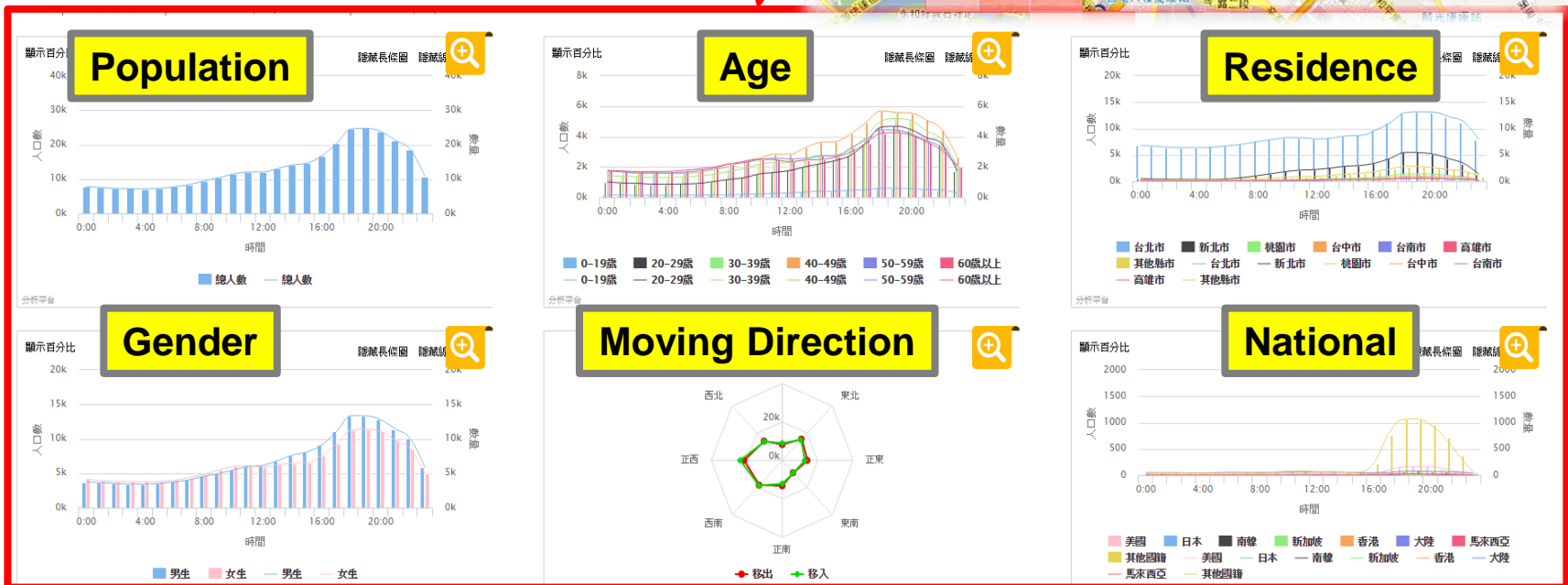
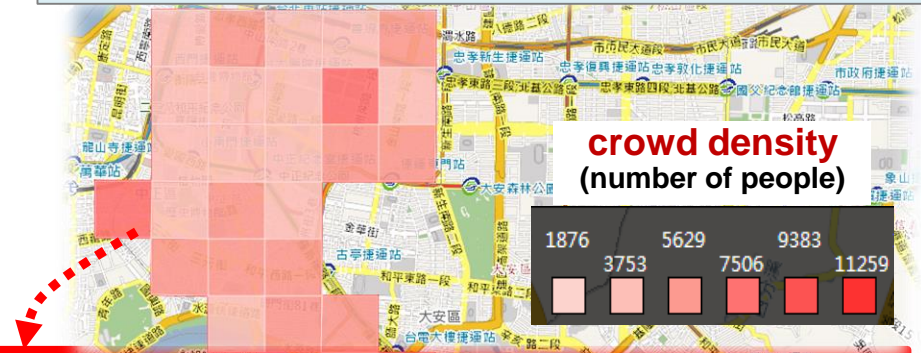
32°C

Trade Center

人 : 1777

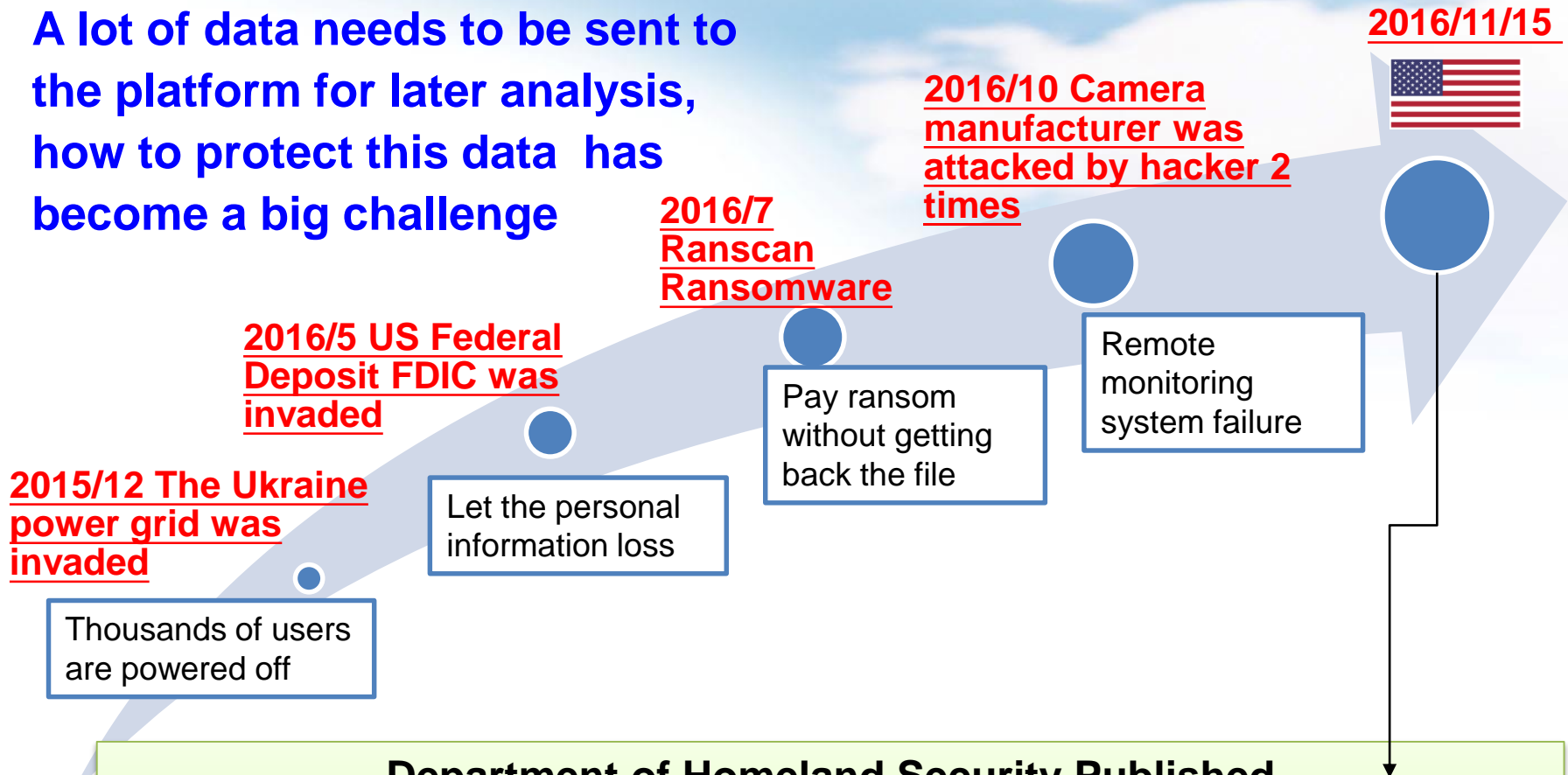
33°C

Feature 2: Analyze crowd density & profile



Challenge : IoT Security

- A lot of data needs to be sent to the platform for later analysis, how to protect this data has become a big challenge



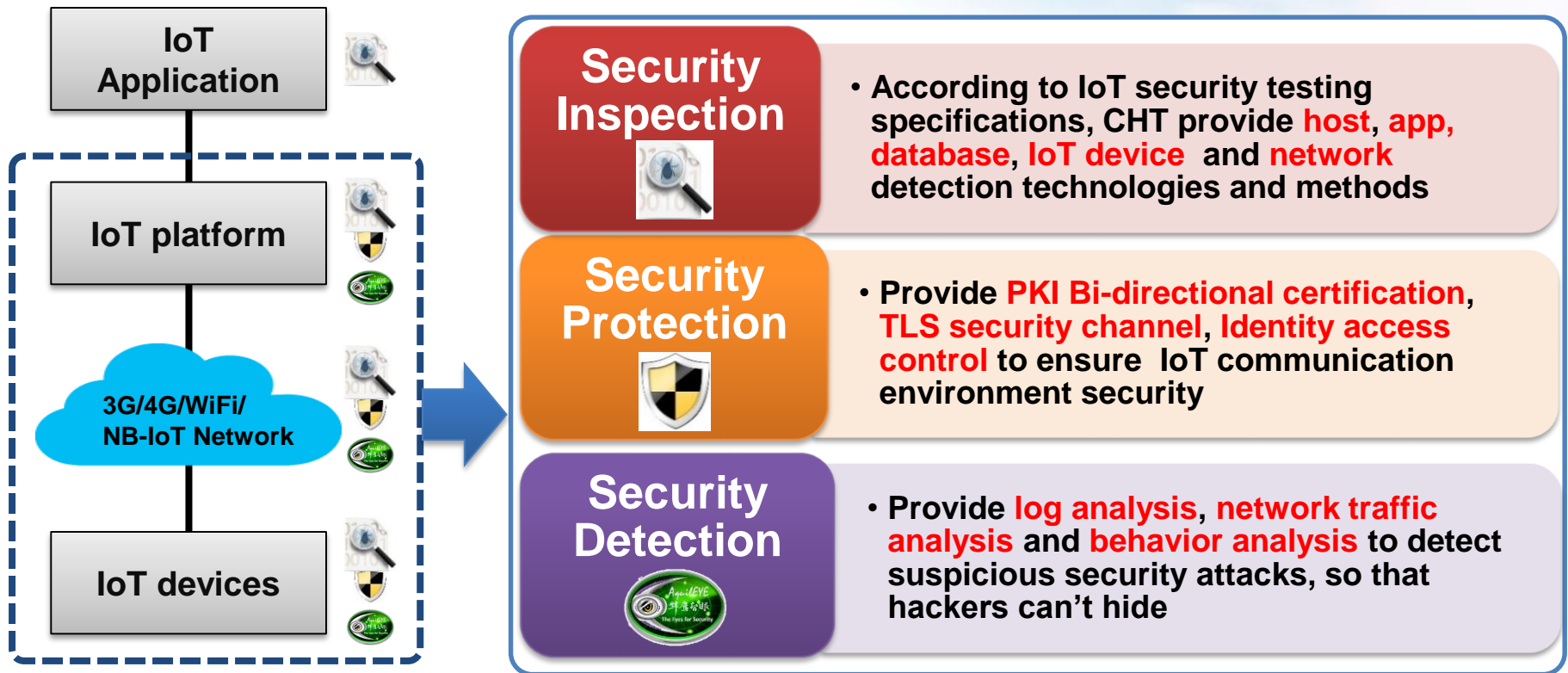
Department of Homeland Security Published

《Security Strategic Principles for Securing the Internet of Things》

- IoT device design stage should consider the security issues
- Improve the security update and vulnerability management mechanism
- Establish the reliable product safety mechanism

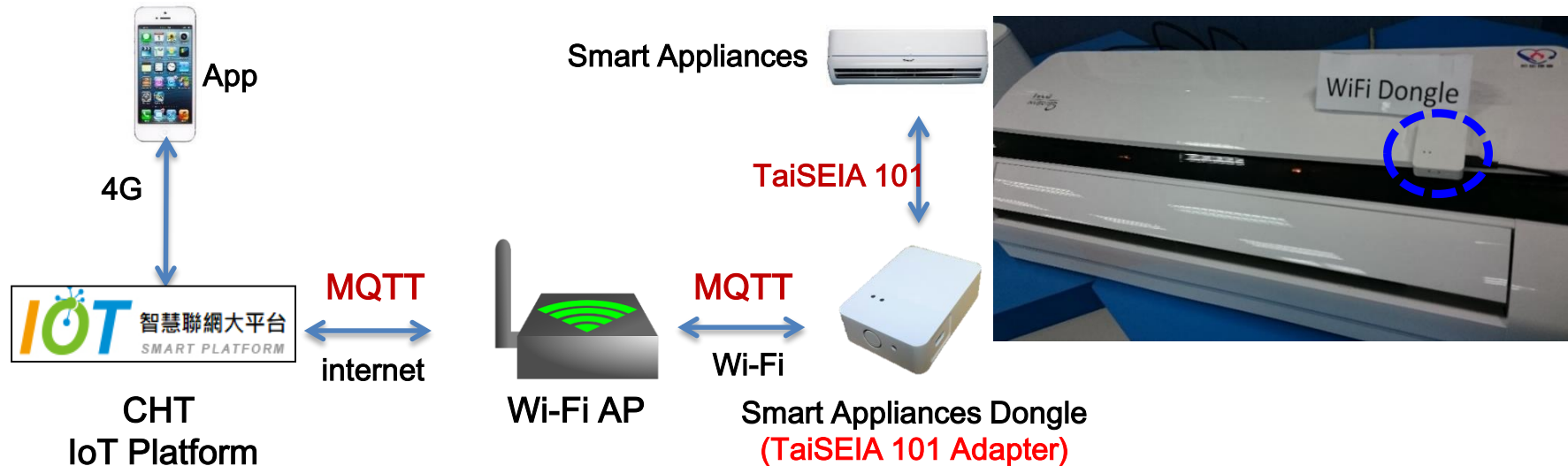
CHT IoT Security

- Use **security inspection**, **security protection**, **security detection** to construct IoT platform security and enhance IoT services competitiveness



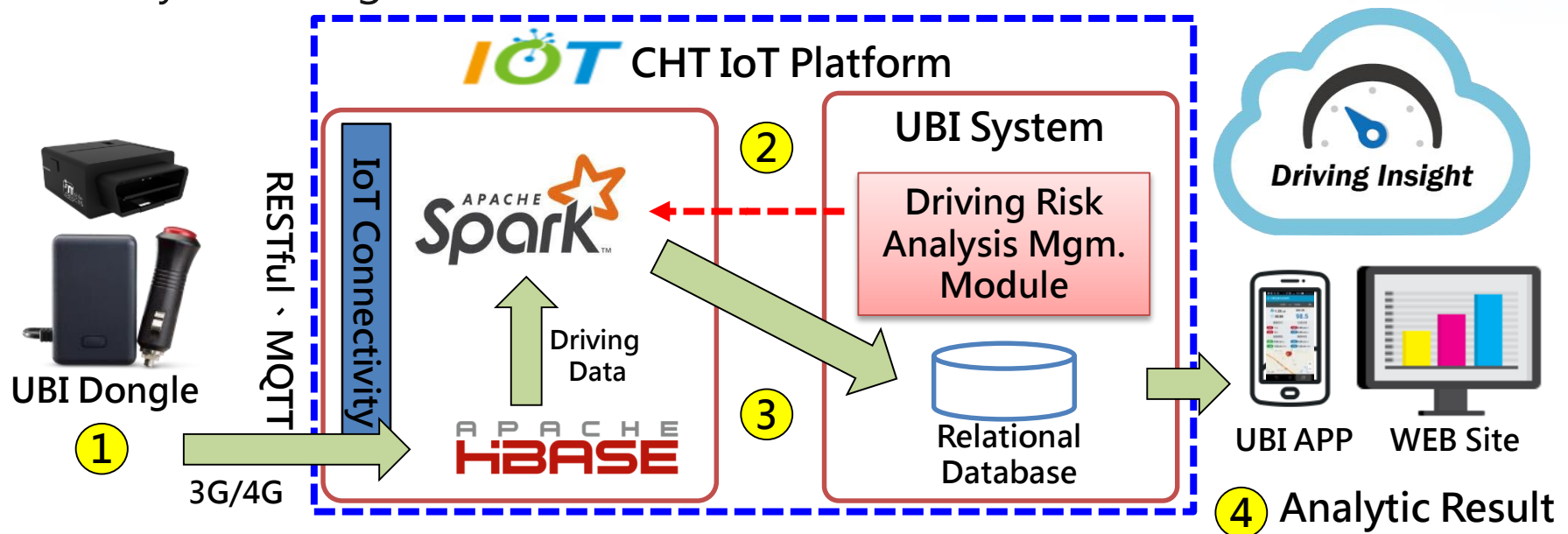
Use Case : Smart Appliances Control

- Smart Appliances Dongle
 - based on MTK LinkIt development board, **built-in adapter for TaiSEIA 101 standard.**
 - Communicates with smart appliances which follow TaiSEIA 101 standard.
 - Collect status data to CHT IoT platform **through Wi-Fi network and MQTT protocol.**
- Users can control smart appliances remotely by Apps.



Use Case : Usage-Based Insurance System

- Usage-Based Insurance (UBI) insurance fee depends on the driving mileage and behavior.
- Using the dongle installed in the vehicle, to **collect driving records through CHT IoT platform**.
- **Using the big data analytics tools provided by CHT IoT platform**, to analyze driving risk.



NB-IoT (Pre-5G technology)

■ Enable the next Billion Connections



+20dB

Wide Coverage
(UL 72K/DL 32K)



~5 years

Low Power



>10K links/BStation

Massive Connection



< 5 USD

Low Cost



4G grade

Reliability

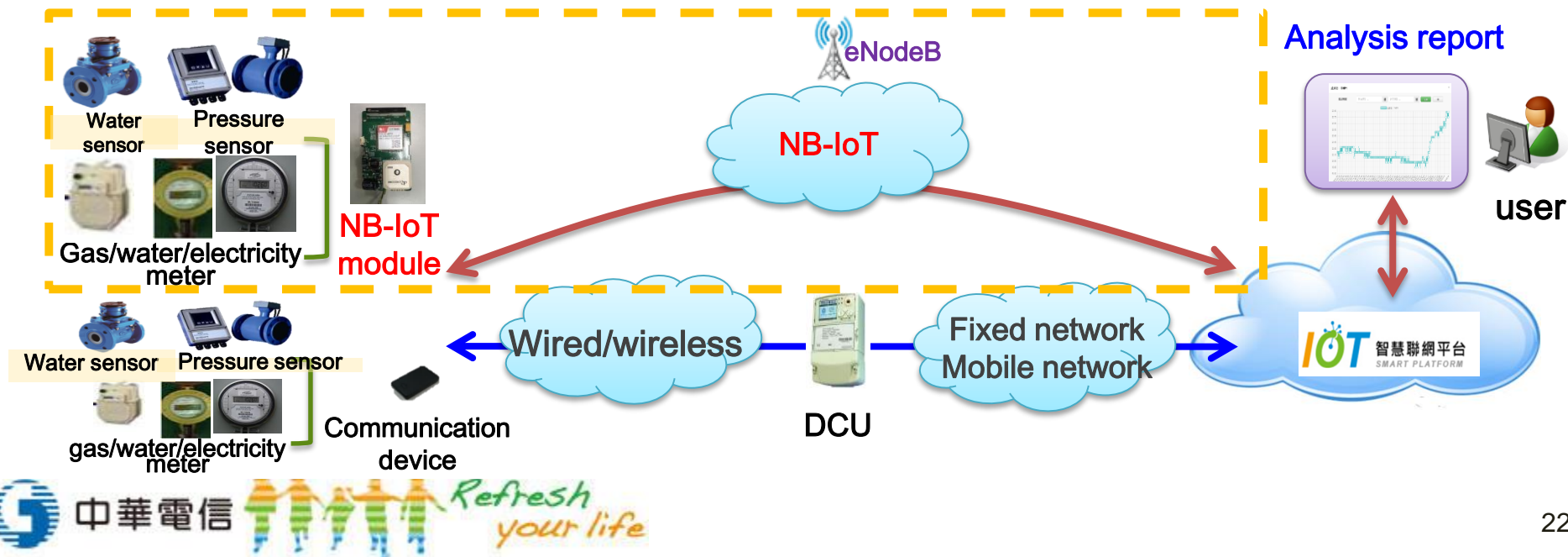


Mobile Ecosystem

Global Standard

Use Case : NB-IoT Smart Meter

- Applying the advantage of NB-IoT (wide coverage and low cost), IoT platform provides a better solution for smart metering by collecting data through southbound interface and developing application interface by calling northbound interface.
- Features
 - **Wide coverage** : providing wide area network coverage(+20db)
 - **Low cost** : No need of data concentrator unit
 - **Security** : 4G-level network security
 - **International standard** : follows NB-IoT technique of 3GPP standard



NB-IoT Smart Meter (cont.)

Development procedure

Related sample code and IoT API document

- IoT platform website > developer center > API document/application case

Setting development board

Devices connecting to platform

Building IoT application service

- Installing software and hardware (sensor, OS, library, etc.)
- Using NB-IoT SDK and refer to sample code

- Adding smart electricity device on IoT platform
- Update values to IoT platform through southbound interface

- Get electricity consumption data (instantaneous VA and electricity demand, total sold watt)by calling northbound interface (Restful API)
- Develop application service and website for smart electricity meter



NB-IoT Development Board

Device management

Profile Extended attribute information

Device name

Device description

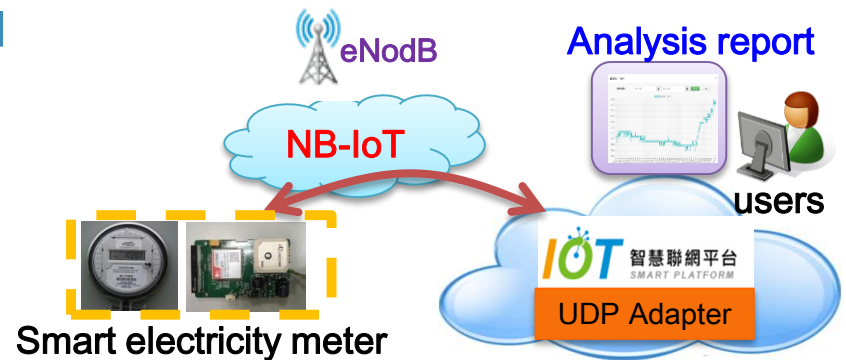
Device type ☒ General ☐ Modbus ☐ ONVIF Video

Longitude Latitude

URI

Installing HW/SW

Adding devices on IoT platform

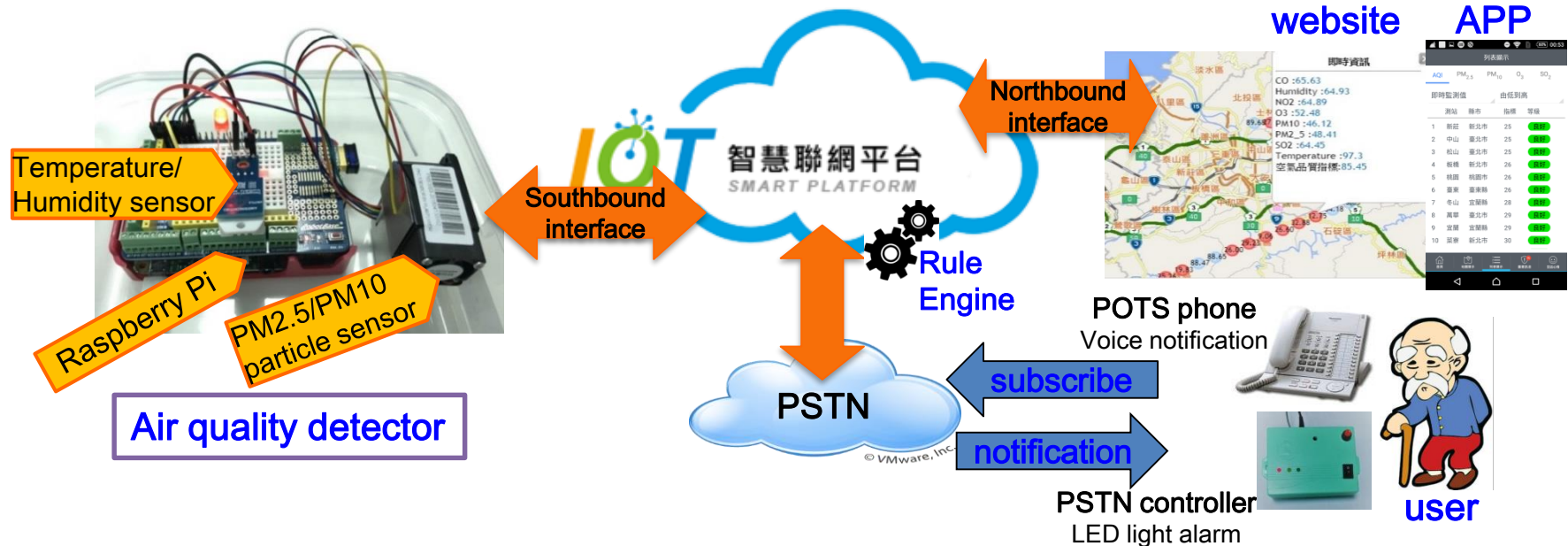


Smart electricity meter

Development for connection between meter and platform

Use Case : Air Quality Notification

- Collecting air quality data through IoT platform, and **informing people about the air quality through PSTN, website, or APP.**
- Features
 - **Multiple SDK** : Easy development for air sensing device with raspberry Pi.
 - **Northbound interface**、**IoT APP framework** : Easy development for air quality monitoring website and APP.
 - **Dedicated PSTN application from telecom operator**: Users can query the air quality status and receive the auto-warning for air pollution through PSTN.



Air Quality Notification (Cont.)

Development procedure

- Related sample code and IoT API document
 - IoT platform website > developer center > API document/application case

Setting Raspberry Pi

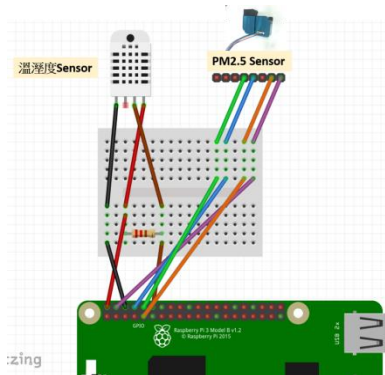
Devices connecting to platform

Building IoT application service

- Installing software and hardware (sensor, OS, library, etc.)
- Refer to sample code, and get sensor value

- Adding air monitoring device on IoT platform
- Update values to IoT platform

- Setting rule engine on IoT platform to call landline phone system and make notifications of air quality.
- Calling northbound interface to build IoT application service



Installing Raspberry Pi

Device management

Profile Extended attribute information

Device name

Device description

Device type ☒ General ☐ Modbus ☐ ONVIF Video

Longitude Latitude

URI

Device

Next

Adding devices on IoT platform

Event Trigger

Edit an Event Trigger

Profile

Name Description

Conditions information (Expression)

Sensor	Type	Condition	Threshold
Please select a sensor	Data comparison	>=	80

Actions information (Action)

Action type	Action Mode	Mode setting
Event triggered action	E-mail notification mode	<input type="text" value="Enter e-mail"/>

Setting Rule Engine



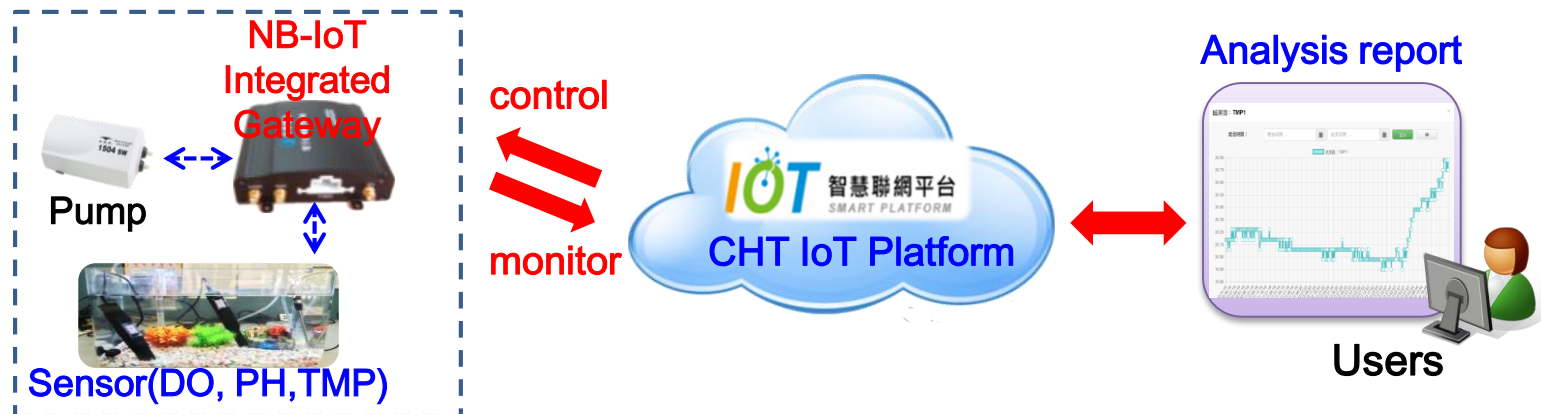
PM2.5 warning



Air Pollution warning

Use Case : Water Quality Monitoring

- With CHT IoT Platform and NB-IoT Integrated Gateway, we develop the water quality monitoring system. Users can remotely monitor and analyze the water quality including dissolved oxygen, PH Value and temperature in order to prevent damage to aquaculture industry such as cold damage or chemical.
- Features
 - NB-IoT tech: for online measurement of consumption without radio frequency interference
 - CHT IoT platform: for gathering and analyzing user's power consumption data, controlling water quality automatically and remotely.
 - Self-running mechanism: for being functional when abnormal internet connection occurs.



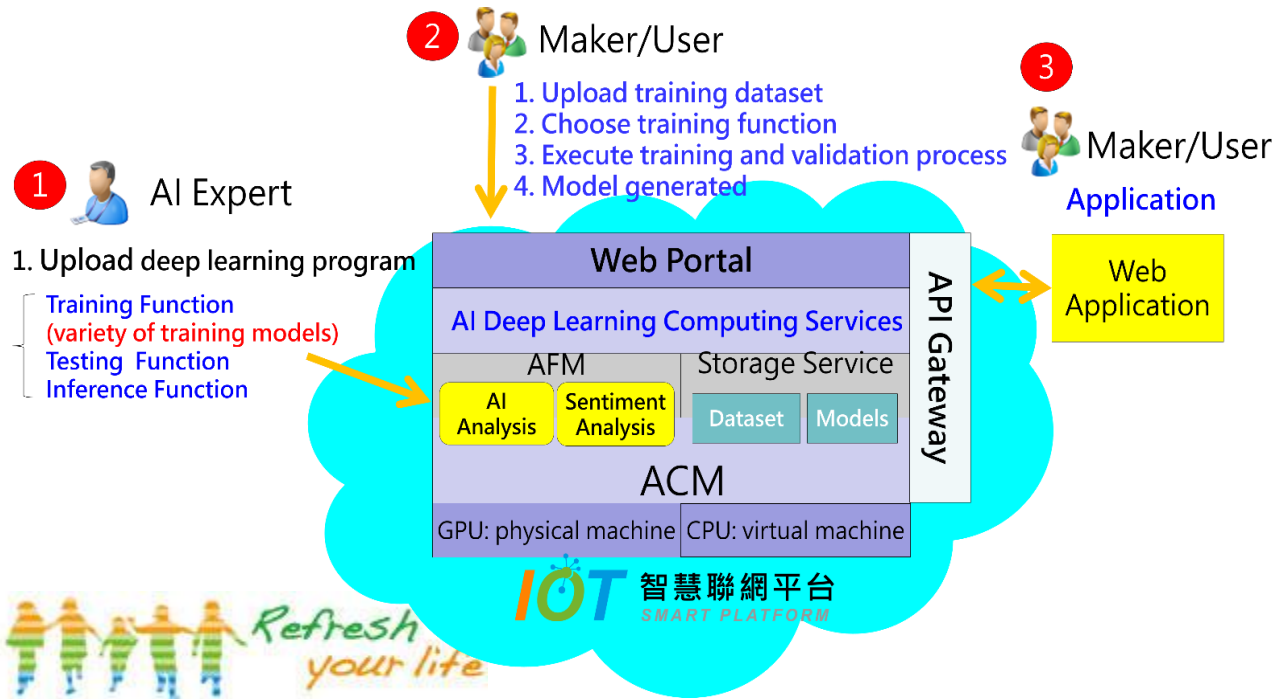
Under Development : AI Deep Learning Sentiment Analysis

■ Introduction:

IoT platform provides convenient **Web Portal** as well as variety of **AI models and framework**, making it easier to fast implement AI techniques such as **deep learning model training** and **AI development** for the makers/users.

■ Features

- Friendly Web Portal with intuition
- Various deep learning models and framework
- High-speed GPU computing environment: **Charge On Demand** and **flexible computing resource deployment** to save cost on development, application, and operations.



Conclusion

- CHT: CT-> ICT-> IOT- > Digital Integration Solution?
- CHT aims to construct a **complete IoT ecosystem** with partners by building up an **open IoT platform** and developing innovative applications on it.
- **Making good use of data analysis** on the IoT platform facilitates the development of value-added services.
- We must face the **big challenge of IoT security threat**.
- CHT provides an open IoT platform, a complete IoT security solution, and lots of innovative IoT services.



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See U IEEE GLOBECOM
2020 Taipei Taiwan**

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