

HUAWEI ENTERPRISE ICT SOLUTIONS **A BETTER WAY**



Huawei AMI Solution

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HUAWEI TECHNOLOGIES CO., LTD.



Agenda

1 Trend and Challenge

2 Huawei AMI Solution

A Overview

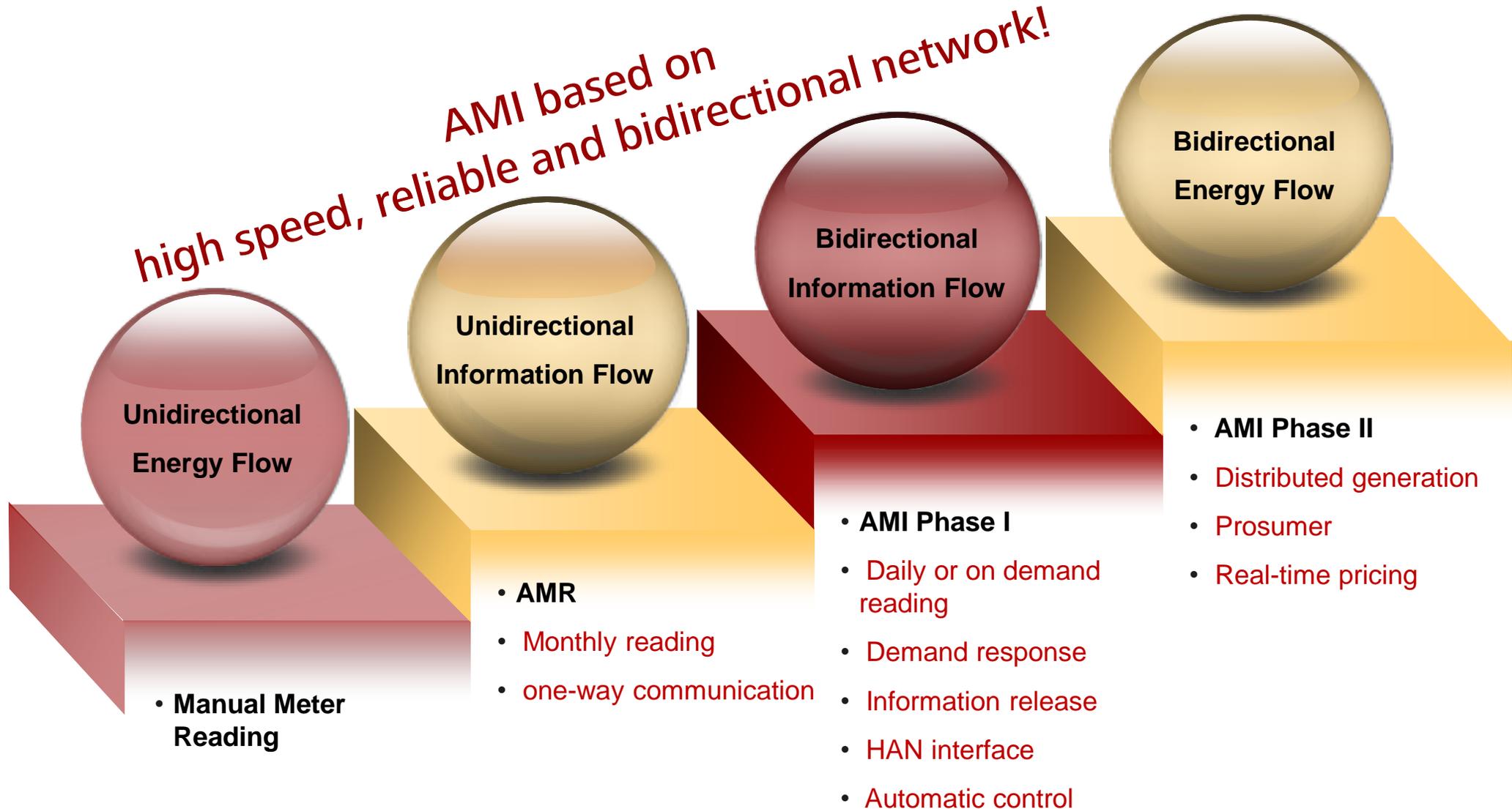
B Core Block

C Scenario

3 Case Study



Trend of AMI: Now and Future



Trend of AMI: the Worldwide



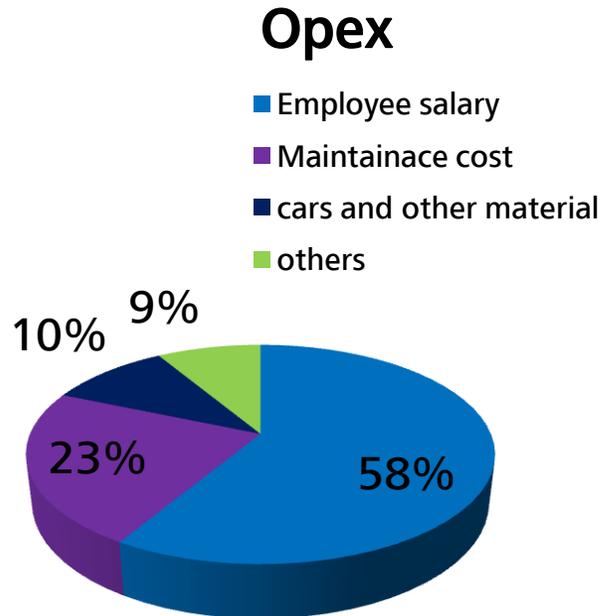
Driving Force of AMI



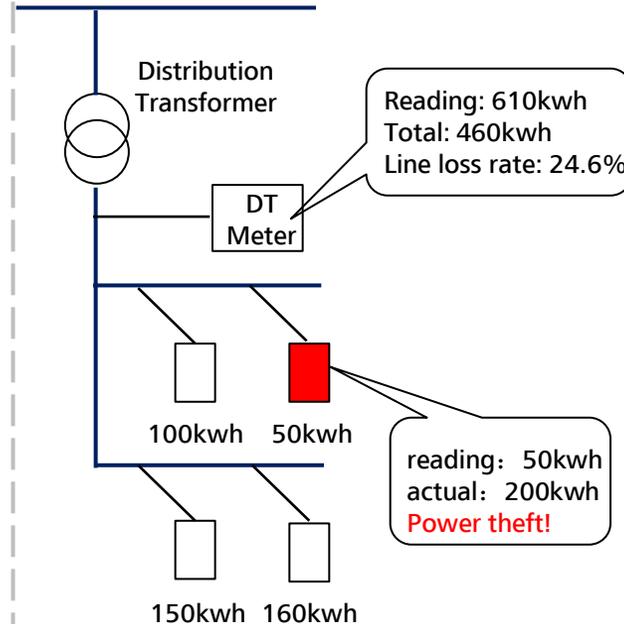
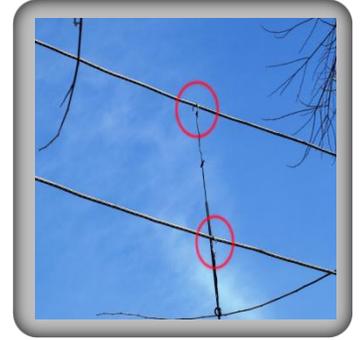
Driving Force 1: Reduce labor cost

- Manual meter reading lead to high labor cost
- Economic loss caused by reading error

Case: BC Hydro(Canada) spend Millions USD per year for operation of manual meter reading.



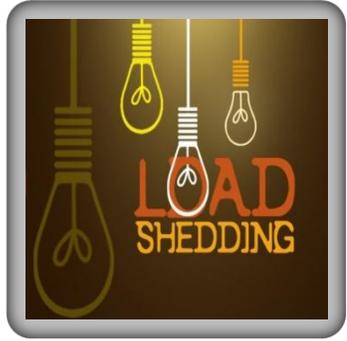
Driving force 2: Anti-tamper, reduce line loss rate



- Power theft is the main cause of line loss
- Hard to position power theft
- Traditional meter can't prevent power theft

Case: UPPCL(India) claim that the line loss rate of Uttar Pradesh up to 40%,power theft is the main reason.

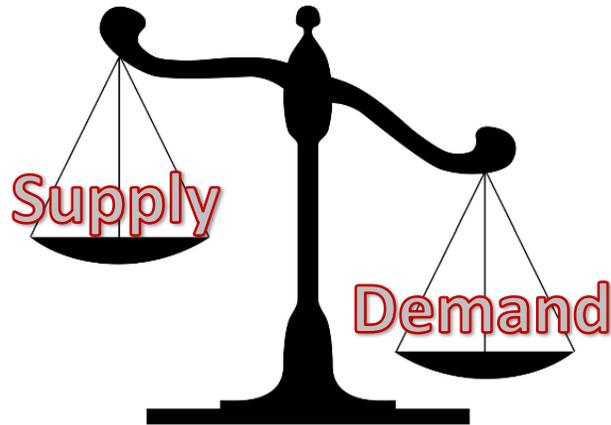
Driving Force of AMI



Driving Force 3: Load Management

- Unbalance of power supply and demand
- Lack of load management, cannot ensure the basic demand of resident

Case: Iraq Kurdistan MoE plan a AMI project to improve the imbalance of power supply and demand



Driving force 4: Interaction with customer, demand response



Monthly Total:
256.7kWh

Details ?

- Consumption details is unclear to customers
- Real-time pricing requirement

Case: Adelaide Solar City(Australia) project provide IHD to customer for information release.

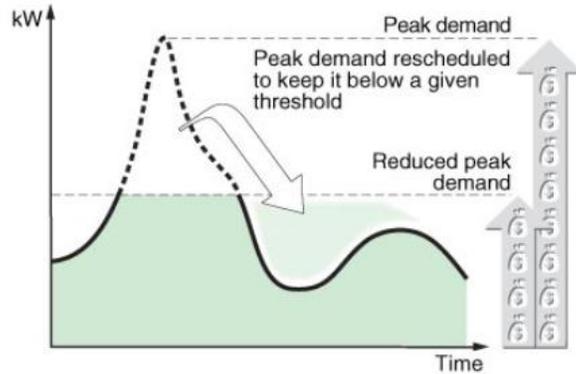
Driving Force of AMI



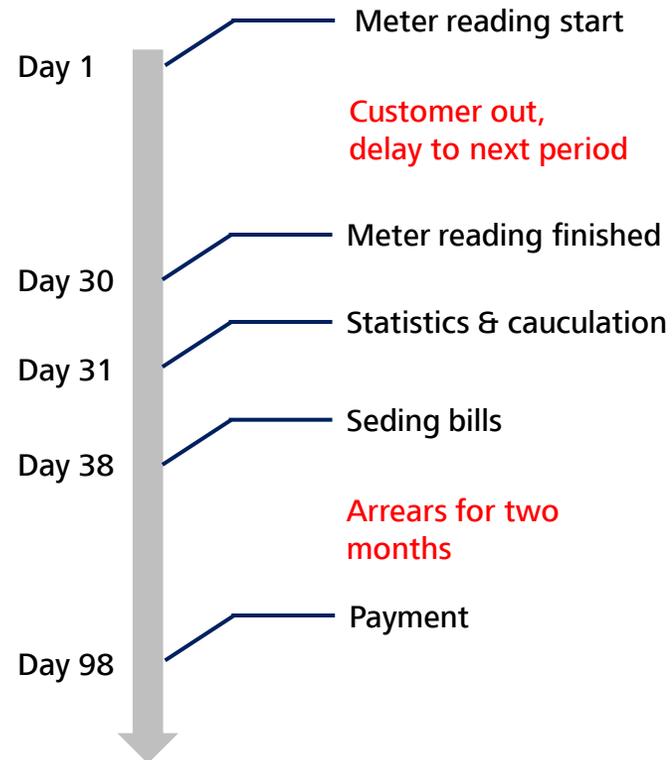
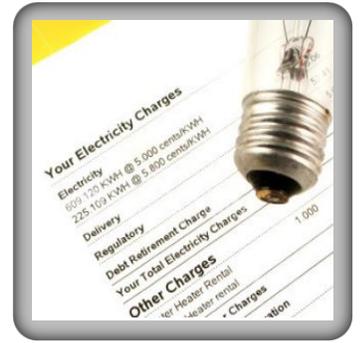
Driving Force 5: Peak Shaving

- Drive of energy saving policy
- Peak load shifting, reduce the capacity of power grid

Case: The vision and strategy for Europe's electricity network of the future: saving energy and reducing greenhouse gas emission



Driving force 6: Speed up cash cycle



- Inevitable delay of each part of manual meter reading
- Effect to cash cycle caused by arrears

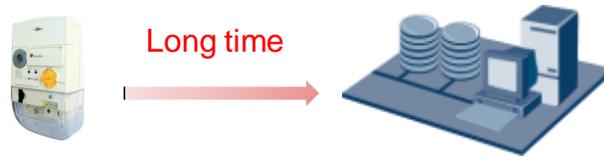
Case: Arrears of SGCC of Xinjiang province (China) up to 442 million RMB

Challenges– the Network

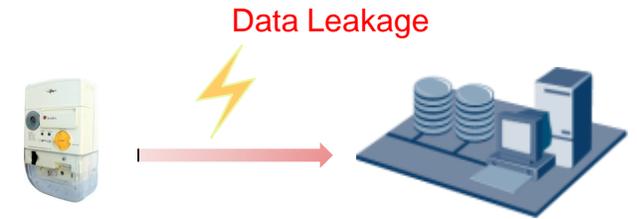
Low Success Rate



Not Real "Real-time"
One-way Communication



Low Security



Meter

You Need A High Speed,Reliable,Bidirectional Pipe



MDM

Challenges– the Platform

Performance:
Massive terminal connection, high requirement to DCP performance

expansibility:
The requirement to expand to capability improving



Compatibility:
Connection with vendor , different protocol terminal

Interoperability :
Interface to different 3rd systems such as billing, SCADA,EMS

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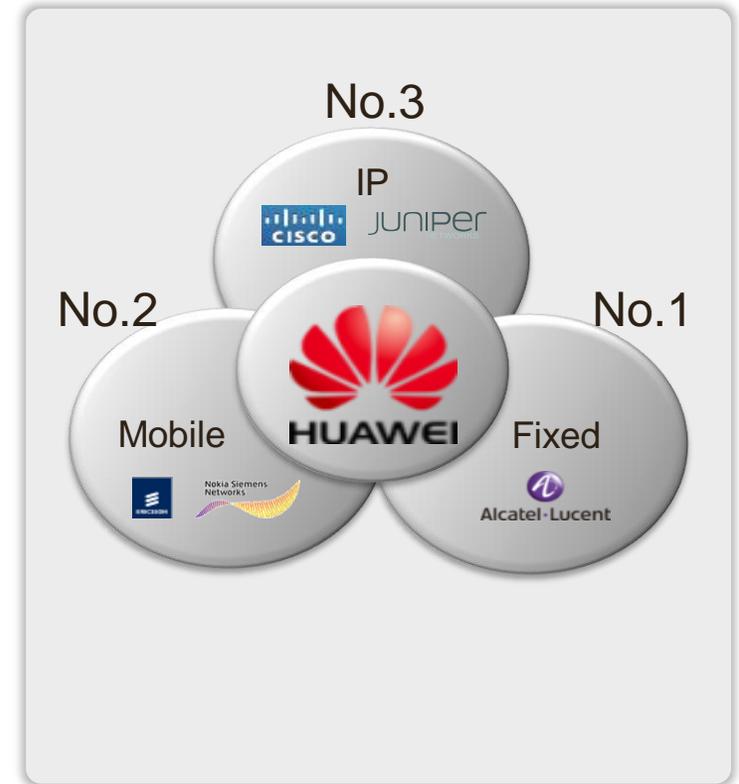
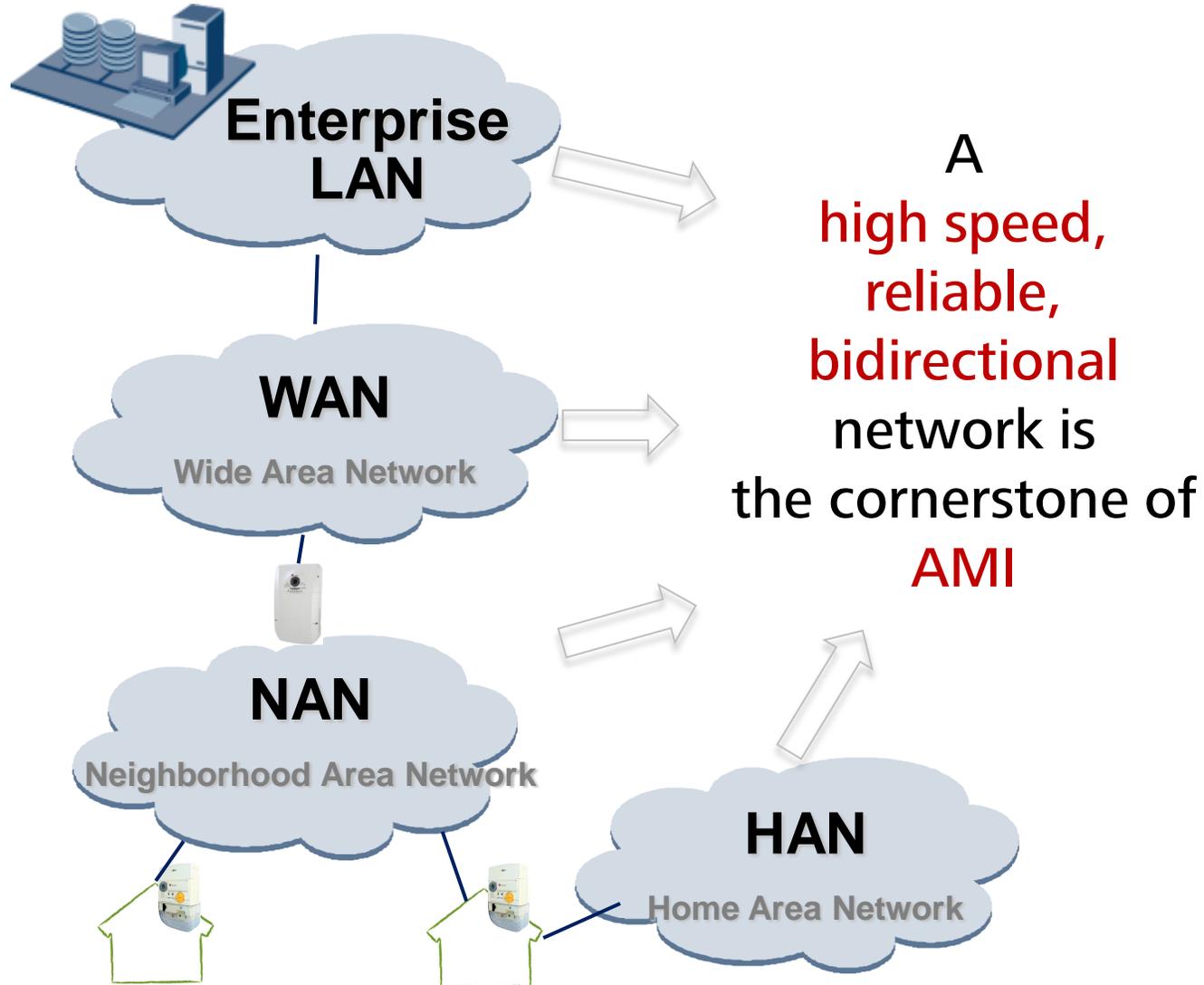
B Core Block

C Scenario

3 Case Study



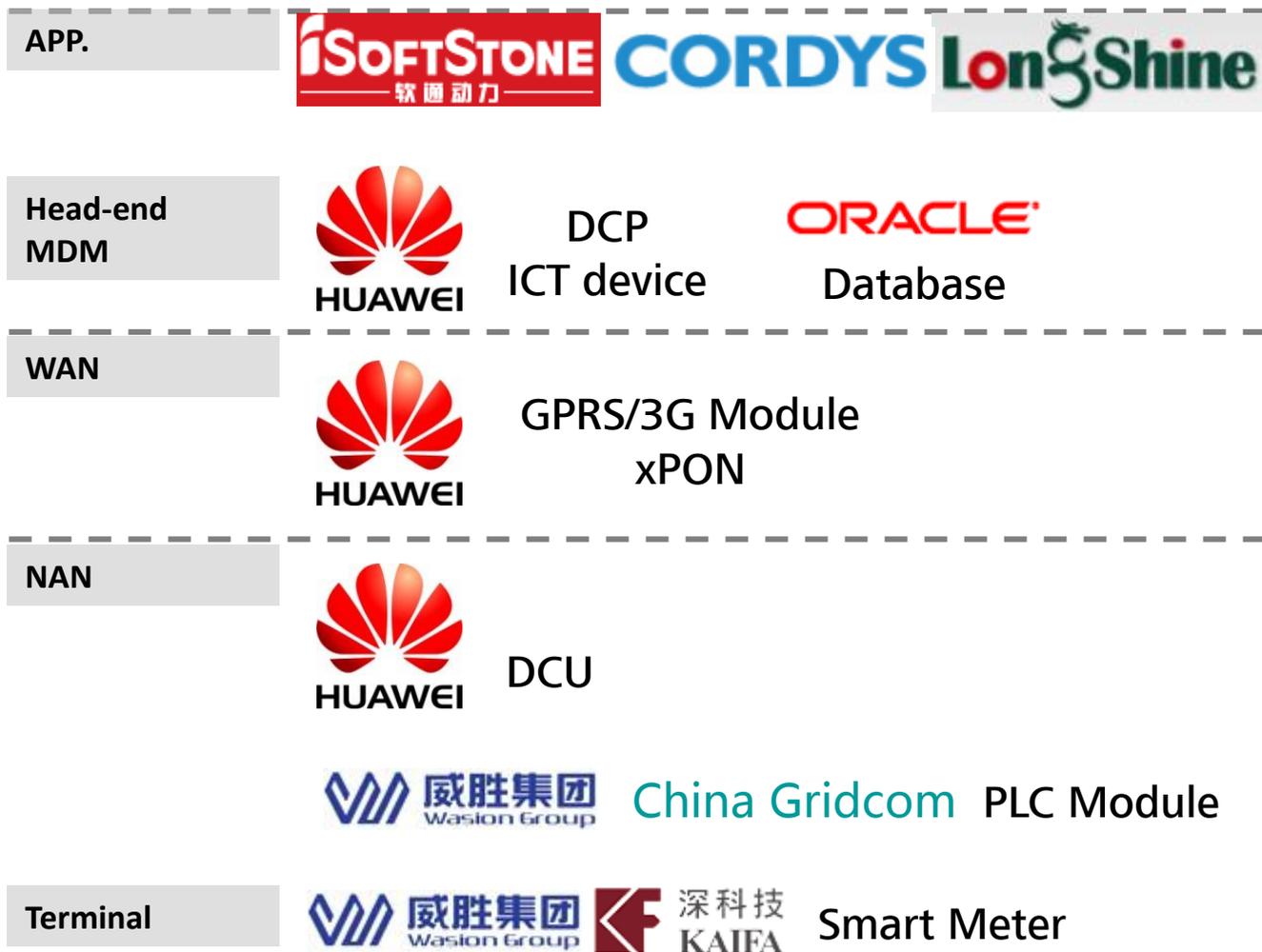
Why Huawei



Huawei: World Leading Communication Vendor

Huawei AMI Ecosystem

Huawei and partners in AMI solution



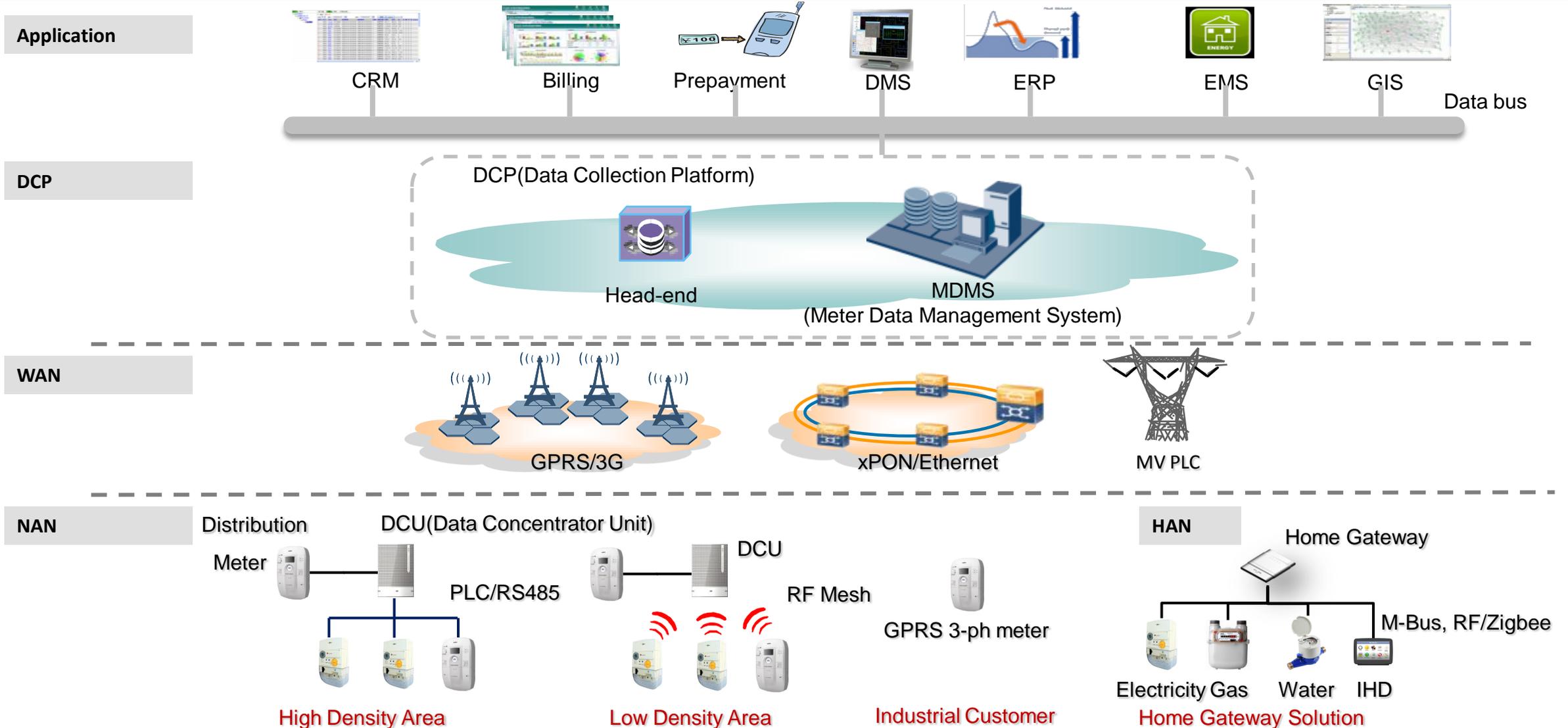
Organization Huawei Joined



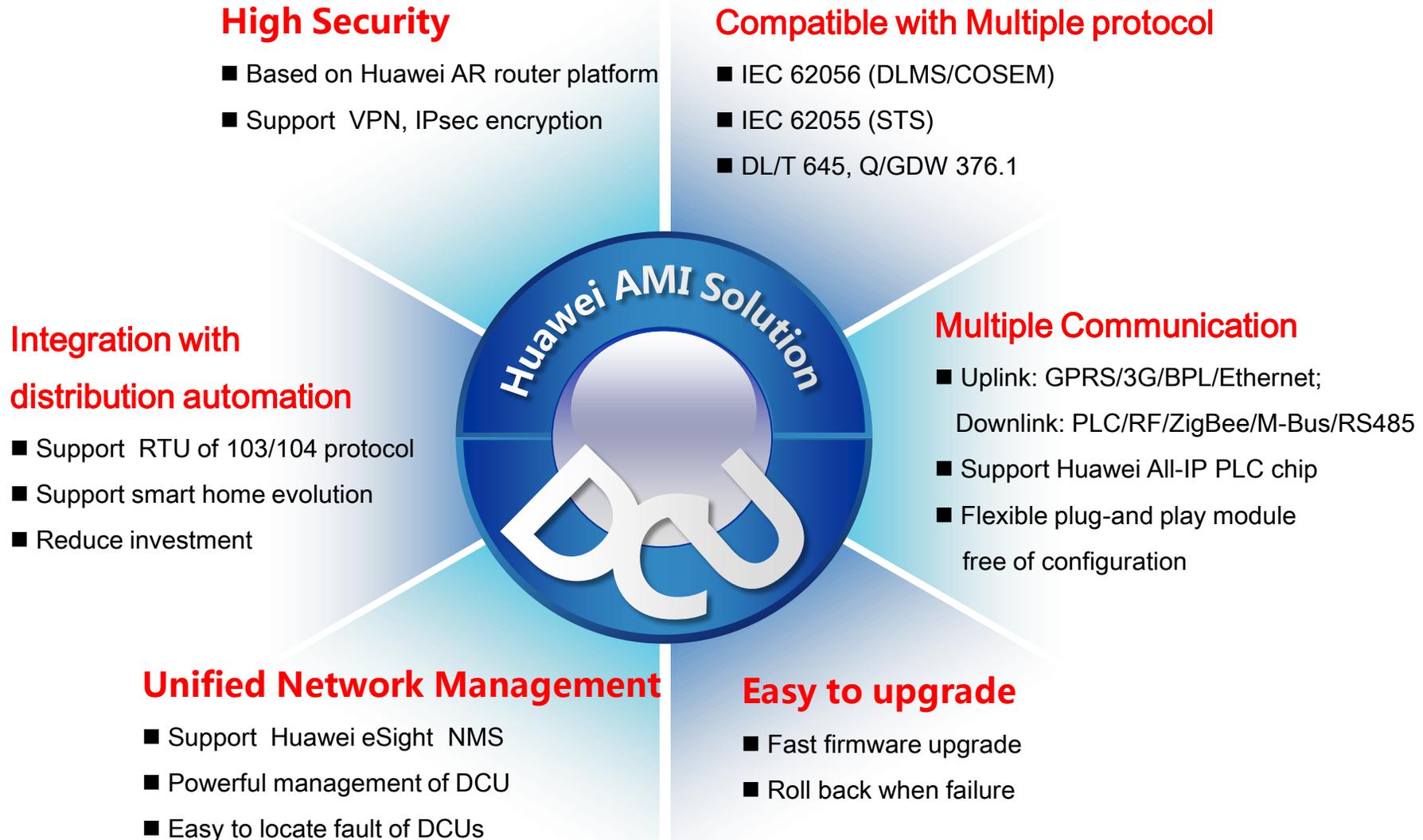
Huawei AMI Key Message

- All-IP, high speed, two-way network
- M2M based platform
- Integration with distribution automation

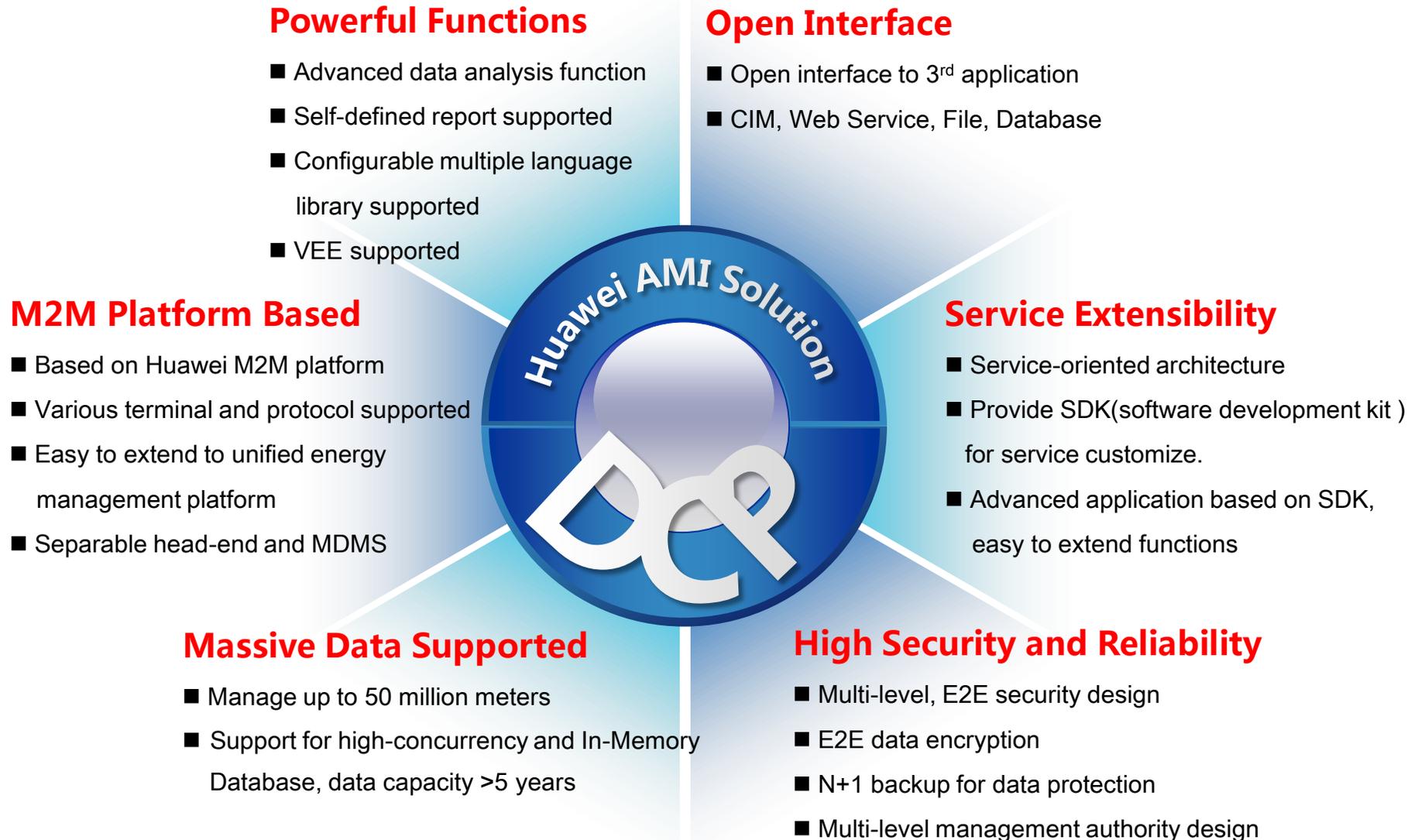
Huawei AMI Solution Overview



Highlight of Huawei DCU



Highlight of Huawei DCP



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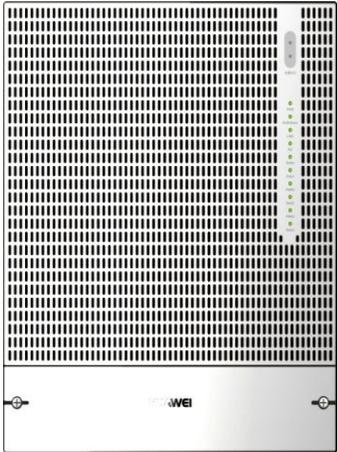
B Core Block

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Core Block 1: DCU



Electrical

Voltage	3*220VAC or 48VDC
Voltage Range	-36V ~ +71V
Frequency	50/60Hz

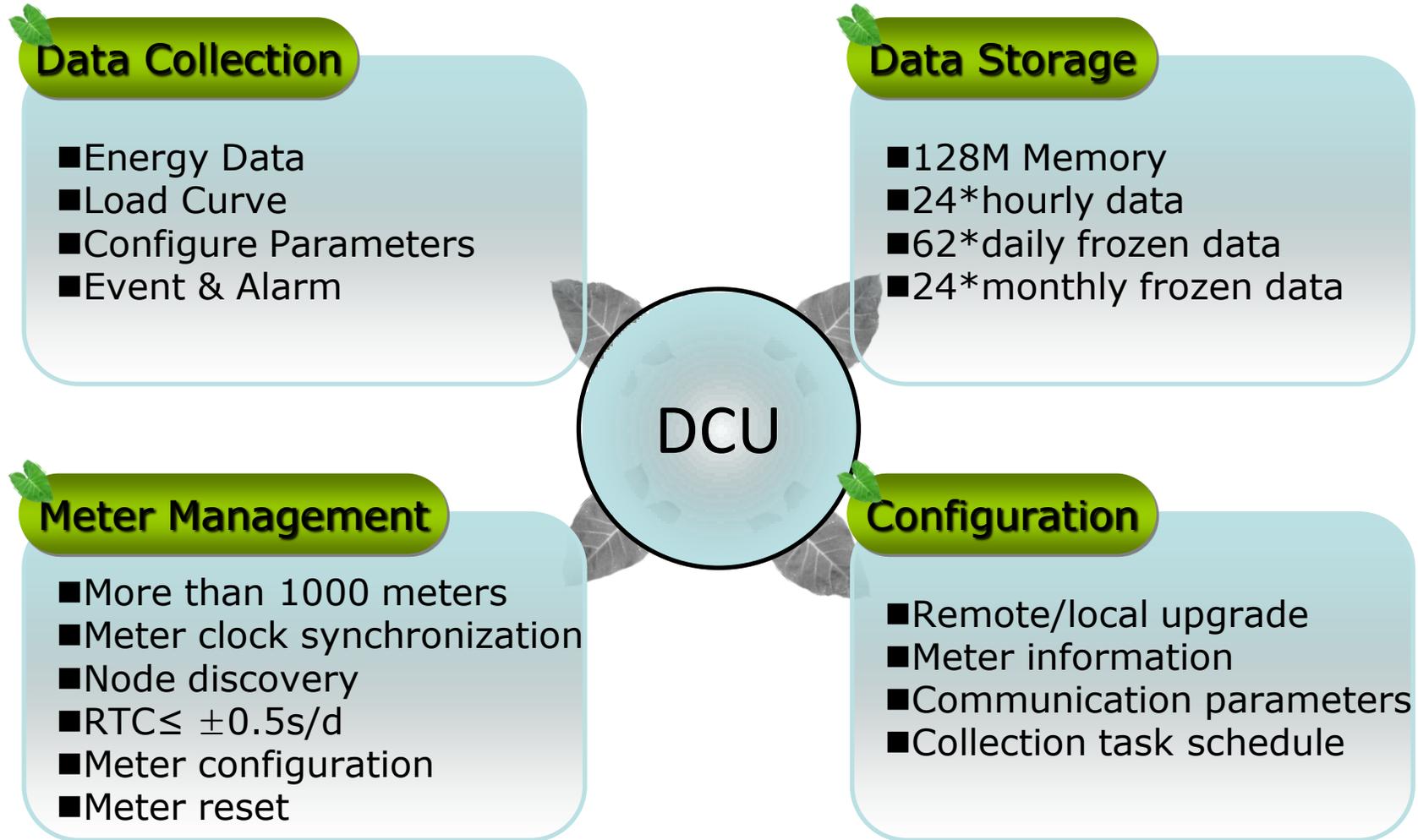
Environmental

Operating Temperature	-40 °C ~ +70 °C
Storage Temperature	-40 °C ~ +80 °C
Operating Humidity	Maximum 95%
Ingress Protection	IP51
Altitude Height	4000m

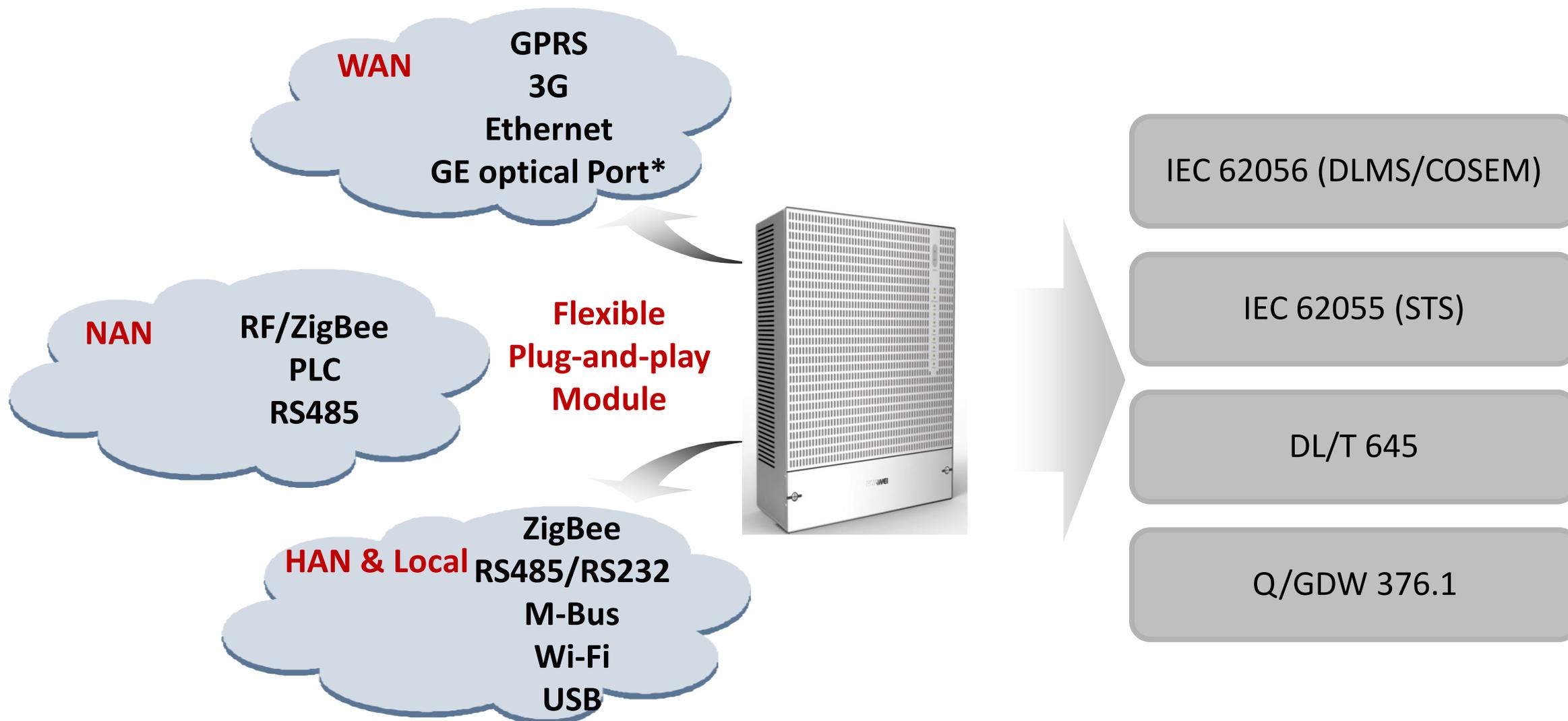
Mechanical

Dimension (L*W*H)	220*250*89.1(mm)
Weight	4.2kg
Material	PC
Lifetime	10 years

DCU feature- Basic Functions

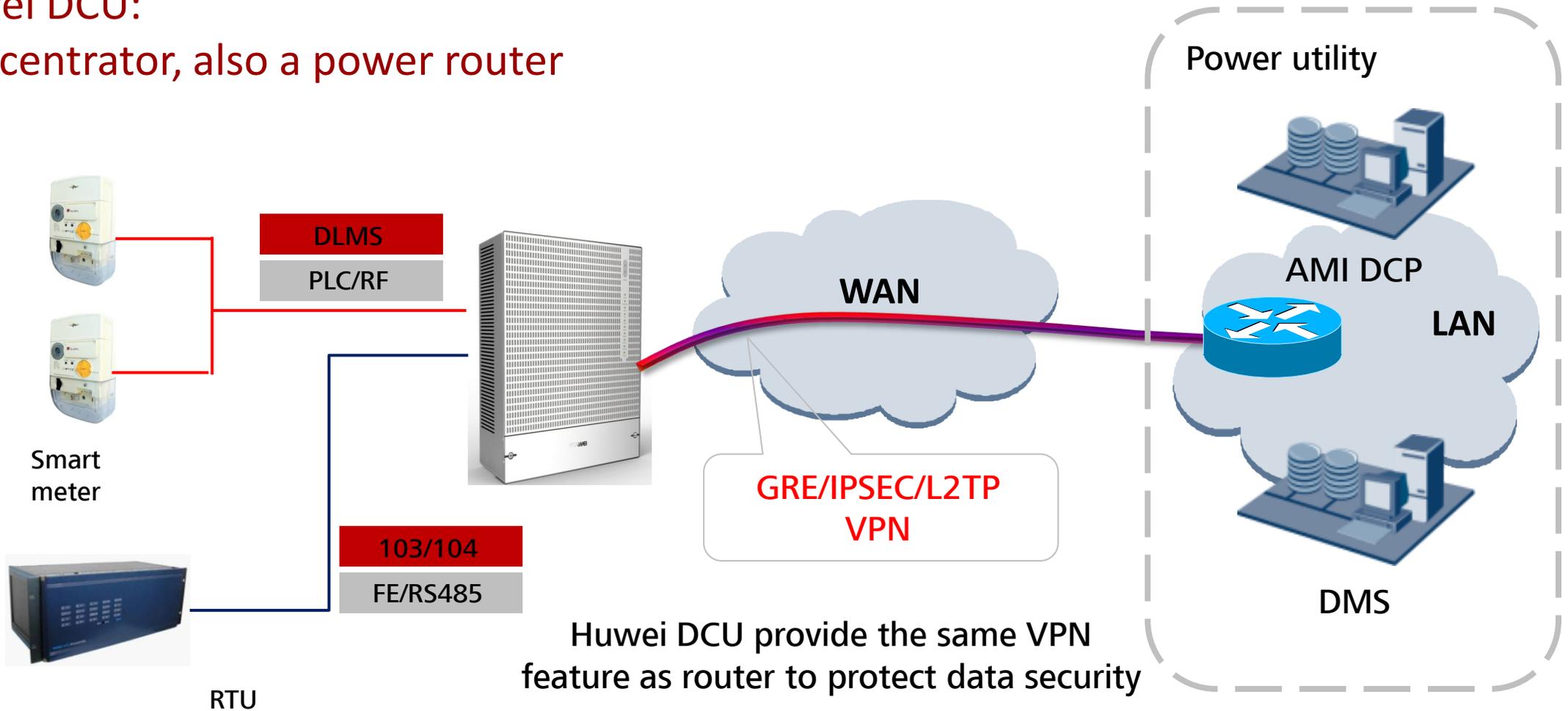


DCU feature- Multiple Interface and Protocol

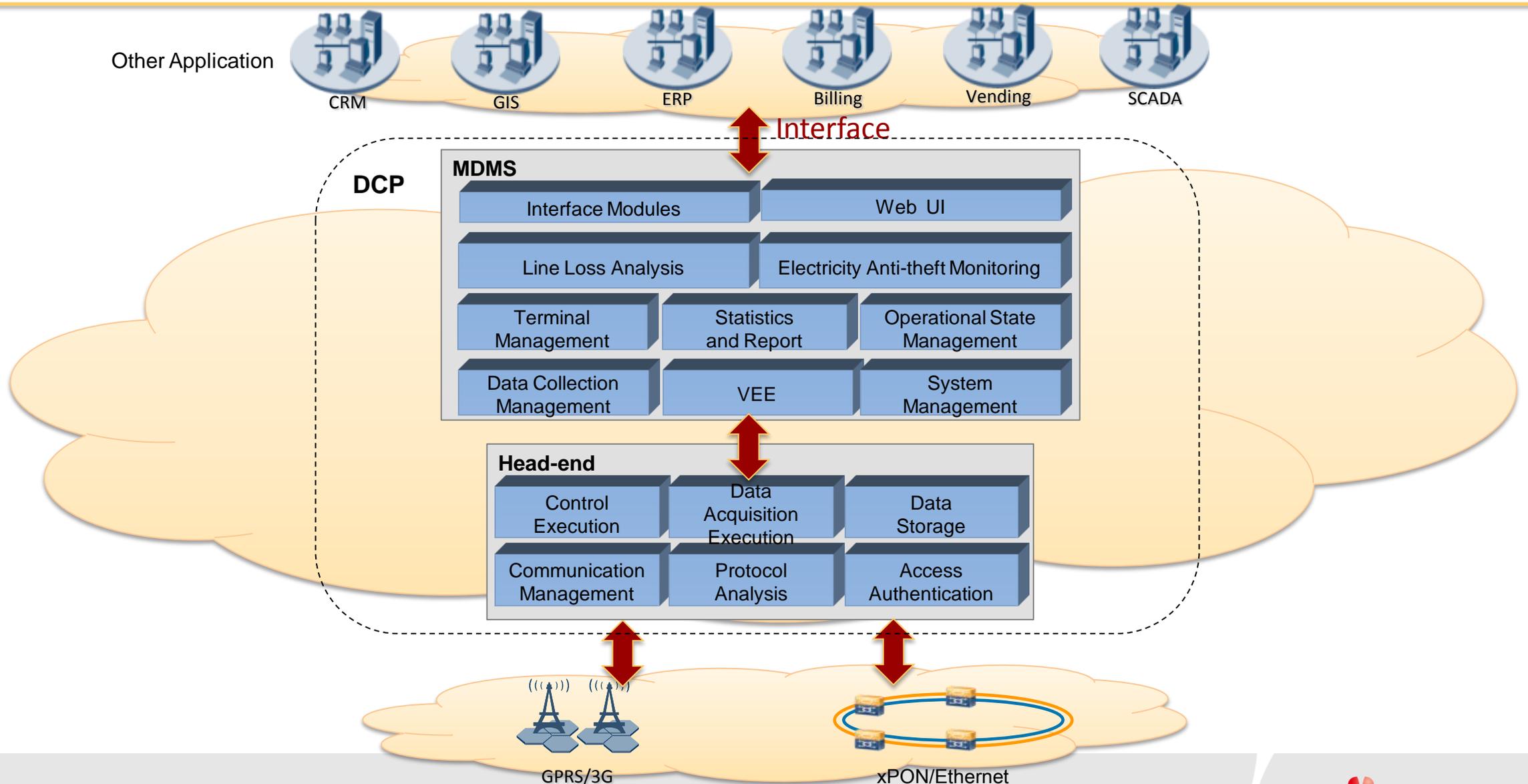


DCU feature-A Power Router

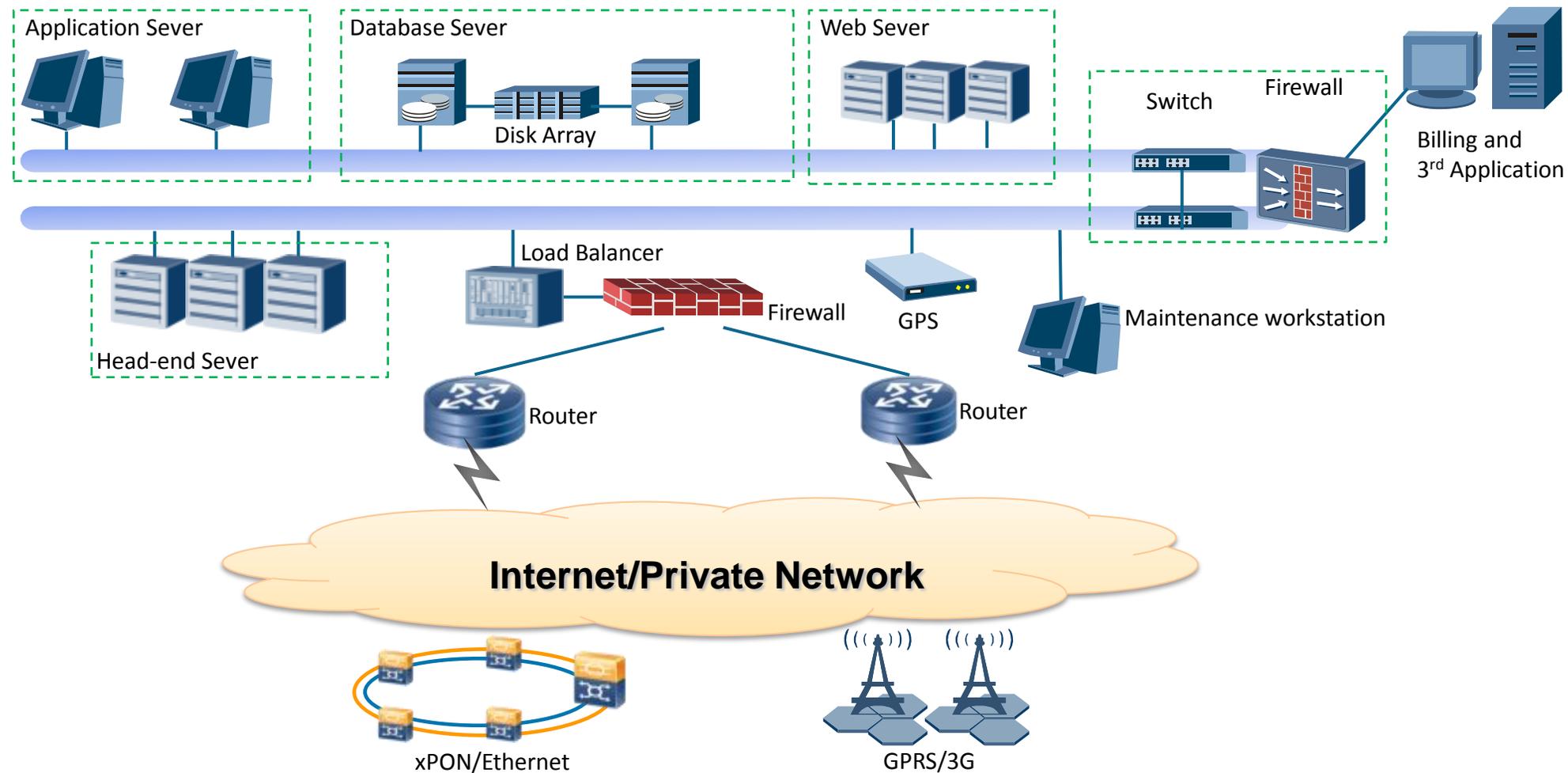
Huawei DCU:
A concentrator, also a power router



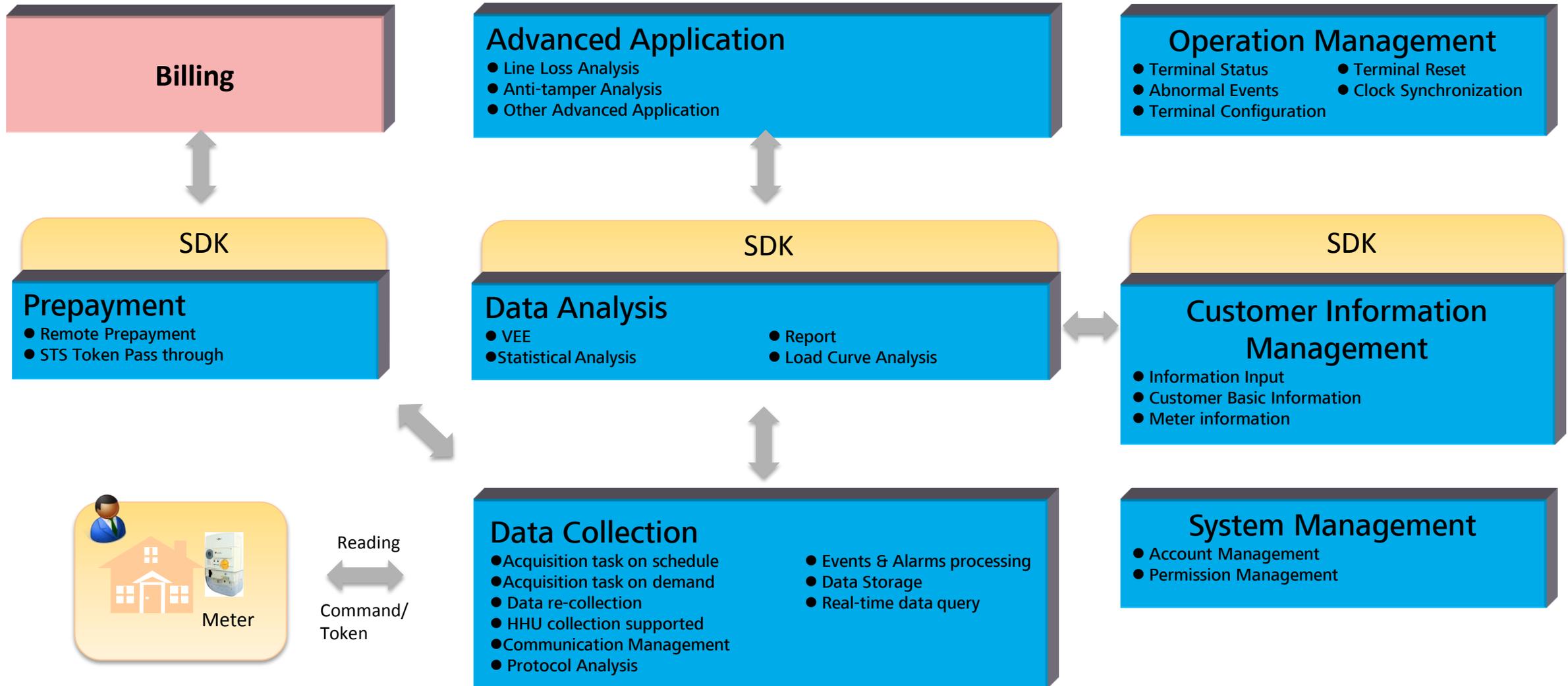
Core Block 2-DCP:Software Architecture



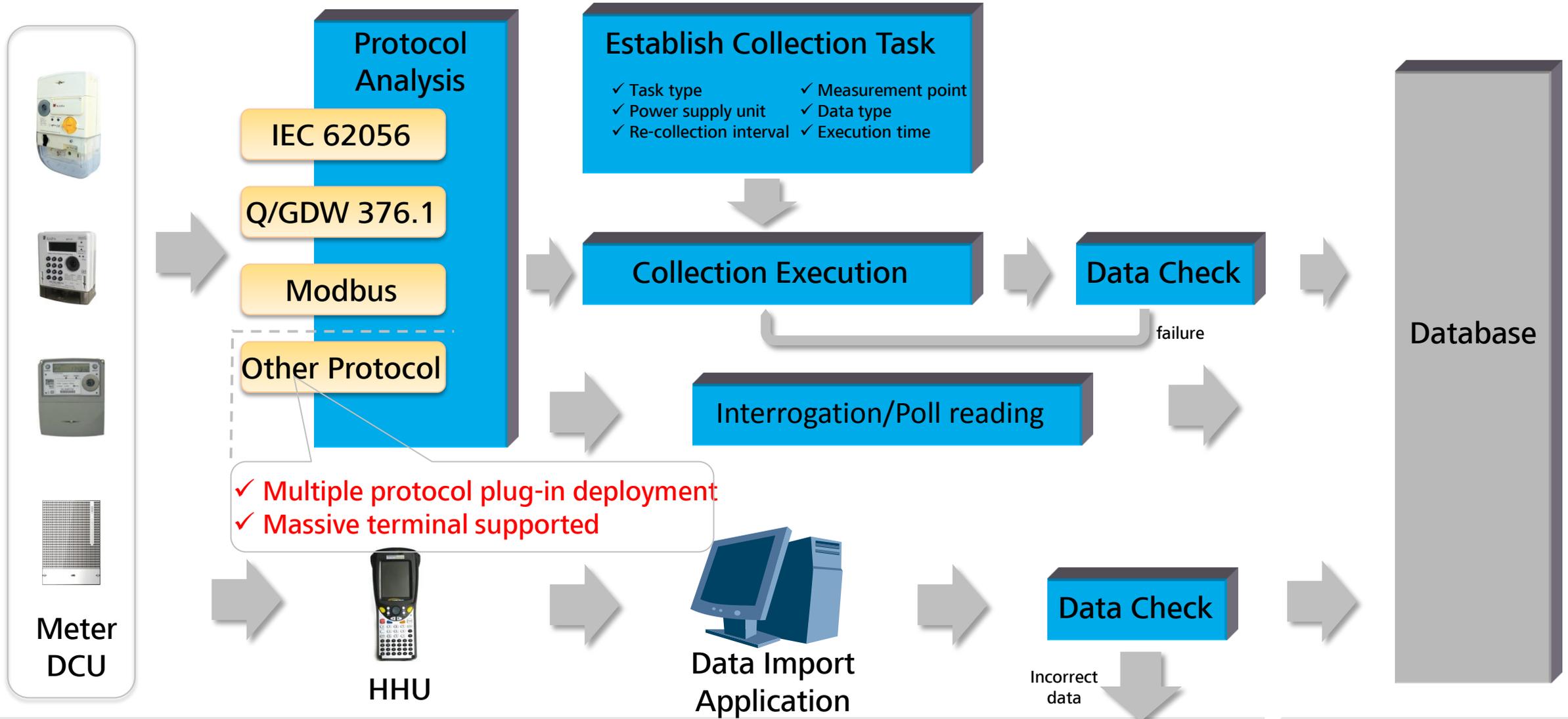
DCP-Hardware Architecture



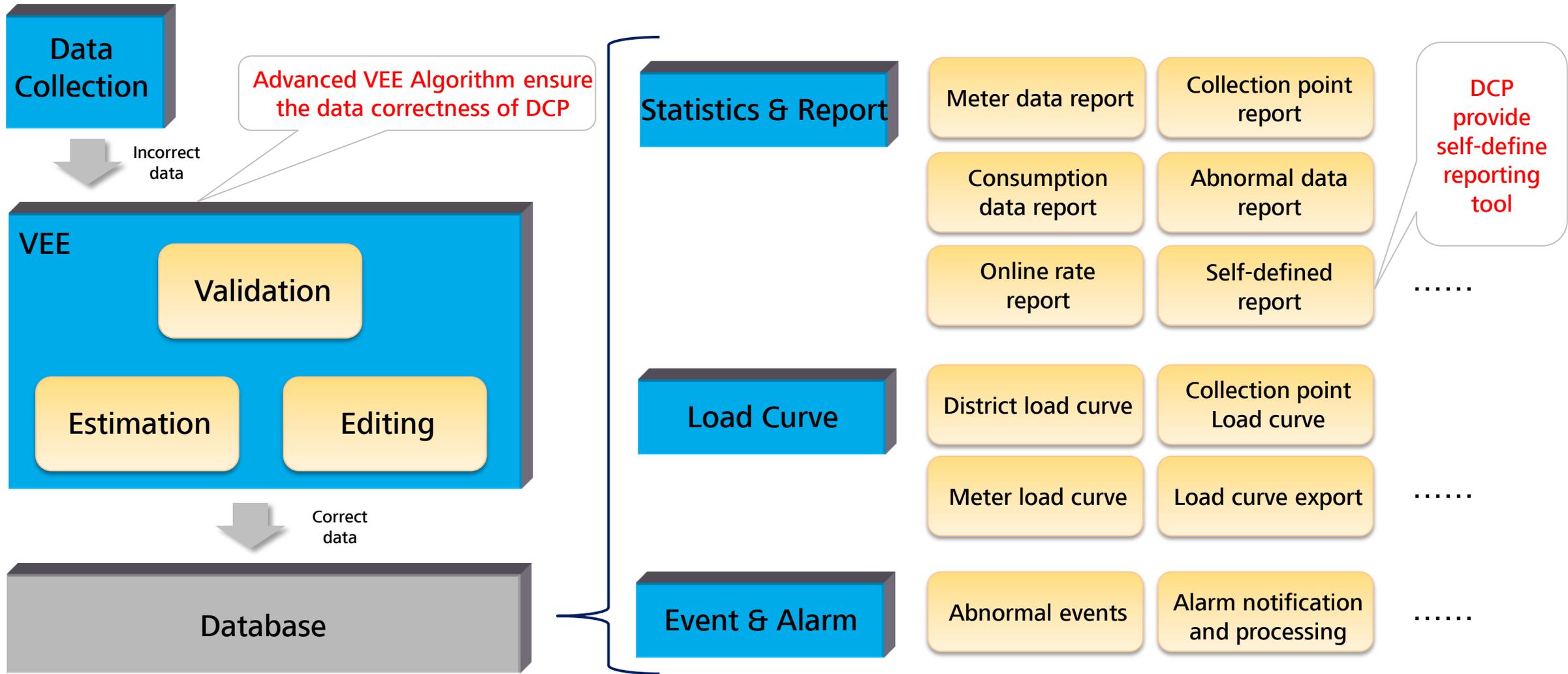
DCP-Function Overview



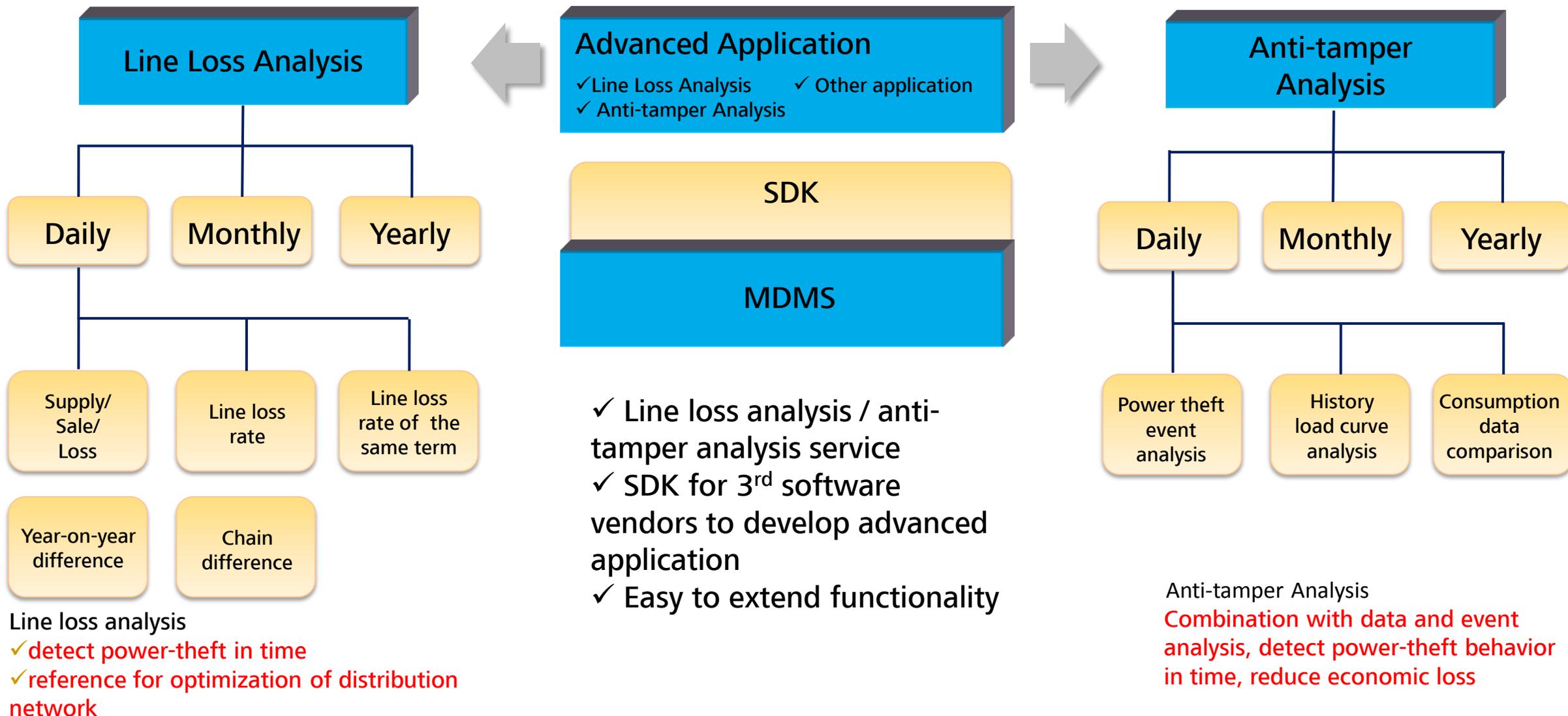
DCP-Data Collection



DCP-Data Analysis

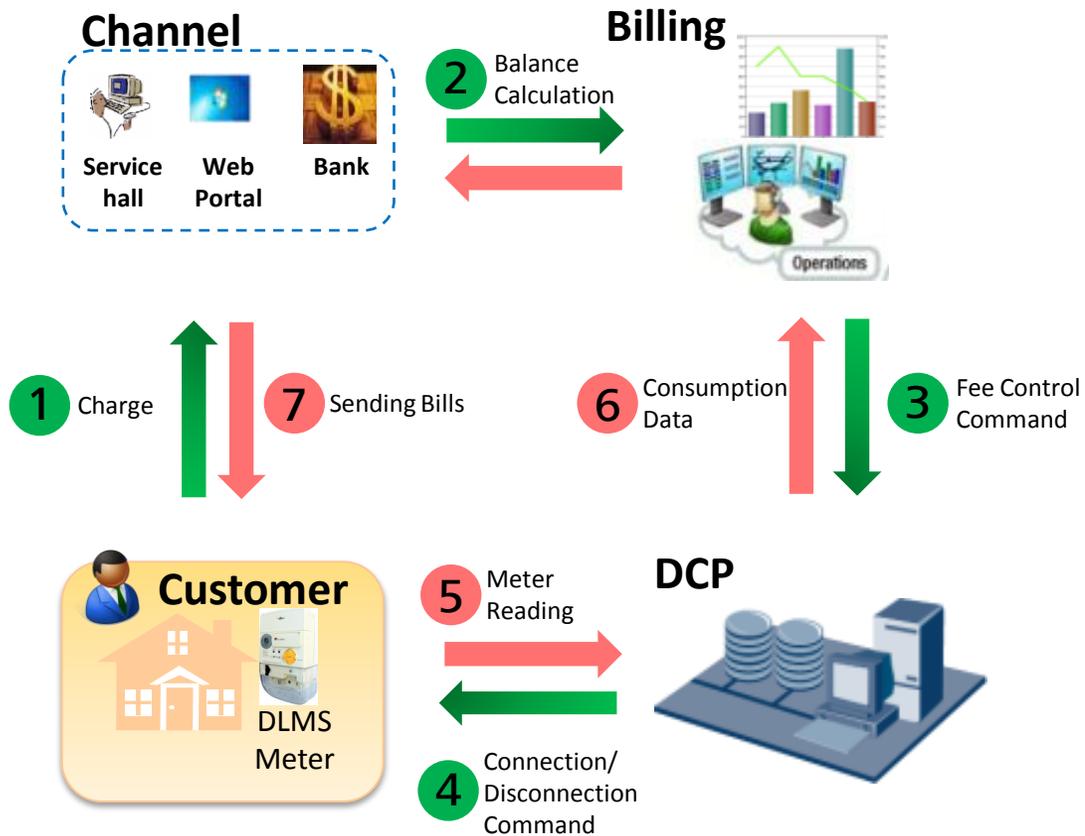


DCP-Advanced Application

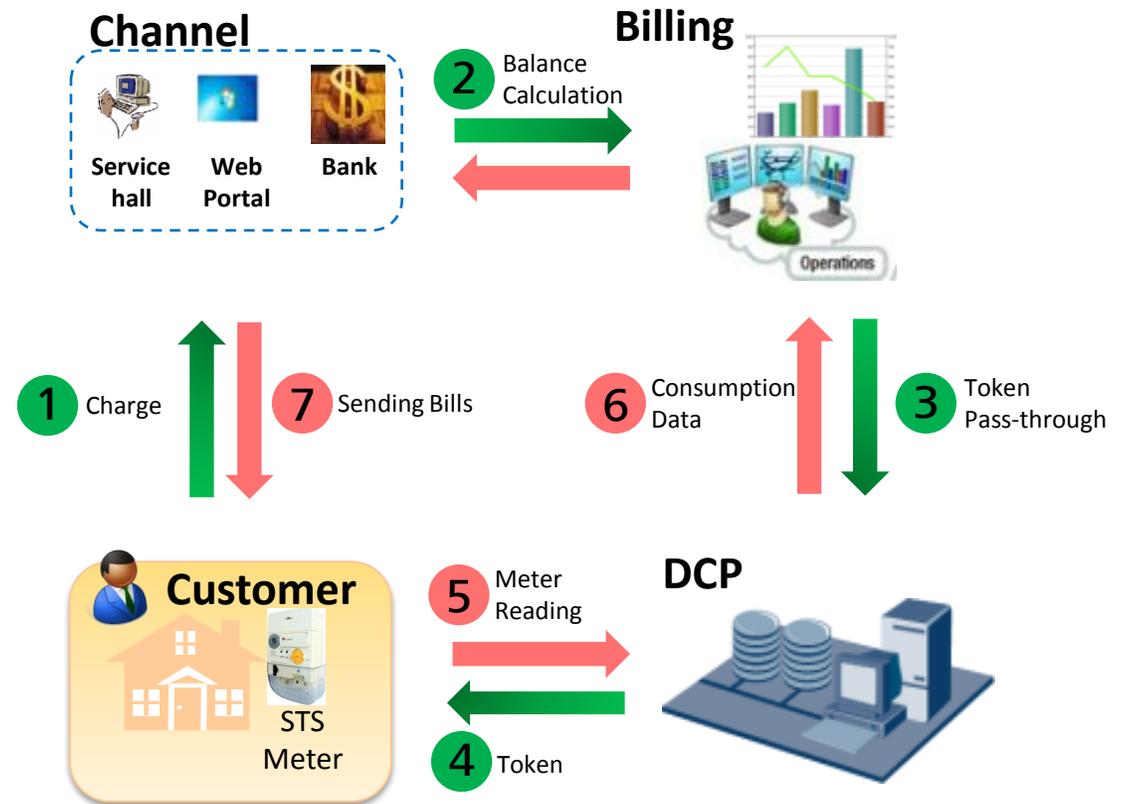


DCP-Prepayment

Remote Prepayment mode

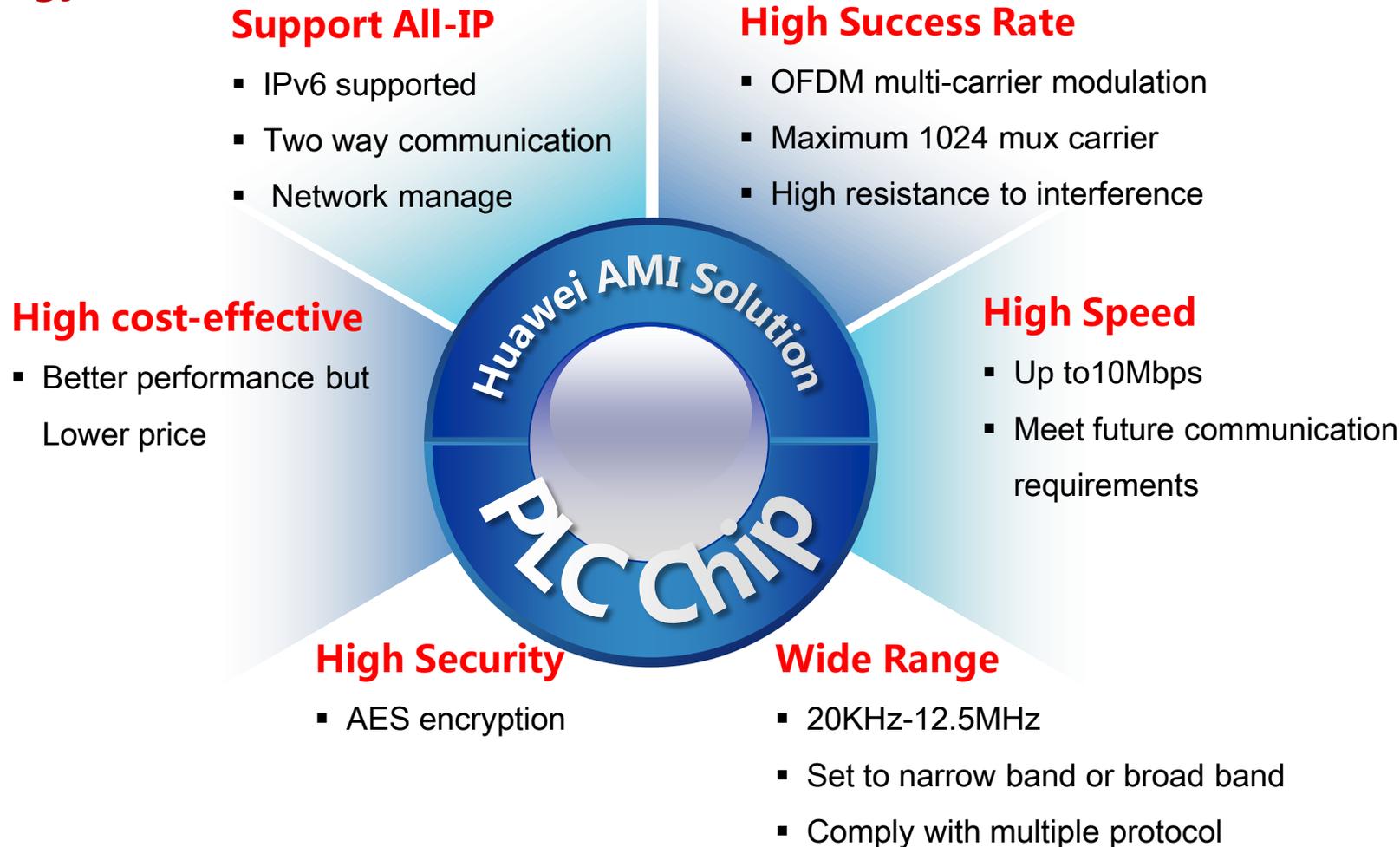


STS Prepayment mode



Core Block 3-Communication Network

Huawei PLC Technology



Core Block 4—Smart Meter: Single Phase Meter



MA101
Single Phase
DLMS Smart Meter

Technical Specifications

Accuracy	Active	Class 1.0
	Reactive	Class 2.0
Voltage	Voltage Range	230V (-25%~20%)
	Voltage with Standard	500VAC 12 hours
Current	Rated Current	5(100)A
	Starting Current	5mA
Frequency		50/60Hz ± 5%
Power Consumption		≤1.7W, 3.5VA
Load Control Relay		250VAC 10A
Operating Temperature		-40 °C ~ +70 °C
Storage Temperature		-40 °C ~ +80 °C
Operating Humidity		Maximum 95%
Ingress Protection		IP54

Main Features

Communication Interface:

PLC/RF/ZigBee, GPRS/3G, RS485, Optical Port
Protocol

DLMS/COSEM

Measurement and Power Quality:

Import/export active/reactive/apparent energy
and power, PF, Vrms, Irms, Frequency

Time-of-use

16 programmable tariffs for energy/demand

Load profile for energy and power quality:

16 programmable channels for energy/demand/power quality

Log books:

Up to 20 events record with a time stamp:

Real time clock:

Clock accuracy within 0.5 s/day under 23°C.

Anti-tamper :

Inverse current detection/Partial earthing detection/Magnetic
field detection/Terminal and meter cover removal

Core Block 4—Smart Meter: Three Phase Meter



MA301 Three Phase Direct Connection Meter



MA302 Three Phase CT Connection Meter



AM202 Three Phase PT/CT Connection Meter

Technical Specifications

		MA301	MA302	AM202
Accuracy	Active	Class 1.0	Class 0.5	Class 0.5S or 0.2s
	Reactive	Class 2.0	Class 2.0	Class 2.0
Voltage	Voltage Range	3*230V (-25%~20%)	3*230V (-25%~20%)	3*57.7/100V (-25%~20%)
	Voltage with Standard	500V 12 hours	500V 12 hours	400VAC 12 hours
Current	Rated Current	5(100)A	5(10)A	2(10)A
	Starting Current	5mA	5mA	2mA
Frequency		50/60Hz ± 5%	50/60Hz ± 5%	50/60Hz ± 5%
Power Consumption		≤1.7W, 3.5VA	≤1.7W, 3.5VA	≤2W, 10VA
Load Control Relay		250VAC 10A	250VAC 10A	250VAC 10A
Operating Temperature		-40℃ ~ +70℃	-40℃ ~ +70℃	-40℃ ~ +70℃
Storage Temperature		-40℃ ~ +80℃	-40℃ ~ +80℃	-40℃ ~ +80℃
Operating Humidity		Maximum 95%	Maximum 95%	Maximum 95%
Ingress Protection		IP54	IP54	IP54

Main Features

Communication Interface:

PLC/RF/ZigBee, GPRS/3G, RS485, Optical Port Protocol

DLMS/COSEM

Measurement and Power Quality:

Import/export active/reactive/apparent energy and power, PF, Vrms, Irms, Frequency, THD

Time-of-use

16 programmable tariffs for energy/demand

Load profile for energy and power quality:

16 programmable channels for energy/demand/power quality

Log books:

Up to 20 events record with a time stamp:

Real time clock:

Clock accuracy within 0.5 s/day under 23℃.

Anti-tamper :

Inverse current detection/Partial earthing detection/Magnetic field detection/Terminal and meter cover removal

Core Block 5-Other ICT Device



AMI Software Platform

Reliable ICT Devices is
the cornerstone of Software Platform



Switch



Router



Storage



Rack Server

Learn more about Huawei ICT device, visit enterprise.huawei.com

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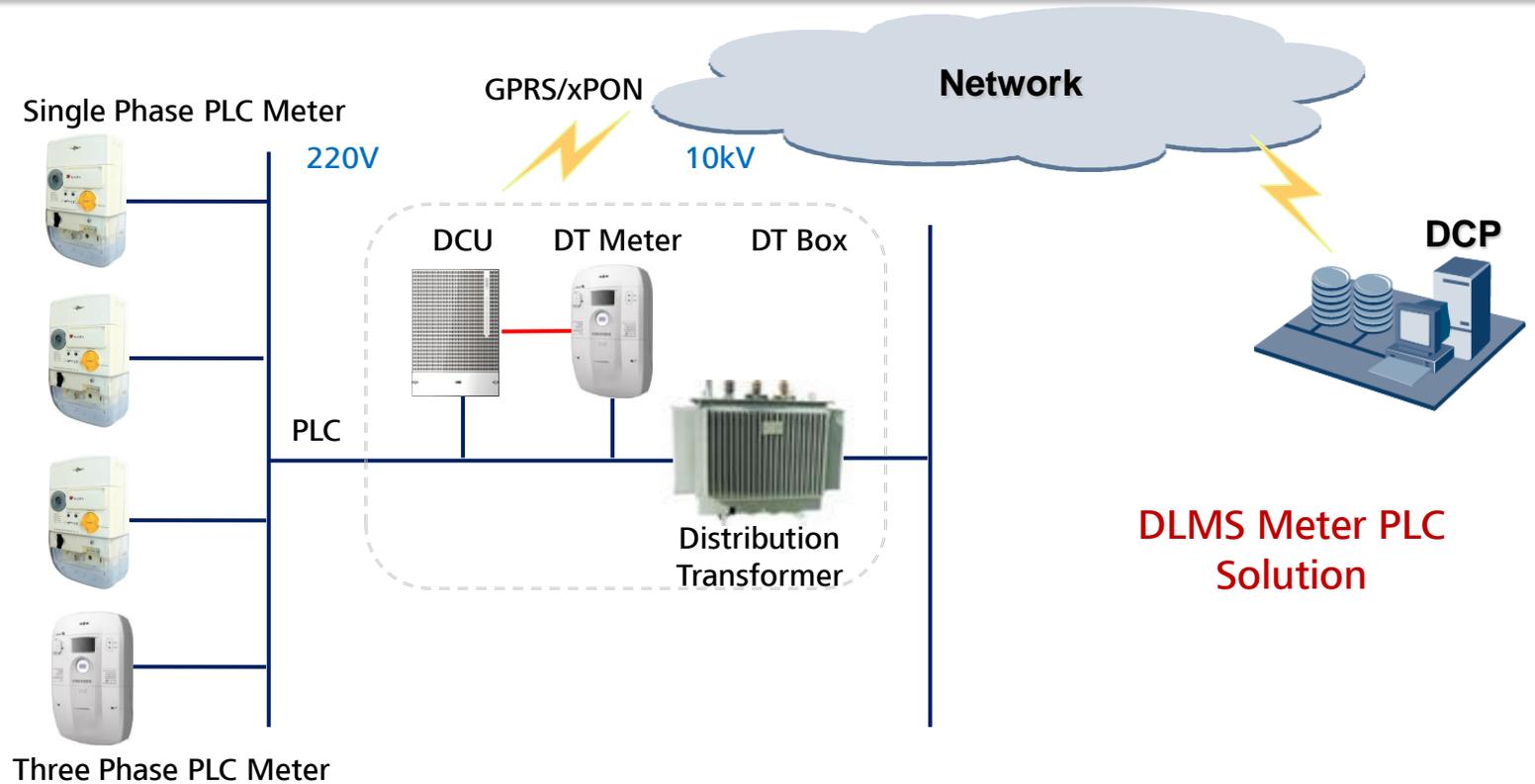


Scenario 1: High Density Area



Scenario Analysis:

- Large number of users
- High density of building
- Difficult for wiring
- Centralized installation of part of buildings
- PON is provided in some place



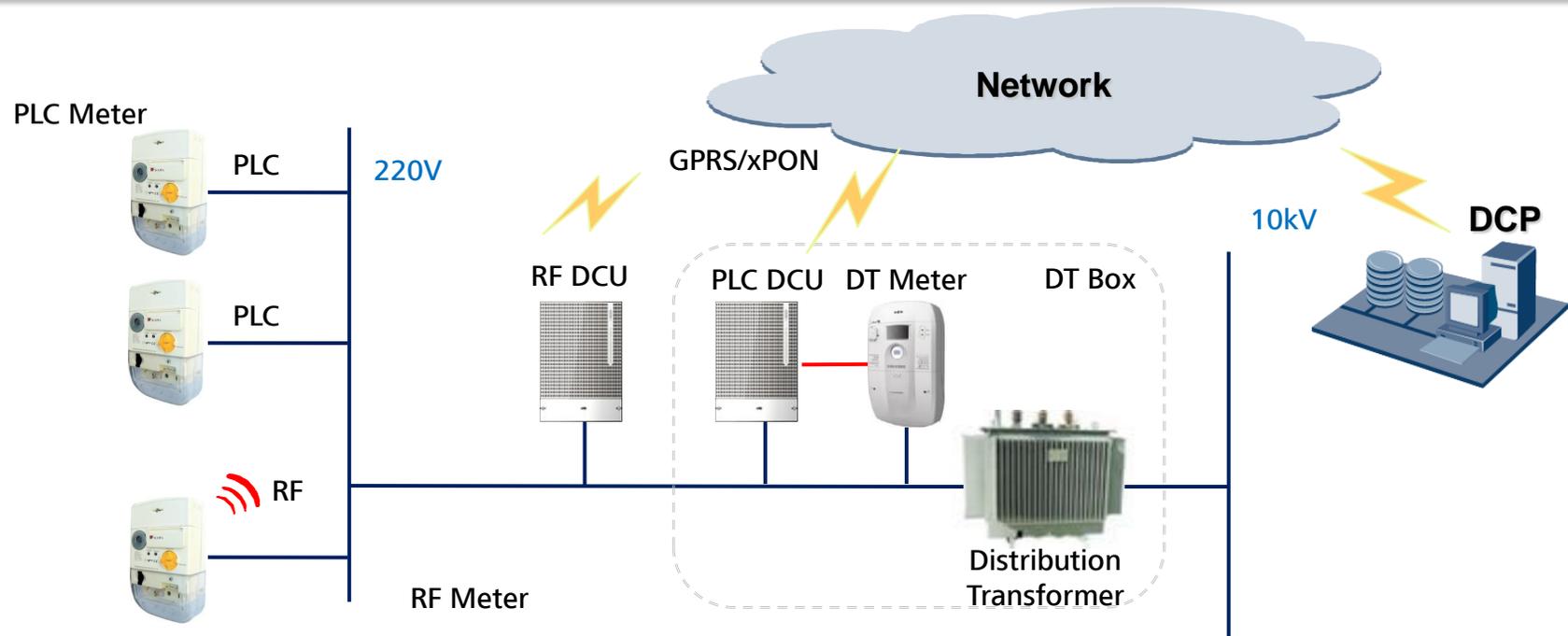
- ✓ Power line carrier, low cost, free of wiring
- ✓ RS-485 is suggested for centralized installation, more stable
- ✓ DCU provide Ethernet port to xPON network

Scenario 2: Low Density Area



Scenario Analysis:

- Small number of users
- Low density of buildings
- Unable for centralized installation
- Unable for wiring



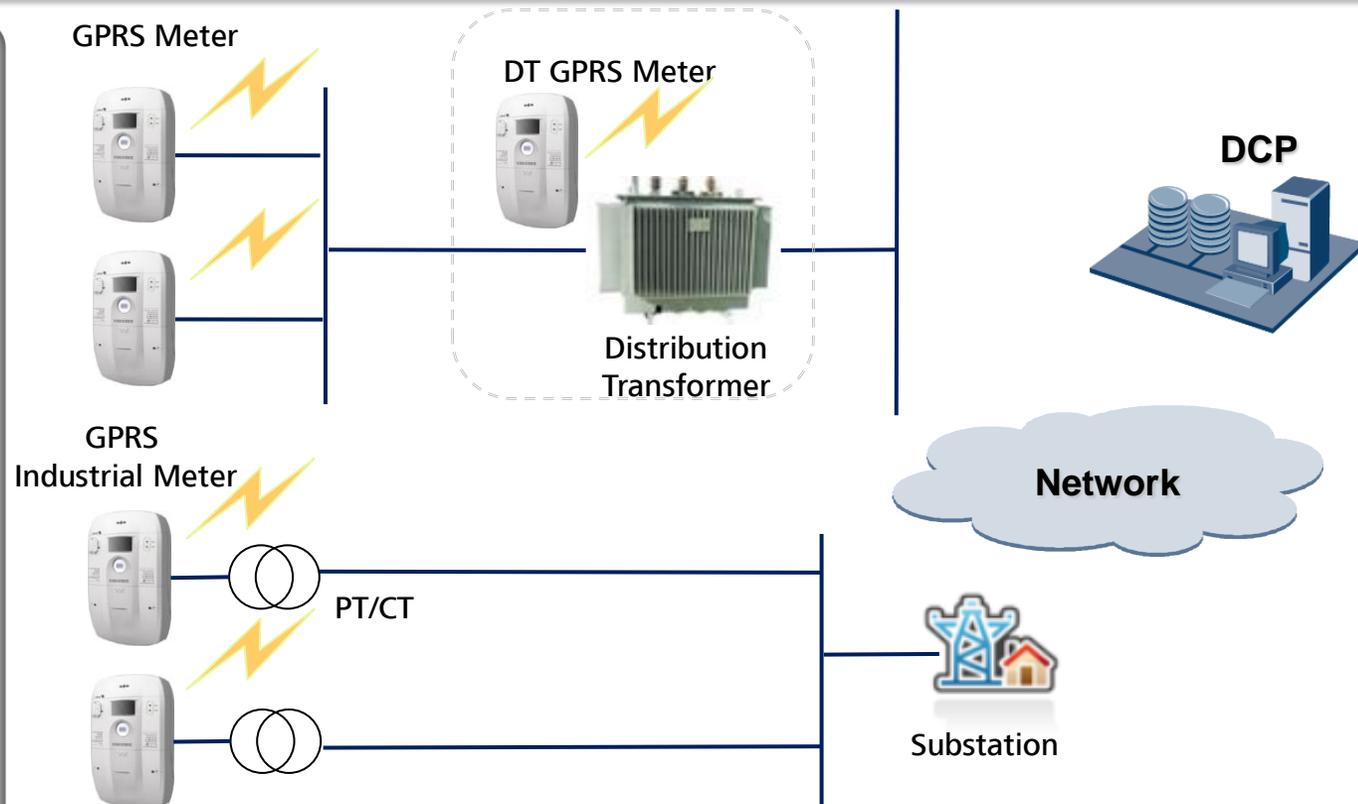
-
- ✓ Mainly PLC solution, but some point may exceed effective distance
 - ✓ RF solution as complement, installation location of RF DCU should be chosen carefully to achieve optimization of communication

Scenario 3: Isolated Area/Industrial Customer



Scenarios Analysis:

- A few of users, isolated
- Harmonic interruption of industrial customer
- High accuracy for industrial customers



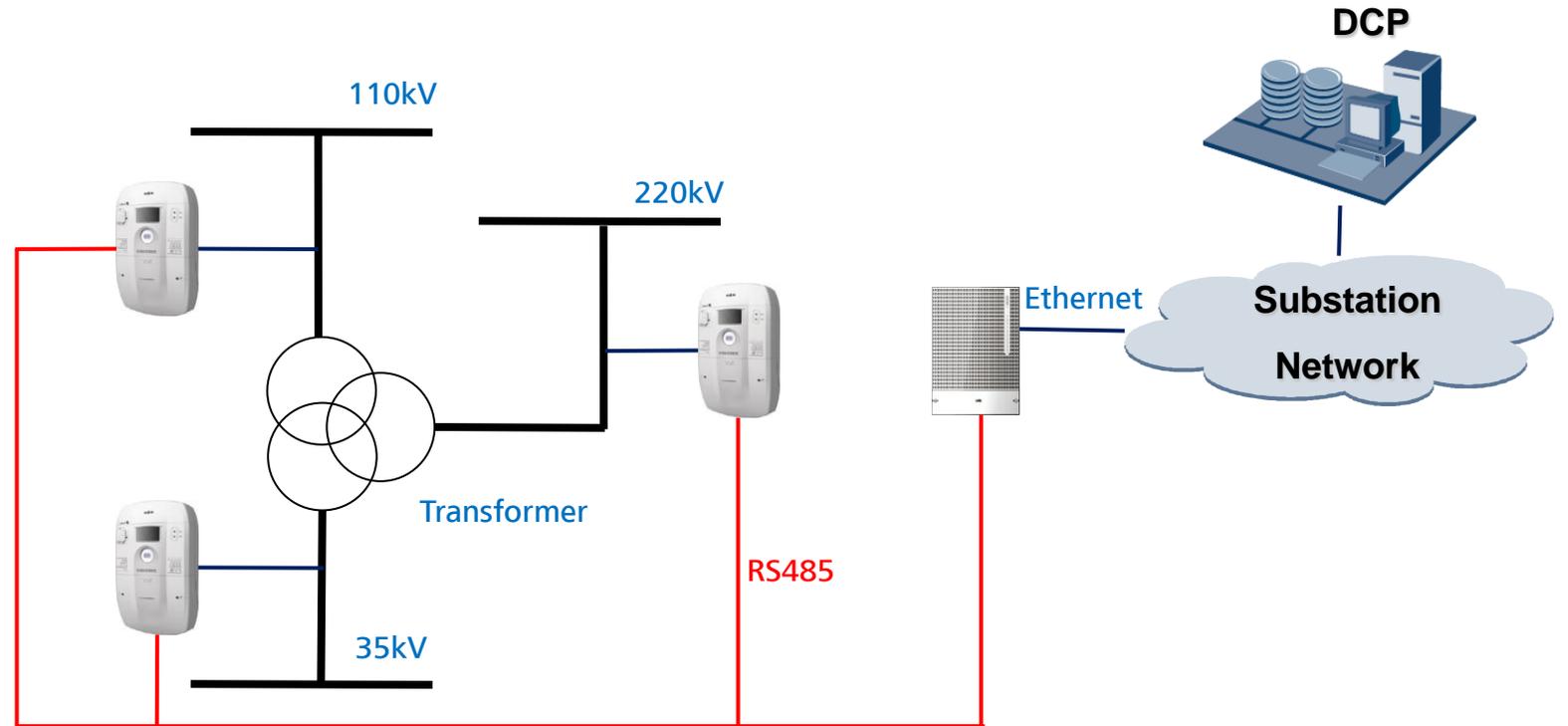
- ✓ For isolated customers, PLC and RF may exceed effective distance, GPRS direct to sever is suggested
- ✓ For Industrial customer, provide high accuracy, GPRS meter solution

Scenario 4: Substation Measurement



Scenario Analysis:

- Network provided in substation
- Very high accuracy requirement
- Installed in cabinet of substation
- Extreme stability requirement



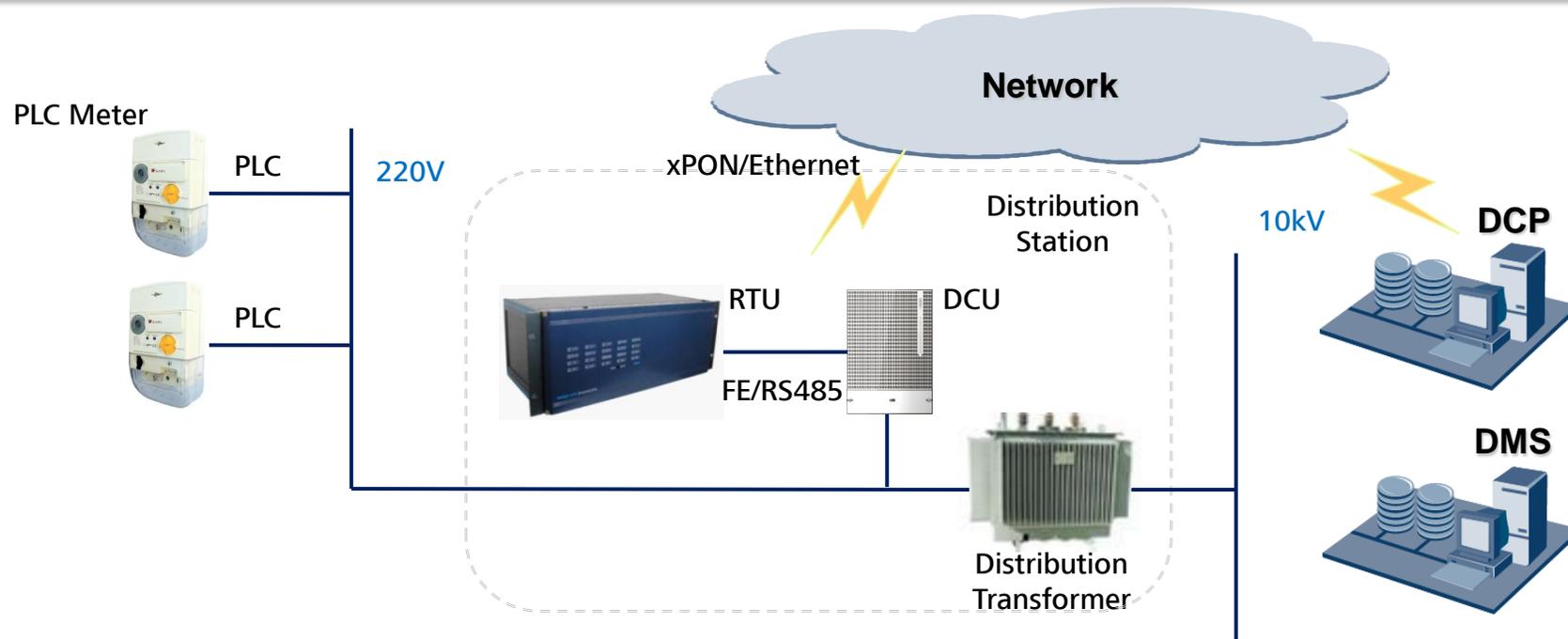
- ✓ Meter and DCU installed in one cabinet, connected with RS485 bus to ensure the stability
- ✓ DCU provide Ethernet port to connect to substation network
- ✓ Accuracy up to 0.2s

Scenario 5: Integration with DA



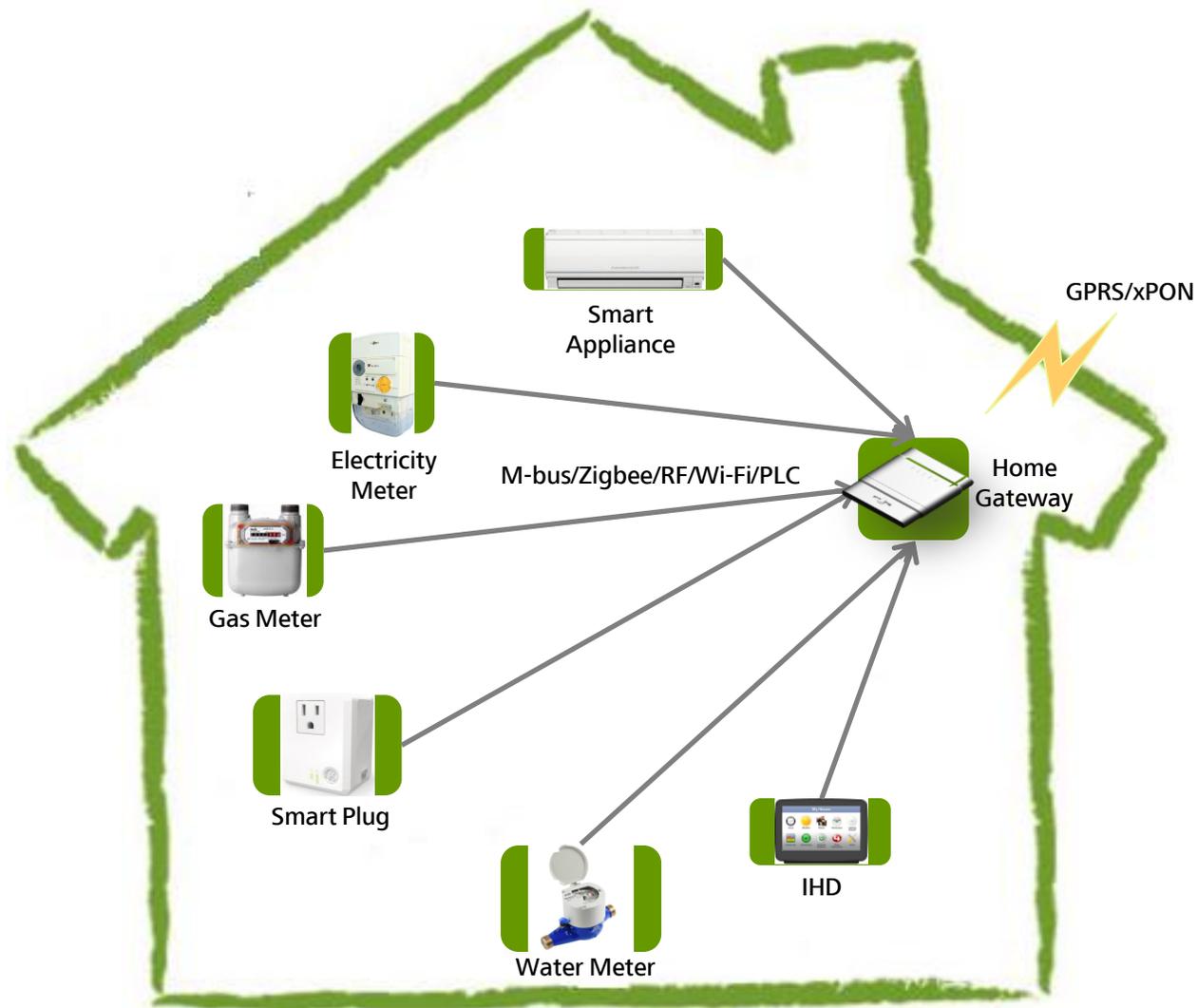
Scenario Analysis:

- AMI and DA (distribution automation) share the same network
- Multiple service and communication interface
- Higher reliability



- ✓ AMI and DA share same xPON/Ethernet network, normally it is private network
- ✓ DCU provide multiple FE & RS485 interface to RTUs and PLC connection to meters
- ✓ Distribution automation protocol supported

Scenario 6: Home Gateway



Scenario Analysis:

- Short distance of HAN(Home Area Network), multiple communication and protocol
- Information release to resident
- Control of smart appliance/smart plug/smart meters
- Massive Gateways connect to DCP

- ✓ Support M-Bus/Zigbee/RF communication of HAN
- ✓ IHD (In-Home Display) for real time information release
- ✓ Unified management of smart appliance/smart plugs/smart meters
- ✓ High concurrent connection performance of DCP

Communication Technology—PLC

IEC 61334



Single carrier

G3-PLC™
Alliance



36 Mux carriers

PRIME
ALLIANCE



97 Mux carriers

Standard	IEC 61334	G3	PRIME
Technology	S-FSK	OFDM	OFDM
Bit Rate	2.4kbps	5.6-45kbps	21.4-128.6kbps
Freq. Band	CENELEC-A	36-90.6kHz	42-89kHz
Success rate (one day)	98%	100%	100%
Capex	Low	High	High

Communication Technology-RF/ZigBee

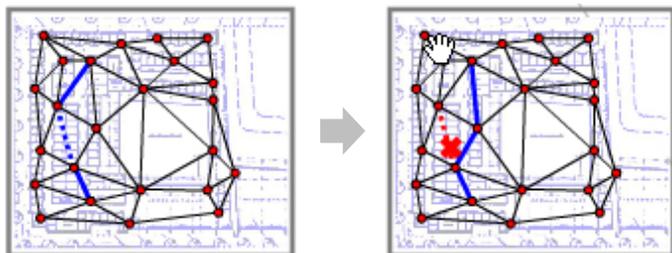
ZigBee Technology

High Security

- AES-128 Encryption
- Authentication
- Integrity protection

High Reliability

- Redundant paths of mesh
- Robust modulation



Public Standard

- Public Standard
- Good interoperability

High Cost-effective

- Free of wiring
- Low OPEX
- No restrict by transformer



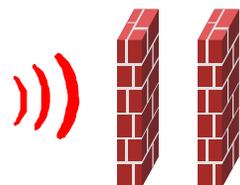
Huawei: Member of board of directors of ZigBee Alliance



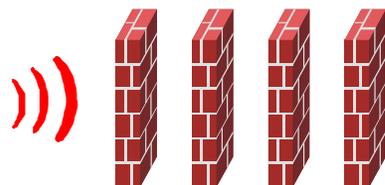
Communication Technology-RF/ZigBee

Comparison of other RF Technology and ZigBee

Higher Penetrability



ZigBee



RF 433MHz/868Hz...

Longer Distance

■ ZigBee: 200m-500m

■ Other: open filed up to 1000m

Lower Transmission Speed

■ ZigBee: 20-250Kbps

■ Other: 9.6-38kbps

Modulation

■ ZigBee: DSSS

■ Other: FSK

Lower Security

■ ZigBee: AES-128

■ Other: no encryption

RF Frequency Band

- 433MHz
- 470-510MHz
- 868MHz
- 915MHz

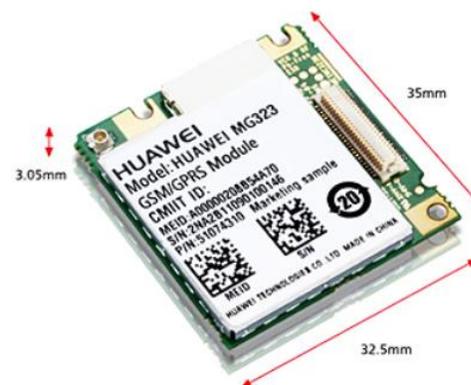
Different country

Allows

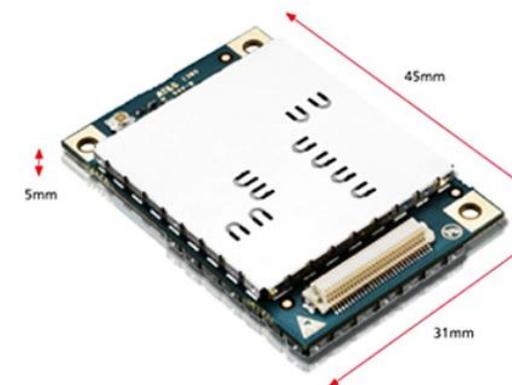
Different frequency band

Communication Technology-GPRS/3G

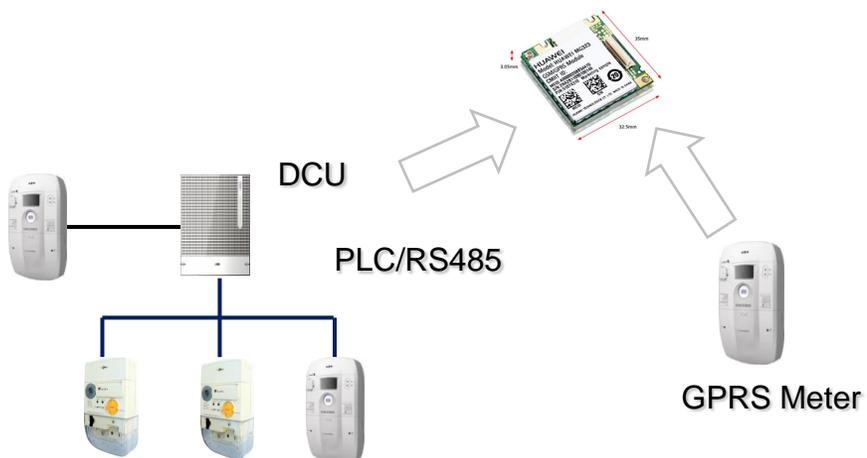
- Low capital investment
- Low cost communication module
- Wide coverage
- Reasonable operation cost
- Low privacy



GPRS Module



3G Module



General features

- Quad-Band GSM:
850/900/1800/1900 MHz
- GPRS multi-slot class 10
- Temperature range
Normal Operation: -20 °C to 70 °C
Humidity: 5%~ 95%
- GPRS data
DL: up to 85.6Kbps/ UL: up to 42.8Kbps
Encoding mode: CS 1/CS 2/CS 3/CS 4
Support PBCCH

General features

- UMTS 900/2100MHz
- Quad-Band GSM/GPRS/EDGE:
850/900/1800/1900 MHz
- EDGE multi-slot class 12 (*options)
- Temperature range
Normal Operation: -20 °C to 70 °C
Humidity: 5%~ 95%
- WCDMA PS: UL 384Kbps/DL 384Kbps
- GPRS: UL 85.6 Kbps/DL 85.6 Kbps
- EDGE: UL 236.8 Kbps/DL: 236.8 Kbps

Communication Technology-xPON

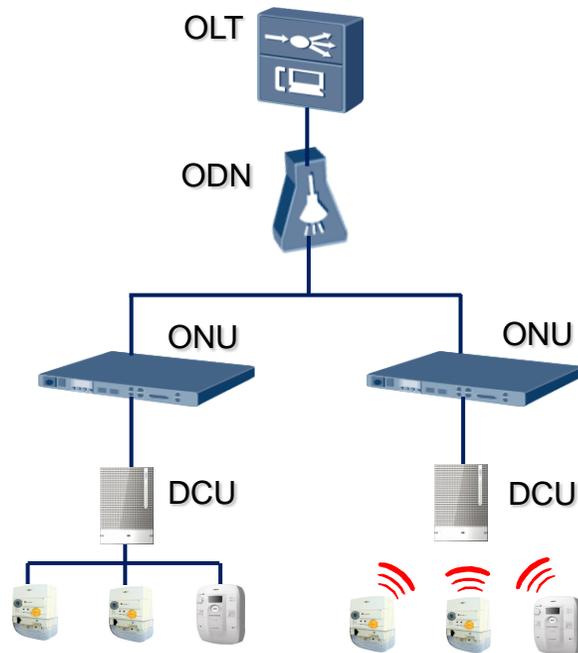
- High capital investment
- Large bandwidth
- One network support multiple services
- Strong privacy
- High reliability and security



ONU

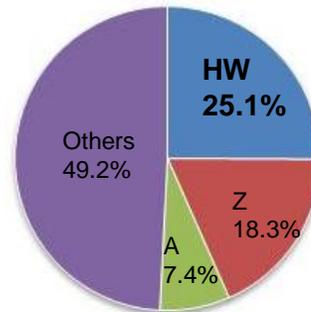


OLT

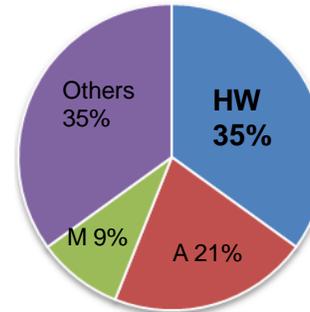


Huawei xPON solution has over 11 years of business experience, ranking first in the global market share for seven consecutive years. It provides services to the leading enterprise groups, and Operators, and end-to-end xPON solution for about 1/3 of global broadband users. Huawei is your trusted partner.

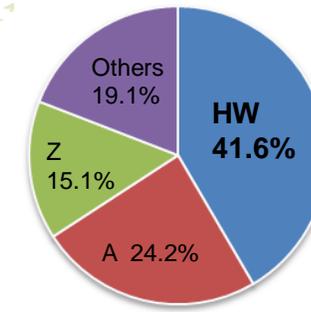
PON ports global shipments ranking first



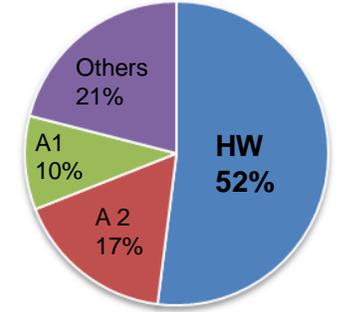
GPON ports global shipments ranking first



GPON Ports shipments ranking first in EMEA regional



Ports shipments ranking first in APAC regional



Data is taken from Infonetics, March 2011, "2010 PON, FTTH, DSL subscribers and market analysis report"

Comparison of Downlink Communication

No.	Spec. Name	PLC (S-FSK)	PLC (OFDM) (G3 & PRIME)	RF/ZigBee	RS-485
1	Applied Scene	High density	All	Disperse, but not too far	Centralized
2	Transmission rate	2.4kbps	33.4kbps(G3) 128.6kbps(PRIME)	9.6~250Kbps	1200-9600bps, theoretically up to 10Mbps
3	Transmission distance	500m	8km (MV) 220m (LV) *	200m ~ 600m, open field up to 1000m	≤1200m
4	Success rate of one collection	About 70-85%	95%	≥85%	100%
5	Success rate of cycle collection	≥95%(period of 1 day)	99%(period of 1 day)	≥95%(period of 1 day)	100%(period of 1 day)
6	Cost	Low	Medium	Medium	High

Comparison of Uplink Communication

Technology	xPON	Public Network 2G/3G
Advantage	<ul style="list-style-type: none">• High capacity• Far transmission distance• Low latency• Strong privacy	<ul style="list-style-type: none">• No network deployment and maintenance• Good coverage• Mature industry chain
Disadvantage	<ul style="list-style-type: none">• Difficult or unable deployment• Long deployment cycle• High one-time investment	<ul style="list-style-type: none">• Resource sharing with public• Poor privacy• Low reliability and security• Low bandwidth• Incapable for Service Development• Subject to 2G/3G telecom operator

Agenda

1 Trend and Challenge

2 Huawei AMI Solution

A Overview

B Core Block

C Scenario

3 Case Study



Iraq Kurdistan Region AMI Solution

Background and Customer Requirements

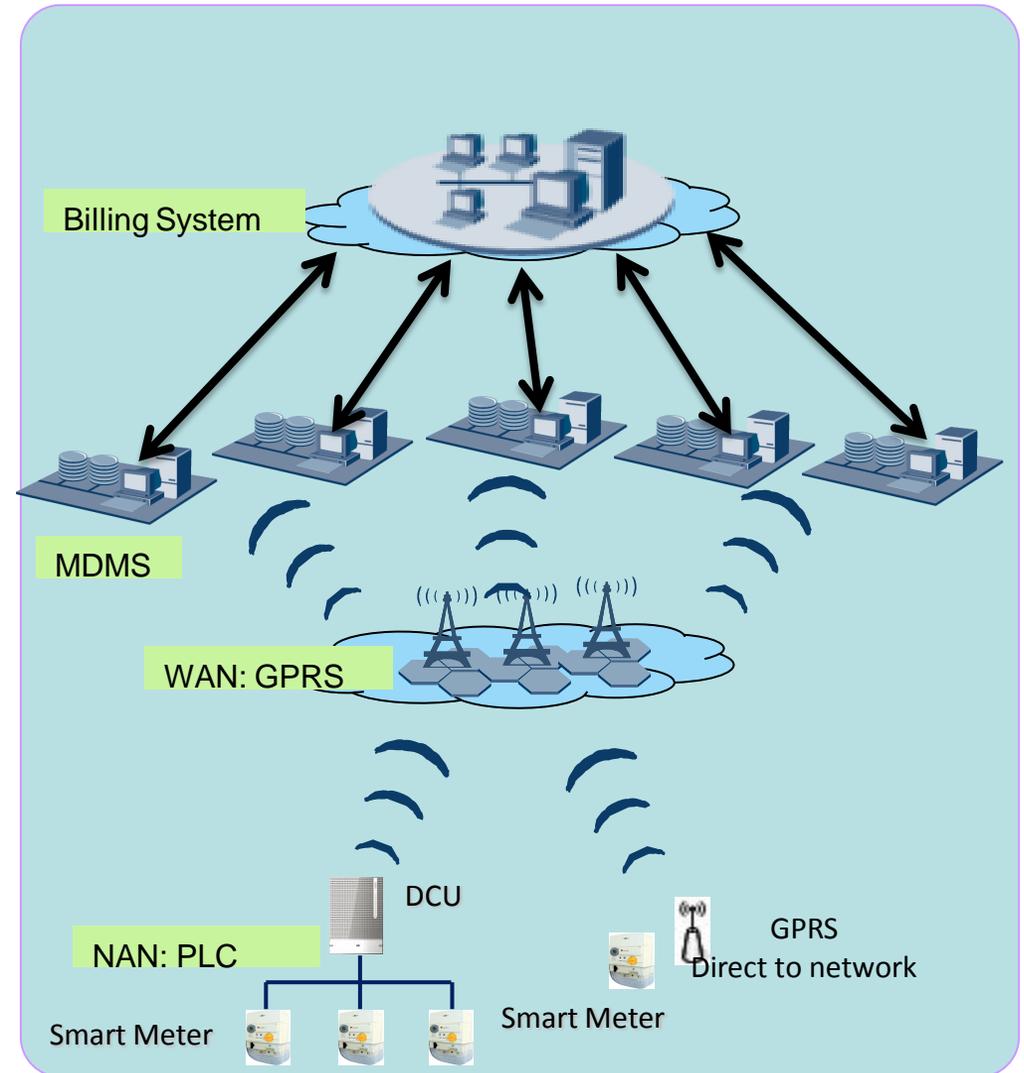
- High Commercial line loss
- It is difficult for the utility to charge the bill of electricity
- Load control due to shortage of electricity
- Five geographic zones of Kurdistan Region involved, each zone contain 150,000 - 250,000 consumers;

Solution

- 1 Unified Billing System + 5 separated MDMS for five geographic zones.
- Remote Communication: GPRS + Last Mile Communication: PLC
- Customized Smart Meter easily evolve to support pre-paid service and communicate with Water Meter & In-Home-Display

Customer Benefits

- Reduce Line Loss based on line loss Analysis and Anti-tamper functions;
- Save manpower and vehicles;
- Lessen area of power outage based on load management to meters;
- Shorten cash cycle to improve the utilities finance performance
- Flexible Architecture to make system expansion easier



Spain Iberdrola AMI Solution

Background and Customer Requirements

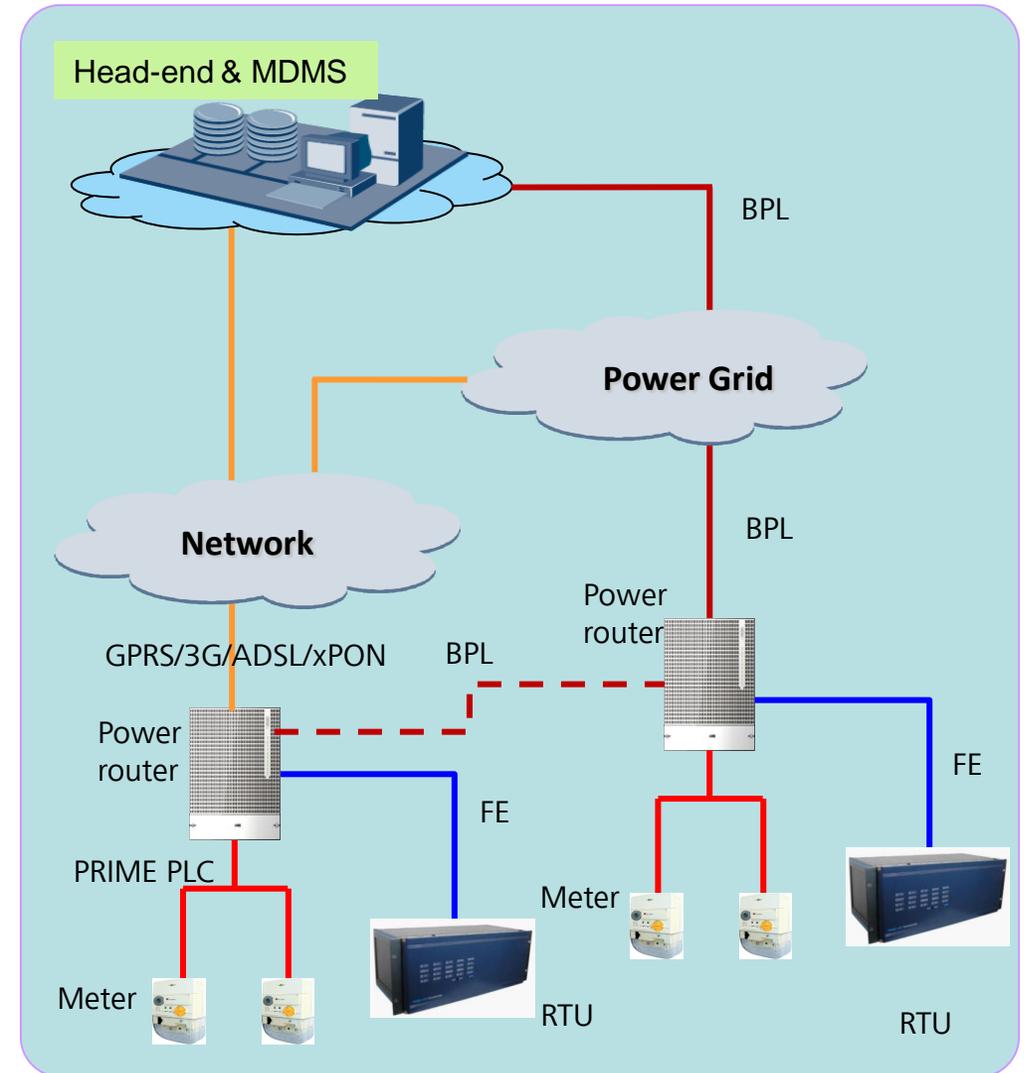
- Low success rate
- Multiple communication device, hard for trouble shooting
- High maintenance cost

Solution

- All-in-one power router integrated router, switch, concentrator
- 72,000 power router manage all smart meters and RTUs
- Local communication: PRIME PLC, FE
- Remote communication: GPRS/3G/ADSL/xPON/BPL
- BPL cascade

Customer Benefits

- All communication devices integrated in one box (power router), reduce the investment of AMI and DA communication devices
- Easy to fault location, reduce maintenance cost
- Increase reading success rate



United Kingdom AMI Solution

Background and Customer Requirements

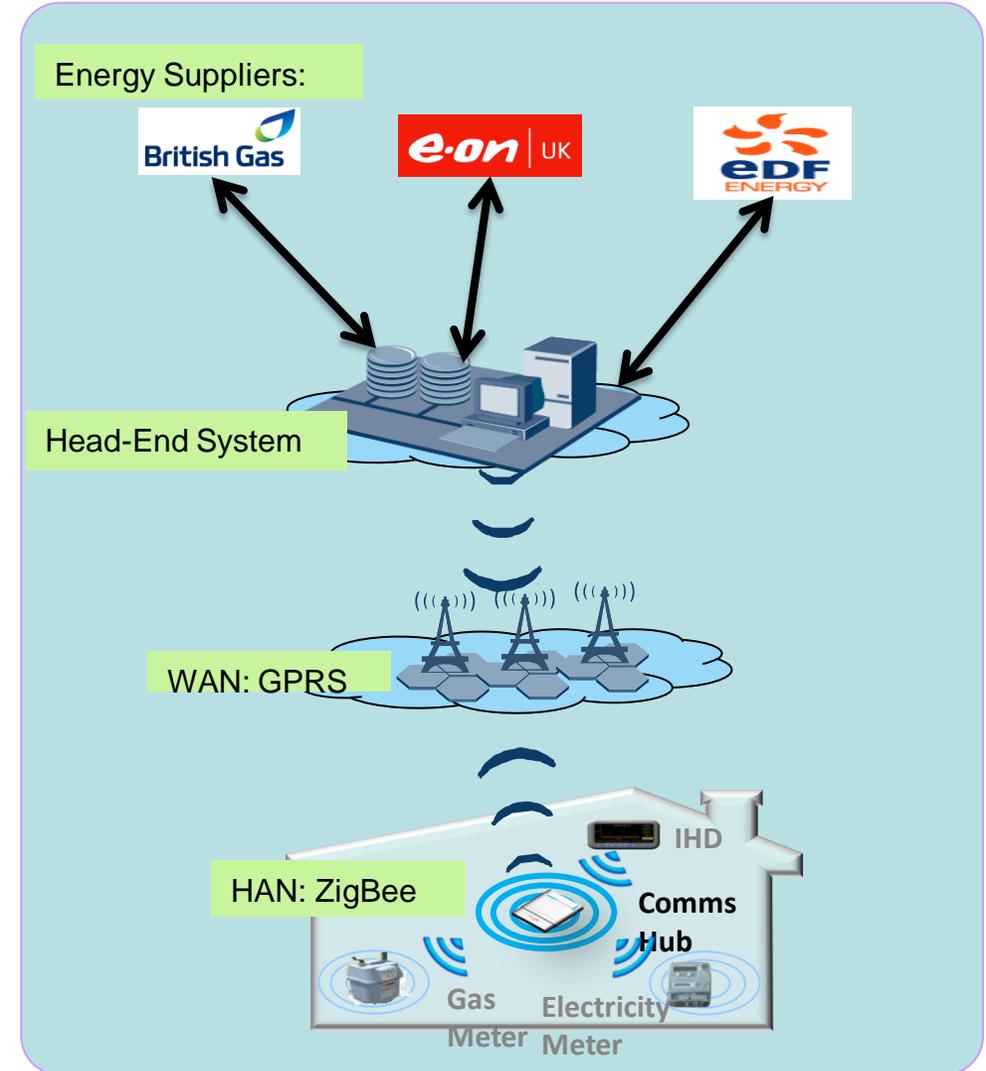
- Government policy for Energy Efficiency
- High manpower cost for collecting metering data from existing meter

Solution

- 1 Unified Head-End System integrated with several MDMS system of different energy supplier
- Remote Communication: GPRS + Home Area Communication: Zigbee
- Communication Hub acting as Smart Home Gateway

Customer Benefits

- Save labor cost and vehicles cost for energy utilities;
- Improve energy efficiency, such as Peak shaving since consumer knows real-time tariff of energy;
- Flexible platform for consumer to freely choose their energy supplier;





HUAWEI ENTERPRISE ICT SOLUTIONS **A BETTER WAY**

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