



Gene Zhang, PPMV Service/Power World 2014, 2014.09.10

Smart Switchgear & Cloud Service Remote, but close

Contents

Online monitoring–iUniGear & iVD4

- Why and what
- State-of-the-art technology of temperature monitoring
- RF and networking technology
- Sensors technologies
- HMI
- Data transfer & storage
- Remote center
- Analysis and prediction

Cloud service

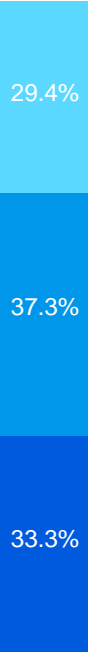
- Cloud service agreement
- Cloud service content

Advanced on-line monitoring tech. iUniGear & iVD4

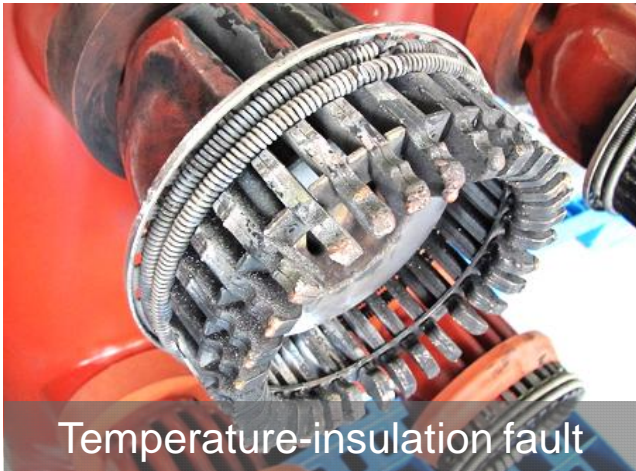
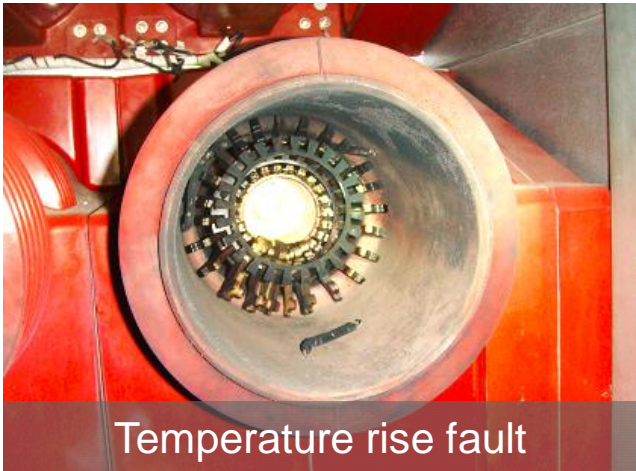
Why we need switchgear on-line monitoring

Most frequent failure model

Failure model distribution of switching device in China



- Temperature rise fault
- Insulation fault
- Mechanism fault

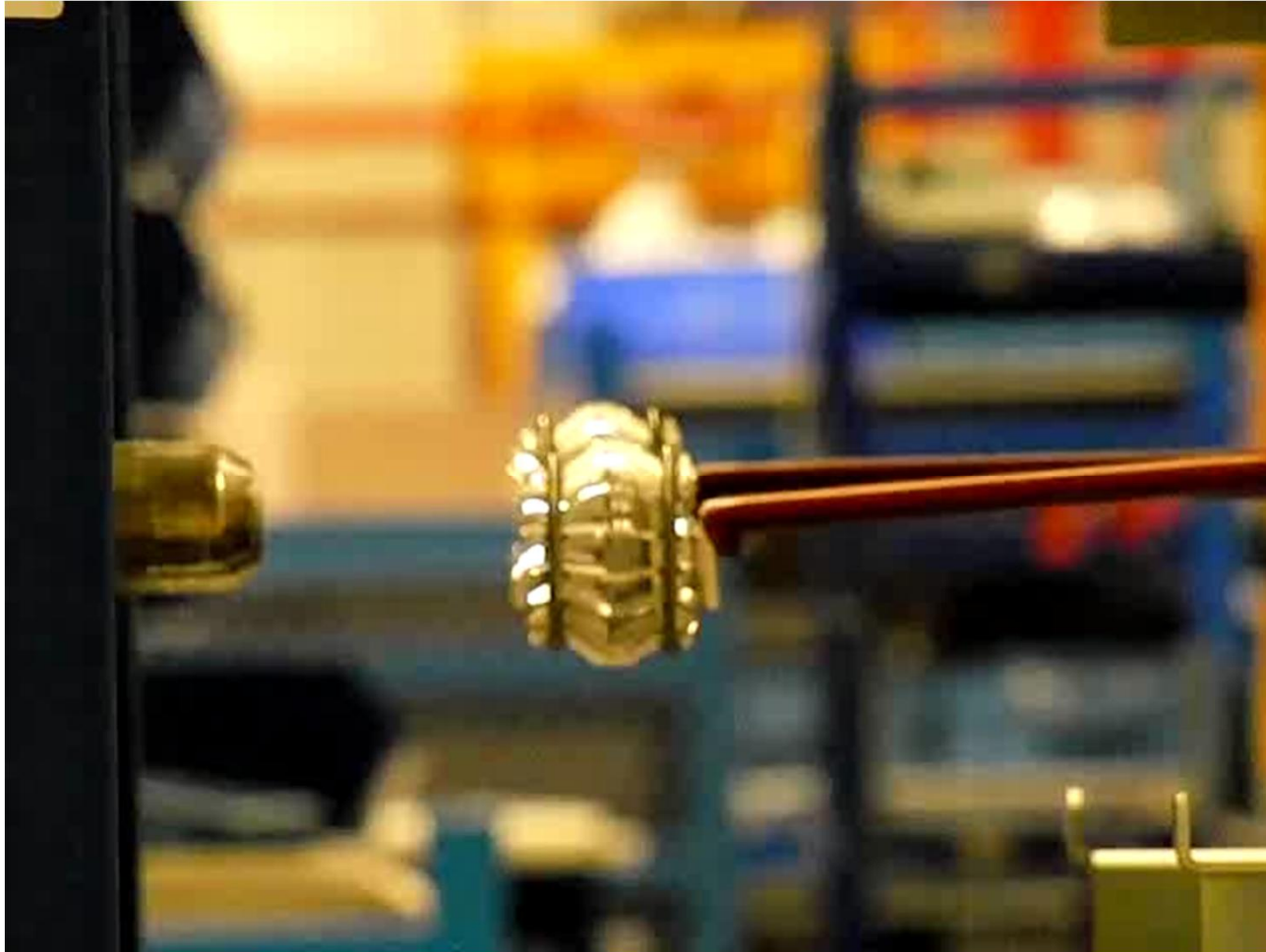


Regular maintenance

The current solution for MV maintenance



To see is to believe



Maintenance strategies

Performance and failure consequence



Corrective maintenance



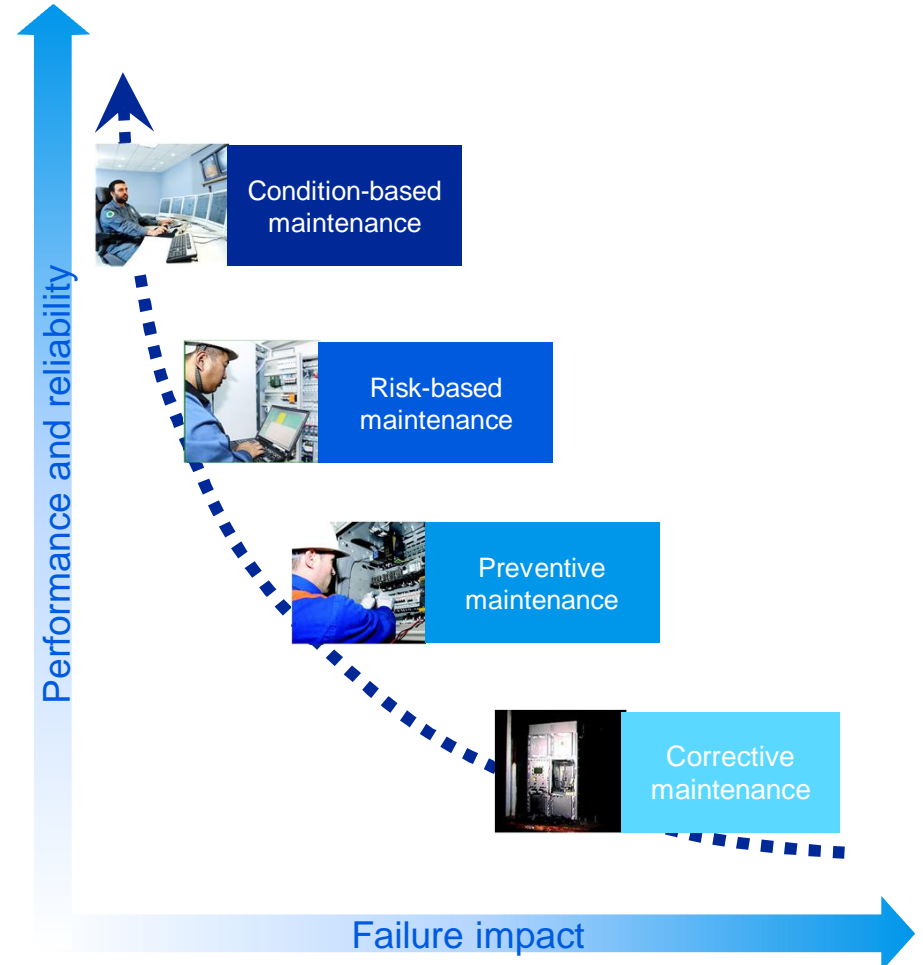
Preventive maintenance



Risk-based maintenance

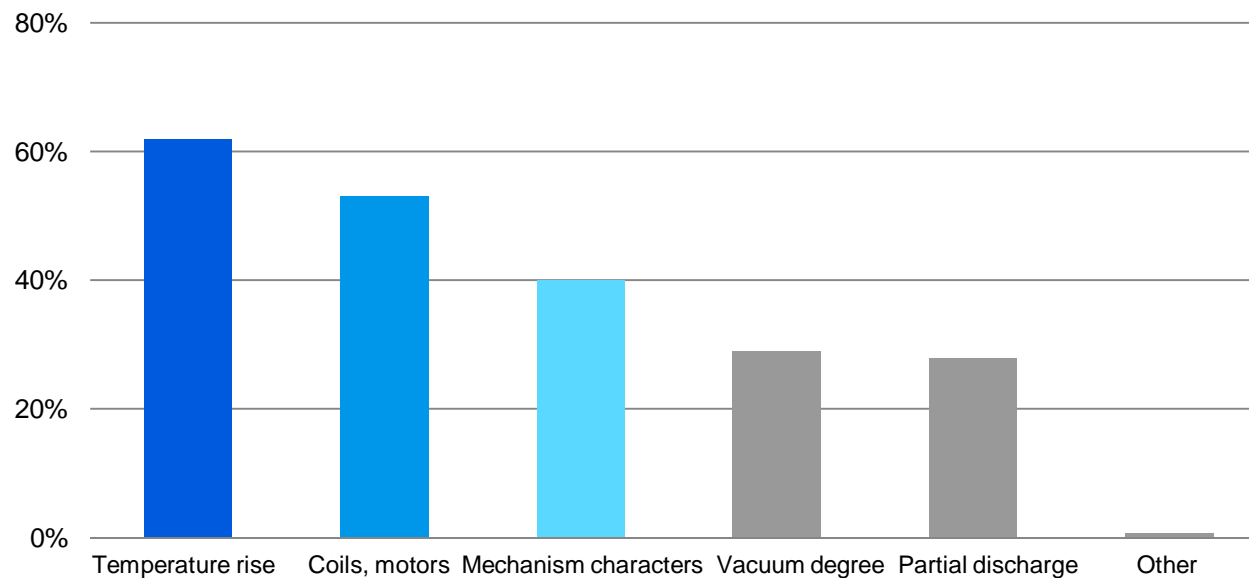


Condition-based maintenance



What should be monitored

The most important to customers



Tulips



Contact arm



Bus bar



Cable connection



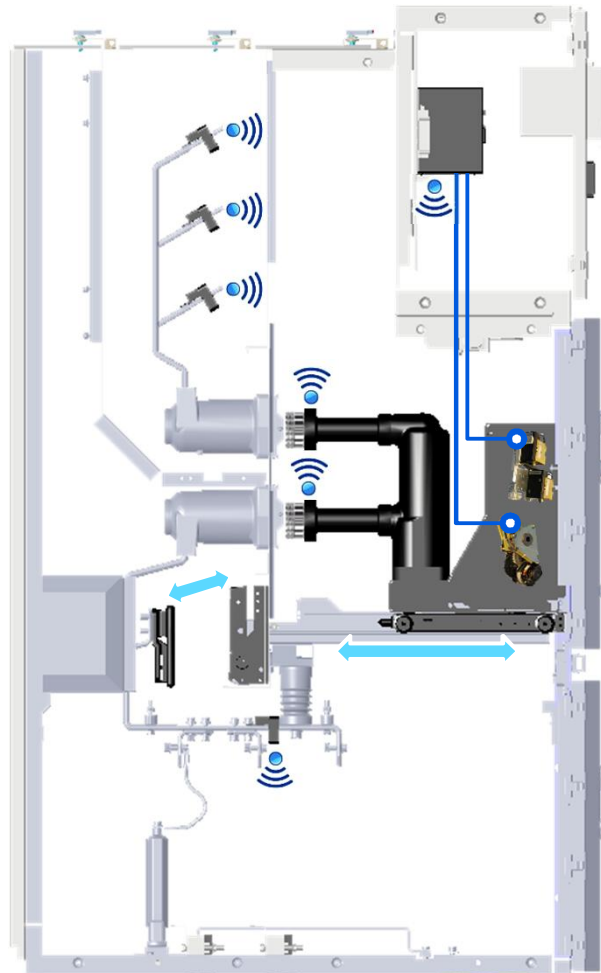
Charging motor



Coils

iUniGear & iVD4

State-of-the-art tech realize the condition monitoring



Temperature rise monitoring

- Temperature of the tulips
- Temperature of the busbar
- Temperature of the cable connection
- Environmental temp. in LV compartment

Secondary accessories condition

- Charging time of motor
- Charging current of motor
- Working current of the shunt release coils
- Status of the aux. switches

Mechanism condition monitoring

- CB closing & opening time

Programmed operation

- Motorized truck
- Motorized earthling switch

Temperature rise monitoring state-of-the-art technologies



Advantages:

- Easy use;
- Fast response;
- Water proof;

Disadvantages:

- Contact system will insert into contact box inside, inconvenience paste and observation;
- Need artificial measurement, increase burden of inspector;

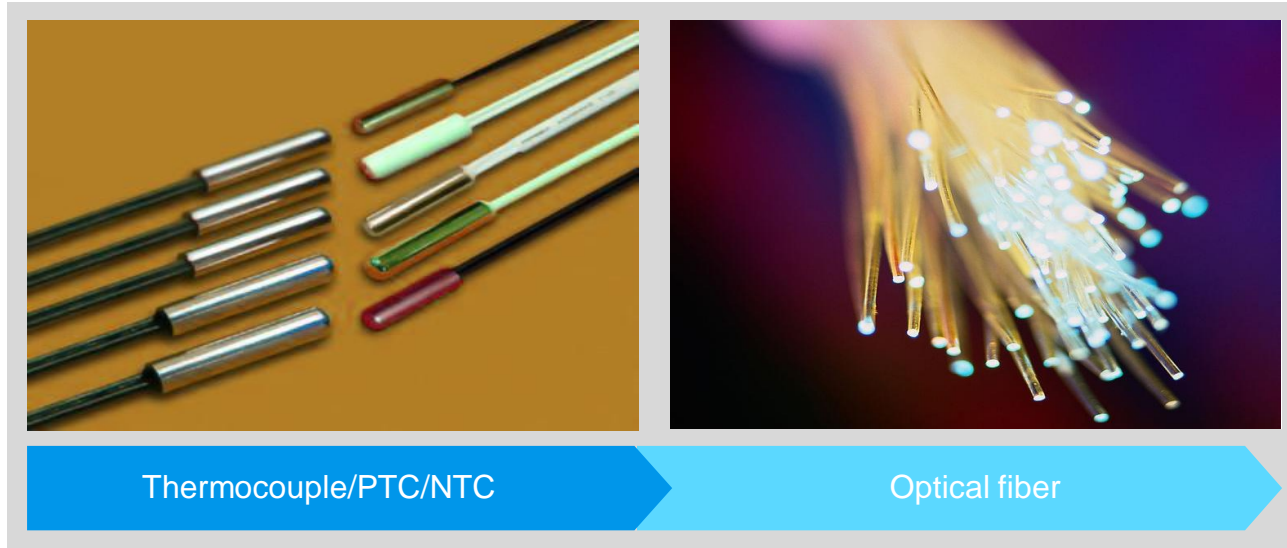
Advantages:

- Non-contact;
- Easy use;
- Without visible light interference

Disadvantages:

- only receive linear reflected light signal, for non visual range cannot be observed;
- Need artificial measurement, increase burden of inspector;

Temperature rise monitoring state-of-the-art technologies



Thermocouple/PTC/NTC

Optical fiber

Advantages:

- High cost performance;
- Result accuracy, high precision;
- Continuous measurement, automatic alarm;

Disadvantages:

- Difficult installation and maintenance;
- Wired communication, difficult electrical isolation between high and low potential;
- Poor reliability, easy to false alarms;

Advantages:

- Real-time, accuracy;
- Anti-high voltage, anti-corrosion;
- Continuous measurement;

Disadvantages:

- Expensive;
- Complex construction;
- High maintenance cost;

Temperature rise monitoring state-of-the-art technologies



Advantages:

- Low cost, Long transmission distance;
- Result accuracy, high precision;
- Wireless communication, easy to realize insulation between high and low potential;

Disadvantages:

- Weak anti-interference ability;
- Big antenna size;
- Poor confidentiality;
- Working frequency drift, poor stability;

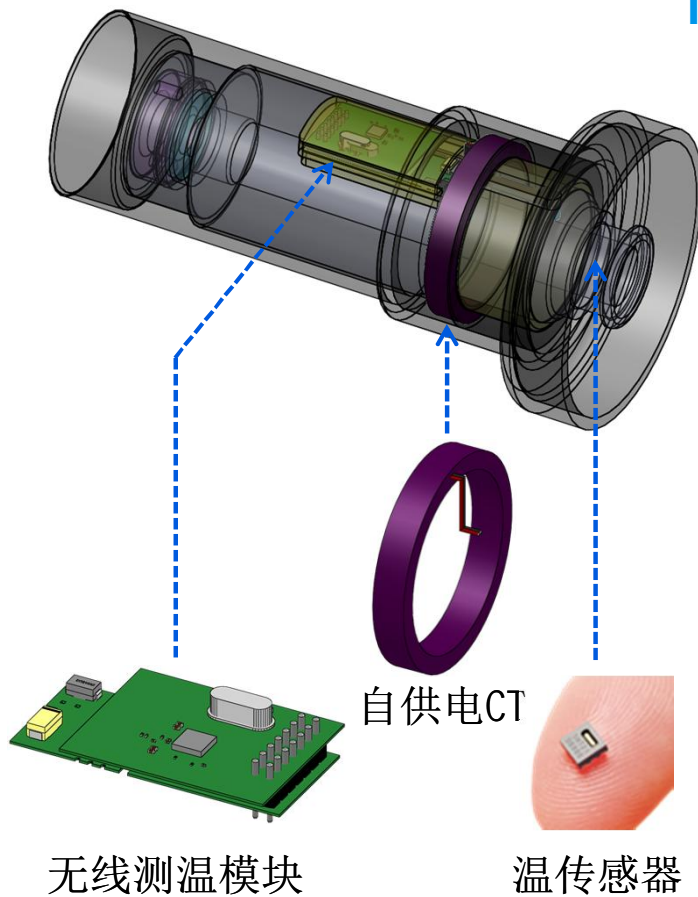
Advantages:

- Low cost, Long transmission distance;
- Result accuracy, high precision;
- Wireless communication, easy to realize insulation between high and low potential;
- High frequency, PCB antenna, small size;
- Standard protocol, WIFI, Bluetooth, Zigbee;
- standard encryption algorithm;
- Low power consumption;

Disadvantages:

- Short communication distance;

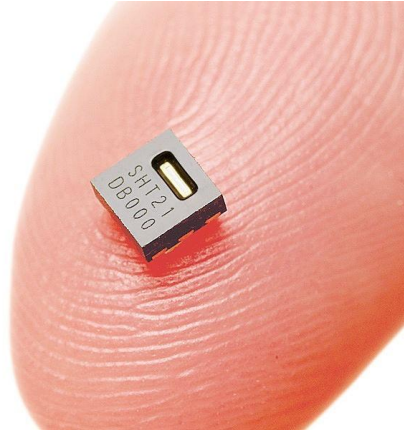
Temperature rise monitoring Smart arm for VD4



Integrated Smart Arm

- Embedded electronics
- Elegant design
- Very safe
- Intelligent
- Easy to inspection or replace
- Easy for retrofit solutions

Temperature rise monitoring electronic component



Digital temperature sensor

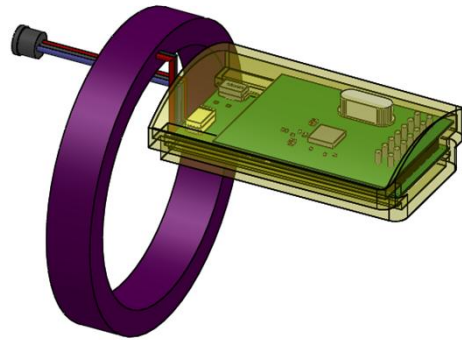
- compact
- reliably
- Precision

Military IC

- all components selected for long-term working environment 40~125°C
- The design passed the heat accelerated aging test

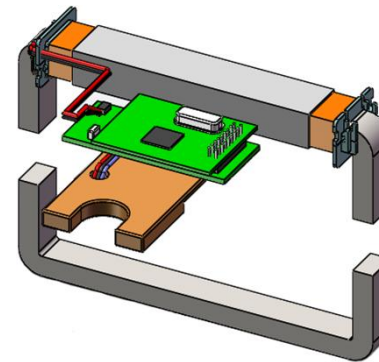
Temperature rise monitoring

Self-powered CT



Smart arm for VD4

- Self-powered CT, battery-free design, avoid the below disadvantages
 - Short working time;
 - Explosion in high temperature environment;
 - Battery liquid leakage;
 - Insulation

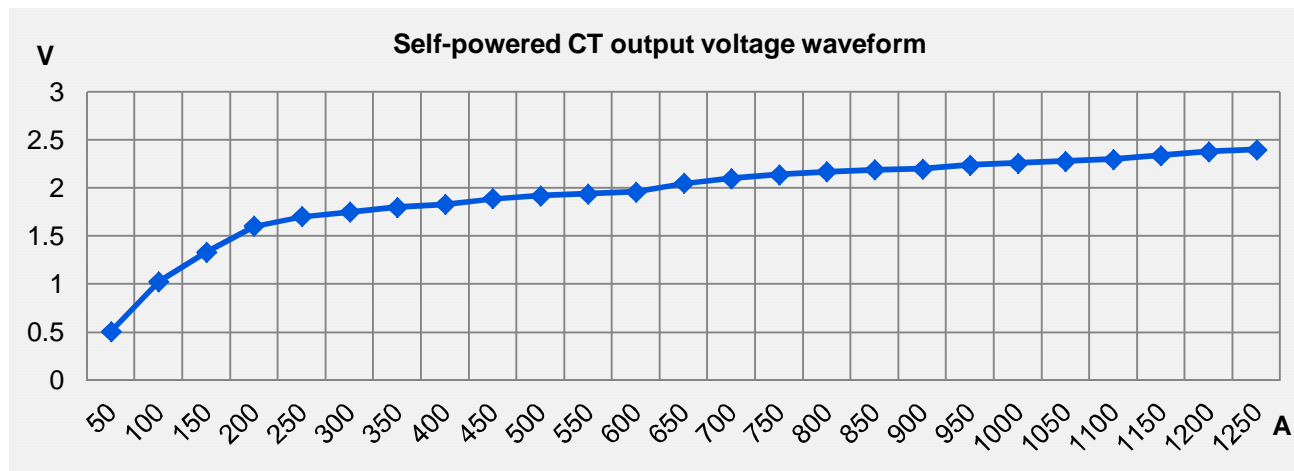
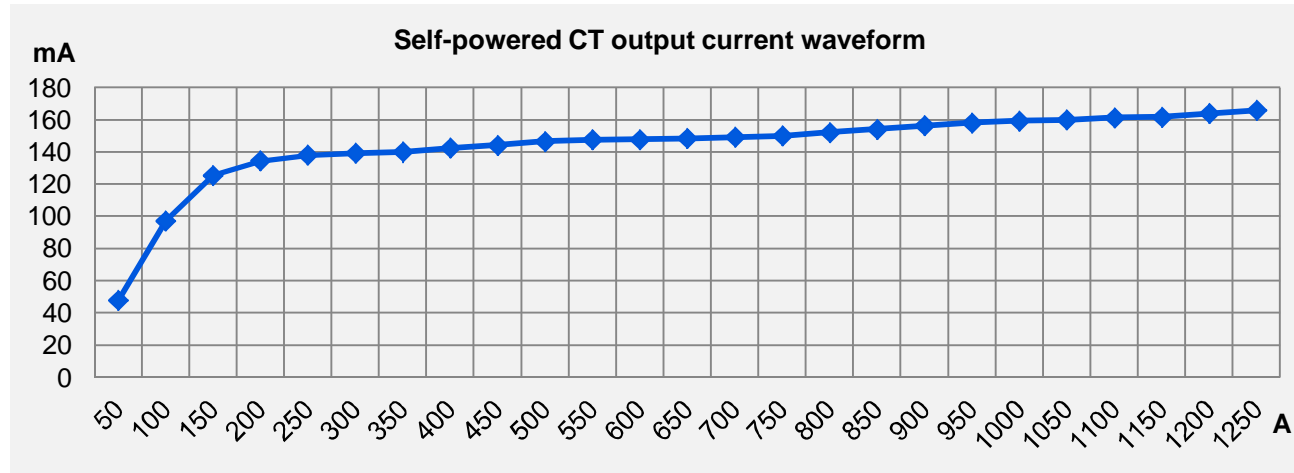


Busbar and cable connection

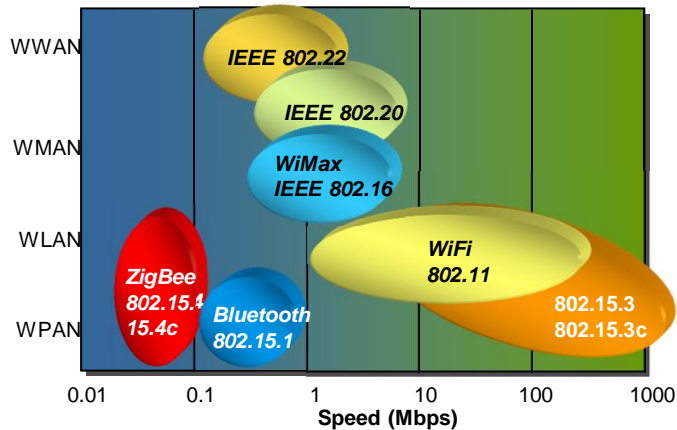
- Open type CT

Temperature rise monitoring

Magnetic saturation waveform of self-powered CT



Temperature rise monitoring Zigbee standard protocol + Private Protocol



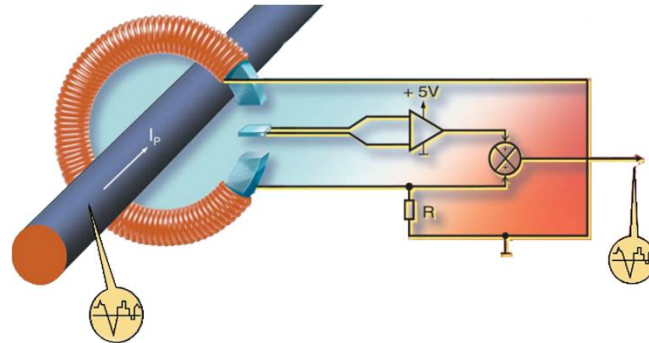
Safe wireless RF technology

- High potential insulation
- Node handshaking
- Multi-node networking
- Data transfer
- Data routing



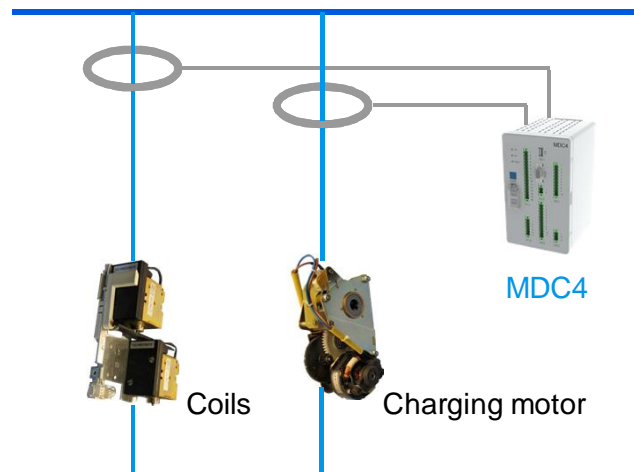
Monitoring of CB accessories

Physically isolated Hall sensor technology



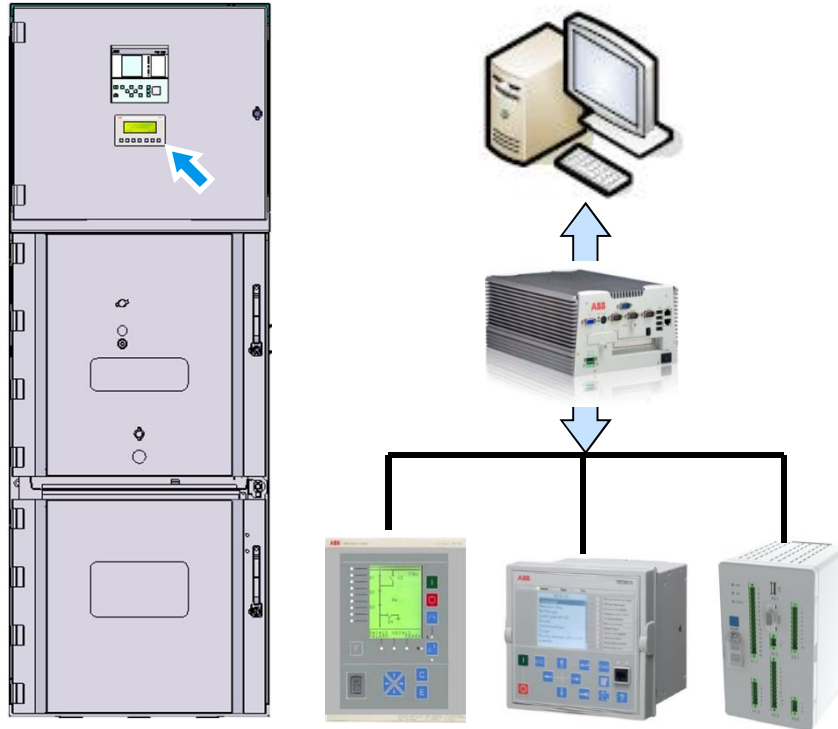
Physically isolated control/protection technology

- Hall sensor used
- Suitable for the monitoring for all the coils, motors...
- Measurement system physically isolated to CB control system
- No impact to normal operation or protection even the monitoring system fault.



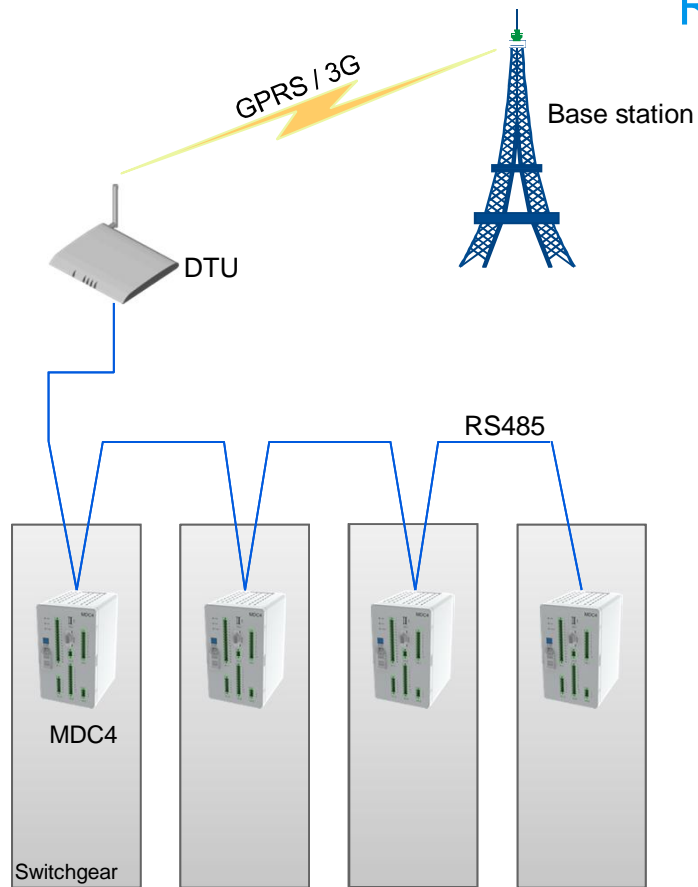
HMI

To HMI and/or to substation management system



- Local HMI on the door provides the basic information of the main parameters, include the temperature and aux. parts measurement and calculation results.
- RS 485 and protocol opening to connect to Network Control Centre / Distributed Control System

Public network GPRS or 3G



Reliable and convenient

- MDC4 via RS485 to public wireless transmission
- Support China Mobil, China Telecom and China Unicom
- Industrial class ARM platform

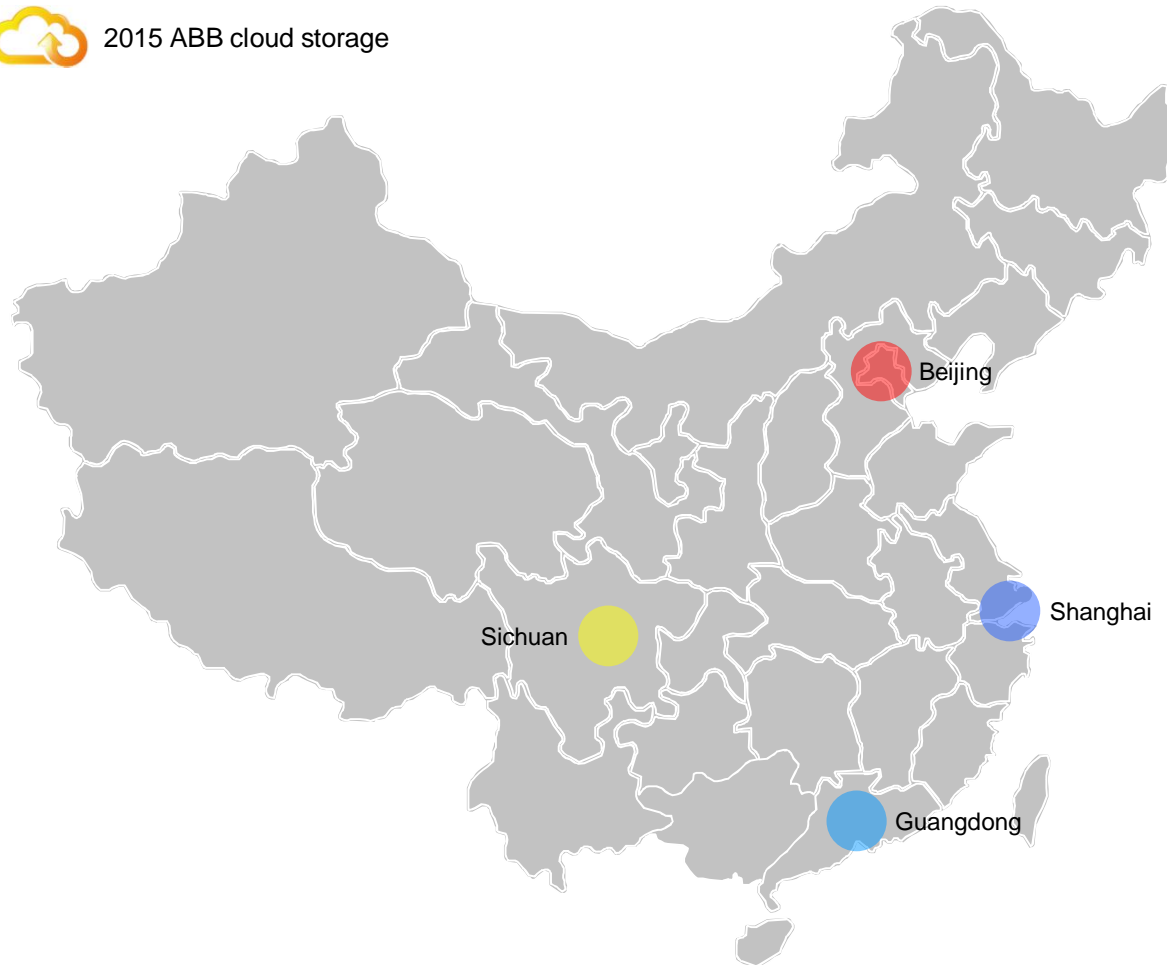
Data transmission and storage

Cloud storage

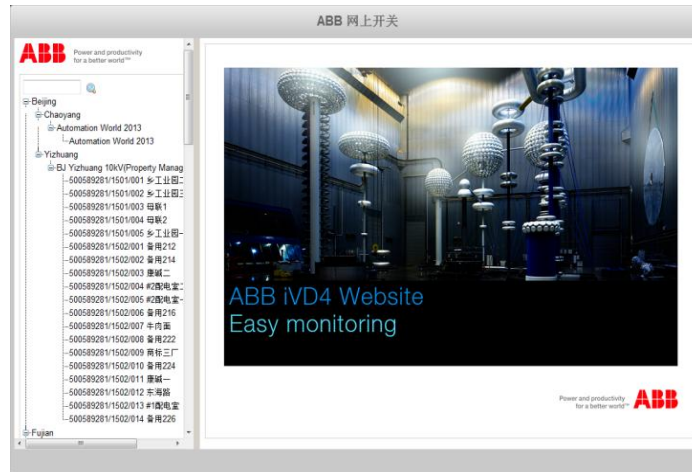
- Based on China telecom there main datacenters, provide the cloud computing resources and services;
- According to DNS analysis, the user access request to the latest cloud storage location;



2015 ABB cloud storage



HMI: www.ivd4.com + Mobil On-line analysis and prediction system



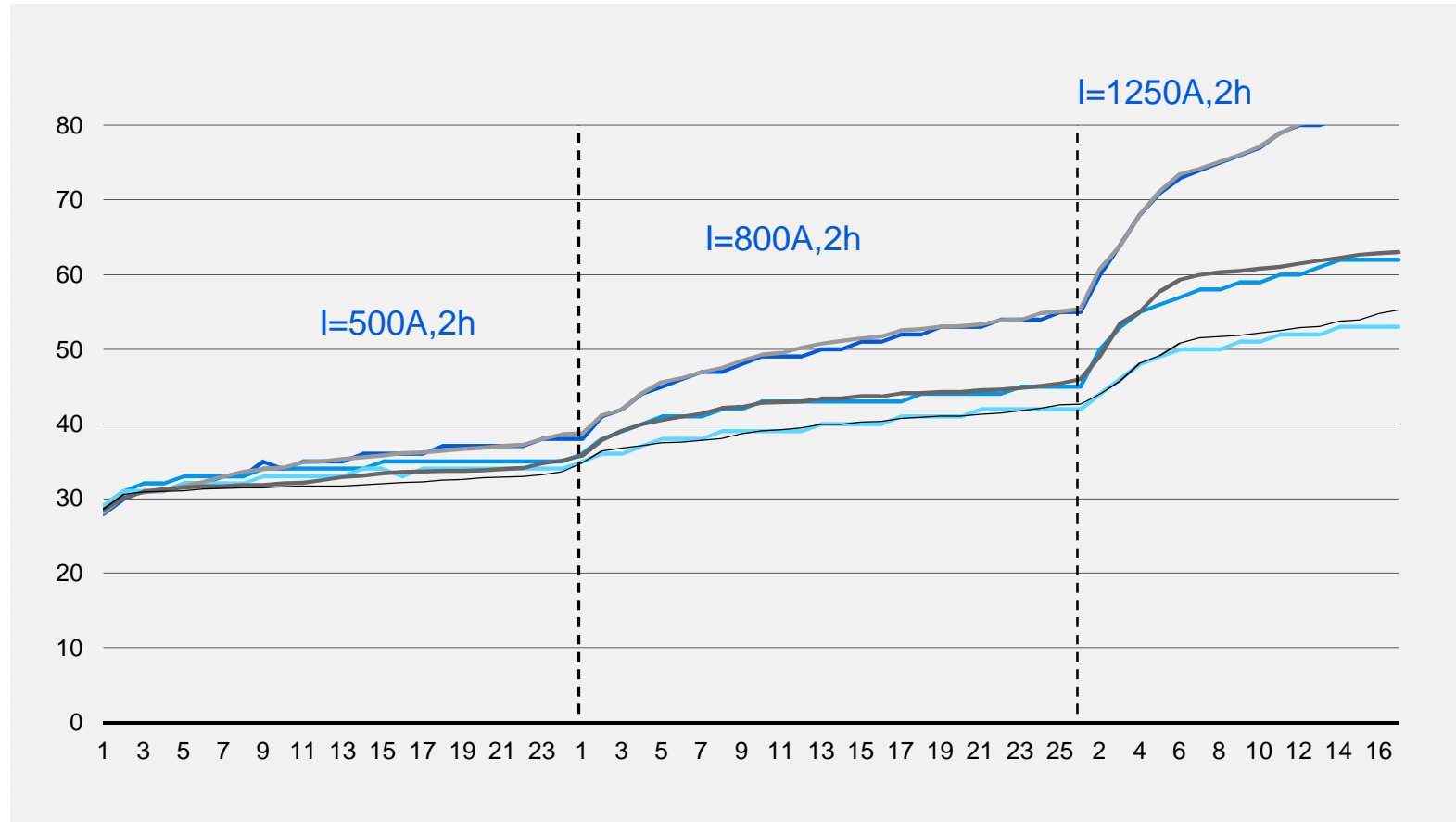
- Famous and familiar interfaces
- Ease of use
- Increased confidence when commissioning switchgears
- Lower inspection cost

Monitoring, analysis & prediction

Temperature condition

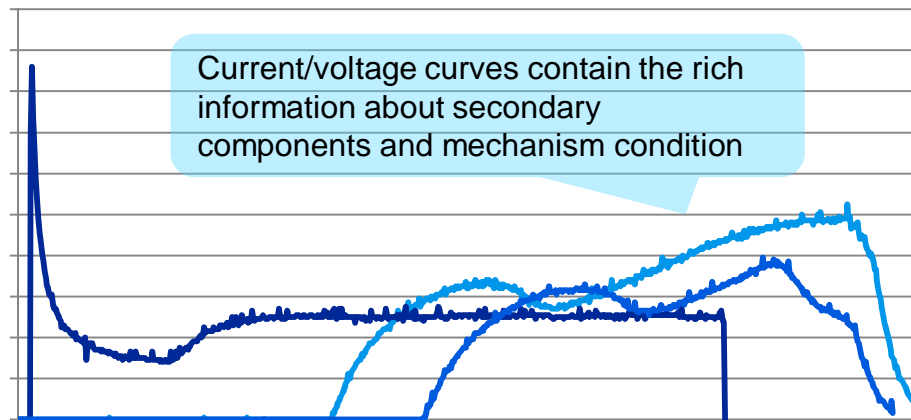
The development of temperature rise fault is a process last for several hours or even days:

- Development
- Analysis
- Prediction
- Decision
- Action



Monitoring, analysis & prediction

Secondary components



Measurement

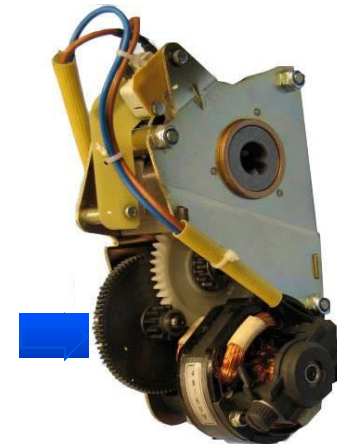
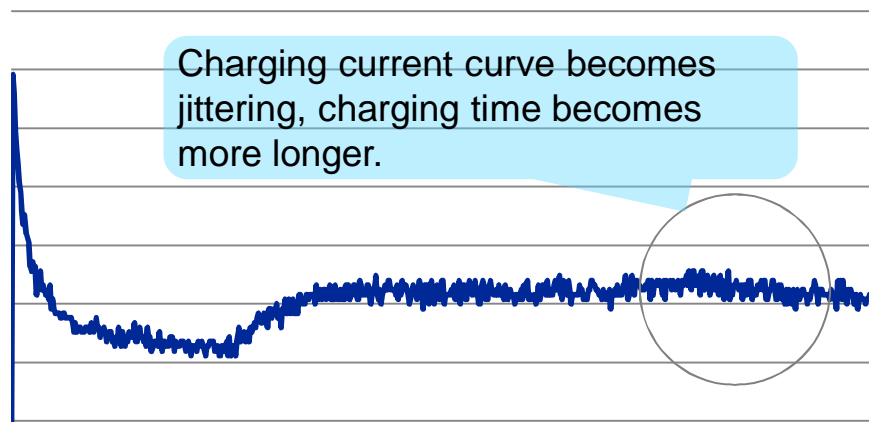
- MS: I_{curve} , U_{curve} , t_{Charging}
- MC: I_{Curve} , U_{Curve}
- MO: I_{Curve} , U_{Curve}
- Aux. switch: 1NO+1NC

Algorithm

- MS: I_{RMS} , U_{RMS}
- MC: I_{RMS} , U_{RMS}
- MO: I_{RMS} , U_{RMS}
- Time: t_{Opening} , t_{Closing}

Monitoring, analysis & prediction

charging motor monitoring



Failure mode:

- Gear wheel broken.
 - Initial stage: One or two teeth broken, but motor could still be able to finish the charging
 - After several operations the entire gear pairs damaged completely
- Maintenance could be planned at convenient time

iUniGear & iVD4 Smart switchgear hardware




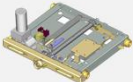


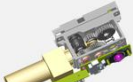


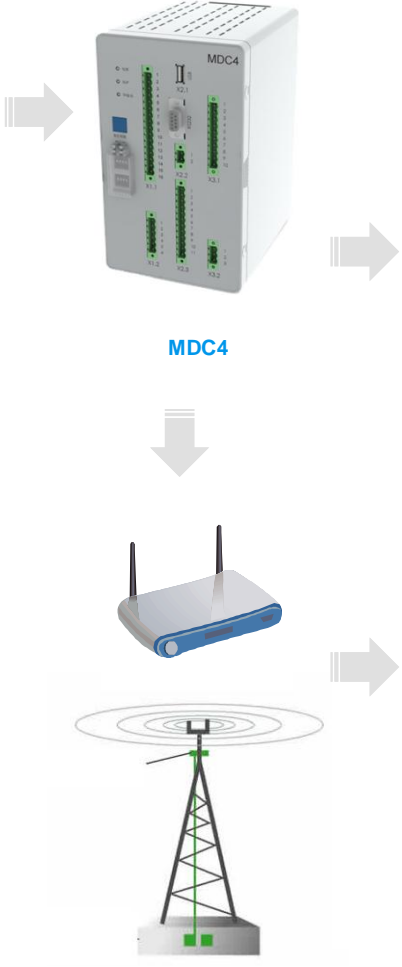
iUniGear®
Smart grid solution




iVD4®
Smart grid solution

Switchgear retrofit

 busbar		
 Coils		
 Contact system	 Motorized truck	
	 Charging motor	
 Cable connection	 Motorized ES	




HMI




Substation platform

WEB client



Mobi I e APP




Cloud service Full service closed to you

Cloud service package

Full service base on remote + local



Cloud service base on:

- Smart panel
- Remote monitoring
- ABB specialist team
- Service footprint
- Local rapid response

Cloud service package value:

- Improve reliability
- Improve substation performance
- Reduce operation cost
- Raise s/s management level

Details of the cloud service package

Full customer support



Remote monitoring

Based on smart switchgear with sensors and wireless RF, ABB provides the real-time remote monitoring service



Routing inspection

to the substation by ABB service engineer with professional facilities



Rapaid response

in 2 or 4 hours service, base on the service station footprint



Technical support

Assign account manager for customers, who will response the requirements rapidly



Diagnose & maint.

to maximize the reliability and availability of equipment and systems

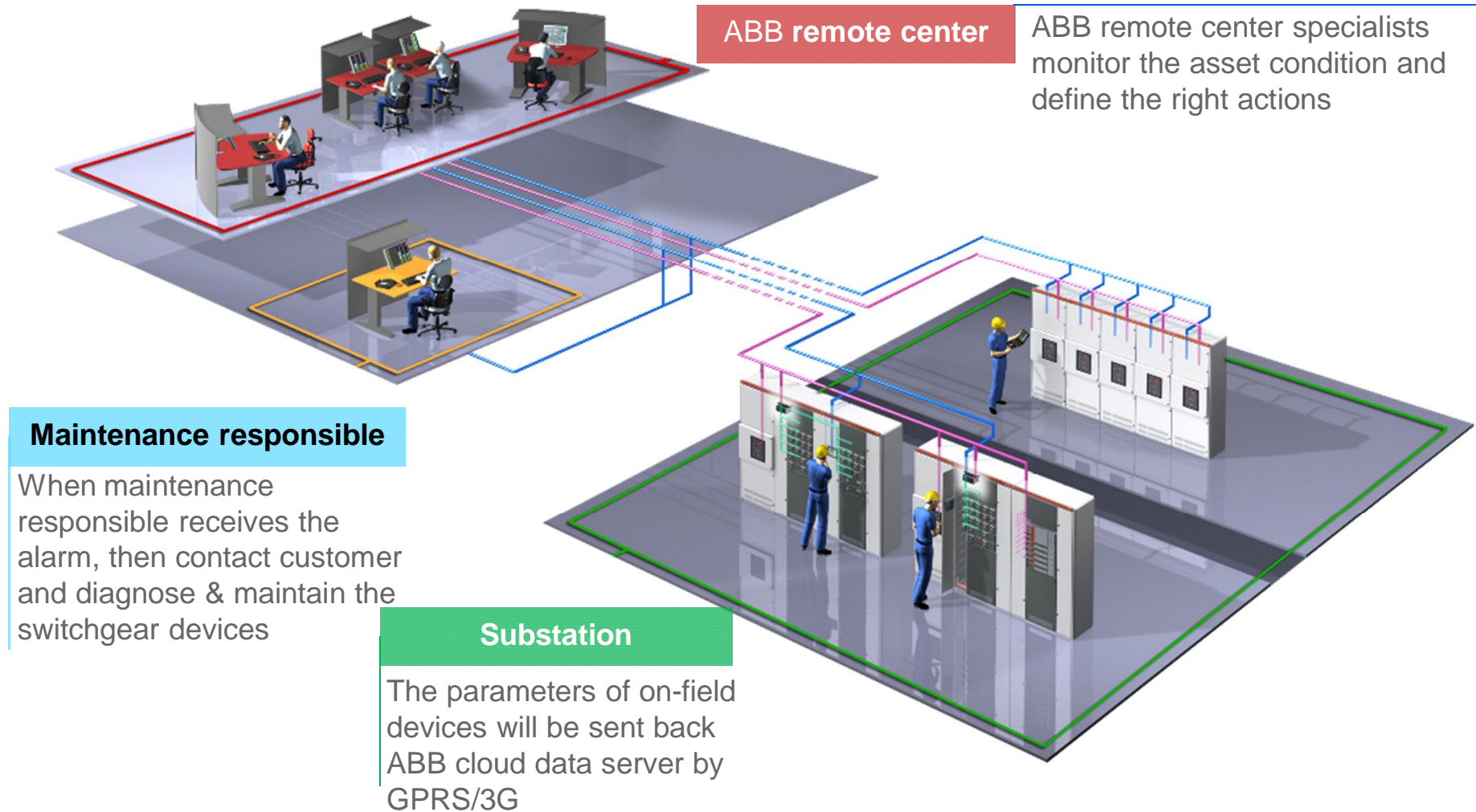


Warranty extension

to cloud service effective period

Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20 ... 30
LC	-	Run-in	Stable						Monitor						Unstable			Lf.extension			
Maint.			■		■			■			■			■			■		■		Annually

ABB specialist on-line Remote monitoring



Remote center “Cloud room” with multifunction



On-line monitoring

On-line monitoring, analysis and decision made by ABB specialist team remotely

Remote issue permit-to-work

Via the 3G network, mobile phone and cloud room video system we issue the “permit-to-work” to site service engineers remotely

400 hot line

400 hot line function combine with Remote PTW, cost efficiency

Service quality survey

Better customer care
More stable service quality

Remote tech. support

Improve the competence of our site service engineer

PPMV service footprint

Rapid response in **2h** & **4h** service offering

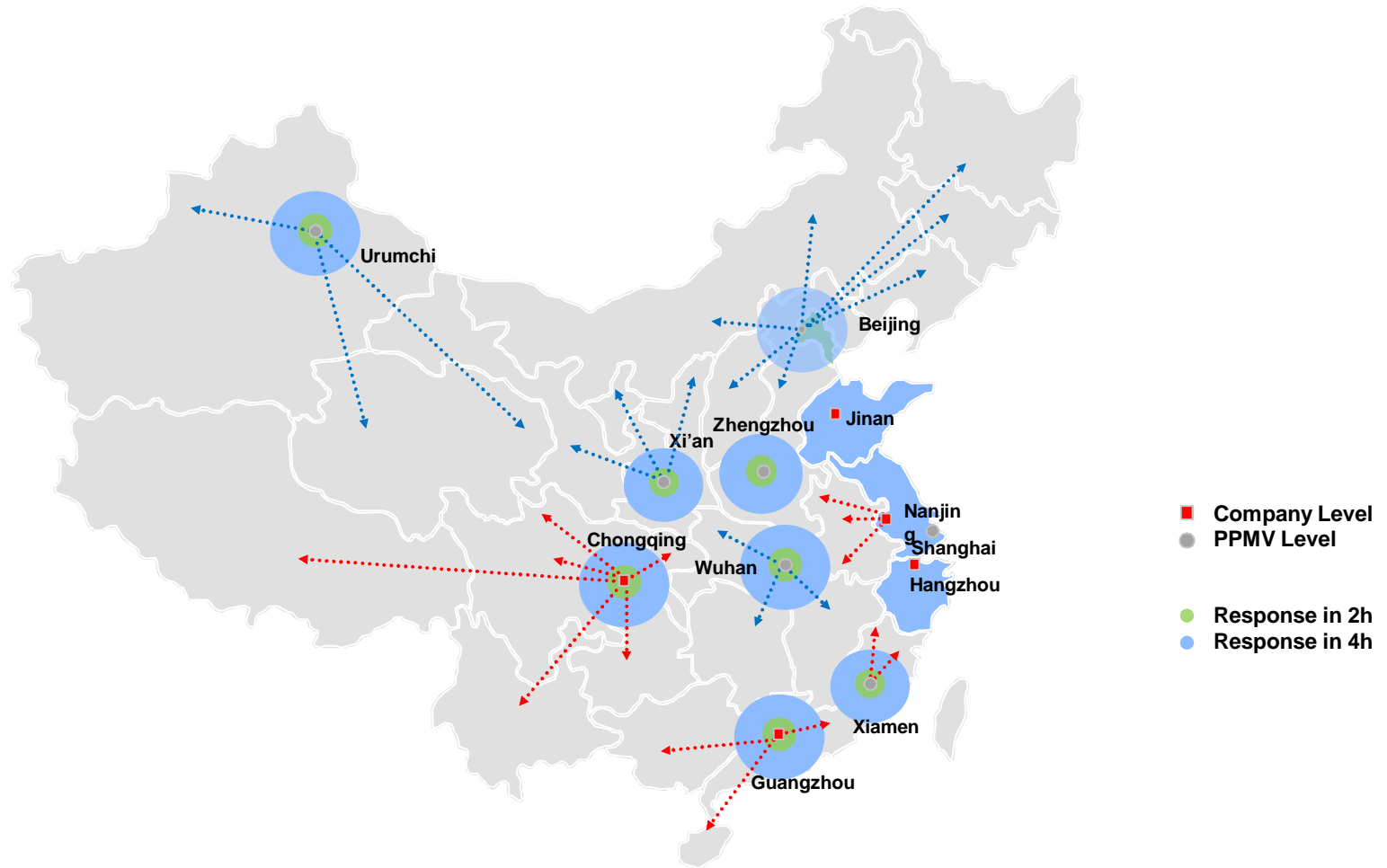
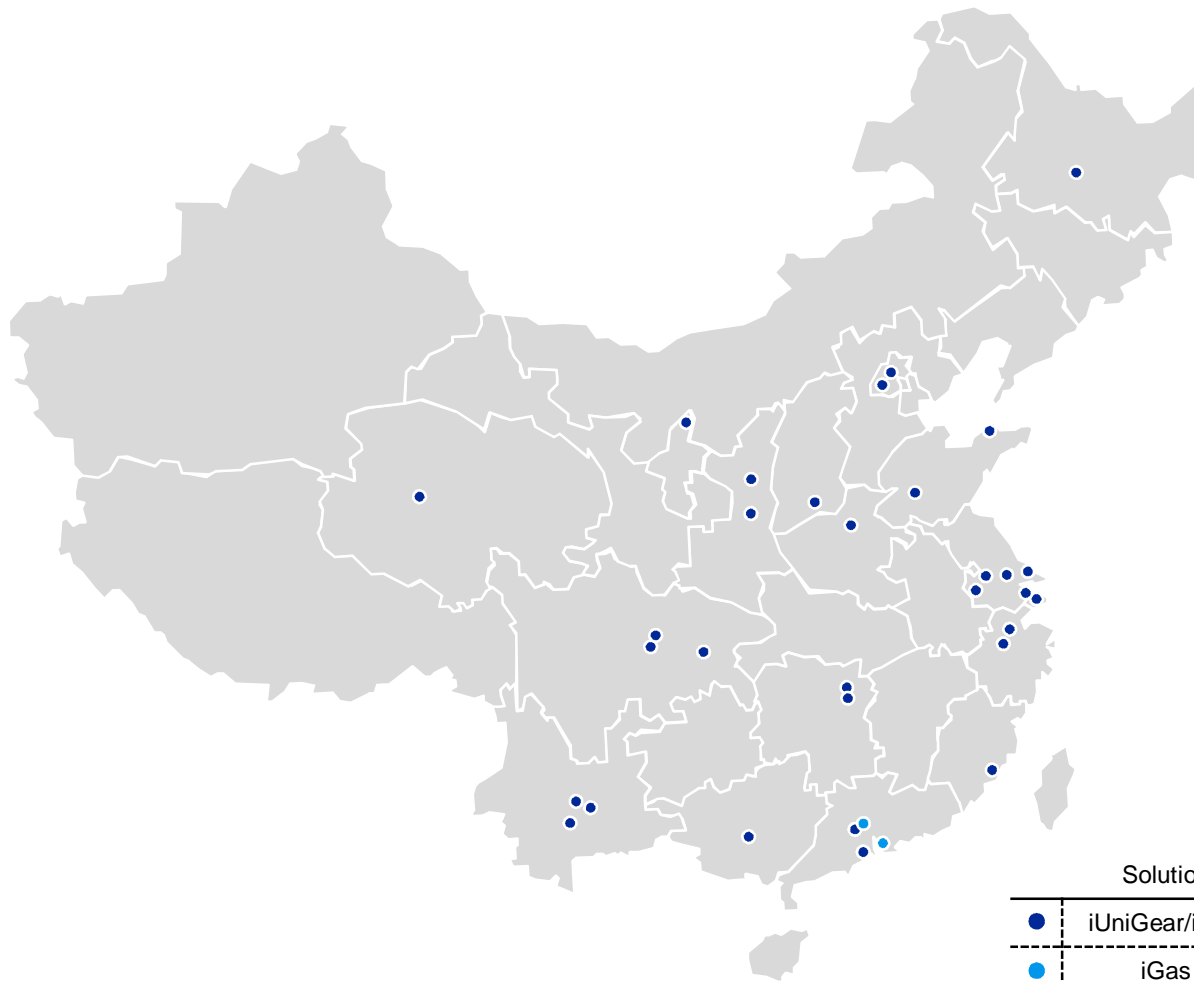


ABB PPMV smart grid solution

Sales performance



	Solution	project	Total
●	iUniGear/iVD4	31+3(overseas)	410
●	iGas	2	3

Pilot project

Shandong Weihai Shangmao Substation



- Pilot Intelligent substation demonstration project
- Based on 3G ABB Online System
- Commissioning from 2011





Power and productivity
for a better world™

