The framework of the next generation automatic weather station in China

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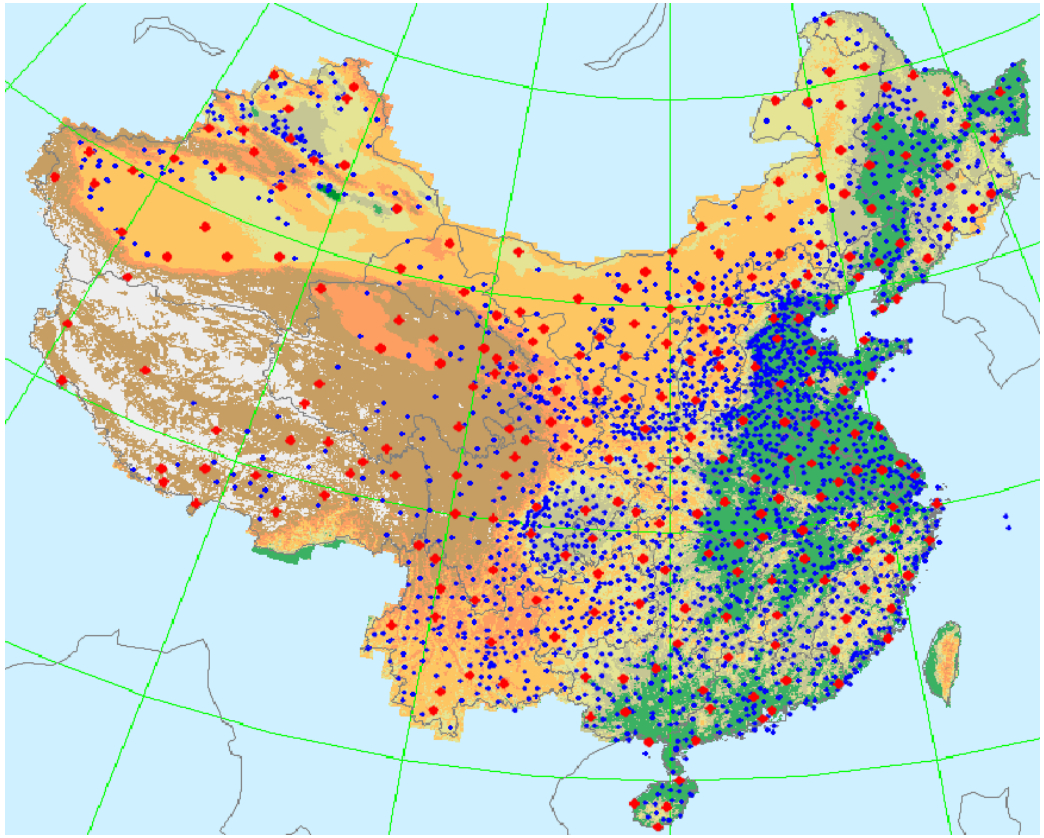
AWS in China

There are 2424 national AWSs and over 30,000 regional AWSs by the end of 2013, AWSs play an very important role for disaster monitoring and forecast.



How to make so many AWSs work more efficiently, measure more accurately, maintain more simply?

First we need to build a system for Operational use

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3 Digital sensors

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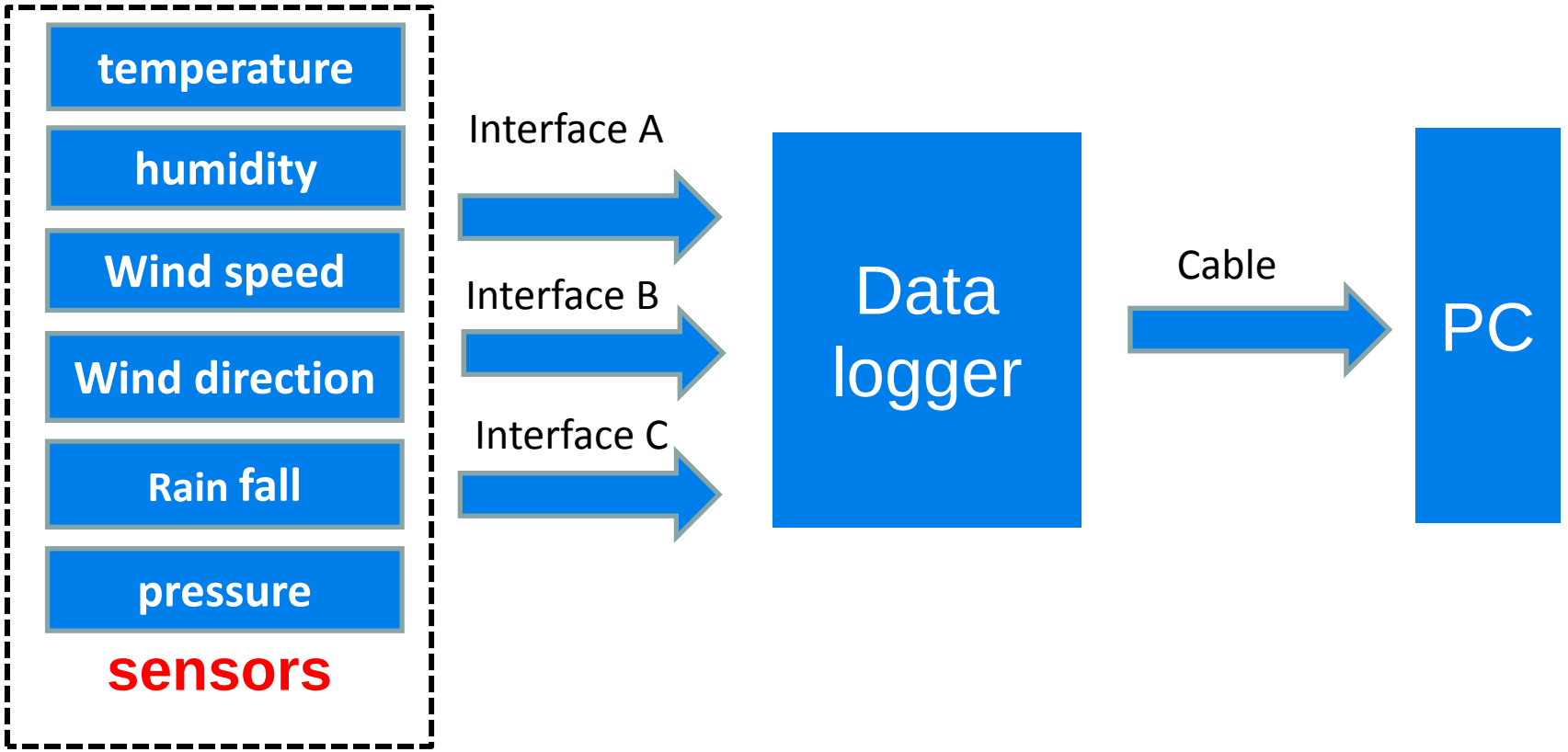
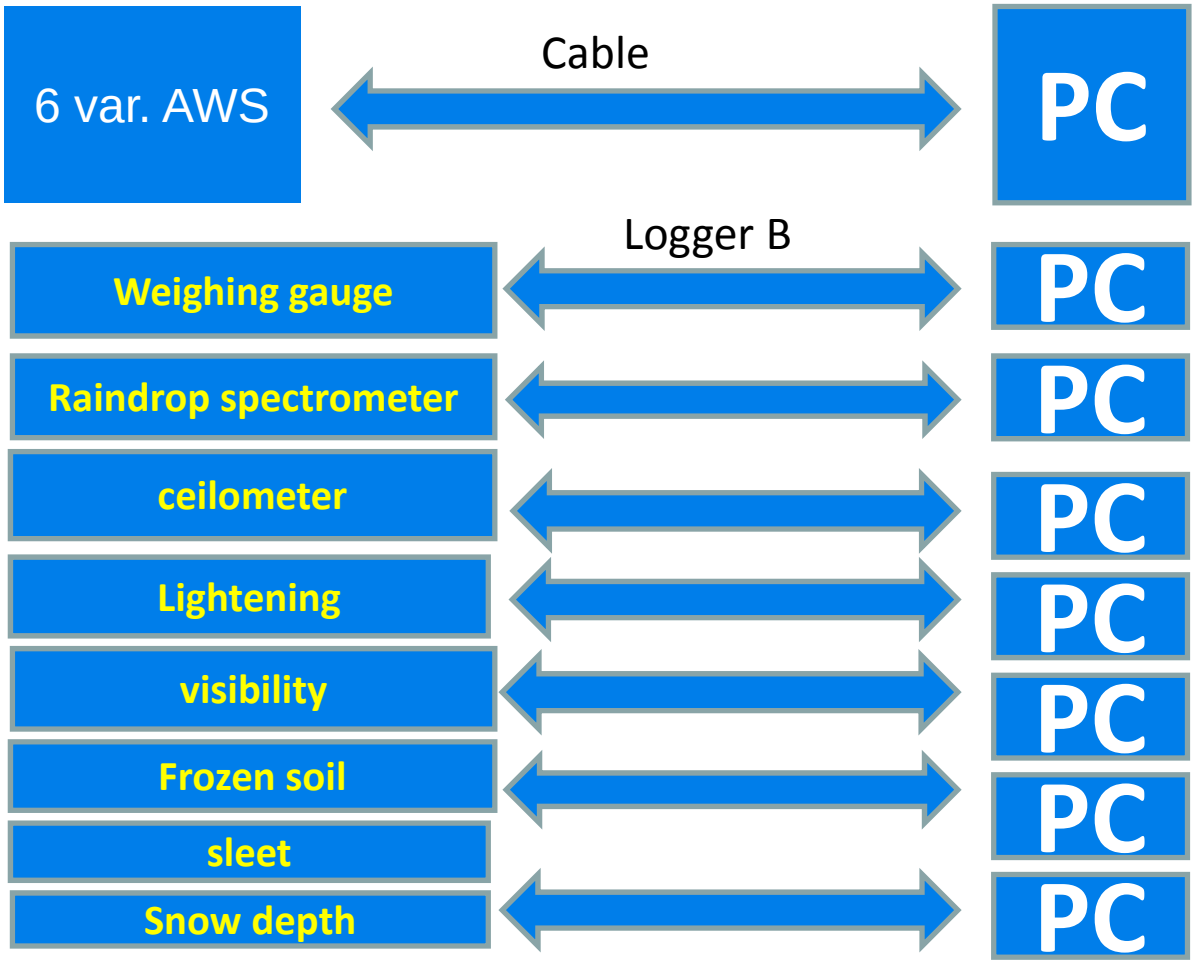
6 Summary

1. Recall of the traditional AWS



1. Recall of the traditional AWS



1. Too many kinds of interface
2. Too many instruments data form
3. Too many cables
4. Too many PCs
5. Too many software

When needs grow, the system goes bloated

1. Recall of the traditional AWS

Summary of the problems in conventional AWS

Three problems.

1) When a new type of sensor needs to be added in the AWS, the data collector interface has to be re-designed, so **it is very difficult to extend** and connect a new meteorological sensor;

2) When a sensor needs to be calibrated, the sensor and the data collector has to be **calibrated** at the same time.

3）Some instruments are difficult to connect to the traditional data logger directly, such as: sky imager, laser ceilometer and so on.

4) OPEN the “box”.

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2. The architecture of ISOS

What ISOS is?

Integrated Surface Observing System --- ISOS

Purpose of ISOS?

Fix the problems and provide flexibility for future.

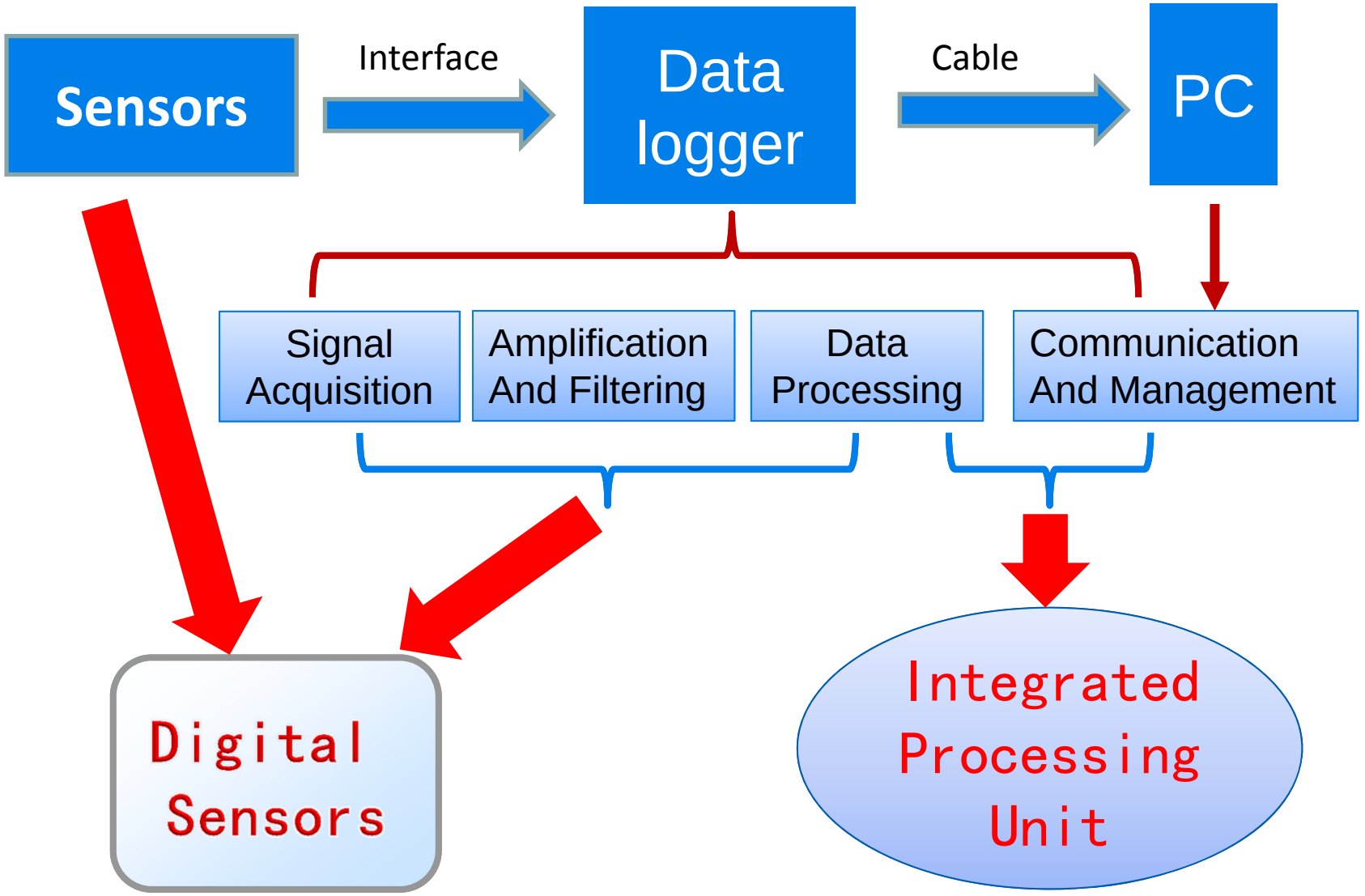
How to accomplish this task?

1.Hardware re-design

2.Software re-program

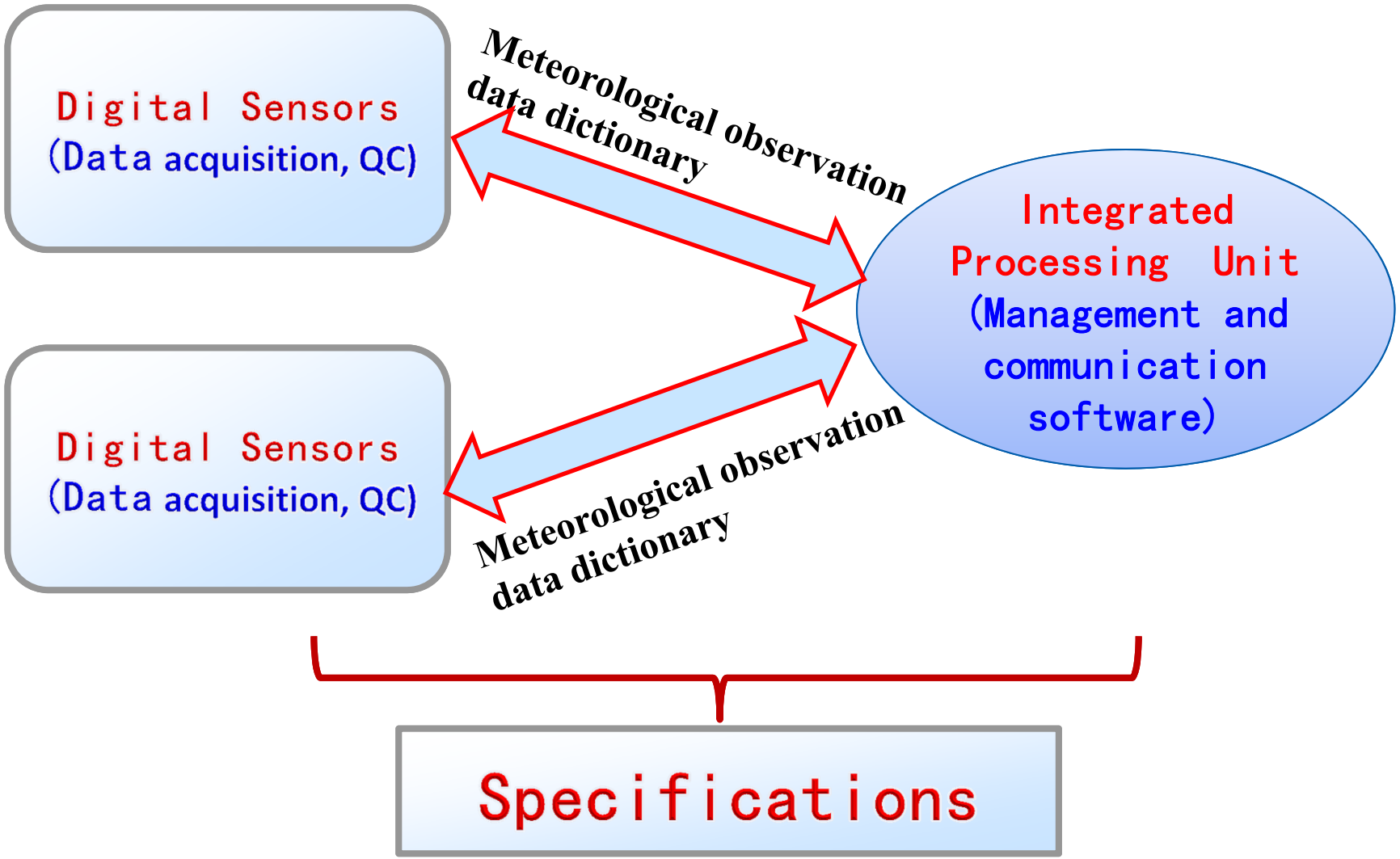
3.Specifications to rule them all

2. The architecture of ISOS



2. The architecture of ISOS

Review of the structure



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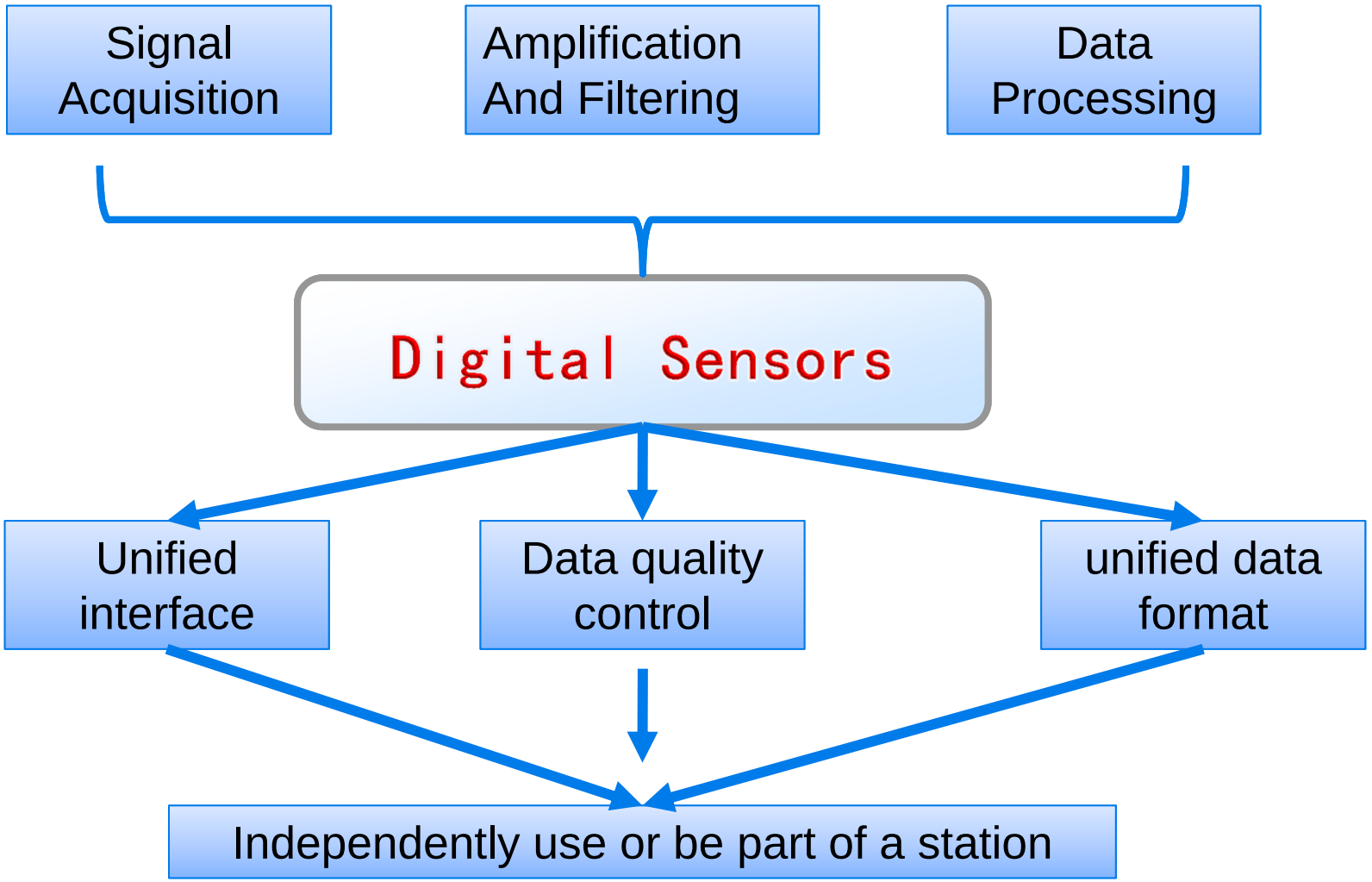
3. Digital sensors



3. Digital sensors

Digital sensor with Data quality control

1. Based on the WMO recommendations (the guide)for data acquisition.

2. Two levels of quality control

(1)Sampling data: limit check, change rate check, calculating the instantaneous meteorological value

(2)Meteorological variable value: limit check, change rate check(not too fast not none)

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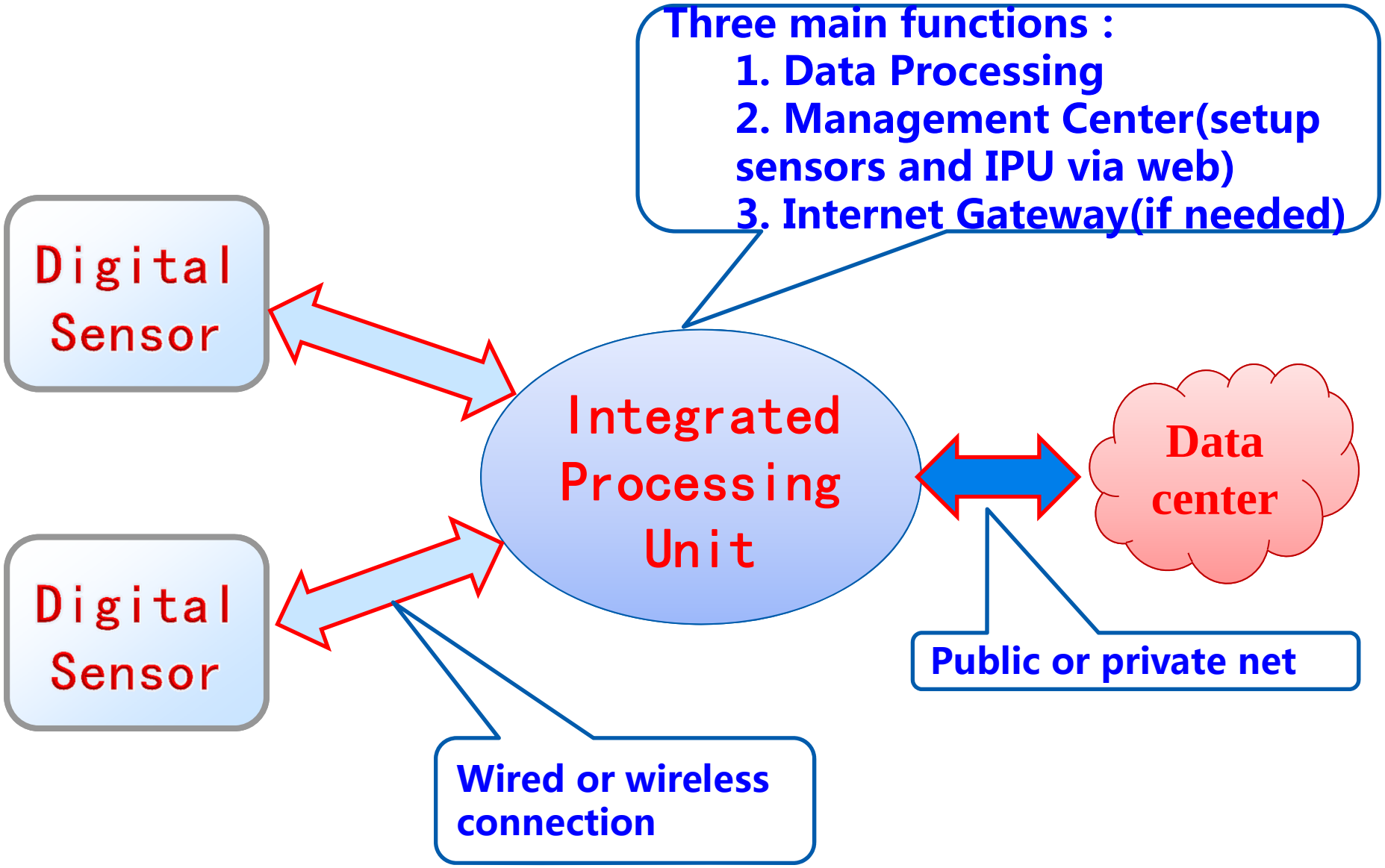
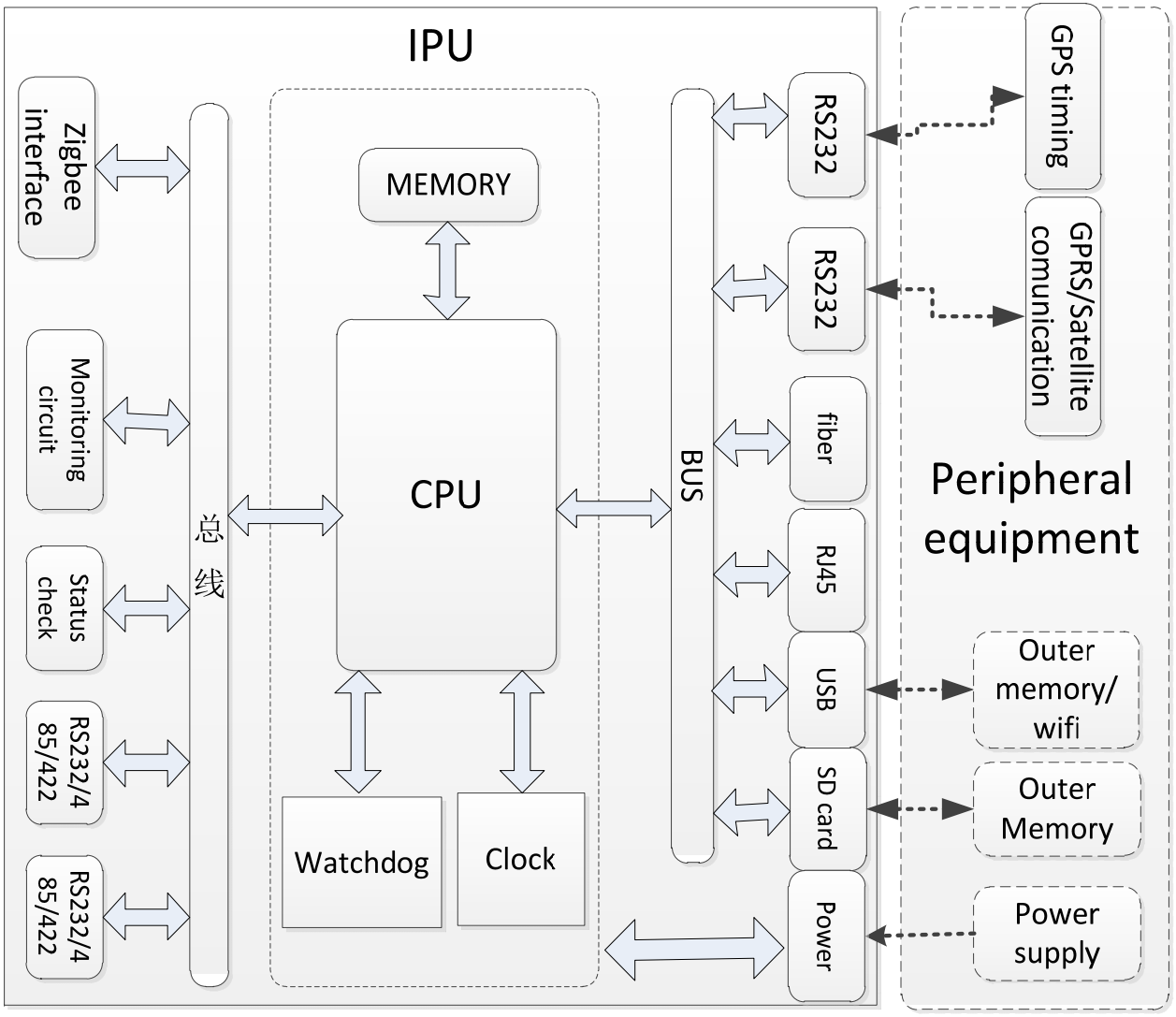
4. The integrated processing unit



4. The integrated processing unit

Diagram of the IPU hardware

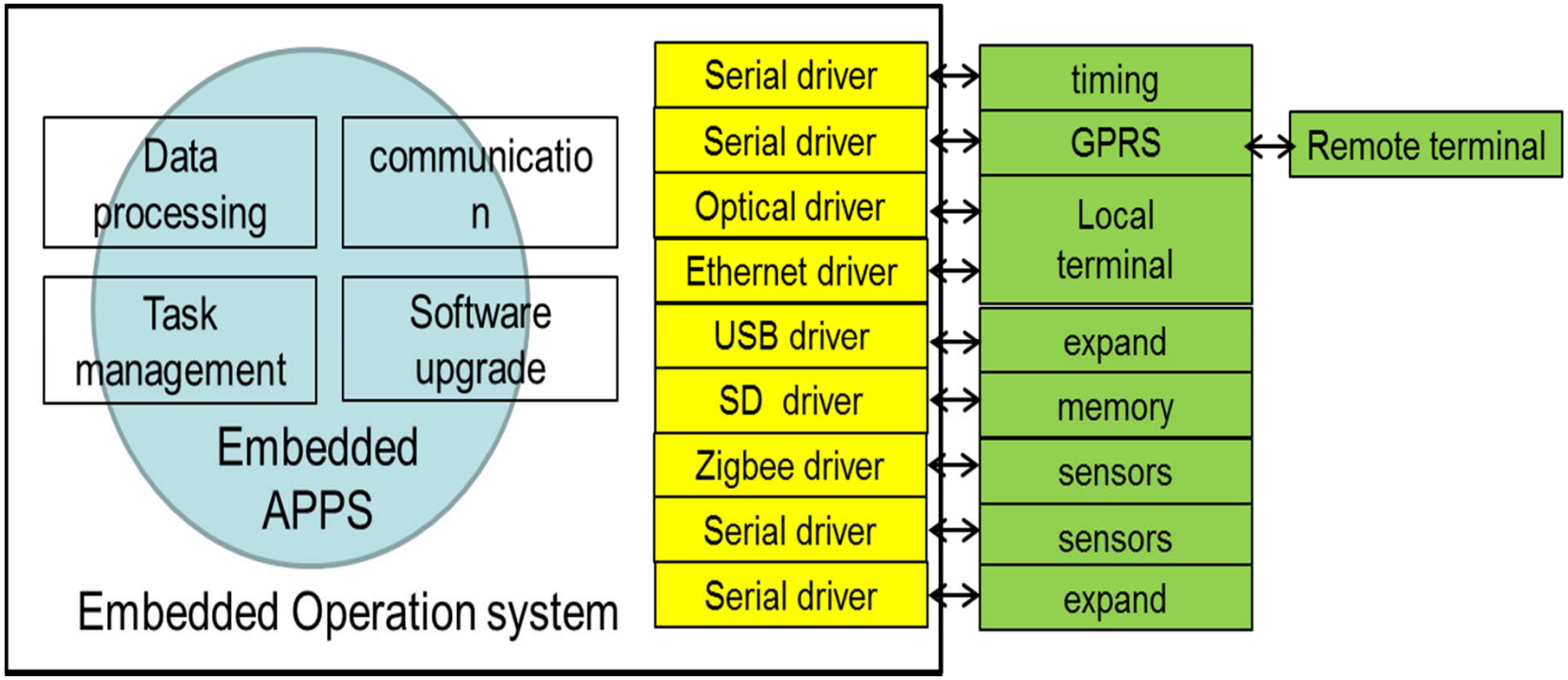


Resources:
processor, clock circuit, memory.
I/O interface (ZigBee interface, RS232, Ethernet interface, optical fiber interface, USB interface, SD card interface), monitoring circuit, power supply interface and indicator lights.

4. The integrated processing unit

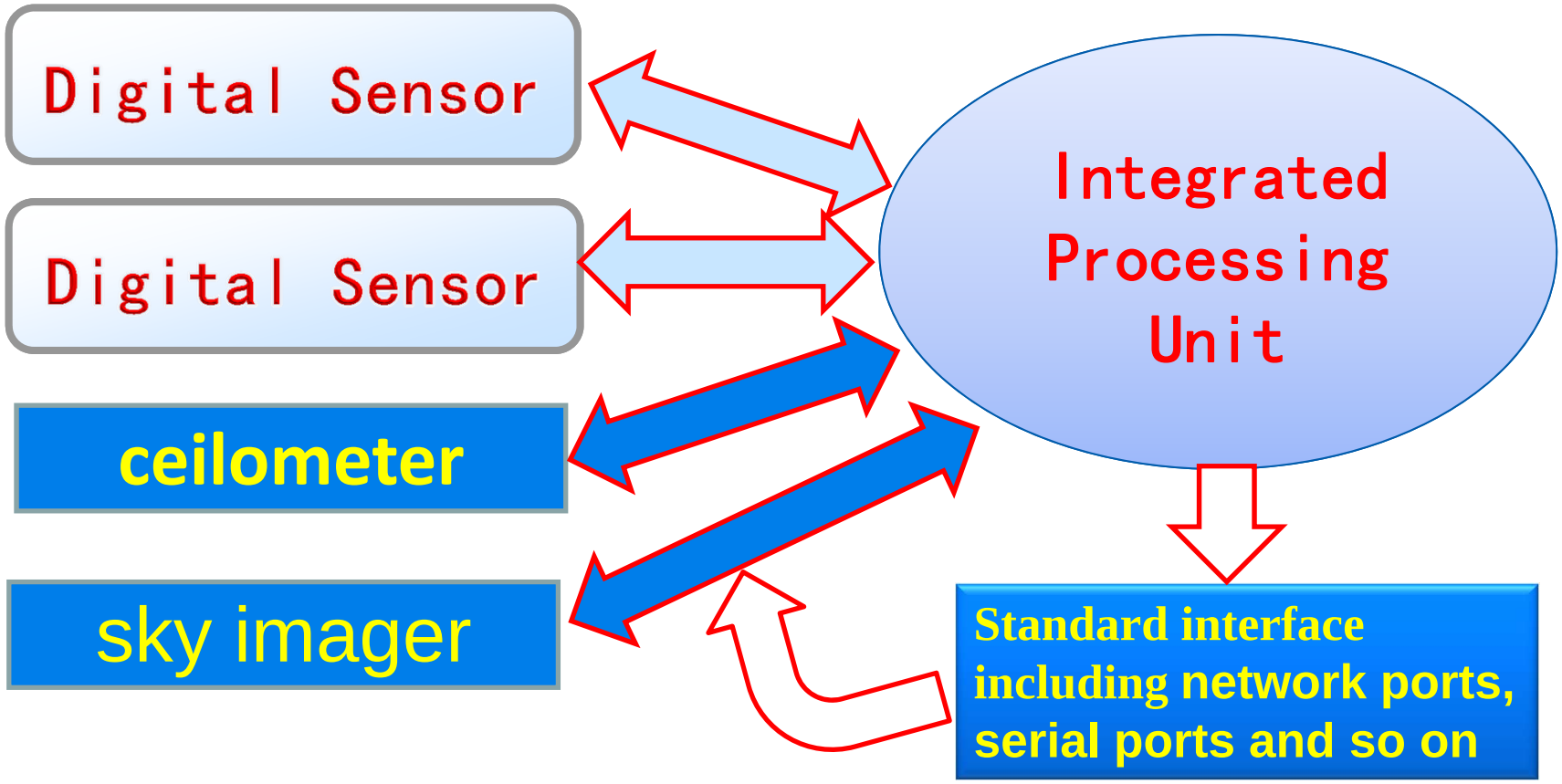
The IPU software

Embedded software running on IPU includes four functional modules: a master control module, a data acquisition processing and monitoring module, a communication module and a software upgrade module.



4. The integrated processing unit

It is very convenient to increase and manage new digital sensors



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5. Meteorological observation data dictionary(MODD)

AWS

Format 1

ceilometer

Format 2

visibility

Format 3

5. Meteorological observation data dictionary

What is the MODD

1.Stipulate meteorological variables and status

2.Index for the database and application programs use XML.

3. Designed for manufactures, programmers and meteorological operation technician.

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        <Discription>1.5米高度的空气温度</Discription>
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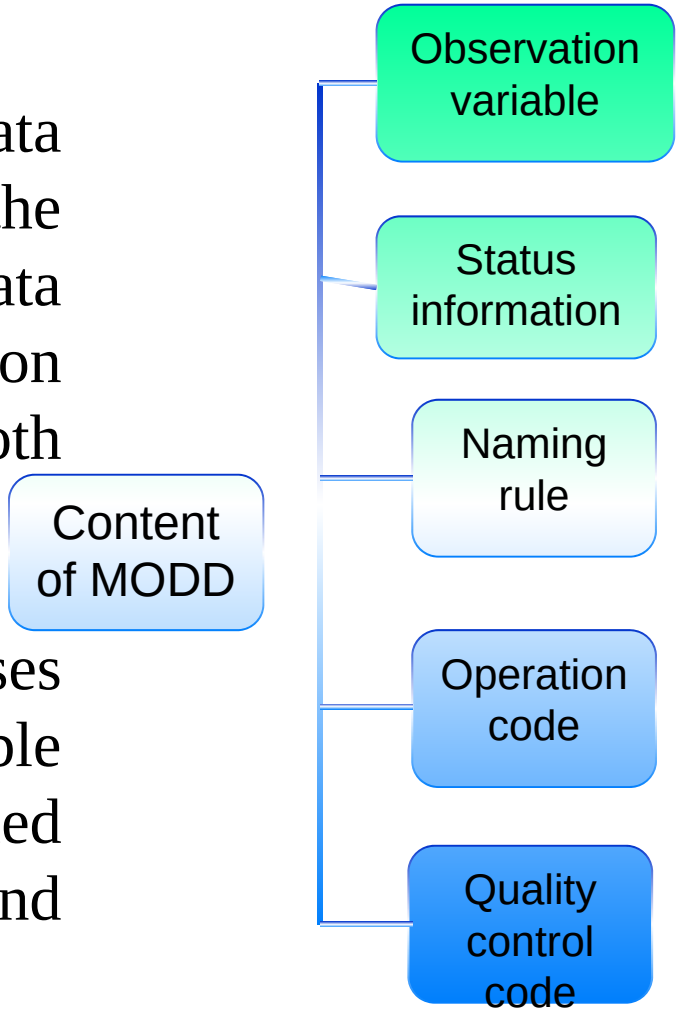
        <Unit>℃</Unit>
        <Range>保留一位小数</Range>
        <Bytes>4</Bytes>
    </Element>
    <Element>
        <Name>AAAa</Name>
        <Discription>最高温度</Discription>
        <Multiple>10</Multiple>
        <Unit>℃</Unit>
        <Range>保留一位小数</Range>
        <Bytes>4</Bytes>
    </Element>
```

5. Meteorological observation data dictionary

Content of MODD

MODD is designed to set a complete data specification, which follows the established rules and can also extend data format flexibly. This specification regulates digital sensor format for both input and output data.

Written in ASCII code table, MODD uses self-defining features from Extensible Markup Language (XML), companied with self-defining, self-description and sequence extension designing methods.



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6. Summary

Problems review

Three problems.

1) **Difficult to extend.** Fixed by unified digital sensor and IPU with plenty of resources.
2) **Calibration**. The digital sensor presents its own performance.
3) Some instruments(as sky imager) are impossible to connect directly. IPU with plenty of resources.

6. Summary

Problems review

Five too many

1. Too many kinds of interface. Unified interface and highly customized by detailed specifications.

2. Too many instruments data form. MODD

3. Too many cables. Wireless communication supported and highly recommended.

4. Too many PCs. One will be enough due to MODD. None if you like.

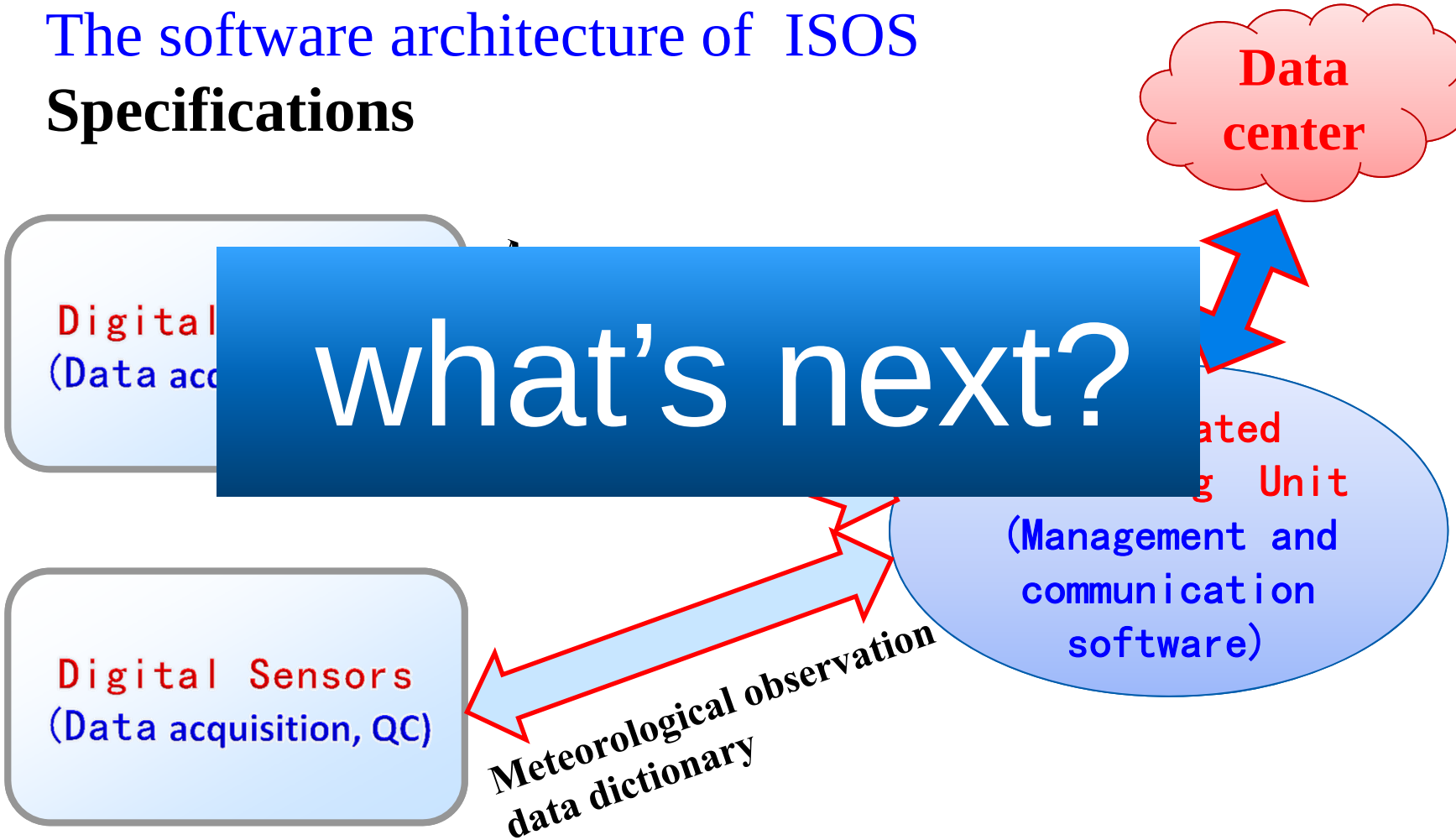
5. Too many software. The ISOS software done all the job under most kinds of circumstance.

6. Summary

The hardware architecture of ISOS

The software architecture of ISOS

Specifications



6. Summary

From ISOS to “I”SOS

- Realize the **intelligence** of sensor （Intelligent access , Lifetime monitoring, Flexible networking ）
- Using Internet of things technology
- Implementing cloud computing(as for data quality control)

Thank you for your attention