

IOT APPLICATION IN THE CONTROL SYSTEM OF THE BEPCII POWER SUPPLIES* C.H. Wang[†], X.L.Wang, L.F.Li[#], IHEP, Beijing, China P. Chu, MSU, East Lansing, MI 48824, USA

INTRODUCTION

The paper introduces the idea how to apply Internet of things IoT to the accelerator control system and take the existing control system of the BEPCII power supplies as an example for IoT application. The purpose is to make the control system more intelligent and automatically identify what and where the problem is when the alarm of the control system of the power supplies occurs. That means that IoT can help to automatically identify which chassis and which module inserted in the chassis and the connection cables. It is great convenient for the maintainer to use a mobile phone to diagnose faults and create the electronic maintenance record.

IoT in the Accelerator

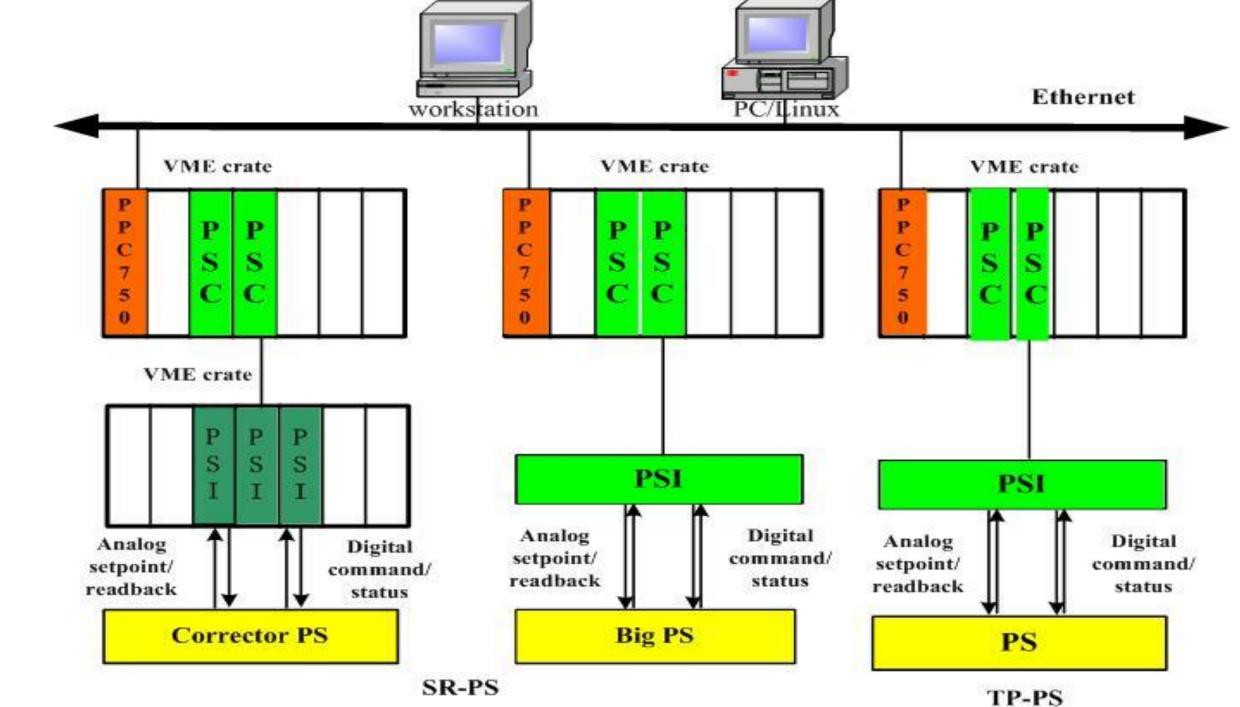
A modern accelerator is complex facility which consists of many systems and a large amount of equipment such as magnets, power supplies, RF and vacuum and so on. During the construction and the installation as well as running of the accelerator, a huge number of data and information related to these equipment are created. So, it's very important for a large accelerator to collect and save and manage such large data. With the benefit of the Interne t of things, these problem can be solved nicely. The idea of IOT application in the accelerator is that every object

Power Supply Control System in the BEPCII

VME IOCs:18

EPICS PVs:~10000

PSC/PSI: ~60/200



is connected and people and objects are also linked together, there should be setup model of two-sided direct interconnecting and

interworking networks. It's
possible to use RFID in the accelerator to construct a sensing layer

chassis plug-ins, cables in database

> Supply Contro

System

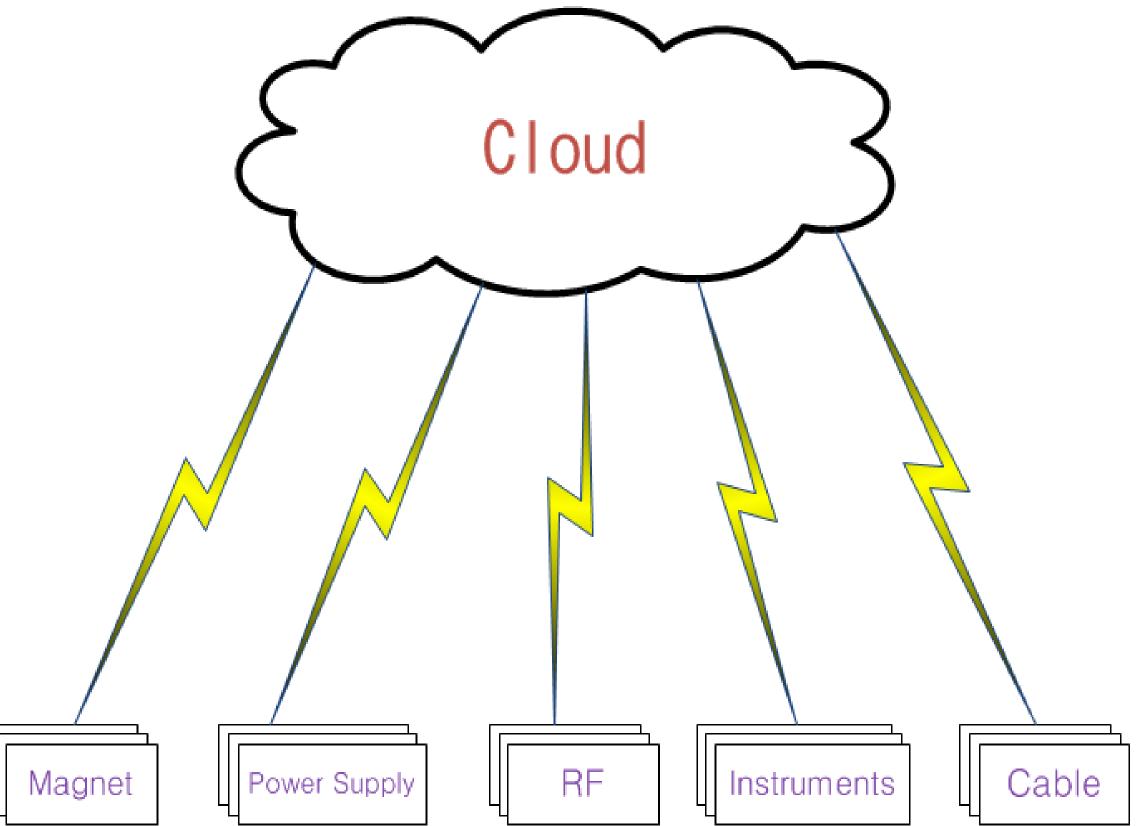
struction

控制本地站mIOC VME机相

Running status

ecord in detai



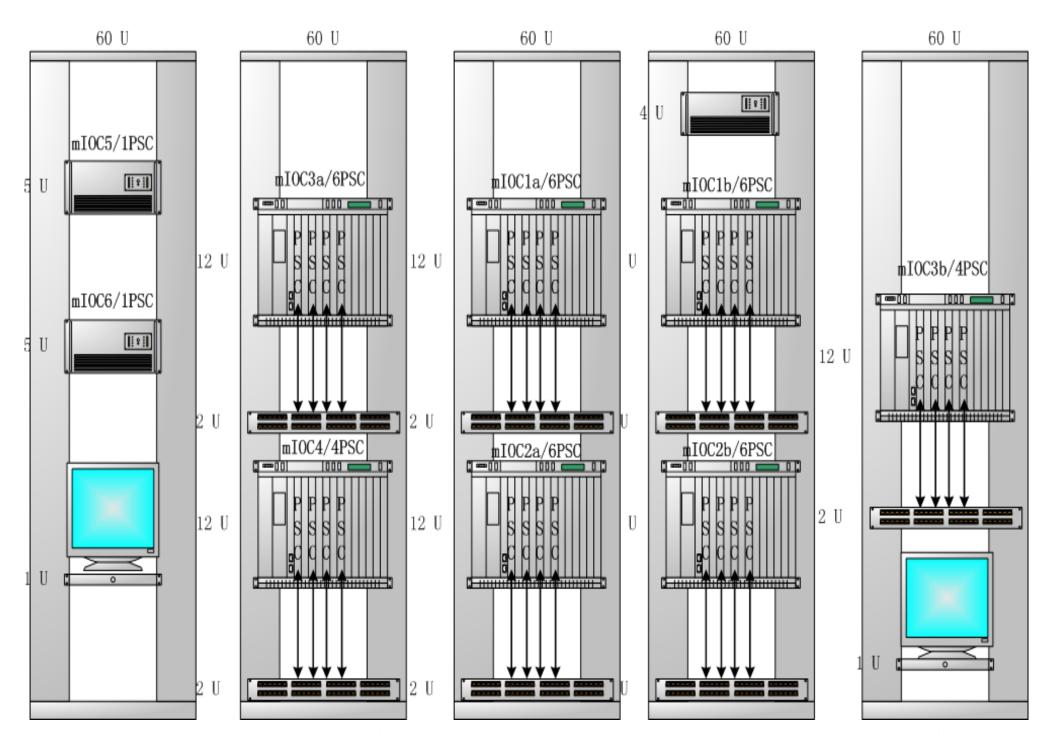


B/Q/S magnets power supplies: ~400

Optical fiber cables : ~400

Layout of the Power Supply Control Station

Four local stations for the power supply control in the BEPCII. There are many cabinets, chassis, plug-ins, cables, etc. It's not so easy for engineers to maintain so



equipment and devices as well as the cables with RFID.

IoT Application in the control system of the power supplies

The engineers on-site scan the QR cord in the local station. The IoT APP functions as follows:
get the permission to repair
recognize what and where the problem happened according to the alarm colour
writing a record and submitting the record
monitor the status of the cabinets, the chassis, the plug-ins, the cables
status of the control system of the PS

Visualization of the VME chassis, the PSC modules and the optic fibers between PSC/PSI. The right lists::(green:ok;red:fault) \checkmark name of the power supply

✓ VME chassis number,
✓ PSC number

many devices.

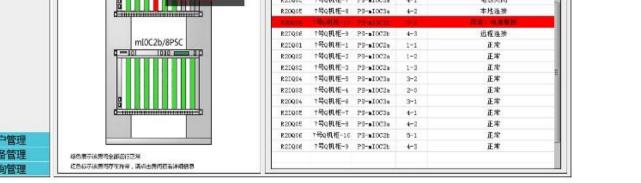
When a fault occurs with the power supplies and the control system, it will take many time to recognize what and where the problem happened. In order to improve the control system intelligent, we will use RFID to construct a sensing layer in each power supply control station. The goal:

- make the operation maintenance convenient
- easy to recognize the fault location
- automatically recording maintenance
- generate electronic maintenance log

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on leave from IHEP



| 首页 | 大电源本地站 PS | 1/7号Q机柜 | | | | | | |
|---|---------------|--|-------|------------------|----------|----------------------|--|--------------------|
| 电源厅本地站 | 机柜可视化 | | | 机柜信息详情 | | | | |
| 7号Q机柜 | | | 输入编号: | | <u>[</u> | | 快速意调 | |
| 号Q机柜 | | | | | | | | |
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| Q机柜 TOTATE | | 4.91 | | RECORE | 7号9机柜-3 | | 1-3 | 正常 |
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| 6773 | | | | R21005 | ?号Q机框-? | | 4-1 | 电遮关闭 |
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| | | | | R2IQ06 | 7号q机柜-9 | PS-aI0C2b | 4-3 | 远程连接 |
| | | | | R2IQ01 | ?号Q机框−1 | PS-mIOC2a | 1-1 | 正常 |
| | | | | R20Q02 | 7号Q机柜-2 | PS-sIOC2a | 1-2 | 正常 |
| | | | | R21Q02 | ?号Q机框-3 | PS-mIOC2a | 1-3 | 正常 |
| | | | | R21Q04 | 7号Q机柜-5 | PS-mIOC3a | 3-2 | 正常 |
| | | | | R2IQ08 | ?号Q机柜-€ | PS-sICC2a | 2-0 | 正常 |
| | | | | R20Q04 | 7号Q机柜-6 | | 3-1 | 正常 |
| | | | | RZIQOE | 7号q机柜-7 | | 4-1 | 正常 |
| | | | | R20005 | 7号0机柜-8 | | 4-2 | 正常 |
| 1户管理 | | | | R20006 | ?号q机柜-10 | | 5-1 | 正常 |
| 2备管理 | 線色表示這麼得全部還行正常 | | | R2IQ06 | 7号q机柜-9 | PS-sIOC2b | 4-3 | 正常 |

- ✓ PSI number
- \checkmark status of the connection between the PSC and the PSI
- \checkmark status of the power supply

Visualization of the cabinets of the power supplies and the PSI chassis sitting in the cabinets. The right lists:(green:ok;red:fault)

- name of the power supply
- ✓ VME chassis number
- ✓ PSC number
- ✓ PSI number
- \checkmark status of the connection between the PSC and the PSI
- \checkmark status of the power supply.

CONCLUSION

The work of the IoT application is still in development. The APP of the IoT supports both IOS and Andriod. It may check the status of the cabinets, the chassis, the plug-ins, the cables and the status of the control system of the power supplies. It's easy for the engineers to recognize the fault location and to automatically record maintenance and to generate electronic maintenance log.