# **Monitoring Control Applications at CERN**

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## INTRODUCTION

The LHC accelerator complex and its associated Experiments rely on many critical auxiliary systems for their safe operation. The Industrial Controls and Engineering (EN-ICE) group of the EN Department at CERN develops solutions and provides support in the domain of medium and large control systems. EN-ICE is currently responsible for the operation and maintenance of around 60 applications that control critical processes for the cryogenics, quench protection systems and power interlocks for the LHC. The Monitoring Operation of cOntrols Networks (MOON) package was developed to centrally manage software updates over the lifetime of these applications and to ensure a quick detection of faults during their operation.

# **MOON Architecture**

- Simatic WinCC Open Architecture [1] commercial SCADA package
- JCOP [2] & UNICOS [3] Frameworks
- The JCOP Component Installation Tool [4] for centralized deployment of software components
- System Overview Tool [5] for farm and application monitoring



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Table 1: Current and expected number of monitored items						
Item	Current number (expected)	Refresh interval (s)				
<b>Application Domains</b>	12 (20)	N/A				
Hosts	52 (100)	30				
WinCC OA applications (PVSS)	57 (300)	30				

Dedicated functionality, e.g. PLC Monitoring

# **Main Features**

ICE Projects\_flat Hosts\_flat Remote DB-Agent Status --STOPPED (11.07.14 08:5, Restart DB-Agent ÷. CIE E CIRCUIT CNGS Set to Central COLLIMATORS PVSS-DB Contents in SYNC + CRYO ±..\_\_\_CV ±..\_\_\_MOON All components are correctly installed MOON QPS PIC POPS WIC LHC PS Supervision WIC\_PS SystemIntegri All component dependencies are Ok No pending post-install scripts Show sub-components guested Component Version Reinstall Restart Pro Overwrite File fwCore 3.2.0 fwTrending 3.1.1 unCPC 4.3.2 gcsTypes gcsTypes +- PLCs unCore unLHCServices vicDevice - SPS unLHC\_Interlock\_QPS 4.3.2 unLHC Interlock QPS unCore InLHCServices wicDevices •• X Auto refresh Register Reinstall (Values refreshed every min) Adopt Configuration Post-installs pending Broken dependencies 🗶 Manage Configuration 🗖 ок Limit log messages 20 🚊 Clear logs before 1 hour ago 👻 Clear Comm Error Not monitored App Erro

Centralized software configuration management

- Integrated software management and application monitoring
- Centralized deployment of software components
- Light-weight access to the run-time databases of remote WinCC OA applications
- Monitoring of all layers of the control systems and their technical infrastructure
- Graphical representation of connections and dependencies amongst components

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- Alarm screen showing live and historical alarms
- Intelligent alarm filtering scheme triggers an SMS to the on-call expert
- Long-term storage of alarms and monitored parameters

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• Trending

MOON

ICE Projects\_flat Hosts\_flat

- ICE

Legends

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# Main graphical interface of MOON

(=) (=) S: fwSystemOverview/fwSystemOverview.pnl

Multiple views

MOON\_1: MOON <@cs-ccr-moni.cern.ch>

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#### Schematic views of the hardware layout





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#### Alarm screen showing live and historical alarms

START STOP KILL Properties	Refresh Close	11 1100 1100 1100-12 1100-20 1100-21
Remote recovery actions		



## CONCLUSIONS

The modular design of the EN-ICE Frameworks, the clear definition of the user requirements, as well as the consistent model of abstraction from the control applications enabled the rapid development of MOON with limited resources. Although this tool has only entered the production phase recently, it has already shown its power in assisting experts in their daily work. Currently all software upgrades of the EN-ICE applications are centrally handled using the tool. MOON has significantly reduced the time required for these interventions thus increasing overall efficiency. MOON has moreover become the primary tool for the members of the EN-ICE On-call service to understand the behavior of the control applications and to monitor their performance.

### References

[1] http://www.pvss.com [2] O. Holme et al., "The JCOP Framework", ICALEPCS 2005, Geneva, Switzerland

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