

# REMUS: The new CERN Radiation and Environment Monitoring Unified Supervision



ICALEPCS 2015, Melbourne, Australia Oct 2015 - Adrien Ledeul on behalf of REMUS Team CERN Health, Safety and Environment Unit





## Introduction

Why do CERN needs a new Radiation Protection & Environment Monitoring System?













Stray Radiation (x43)







#### Environment Monitoring:



Stray Radiation (x43)





#### Environment Monitoring:



Stray Radiation (x43)



Ventilation (x47)





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Stray Radiation (x43)



Ventilation (x47)



Water (x14)





50 km Accelerator Tunnel - 60 Access Points - 160 Experiments - 8,000 Radiation Workers

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Water (x14) Many more!





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#### **Radiation Protection:**



Gamma Radiation (x46)



Hand-Foot Contamination (x60)



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Hand-Foot Contamination (x60)



Radiation with Alarm Units (x100)



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Radiation with Alarm Units (x100) Many more!





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Water (x14)

Many more!

50 km Accelerator Tunnel - 60 Access Points - 160 Experiments - 8,000 Radiation Workers

#### ~500 Monitoring Stations:

- 30 different types
- Commercial Off-the-Shelf & Internally Developed Stations
- Surface and Underground areas
- ~3,000 Measurement Channels:
  - 700 measurements to logging / second

Workplace and Environment Safety

#### **Reporting to authorities:**

CMS

- Nature and quantities of emitted ionizing radiation

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L HCh

- Conventional environmental measured values

#### **Radiation Protection:**





Radiation with Alarm Units (x100) Many more!



### Previous Supervisory Systems

- RAMSES RAdiation Monitoring System for the Environment and Safety (2005)
  - Data Acquisition, Supervision and Control of **1,500** channels
- ARCON ARea CONtroller
  - Data Acquisition and Control of **300** channels (~1980)
- Proprietary Software (such as Berthold MEVIS)
  - Data Acquisition and Supervision of 100 channels
- Stand-alone devices
  - More than 1,000 channels not remotely supervised





BERTHOLD ....





Introduction – Heterogeneous Devices – Diversity of Users – Architecture REMUS - ICALEPCS 2015

## Requirements & Scope of the new Supervision: REMUS

- REMUS Radiation and Environment Monitoring Unified Supervision
  - Data Acquisition, Supervision and Control of Environment and Radiation Monitoring Stations
  - In continuous operation since 2013 (1,000 channels so far)
  - In 2016: 500 Monitoring Stations 3,000 Channels 500,000 Tags
  - 365 days/year, 24/7 operation (even during shutdowns of accelerators!)
- Aims
  - Unify all CERN Radiation and Environment supervisory systems
  - **Reduce delay** and the cost of **adding new devices** to the supervision
  - Provide light and fast clients, customized for each user's requirements
  - Reduce overall maintenance needs for operation
  - Use CERN common software & framework for SCADA:
    - SIMATIC WinCC OA
    - CERN JCOP(Joint COntrols Project) framework
- Guideline
  - Reliability, Scalability, Performance, Adaptability, Cost-Effectiveness





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RADIATION AND ENVIRONMENT MONITORING UNIFIED SUPERVISION

# Heterogeneous Device Types

How do REMUS handles heterogeneous Device Types Integration?



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#### Model and Basic Concepts

- Generic model of instrumentation
  - 3 basic concepts:
    - Channel: One point of measurement
    - Device: Piece of equipment, connected to other devices and channels
    - Monitoring Station (MS): Encapsulation of devices and channels
  - All the instrumentation is modelled using those 3 concepts



• Advantages:

•

- Homogeneous set of equipment
- Uniform development process
- Re-usable source code
- Infrastructure Independency





## **Run-time Installation of new Devices**

- A changing environment
  - CERN often dismantles / moves / installs instrumentation
  - Adding new MS to a supervision typically requires:
    - Software qualification for each new MS
    - Server Restart
- Abstraction of the complexity
  - REMUS allows users that have advanced access rights to add MS to the system
  - Instantiation of model previously defined in an external Oracle DB, used to creates variables in REMUS
  - The process of adding a new MS itself is qualified
  - This process can be executed during run-time
- Advantages :
  - A new Monitoring Station can be installed in a few minutes in REMUS
  - No Server restart is necessary
  - Low maintenance effort







## **Diversity of Users**

How do REMUS provides customized User Interfaces?





#### **REMUS** Applications

- Users have different needs
  - **Many different user profiles** use REMUS (accelerator & experiments operators, radiation protection engineers, environmental engineers, physicists, maintenance teams...)
- Customized User interfaces
  - REMUS is split into several **Applications** (subsets of REMUS instrumentation), with a specific layout (synoptic, widgets):
    - Applications are fully described in xml files, editable through a user friendly editor
    - Applications can be uploaded/downloaded from the supervision
    - Advanced Users (Application Administrators)
       are able to modify the layout of the supervision in runtime
- Advantages
  - Users can focus on the **part of the supervision** they are interested in
  - Improved Performance
  - Distributed maintenance effort





#### **REMUS** Applications





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### **REMUS** Applications



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#### Created by Radiation Protection and Environmental Engineers!









#### Architecture

How do REMUS allows continuous Operation, Integration & Deployment?



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**Data Acquisition** 





**Data Acquisition** 

Real time animation of Widgets & Alarm Screen





**Data Acquisition** 

Real time animation of Widgets & Alarm Screen

Configuration / Parameterization





**Data Acquisition** 

Real time animation of Widgets & Alarm Screen

Configuration / Parameterization

Installation of a new Monitoring Station





- Light and simple!
  - Low maintenance effort
  - Easy to understand for new developers



- Not CERN-dependant: Requirements to deploy REMUS in another facility:
  - 2 to 4 Linux or Windows **Servers** (2x WinCC OA + 2x File Servers if needed)
  - 1 Oracle Database
  - 2 WinCC OA licenses
  - In-house developed **Drivers** if not available in WinCC OA / JCOP framework or REMUS (**API available**)
  - In-house developed Widgets/specific UI panels if not yet existing (API available)
  - SQL Models of Device Types (API available)



- Resilience
  - Redundancy
  - Data Acquisition Watchdog
  - Buffering of measurement in case of network outages
- Continuous integration and run-time deployment









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So far (as from 2013): Availability of the Supervision: 100% Successful Data Acquisition: 99.8%

Continuous integration and run-time deployment





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Continuous integration and run-time deployment





## Thank you!

Special thank to REMUS Team, CERN HSE Unit, EN-ICE Group, BE-CO Group, IT Department, ICALEPCS 2015 Committees



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