

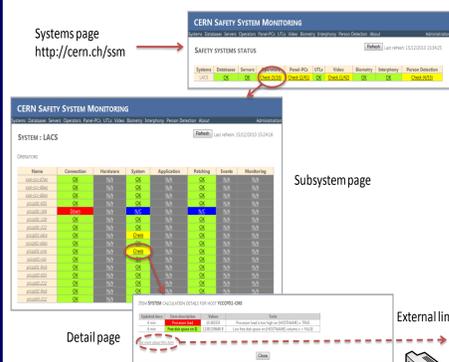
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CERN SSM (Safety System Monitoring) is a system for monitoring state-of-health of the various access and safety systems of the CERN site and accelerator infrastructure. The emphasis of SSM is on the needs of maintenance and system operation with the aim of providing an independent and reliable verification path of the basic operational parameters of each system. Included are all network-connected devices, such as PLCs, servers, panel displays, operator posts, etc. The basic monitoring engine of SSM is a freely available system monitoring framework Zabbix, on top of which a simplified traffic-light-type web-interface has been built. The web-interface of SSM is designed to be ultra-light to facilitate access from handheld devices over slow connections. The underlying Zabbix system offers history and notification mechanisms typical advanced monitoring systems

Motivation: why yet another monitoring system?

Several monitoring systems exist at CERN. However: Safety and access systems are very **heterogeneous** – none of the pre-existing systems supported all the equipment to be monitored. The **focus** of SSM is different from the other systems: Its goal is to provide a simple, independent verification path rather than a comprehensive status view. None of the other systems lend themselves to easy viewing with **portable devices**.

SSM – Web Interface



TIM – Graphical User Interface



Design principles

- Simplicity:** Well-defined interfaces with clear functional separation. Use existing systems and CERN standard services whenever possible (example: Oracle, web-services, authentication).
- Reliability:** Self-diagnostic checks to tell if the displayed information trustworthy.
- Independency:** Look at the system to be monitored from the outside and avoid using information produced by that system. Go to the source whenever possible (example: access PLCs directly).
- Maintainability:** Scripts and database structure simple and easy to understand with up to date documentation.
- Accessibility:** Works with all major web-browsers and handheld devices from anywhere.
- Confidentiality:** Access limited to a well-defined group and login with CERN password required.

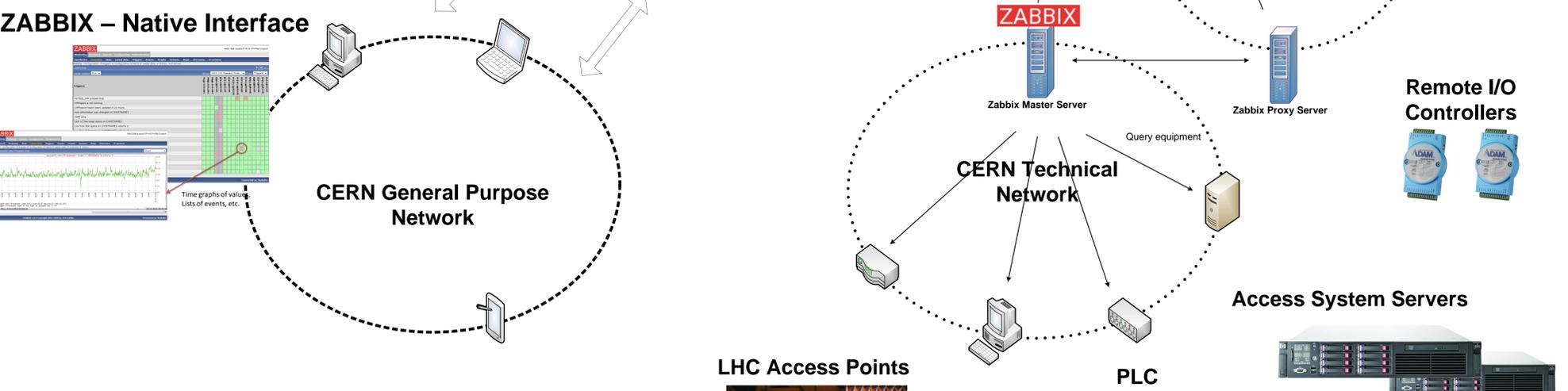
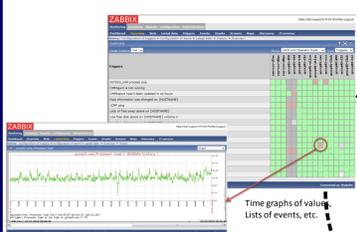
SIP – Site Information Panels



View from anywhere: SSM on Ipad



ZABBIX – Native Interface



Access and safety systems by GS/AE

- LACS (LHC Access Control System) – who enters LHC and when?
- LASS (LHC Access Safety System) – is it safe for beam or access?
- PACS (PS Access Control System) – idem for PS (soon).
- PASS (PS Access Safety System) – idem ...
- SPS PSS – integrated personnel safety system for SPS.
- SUSI (Surveillance des Sites) – who enters CERN sites and areas other than the accelerators.
- CSAM (CERN Safety Alarm Monitoring) – alarms for the fire brigade.
- Sniffer – gas detection.
- SIP (Site Information Panels) – display relevant info at access points.
- Safety systems developed by us but operated by others: SSA (Atlas), Ramses (radiation monitoring).

LHC Access Points



PLC Controllers



Access System Servers



Functional separation

- Collect** – the underlying monitoring engine:
 - Carries out the actual monitoring tasks (local agents, connection, item logging, events, notification).
 - Zabbix: support for Windows, SNMP, special purpose scripting, etc.
 - Linux server, Oracle database, web-based user interface.
 - “Expert information tool”.
- Synthesize** – the integration and synthesis layer:
 - A separate “scratch” Oracle database, which has access to Zabbix database tables.
 - Imports the group/machine/item/trigger structure from Zabbix.
 - All the synthesis rules defined as Oracle procedures.
- Visualize** – the visualization layer:
 - Web-page: <http://cern.ch/ssm>.
 - Accesses the synthesis database.
 - PHP-scripts: light and simple.
 - Both interactive and static displays.

Why Zabbix as monitoring engine?

- Support for Windows, Linux, other Unixes.
- SNMP, IPMI, database monitoring, web-monitoring, ...
- Extensible: server scripts, client scripts.
- Proxy servers (monitor restricted networks).
- Oracle database interface (let someone else take care of the DB).
- Web-interface out of the box (PHP – practically a drop-in).
- Can do mass updates using XML files (not quite a command line, but it'll do).
- Robust (very few problems).
- Already known within the access team.
- Active development and user groups.
- Free.