# USING WEB SYNDICATION FOR FLEXIBLE REMOTE MONITORING

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*Abstract*

With the experience gained in the first years of running the ALICE apparatus we have identified the need of collecting and aggregating different data to be displayed to the user in a simplified, personalized and clear way. The data comes from different sources in several formats, can contain data, text, pictures or can simply be a link to an extended content. This paper will describe the idea to design a light and flexible infrastructure, to aggregate information produced in different systems and offer them to the readers. In this model, a reader is presented with the information relevant to him, without being obliged to browse through different systems. The project consists of data production, collection and syndication, and is being developed in parallel with more traditional monitoring interfaces, with the aim of offering the ALICE users an alternative and convenient way to stay updated about their preferred systems even when they are far from the experiment.

## INTRODUCTION

ALICE [1] is one of the four general purpose experiments installed at CERN in Geneva, around the Large Hadron Collider. The experimental apparatus is extremely complex, being composed by 18 sub-detectors, each with its own specific technology choice. Monitoring, operating and managing ALICE is accomplished in collaboration by more than 1000 physicists and engineers, from 105 Institutes in 30 different countries.

The ALICE Detector Control System (DCS) [2] is a composite hardware and software structure, connecting and coordinating controls and operations on the sub-detectors through the SCADA infrastructure WinCC OA [3].

Operating ALICE is typically accomplished on site, even if some operations can occasionally be executed remotely, through special protocols that can guarantee a safe access.

Monitoring and controlling the DCS system is performed by an onsite shifter on a 24/7 basis, whose main duties are to guarantee the safety and the integrity of the detectors and the infrastructure, and a smooth running of the experiment. Several on-call experts collaborate with the shifter for the most delicate operations.

Most of the information is however also of interest for a relevant part of collaborators, not necessarily experts, who follow with passion the activities around the experiment to which they collaborate.

Almost all of them are content to access this information in a passive way, reading quasi-online data, consulting tables, graphs or observing screenshots of the monitoring system.

In case of need, they can log on authenticated and secure gateways and access the operations, in accordance with the activities of the shift crew.

Availability of information and easy access are however in contrast with safety policies. For this reason, ALICE chose to centrally export static information from the private control network to the Internet.

During Run1 (2007-2013) several screenshots updated on a regular basis have been made available on the public ALICE DCS web site: up to three per sub-detector, plus panel screenshots related to the central infrastructure. Furthermore, users could access plots and trends for environmental data, exported as tables and rebuilt in a graphical form on the server side.

The update frequency of data depends on two elements:

- The frequency with which the panel screenshots are produced
- The frequency with which the teleporting service from private network to internet works

This type of structure demonstrated to be secure and efficient, but not flexible enough. Furthermore, with time and experience the users' needs have grown, including how they access information. Today, users stay continuously connected to the Internet, as a result of the diffusion of smartphones and tablets, and are therefore not limited to their presence in offices and laboratories.

In order to satisfy their needs, the ALICE DCS group is developing a more modern and flexible infrastructure to publish data, allowing for an easy, fast and customizable access to wider information, based on web syndication.

## WHAT WEB SYNDICATION AND RSS ARE

Web Content Syndication is a form of syndication in which a section of a website is made available for other sites to use and republish. In this case, it consists of making the content of the ALICE DCS website available through *web feeds*, and allows users to display an updating list of content, according to their specific interests.

The terms *publishing a feed* and *syndication* are used to describe making a *feed* available for an information source.

The feeds are simple summaries of the website's recently added content, so that readers are facilitated identifying the content they look for, and can easily access the full content advertised in the feed, if they want. The feed formats provide web content or summaries of web content, together with links to the full versions of the content, and other meta-data.

ISBN 978-3-95450-139-7

Web feeds are collected in lists, and mainly found in various RSS or Atom formats. In the ALICE implementation, the feeds are compiled following the "standard" RSS 2.0 [4], where RSS stands for *Really Simple Syndication*, and is generally written in XML.

From the author's point of view, RSS allows syndication of the site content, and represents an easy way to share and view headlines and content. Regenerating the list permits an automatic update.

From the reader's point of view, RSS allows tracking of updates on the site using a *feed reader* (or *aggregator*), allowing for personalized views for different sites, and fast browsing for news and updates.

Popular feed aggregators are available as programs, apps or simply through a web browser. Users preferring a standalone desktop client can have feeds downloaded to their computer and visualized in a software program. Plugins are available for e-mail clients, allowing the user to receive feeds in the e-mail window. Another method is to profit from web browser plug-ins or access to an aggregator web site. In this case, a site may offer an online subscription service that allows viewing feeds using a web browser. With a web-based reader users can access feeds from anywhere, just by signing into the website that manages the feeds. This approach doesn't usually require downloading and installing software. On the other hand, having the feeds collected on a single web page means users still have to visit that web page.

Users with smartphones or other mobile devices can access an aggregator web site, or install one of the several Feed reader applications.

## REWORKING AND ORGANIZING THE DATA FLOW

The ALICE DCS group has chosen to adopt these technologies and organize and publish DCS data in feeds in the XML format. In the feeds, new information is presented in the form of articles in a list, with a short description for each fact and a link to the full post with details, comments, pictures etc.

An effort has been made to stay as close as possible to the RSS 2.0 standard, which foresees a structure like the one shown in Figure 1.

```
<?xml version="1.0" encoding="ISO-8859-1" ?>
<rss version="2.0">

<channel>
  <title>ALICE DCS alerts</title>
  <link>http://alidcs.cern.ch/alerts</link>
  <description>Active alerts in the ALICE DCS</description>
  <item>
    <title>MTR cooling plant - Error</title>
    <link>http://alidcs.cern.ch/alerts/mtr_cooling_lowpressure.html</link>
    <description>Low pressure in cooling plant</description>
  </item>
  <item>
    <title>Cavern temperature - Warning</title>
  <link>http://alidcs.cern.ch/alerts/cavern_temperature.html</link>
    <description>Cavern temperature above warning threshold.</description>
  </item>
</channel>

</rss>
```

Figure 1: Excerpt from the AliDcs.rss feeds list.

The information to be published comes from several assorted sources connected to different private networks. There are sensors installed in the experimental site, which record and send environment data (pressure, temperature, humidity, radiation level, magnetic field etc.).

Assortments of data are provided by sub-detectors or other online systems. Data can be in a numerical format, which may later be plotted or organized in tables; some systems still prefer to publish an image, a screenshot, showing the same panel as seen by the experts on site. This approach is still considered as the simplest one, and avoids duplicating data and ways to visualize it.

Another category of information comes from the alert systems, collecting all alerts from the sub-detectors, the safety systems and other infrastructures and services. An alert is usually provided as an array composed of several elements identifying the device, the sector or the sensor registering the alert condition, the severity level (warning, error, fatal), a brief explanation text and sometimes a picture.

The operations logbook in the control room (called *ALICE logbook*) represents another rich source of information, from which a reader can especially perceive the status of the data taking. It's collecting manual entries from the shift crew members, their end-of-shift reports and automatic entries from online systems, to record all operations performed in the control room:

- detectors operated to reach a defined state
- actions taken by the shifters to fix problems raising a DCS alert
- any other relevant fact, pertinent to data taking, safety, beam operations etc.

Detailed information is easily classified from its origin; to the contrary, manual entries often require proper reformatting work before they can be published.

Beforehand, data are tagged according to their nature (origin, severity or importance). Then, data are reorganized in a suitable format, allowing easy classification, and redirected to a collector. The collector hosts a web server, and is trusted in the private control networks. Its role is to build the RSS feeds and keep them up-to-date whenever a new event is registered.

The web server is then duplicated on the Internet, where it can offer the RSS feeds to subscribers.

## SOFTWARE LIBRARIES AND NETWORK PROTOCOLS

Sensors and devices are read by WinCC projects through different protocols, mainly on Ethernet and CANbus. Almost all of them are now IP capable and transmit their data through TCP/IP. Eventually, a WinCC project is configured as a *data collector*. Its main role is to receive and rework data according to the following schema, where the standard RSS and ALICE DCS elements are shown:



ISBN 978-3-95450-139-7

Table 1: RSS Items and ALICE DCS Correspondence

| ALICE RSS Element | RSS Element | RSS Description |
|---|---|---|
| Specific system support e-mail | <author> | Optional. Specifies the author of the item |
| Subsystem and level (info, warning, error, fatal) | <category> | Optional. Defines one or more categories the item belongs to |
| Comment, or detailed description | <comments> | Optional. Allows an item to link to comments about that item |
| Summary | <description> | Required. Describes the item |
| Panel screenshot or map | <enclosure> | Optional. Allows a media file to be included with the item |
| ID | <guid> | Optional. Defines a unique identifier for the item |
| HTTP link to the detailed description | <link> | Required. Defines the hyperlink to the item |
| Timestamp | <pubDate> | Optional. Defines the publication date for the item |
| Source, origin of data | <source> | Optional. Specifies a source for the item |
| Title | <title> | Required. Defines the title of the item |

Remote systems wishing to provide data and screenshots to the collector run a specific process (a WinCC CTRL manager) based on the AliceRSS library written by the ALICE DCS group for WinCC. The library helps rework data into a common ready-to-use format, and provides functions to build the RSS array and send it to the collector using the DIM client-server software [5].

The collector runs a DIM server and accepts data in the predefined format, as well as links to screenshots or other images. From the data array, the HTML file containing the extended description is produced and the <link> element is generated.

Every time a new post is received, a new XML file containing all items is assembled and published on the official web site, reachable from the Internet. A mechanism is in place to avoid flooding, limiting the publication to once per minute.

An outline of the data flow with the different actors, their role and the mechanisms utilized to communicate is illustrated in Figure 2.

## READER'S EXPERIENCE

The aim of this mechanism is to facilitate a personal experience for subscribed users, who can get updates about the ALICE system according to their preference.

Depending on the web browser or the application they are using, they can customize the way posts are shown, if they are kept or not after reading, the way of moving from one to another, etc.

The ALICE DCS items are categorized according to their origin in "Alerts", "Information", "Activities", and tagged in relation to the sub-system (ex. "Cooling", "LHC", "TPC", etc.). Physicists from a specific detector can then limit the information they get and select those produced by their specific system, or the neighboring ones. Technicians and engineers can focus their subscriptions to the principal and more severe alerts, coming from the central systems or the CERN infrastructure. Data analysts are mainly interested in the status of the data taking, and therefore prefer to stay tuned on the activities logged by people working in the control room.

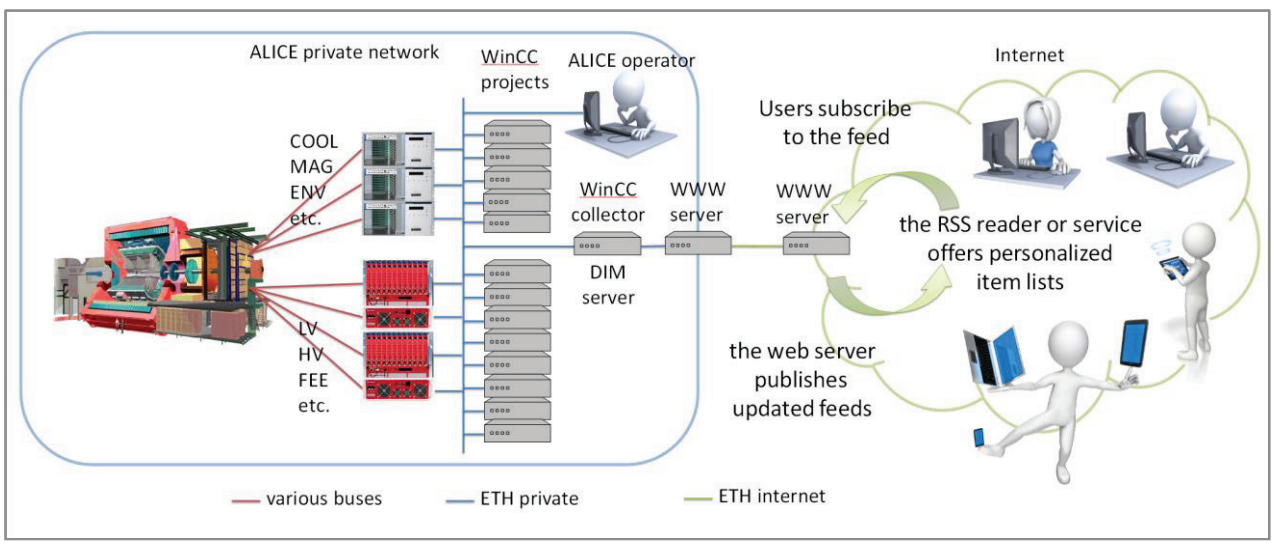


Figure 2: Layout of data flow, from data origin to the final user.



ISBN 978-3-95450-139-7

A sample of the resulting page, read with a web based plugin from the Chrome browser is shown in the Figure 3.

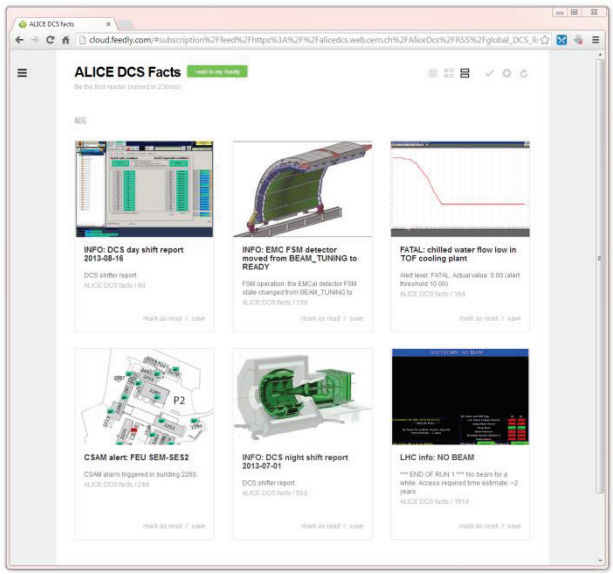


Figure 3: Chrome browser.

A similar view is available on most smartphones, nowadays provided with several applications allowing an easy RSS experience. Figure 4 illustrates how feeds can be read through a dedicated app running on a smartphone.

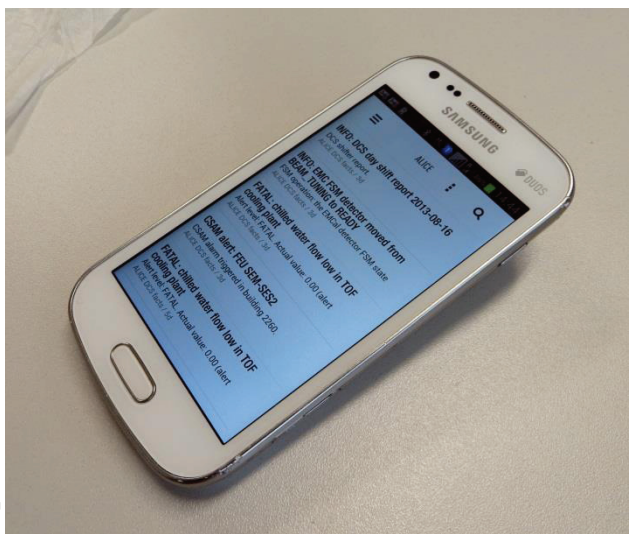


Figure 4: RSS Feedly app, running on an Android smartphone.

## CONCLUSIONS

The ALICE DCS is developing a flexible, web based software structure to provide its users a further way to stay updated on their experiment.

Exploiting standardized web syndication and RSS it is possible to distribute up-to-date web content from one web site to thousands of other web sites around the world.

Subscribed readers can access the content in their most convenient manner, profiting from their preferred device, which could be a web browser running on a smartphone or a computer, a dedicated app for their iPhone or Android tablet, etc.

Nowadays several free web aggregators and services are available, and the ALICE DCS information can fully profit from the advanced features offered by popular software.

This publication technique is offered as a complement to more traditional ways of accessing the control system, like logging into gateways and accessing the SCADA systems directly. It's a lightweight and secure way to deliver customizable information and facilitates a personal experience to interested users.

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ISBN 978-3-95450-139-7