

AN EQUIPMENT HUB FOR MANAGING A SMALL TOWN AND A COMPLEX MACHINE

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Abstract

Effective maintenance of the accelerators’ complex is vital for CERN’s mission. While this work is highly dependent on operational planning and constraints, it also needs to be coordinated with the maintenance of the infrastructure where the complex is embedded. The nature and degree of the logistics problems that arise from this interdependence cannot be handled by partial, decoupled solutions from each of the stakeholders. CERN’s Enterprise Asset Management system is the central hub where all relevant data about equipment and its maintenance is kept. It is also where data and documents about the manufacturing, installation, safety inspection, radiation measurements, disposal, etc. of the scientific equipment reside. This hub allows the effective sharing of consistent equipment data, accessed by a large number of people and systems, and supplies a wide range of interfaces – ranging from the user in the field with no access to a desktop computer, to scheduling systems that need to interact with it through Web services; this is achieved by means of a series of systems, tools and mechanisms, all dedicated to different needs but working on the same data and sharing common policies.

THE HUB ROLE

Infor Enterprise Asset Management (EAM) is a commercial product and the central repository of equipment data for CERN, both in what the scientific instruments and the laboratory’s infrastructure is concerned. This hub role is ensured by a multitude of mechanisms and interfaces, as people and systems requiring data access are very different from each other, both in nature and the requirements they have.

CERN’s EAM provides tailored solutions to each system and user group requiring any sort of access, going from simple and exposed data structures to a set of web services and evolved user interfaces delivered over the web; some of these supplied solutions are the object of the following chapters.

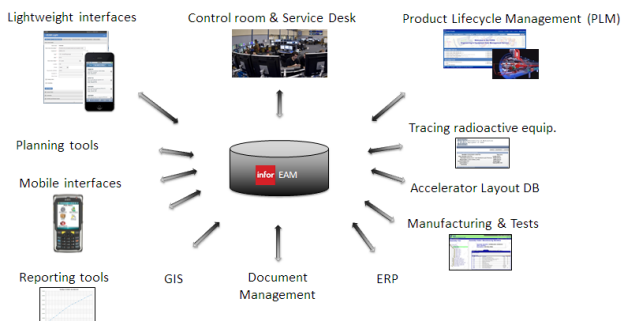


Figure 1: A diagram of the systems linked to Infor EAM.

MTF

The Manufacturing and Test Folder (MTF) [1] is a system interfacing EAM and CERN’s EDMS (a document and product lifecycle management system [2]); it was created to follow-up the manufacturing of hundreds of thousands of the Large Hadron Collider’s (LHC) components; it presents EAM and EDMS’ data in manner which is relevant for the manufacturing, installation and commissioning of the LHC and has been used world-wide by manufacturers, participating institutes and CERN.

The coupling of EAM and EDMS was implemented both at data and interface levels. At data level, an abstraction layer composed by structures intertwining data from both systems (and the methods that allow their manipulation) has been created; more importantly, EAM’s native document management functionality has been disabled and replaced by EDMS, allowing EAM to take advantage of the existing document and product lifecycle management procedures and standards. At interface level, a web application has been developed that exposes and allows navigating between data of both systems in an integrated and transparent way.

Common data in EAM and MTF is shared, but presented in a native, less coupled interface in EAM, where all its functionality (maintenance management, asset tracking, etc.) is available, and in a simpler, but in a manufacturing and installation contextually richer interface in MTF.

TREC

TREC–Traceability of Radioactive Equipment at CERN - is a system aimed at presenting a simplified, web based way of registering and completing radio protection (RP) measurement jobs for any piece of equipment coming out of CERN accelerators’ premises which is considered as potentially radioactive [3]. TREC behaves as a frontend to both EAM and other administrative tools; as far as EAM is concerned it allows the user to avoid the relative complexity of equipment search, creation and identification operations and more importantly, the request and follow-up of radiation measure jobs to the relevant RP service; as far as AIS is concerned, it handles the automatic generation of transport requests for the equipment (transfer or disposal), once the RP measurement job is completed.

GIS

CERN’s Geographical Information System (ESRI ArcGIS – a commercial tool) has been integrated with EAM so that equipment information may be visible and

accessible based on its geographical location. This integration is done by having EAM expose structures that contain basic, yet contextually relevant data about equipment.

The above described mechanism allows displaying in the GIS a piece of equipment's identifier and technical characteristics, without having to explicitly open EAM and search for the desired equipment; of course, should more detailed information or functionality be required, the GIS automatically launches EAM, in the right data context.

IMPACT

EAM is interfaced with IMPACT (Intervention Management Planning & Activity Coordination Tool) [4], used at CERN to coordinate work done in the LHC tunnel during technical stops and shutdowns. With an operation running 24h per day, and being a technically very complex and large installation, the LHC generates a continuous flow of work requests, that must be examined, approved and scheduled in order to be executed during very short periods of time. As access to the tunnel is controlled (both in the total number of people at any time and duration of stay) and only possible for very limited periods of time, the coordination of "who goes where and when to do what" is essential.

EAM fetches IMPACT-defined technical stops and shutdown periods and allows the scheduling of existing (planned) jobs to one of them. It also fetches IMPACT's facilities and access zones and allows equipment in EAM to be linked to one or more of them, so that a work request for a certain piece of equipment may be translated, in IMPACT, to a set of access requirements to be fulfilled in advance by the people actually performing the work.

By integrating both systems, it is possible to plan and coordinate the work to be done in IMPACT; once approved, it automatically generates and updates the corresponding work orders (which is what those actually carrying out the work must see) that are to be followed with EAM.

SERVICE NOW AND CCC LOGBOOK

CERN has 2 main call centres: the "Service Desk", for matters related to the facilities management, administration, etc. and CERN's Control Centre (CCC) for the accelerators and experiments. Both these systems handle hundreds of requests per day, with many of them requiring work – which is to be followed in EAM - to be done. A set of mechanisms allowing the generation and follow-up of work orders in EAM from these 2 systems has been created.

For the generation and update of work orders, EAM supplies a set of web services, which are consumed from the call centre's applications ("Service Now" for the Service Desk and "Logbook" for the CCC) without having to explicitly log into EAM. Once created or updated, the work orders are just like any other work

order in the system, and follows their programmed lifecycle in EAM.

The follow-up of the previously generated work orders is done via a set of structures that expose their status (and some more basic data) to the two systems; once the work is signalled in EAM as terminated, the originating system may react accordingly by closing the original request, signalling the requestor about it, perform a series of tests, etc.

EAM LIGHT

With such a wide span of activities handled in EAM, hundreds of people end up having some sort of interaction with EAM, from the simple printed job card (a report generated by another connected system with complete data and instructions about the work to be done) to the more complex booking of labour done, or part automatic reordering process, etc.

As any other piece of Enterprise Software, EAM is not easily used without training. Its powerful functionality comes bundled in a complex interface that may be too complicated for those users who only deal with a subset of its functionality and/or data, or that only rarely use it; this is why a "light" version of EAM has been developed, covering only a very small, yet widely used subset of the functionality of EAM itself.

This system is a web application developed using the Oracle APEX framework, available to any authorized user who needs to interact with EAM. For the time being, it allows the creation, consultation and modification of data about equipment and work orders; the interaction with the system was developed in an intuitive and easy way, and has been widely adopted by those users requiring a simple access with limited functionality.

The system, known as "EAM Light" accesses EAM data and methods via EAM's own web services and thus, enforces all the system's constraints and rules; it is simply a light user interface for a powerful system.

EAM MOBILE

Being the size and having the complexity of a small town, CERN has a myriad of types of work to be done each day, by people not having desktop access while needing to interact with EAM in order to receive work orders and signal their completion. Having administrative personnel handling EAM data for them, not only adds huge delays and costs to the process, but may also be source for errors and misunderstandings.

Using the framework developed for EAM Light, a simpler, mobile version of it has been developed so that people in the field may be notified of new work assigned to them, and may signal its completion, without the intervention of administrative personnel. The advantages are huge, cutting the delay in signalling new and completed work to the minimum (and thus allowing whatever workflow on hold on any system to proceed) and eliminating the "middle man".

For those zones of CERN without data connectivity of any sort, and where data collection work is done (e.g.

transformers in a confined space with periodic inspections being done on them), a small set of offline, data capture functionality has been implemented, proposing a clear and simple interface running on mobile devices. It allows the in situ capturing and later uploading of data, with a simple and trustable tool, where in the past, paper, pen and a lot of manual work had to be done in order to feed the system with the collected data.

CONCLUSION

EAM is CERN's equipment data hub. It is linked and interfaced with a large (and ever growing) number of other systems so that CERN's infrastructure and accelerator complex may be effectively maintained and operated. It does so by fetching data from a number of sources, combining it with its own, and supplying it to systems who accomplish a series of more or less specialized functions, which are not in its scope.

EAM is also integrated with a number of other systems, which interact directly with it, via a set of exposed and ready to be consumed web services. It allows the usage of

real EAM functionality, without using EAM's native interface.

As Infor EAM evolves as a commercial product, with new possibilities and modules (e.g. Alert Management, etc.) we will keep integrating it as effectively as possible, using the full set of its abilities, in order to maximize the efficiency of CERN's asset management.

REFERENCES

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