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Administrative Information Systems In an International Research Environment

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Abstract

We present here the administrative IT tools deployed at CERN, to support our international collaborative research environment. CERN specific requirements are presented together with our solutions to support them.

Finally a simple quantitative analysis of costs and benefits is presented for a few selected areas.

What is CERN

CERN - the European Laboratory for Particle Physics - is one of the world's largest scientific research laboratories. An early European joint venture, CERN was founded in 1954 by the Conseil Européen pour la Recherche Nucléaire (whence the acronym) and straddles the French- Swiss border west of the city of Geneva. CERN's nineteen Member States - Austria, Belgium, the Czech Republic, Denmark, Hungary, Germany, France, Finland, Greece, Italy, the Netherlands, Norway, Poland, Portugal, Slovakia, Spain, Sweden, Switzerland, and the United Kingdom - provide the budget (918 million Swiss francs in 1995) in proportion to their national revenues.

International involvement in CERN's experiments is an outstanding example of scientific collaboration which transcends political differences. The research programme, based on a unique collection of facilities, attracts over 50% of the world's particle physicists, not only from Member States but from a wide range of countries, some 6,500 visiting scientists each year. Currently over 500 US scientists are involved in CERN collaborations, a level of participation which equals that of a major European country.

CERN's scientific results are discussed in open meetings and published in journals available to all.

Specific IT Problems at CERN

Just like any other large organization, CERN has to report to its shareholders, the Member States. At the

same time, a large fraction of CERN's population comes from the academic world, and is not employed by CERN.

In addition, many, if not most, users are not present in CERN all the time, thus making official communications, especially administrative ones, more difficult or just impossible.

Recognizing this duality, CERN has based its traditional applications (General Ledger, Purchasing, Human Resources, etc.) on commercial software while at the same time developing our own special software for the interaction of users with the administration.

The criteria used to establish which applications should be developed are as follows:

1. user community is large and coming from many different backgrounds
2. non-daily usage
3. internal and external usage

Before 1990, CERN's administrative applications were considered as working tools of the administration, Financials for Finance division, Human Resources for Personnel division and so on.

At the start of our work [E. Dheur, J. Ferguson, R. Martens, A. Petrilli, B. Smale, *Modernizing Corporate MIS: from Information System Modelling to Implementation*, 9th European Oracle User Conference, March 1992, Cannes, France], we focused on an integrated set of applications, each one considered as a tool for the whole Organization, researchers and administration. It was quickly realized that exposing the available information to all providers of information was the best way to obtain reliable, up to date and useful data bases.

For this reason, and being free of trade secrets, we centered our implementation on the users, scientists and engineers, to make it easy for them to do their job (performing easily the required administrative actions) while at the same time providing CERN's administration with the necessary information.

Traditionally, administration is seen in many countries as an obstacle to whatever one wants to do, requesting all sort of useless details and delaying the "real" work from being done. CERN is no different in this. To remove, at least partly, these feelings, we have also implemented feedback mechanisms which researchers can use to easily check the financial status of their projects. This helps to remove some of the "black hole" aspect from the administration while making people more aware of the financial implications of their research.

The feedback mechanism is currently being augmented to cover also the human resources area.

IT Architecture

The CERN administrative IT architecture is based on off-the-shelf Unix and RDBMS technology. The tendency is to stay safely behind latest releases of hardware and software to guarantee the stability while at the same time maintain a reasonably recent environment.

PCs and Macintosh are used on the user's desktop to access the end users tools and the applications,

when required.

Databases

Each application or set of related applications (e.g.: Financial applications) run on its own server, communicating with the other servers either on-line or periodically via batch jobs.

There is nothing particular about this setup, all applications, but a few "glue" ones, are available commercially.

User Tools

User tools have been developed as front-ends and as back-ends to the traditional applications. They are based on their own data bases which again communicate with all others either on-line or via batch jobs.

As a result of this architecture, we have achieved the following goals:

- independence from the actual application
- lesser need for training (standard desktop computer look and feel and usage)
- administrative actions fully reflect paper forms and the status of documents can be followed from the user's desktop
- the results of each action can be consulted from the user's desktop

Current Status

A number of applications have been put in production since 1990. These cover the Financial [R. Martens, *A kamikaze approach to turn your corporate applications into an integrated ORACLE/open systems solution*, EOUG Oracle User Forum 93, March 1993, Vienna, Austria], the Human Resources and the Logistics needs of the Organization.
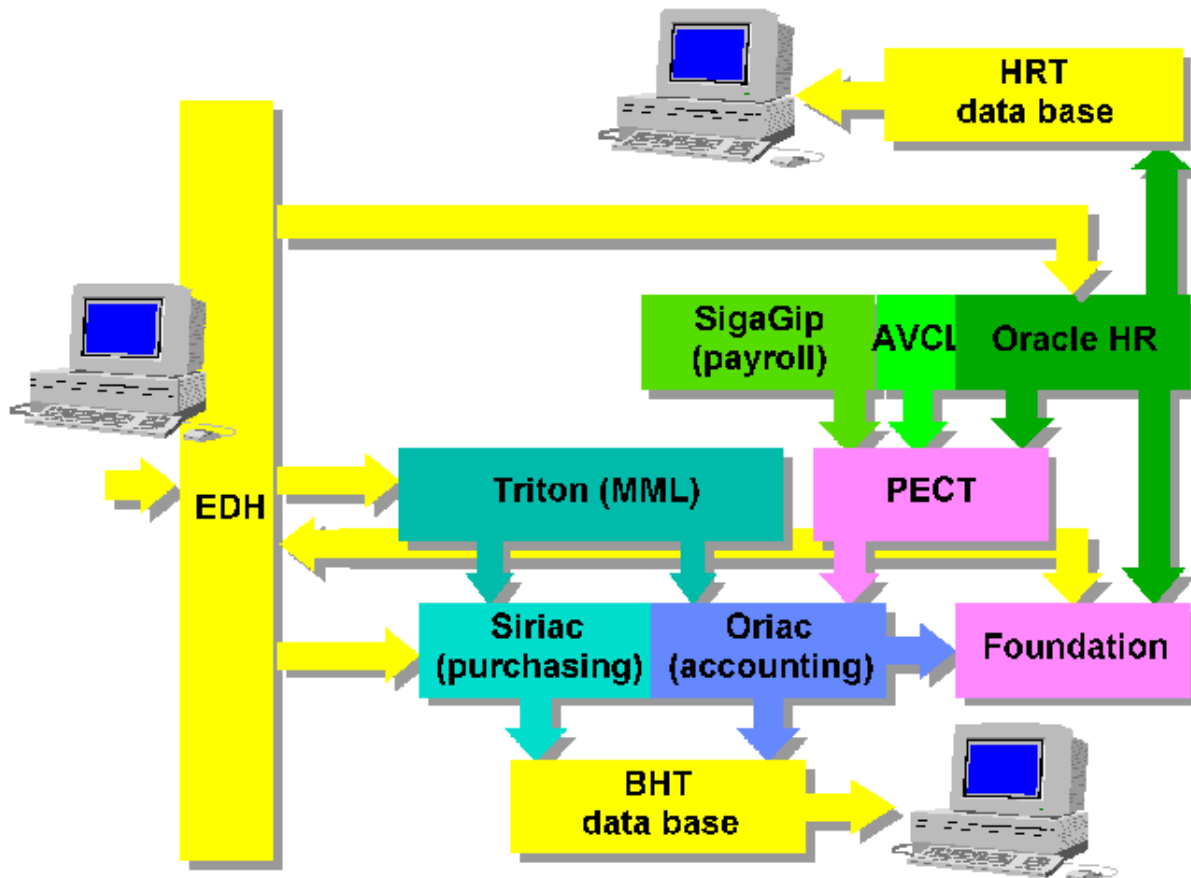
The above figure depicts the various databases, the end users' tools and their interactions.

In addition to the traditional applications, two end-users' tools are in production with a new one scheduled for test in September 1996.

The most innovative one, the Electronic Document Handling system - EDH [J. De Jonghe, The Paperless Organisation ? , EOUG Oracle User Forum 93, Vienna, Austria, Various Authors], is an open ended system that treats currently 8 forms completely electronically, allowing users to carry out administrative actions without any low level human work, all authorization and dispatching of documents being handled by the system.

The other two, the Budget Holder's Toolkit - BHT [M. Moller, J. Purvis, A Graphical Client-Server approach to Financial Management , EOUG Oracle User Forum 94, April 1994, Maastricht, The Netherlands, Various Authors] - and the Human Resources Toolkit - HRT [Various Authors] - provide users with interactive access to financial and human resource information needed for their daily work.

Benefits

The benefits CERN has experienced from the new IT architecture are mostly qualitative and can only be

evaluated over a number of years. Globally we can present the ones which have made the greatest impact on the effectiveness of CERN, so that we can cope with the new accelerator project, the Large Hadron Collider - LHC [Various Authors].

DB coherency All administrative data have a single point of entry, a unique definition and name. Any current or future peripheral application that needs access to administrative data has a well defined interface point.

Flexibility The usage of off-the-shelf commercial applications has actually reduced our flexibility as seen by the Administration staff. On the other hand, the choice to implement ourselves the end users tools has increased the flexibility as perceived by the end users, physicists and engineers.

Timeliness Not only CERN has managed to cope with reducing staff numbers, but the overall time needed to complete administrative actions has decreased.

Transparency Administrative procedures fully automated as described above are now much more transparent to the users, the status of documents can be traced at any moment.

Ignorance Our users can now completely ignore the rules for authorization, which the system handles automatically. This is extremely important in CERN, as a large fraction of our researchers come from external institutes and for short periods of time.

Of course there are also some quantifiable advantages linked to the streamlining of procedures, the suppression of double data entry and so on.

For the specific case of EDH, we have made a study [A. Petrilli, *EDH Return On Investment Analysis*, AS Division, CERN, April 1996, Geneva, Switzerland. To be published] of the Return On Investment taking into account only the quantifiable benefits, namely:

- data entry suppression
- direct costs linked to paper forms
- personal communications time
- internal mailing

To keep the results less controversial, no attempt has been made to quantify the saving due additional operations linked to paper forms (e.g. filing, photocopying) or to the streamlining of the procedure.

No value has been attached to the decrease in time observed for the authorization process (EDH documents are fully approved and transferred into the Corporate data bases in an average of 1.66 calendar days per document, with the fastest type of document, Material Request, taking an average of 0.45 calendar days).

EDH Return On Investment

As CERN operates, unlike many other organizations, on separate Material and Personnel budgets, our figures below reflect this.

Investment

The following table summarize the material expenses (in thousands CHF) and the human resources (in full time equivalents - FTE - i.e. man-years) employed to build the EDH system up to the end of the current year (9 electronic documents in production). It also shows the foreseen yearly maintenance effort, should the project be stopped at its end of year state.

	Material (KCHF)	Human Resources (FTE)
Development (9 forms)	250	27.1
Maintenance (9 forms)	35	2.0

Savings

As only 4 documents have been in production for long enough to let us collect information about them, our savings figures show only those 4 documents. The figures below are in thousands of CHF/year and in FTE/year respectively, calculated on the basis of the 12 month period July 1995 to June 1996 documents volume, and of all documents being created in EDH.

The material savings indicated above are due simply to the suppression of special paper forms produced for CERN.

	Material (KCHF)	Human Resources (FTE)
DAI	6.38	4.14
TID	4.83	1.16
MR	6.60	7.00
SR	1.96	1.35
Total	19.77	13.65

Reality is of course different from the above black & white picture: not all documents are created inside EDH, paper is still preferred by a large user population and in some special cases paper may be required, although this is a very exceptional case.

The following table presents the actual document volume for the 12 month period July 1995 to June 1996, the EDH percentage and the actual savings realized (in thousands CHF/year and FTE/year).

	Document Volume (thousands)	EDH %	Material (KCHF)	Human Resources (FTE)
DAI	22.3	87	5.55	3.60
TID	8.6	65	3.14	0.75
MR	74.6	55	3.63	3.85
SR	7.0	40	0.78	0.54
Total	112.5	61	13.10	8.74

We can therefore compare in the following two tables the development and the maintenance charges for EDH with the maximum possible and the actual savings, respectively for material and human resources.

	Material (KCHF)	AS Maint. %	AS Dev. %	Human Resources (FTE)	As Maint. %	As Dev. %
Development	250.00	NM	NM	27.10	NM	NM
Maintenance	35.00	NM	14	2.00	NM	7
Maximum	19.77	56	8	13.65	683	50
Actual	13.10	37	5	8.74	437	32

As we can see from the above, the actual material savings, are covering for a third of the yearly maintenance costs and the human resources savings cover a third of the total development costs.

Full EDH usage would pay back on the material side the investment in 12 years and on the human resources side in 2 years. And this does not take into account any indirect advantage the Organization gains from automation.

In addition, as a bare minimum, full usage of EDH for the 4 documents in question leads to a 13% decrease of the internal paper mail traffic (over a total of 900,000 envelopes per year), or 7.8% of the total paper mail traffic in CERN (over a total of 1,500,000 internal and external envelopes per year).

Similar quantitative savings are expected from the other documents not included in this summary.

Conclusions

As we have seen above, the users tools produce enough direct benefits to pay back for the development and the maintenance of those systems.

Researchers have seen their interactions with Administration become more efficient and feel more in control of the procedures, despite the fact they have to know much less about the administrative subtleties.

Despite this success, CERN is not yet up to speed to the coming challenge of LHC experiments:

- users make many administrative actions on their own funds which still require interactions with CERN (e.g. experiments can have their own funds spent via CERN's Purchasing Office, with different authorization rules than CERN's own, Institutes may buy goods to be shipped directly to CERN)
- more and more users, including the ones with managerial responsibilities, will not be based most of their time in CERN
- interactions between CERN and non-CERN staff must be possible at all levels, technical and administrative, across many countries

Currently , EDH can only be used inside CERN, BHT can provide only batch access to outside users and HRT is even more restrictive.

It is clear to us that all our end-users tools will have to widen their usage of encryption and become more integrated with the Internet. We are currently testing technical solutions based on WWW technology to provide read-only access to information (e.g. CERN Stores Catalogue) which is not confidential.

Another area where momentum is building is the reengineering of our administrative procedures to adapt to the more complex interactions required by our users.

Overall, our aim is to be able to integrate administrative actions seamlessly into the global lifetime of a large High Energy Physics experiment.