Conference Summary Talk

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INTRODUCTION

Let me first of all thank the organizing committee for inviting me to give the conference summary. My thanks go also to W. Busse, D.R. Myers and R. Rausch for listening to the parallel sessions I did not attend and for giving me their views on these talks. Progress in desktop computing has been demonstrated in multiple ways during this conference and the ability to project my slides on-line right now is another example. Thanks to the technical support staff.

As you may expect I will not attempt to provide a compressed version of all talks in less than one hour, but rather will try to address the main topics of this conference, sometimes biased by my personal view.

The community represented here comes essentially from four areas of activity: industrial controls, accelerators, experiments and telescopes, an interesting mixture.

MAIN TOPICS

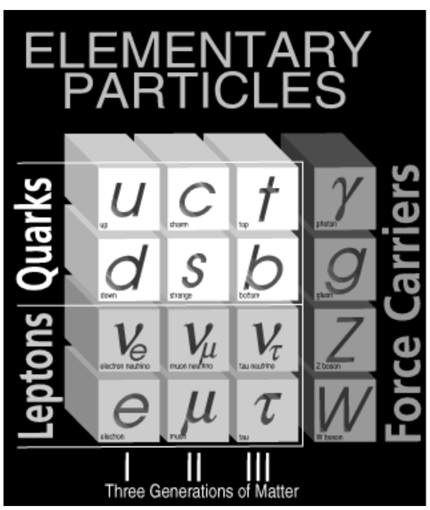
Let me now turn to my selection of main topics.

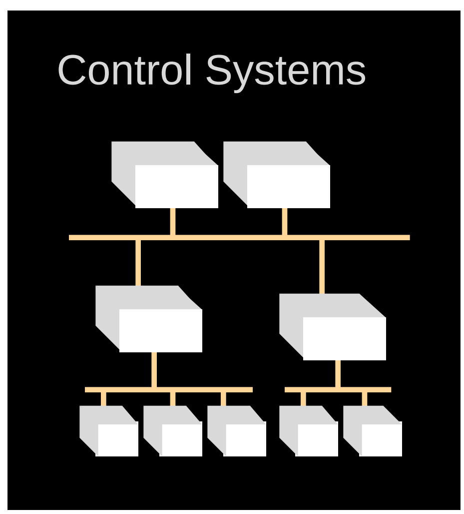
Control Theory

The field of control theory is very complex. Work is going on steadily with good progress in several domains, although no exciting breakthrough was presented.

Control Model

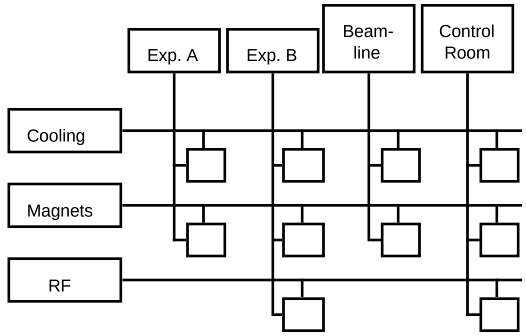
We talked a lot about the 'standard' model during the past days. Being a physicist by education, I cannot resist the temptation to present what a physicist sees under this heading, and compare it to what a controls person would expect:





Well, not all that different after all …

The standard model is not sufficient for complex control systems. On a large accelerator, for example, you will find a repetition of similar sub-systems such as cooling plants, electricity installations or vacuum systems. People in charge of a particular system, lets say the electricity distribution, need to see and control all sub-systems from a common supervisory station using synoptic displays based on their standards. A circuit under power is usually shown in red, because it represents a danger for the user. Cryogenic plants use different sets of symbols and will therefore use their own displays. Let us define such views of parts of the system as 'horizontal' views. A person operating the accelerator or an experiment needs a different view. Firstly, he or she does not want to see the complexity of the sub-system, nor the symbols or color conventions used. Green lights mean OK for an operator. A ‘vertical’ view providing global information on all sub-systems is appropriate. This combination of vertical and horizontal views could be defined as the ‘extended’ model of controls.



‘Extended’ Model of Controls

Controls Hardware

From the session on controls hardware we have learned of

- the arrival of powerful risc processors in controls
- the acceptance of standard field buses (FIP, Profibus, CAN, etc.)
- the existing components satisfy the needs of today and for the near future (VME, VXI, GPIB, PLCs)
- the availability of sophisticated software support (LabView, etc.)

An interesting example was shown by P. Charrue, the CES PowerPC-based VME card, which was recently selected by CERN as one of the future standard components for accelerator control systems. It has capabilities similar to those of a mainframe from not so along ago. The basic demand for CPU power to control equipment has not grown at the same rate as the power available, but the use of more and more sophisticated software accounts for a good fraction of the required resources.

Software Technology and Methods

In the area of software technology the most remarkable change is the use of object oriented programming. The arguments in its favor are amongst others modularity, information hiding and re-use. As we control physical objects and usually a large number of identical devices, OO programming is especially well suited in controls. If one takes care to design classes which strictly correspond to physical devices, allowing the setting of parameters according to the options available on the device, a system can be constructed by generating objects automatically from a simple database. No software changes are needed to compose a system from existing components and, therefore, systems can be maintained largely by end-users. Object oriented databases slowly find their way into our field, but will they replace RDBM systems?

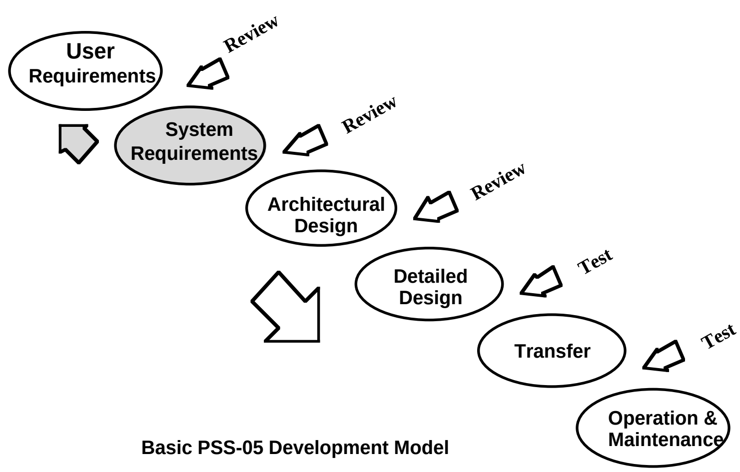
Formal software development methods are used at most with hesitation. Although around for more than 15 years, they are hardly accepted, although the need for a quality system is recognized. I should like to quote Steve Wampler, who expressed my view on the matter very nicely:

> “People who write software for big computer projects like to describe themselves as engineers. To deserve the name, they must behave as other engineers do.”

In Europe, the software engineering standards developed by the European Space Agency are beginning to enter the physics research community. At CERN several groups have successfully applied the standard, either partially or as a whole, both for internal development and for sub-contracting. Even some physics experiment teams agreed to follow the first phase of the standard to define their user requirements. After initial resistance, the benefits were quickly recognized.

Commercial Solutions

With the increasing complexity of our control systems and under the pressure of staff reduction, commercial solutions are becoming an alternative choice (PLCs, SCADA, LabView, FactoryLink, RtWorks, Vsystem, etc.) to in-house development. They can do a good fraction of the tasks required and can in general be easily interfaced to custom specific solutions. This feature is essential to introduce them into existing environments.



Basic PSS-05 Development Model

They are cost-effective, despite the high initial investment.

Software Sharing

Software sharing and collaborative efforts are getting stronger. One could get the impression that the times of competition inside and between research laboratories are over. Many initiatives inside and between labs (for example CERN-ESRF, CERN-GSI, EPICS) have been started to join forces. At CERN a controls group for experiments has been set up and a controls board co-ordinates the activities between five controls groups (accelerator, experiments, infrastructure). The Software Sharing (SOSH) initiative goes even further. EPICS deserves a few extra words since it was one of the dominating topics of the conference. It has come to its present popularity thanks to impressive collaborative efforts put into the development. Due to the ongoing commitment of major laboratories, it has a steadily growing number of users, and industry is becoming interested as well. If it were available under LynxOs, it would find its way into European institutes faster.

Communications

In the area communications the de facto standard is TCP/IP. Is OSI dead? Fieldbuses do not seem to be an issue anymore, but fast data-links for high throughput demand are coming to the fore. With the WWW growing rapidly, we find WebServers with direct links to controls applications. Virtual reality is on the horizon of controls.

CONCLUSIONS

Let me conclude by addressing some organizational aspects of the conference. The usual and again unanswered question came up, if there was enough time for discussions. The participants were split roughly 50-50 on having parallel sessions or not. Some topics could have been shortened.

Being right in the center of the beautiful city of Chicago contributed to the attraction of the conference. Apart from the flat lecture hall, the location and accommodations were a real pleasure. The computing facilities with the efficient and friendly support staff have set a high mark, a real challenge for the organizers of the next conference. During the tours to Argonne and Fermilab the application of controls was demonstrated and we had a glance at future in the Virtual Reality Cave. One of the highlights was our VIP visit to the Monet exhibition, which by itself would have been reason enough to come to Chicago. The banquet was another occasion to admire the good organization. Thanks also to those I forgot, which usually happens to me.

Last, but not least, I would like to express our warmest thanks to Peter Lucas and his superb team, who made ICALEPCS ‘95 an unforgettable event.