

Overview Of Accelerator Control Systems

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Caveats

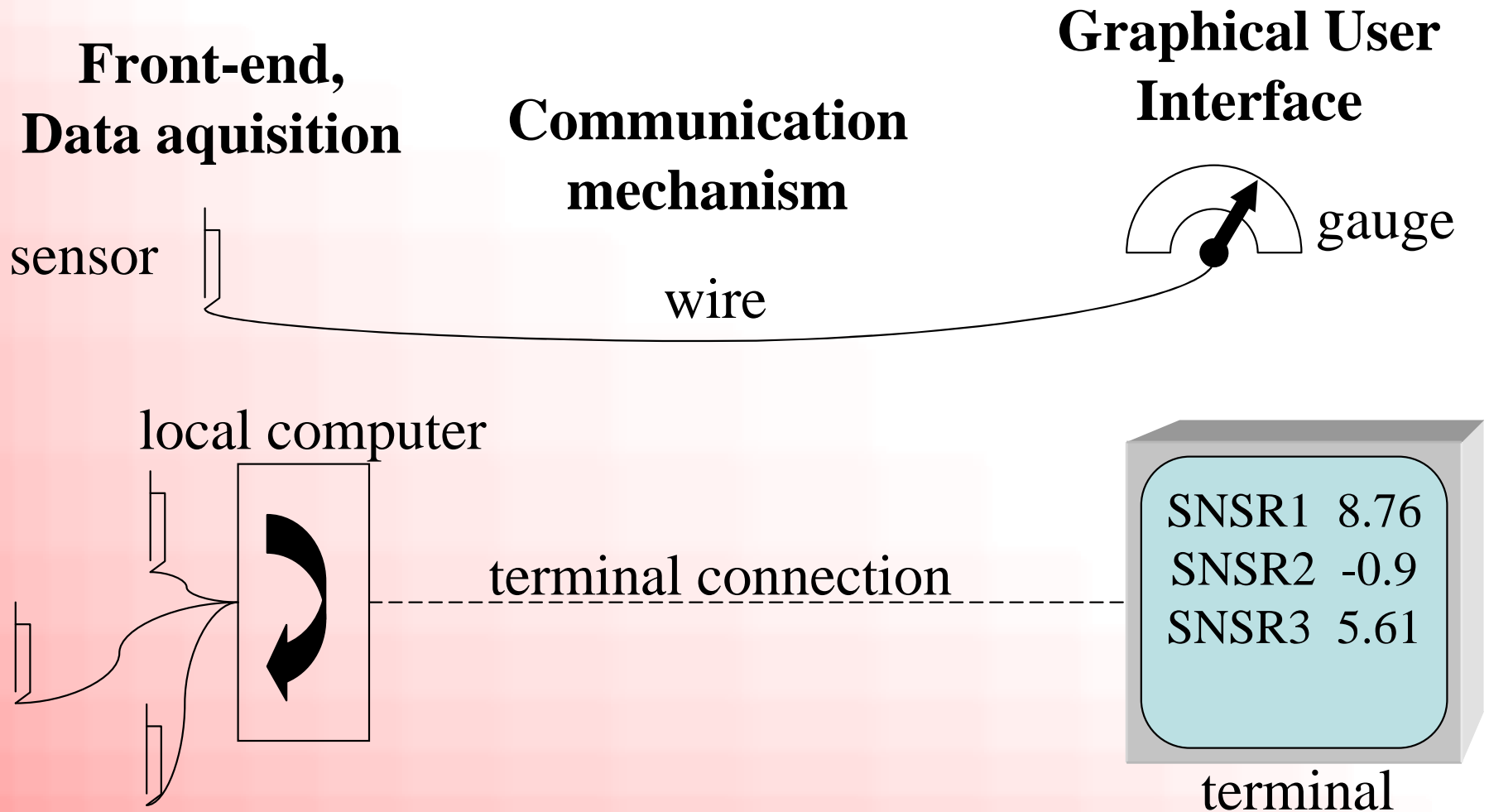
- A personal view, not a series of facts
- Deliberately provocative
 - Trying to point out the obvious that people don't talk about
- I work (and am co-founder and co-owner) at a commercial company that sells control system development and consulting
 - And might try to be selling my services to you!
 - even subconsciously 😊

- **Part I: What the Hell is a Control System?**
- Part II: Can a Control System Be Bought From Industry?
- Part III: The Cosylab Approach

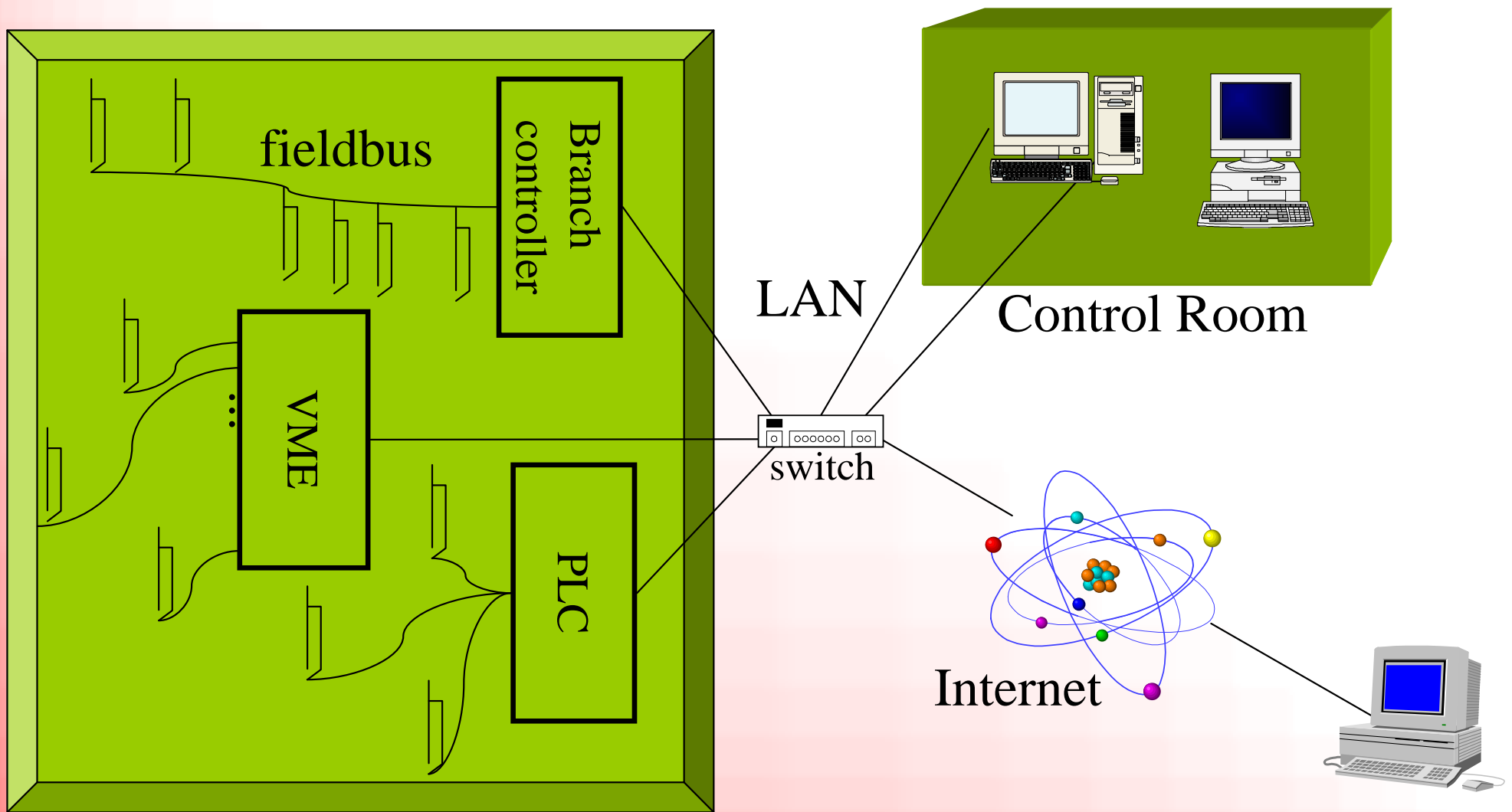
What Is Meant By “Control System”

- Not a shrink-wrap package with an installation wizard, but rather a **service**
 - Engineering according to specifications
 - Configuration of packages like EPICS, TANGO or ACS
 - Some hope this is just a few days of work
 - “Outsourcing” software/hardware development
 - Installation
 - Some believe this refers to cabling
- All customized for a specific accelerator
- => System Integration!

From the Analog to the Digital...



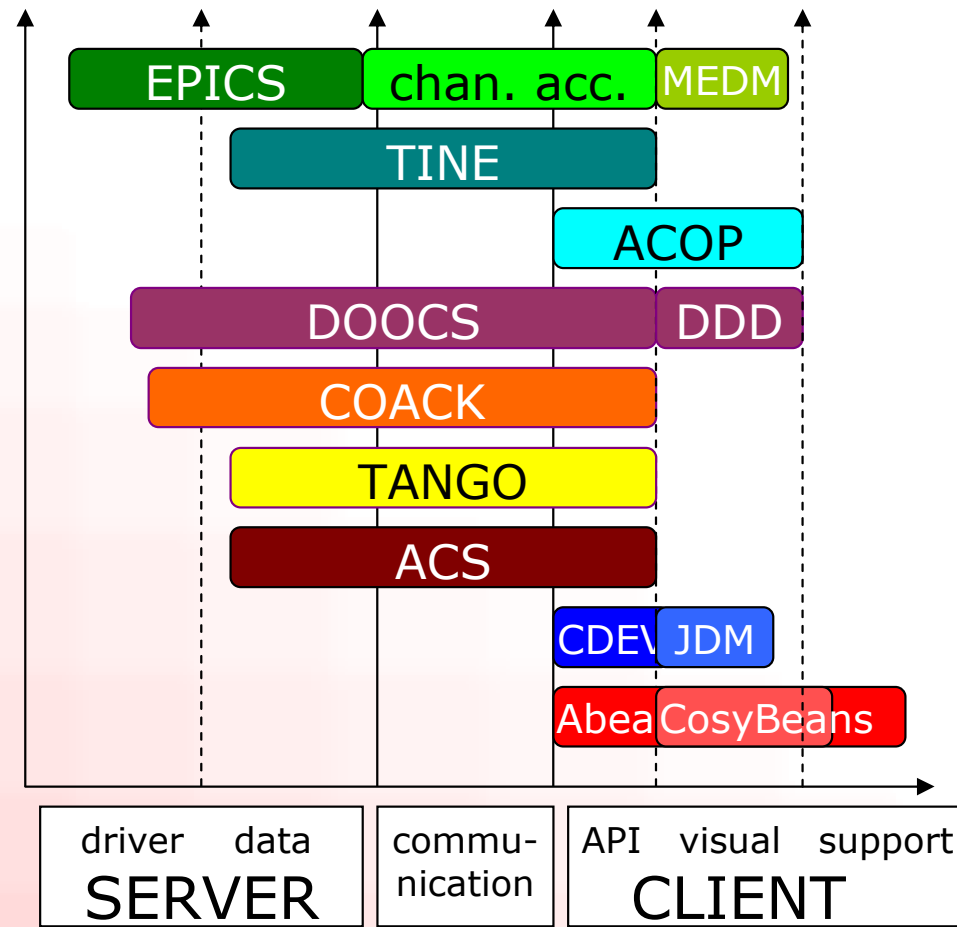
... to the Distributed Era



Confused?

- Check this Object Oriented Programming language:
 1. "persistent store"
 2. "method"
 3. "field"
- Translation:
 1. save to file
 2. function, subroutine
 3. variable
- Just don't trust buzzwords!

How To Compare Control System Packages



All have applications (alarm manager, GUI, logger, trending, scripting etc.), but their quality, flexibility, configurable etc. makes the largest difference

Which to Choose?

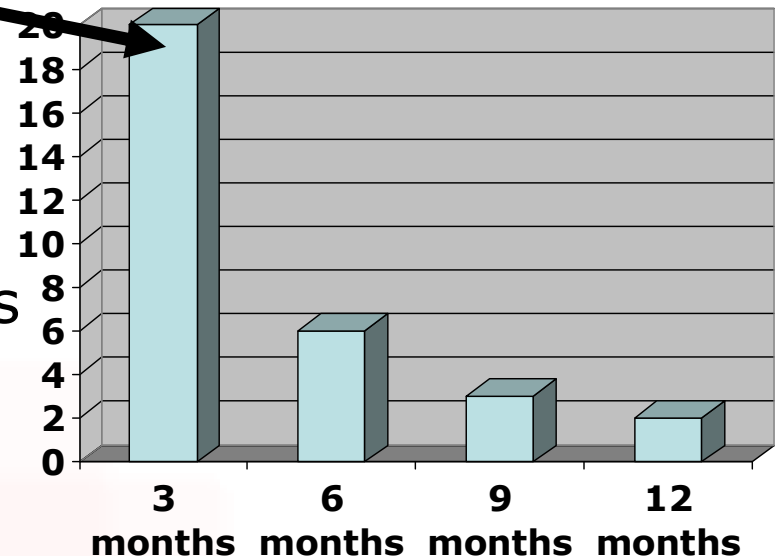
- Don't worry:
 - Computing including control is now totally industry driven
 - modern computer technology allows any reasonable implementation of software and hardware to function properly
- So what is really important?
 - To define the development procedures
 - Project management
 - Resource plan
 - To make everyone agree on the interfaces (not just API)
 - To have documentation (specs, design, test plan, etc. maybe even manuals) **before** implementation starts

Use Development Procedures: Control System is NOT just Playing with Software

- Control Systems are an **engineering** discipline like all the others, but with an even more complicated cycle
 - **Write specifications**
 - Architecture
 - Design
 - Prototyping – **probably the only fun part**
 - Test procedures
 - Implementation (coding) – **the only software part**
 - Documentation
 - Testing
 - Debugging
 - **Acceptance at customer**

It Just Takes Time (There Is No Silver Bullet)

- Saving money costs more time than you think
 - Time is money – expensive is what you can't get done!
 - Big effective cost of new people
- Why is so little done in a day?
 - Effective work time is 4 hours
- But it's only a matter of a few hours
 - With or without bugs?
 - Beware of 80/20 rule
- Writing documentation takes 1 day per page
- We just take the software from another lab
 - It takes as much time to understand software as to write it



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Why Getting the Control System from Industry?

- Would you build the vacuum chamber or the magnets in-house?
- Why not?
 - Too complicated (technically, procedures, volume)
 - Boring (not fun playing)
- Even electronics mainly isn't built in-house anymore
- What's so different about the control system then?
 - It can be changed arbitrary number of times?
 - It can't be described by a Hamiltonian!

The Three Phases of Non-outsourcing

1. We will outsource, but we don't know yet what, as we have no specs
 2. We have some nice technical prototypes, and we don't really need any specs for now
 3. We should have outsourced to you, but now we have already invested so much of our work that we can not justify throwing it all away
- Reminds me of unsuccessful dating 😊

In-house or Outsourcing?

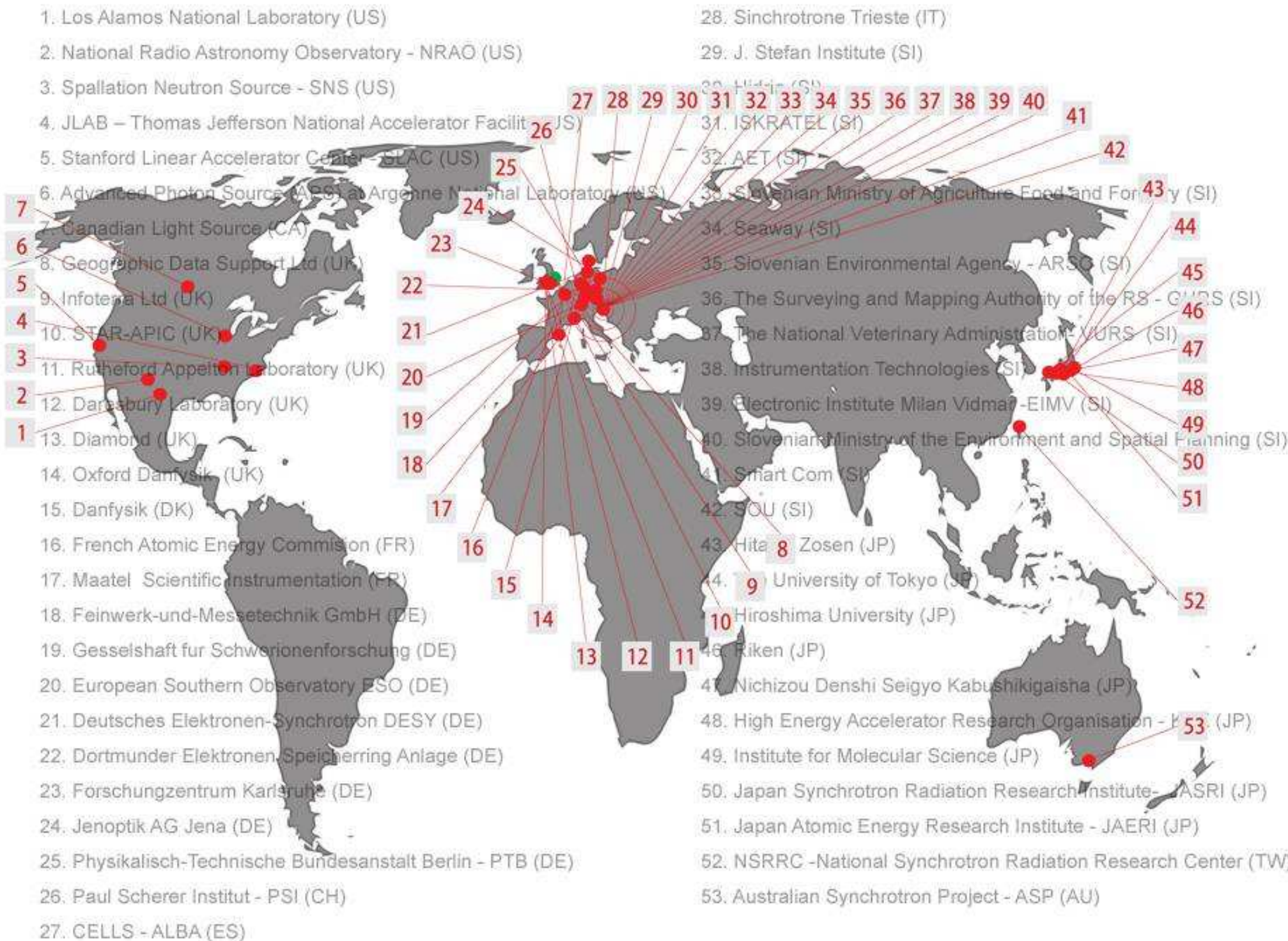
- For in-house: maintenance, upgrades
- Wrong!
- In-house people are smart: but get N different solutions
- Nobody is writing documentation unless forced
 - “Outsourcer” is forced, because of payment
 - In-house person will just tell you, until she/he is gone
- In-house knowhow rests with people, not the lab
- Outsourced knowhow from competent suppliers is like an escrow vault:
 - You pay, but it is well kept for you
 - Over the whole lifetime of the project

The Keyword is Competent Supplier

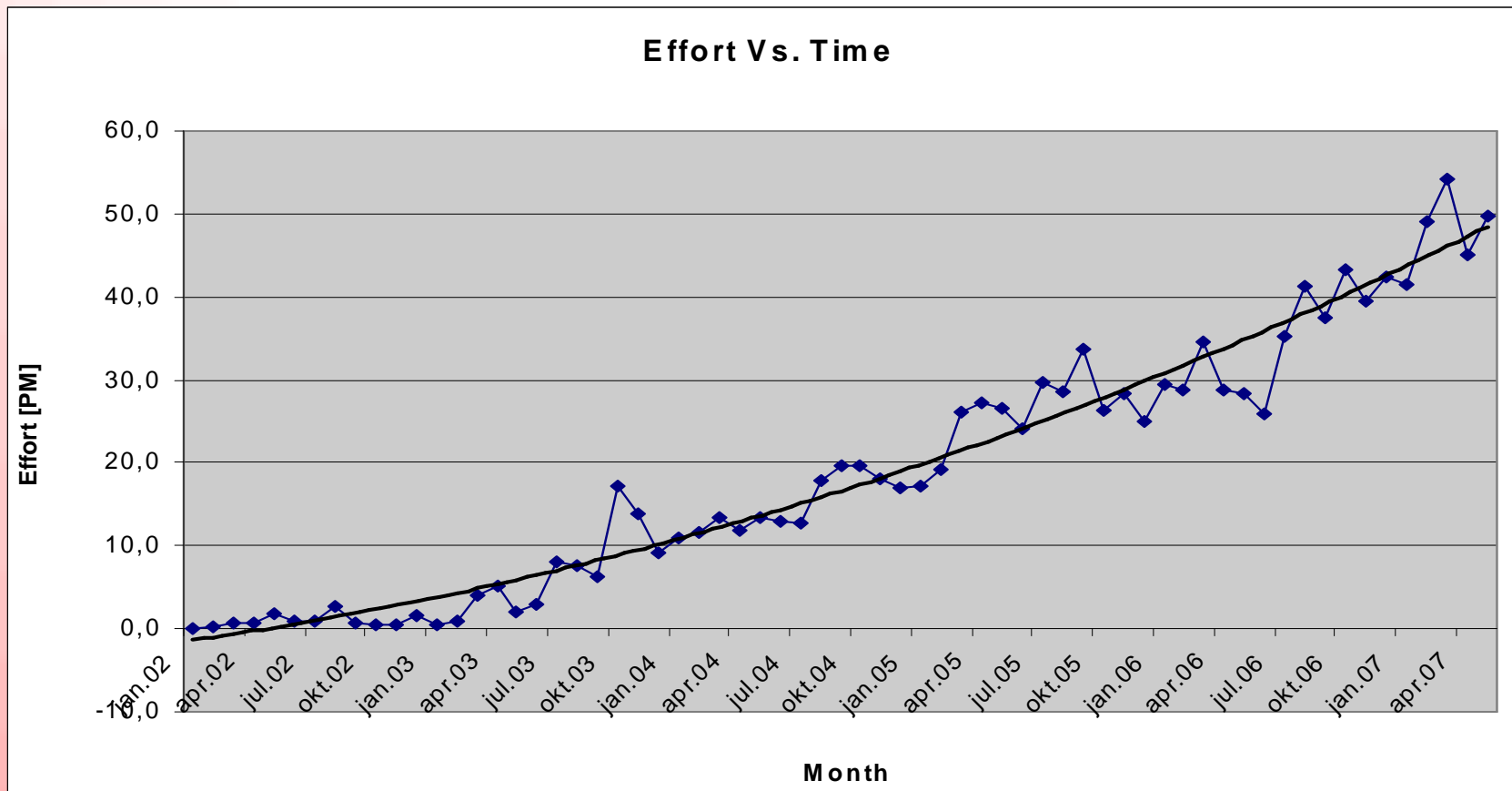
- Offers standard solutions, well tested **optimized procedures** and **project management**
 - Local scientist-developers have all excellent solutions, but all slightly unique and different
 - A competent suppliers delivers usually more than internal people, just because he knows that he only gets paid at the end!
- Understands accelerators
 - General programming or automation knowledge by contractors and system integrators is not enough

- Part I: What the Hell Is a Control System?
- Part II: Can the Control System Be Bought From Industry?
- **Part III: The Cosylab Approach**
 - **Specialized in “Big Physics” Control Systems**
 - **Competent People**
 - **Optimized Development Procedures**

Customers



Over 50 FTE Engineers



Cosylab – People and Procedures

- **Hiring only the best people**
 - Talent scouting the best students
 - Own education and training system (CosyAcademy)
- **Certified ISO 9001:2000**
 - “Best practices” development processes, project management, QA
- **Cosylab is a well recognized brand and part of the community**
 - **Invited talks** at EPAC, ICALEPCS, PCaPAC, WAO
 - **General sponsor** of ICALEPCS 2007 conference
 - **Organizer** of PCaPAC 2008 workshop
 - **Hamid Shoae, SLAC:** “your clients are very satisfied with the quality of your work, your responsiveness and your price”

Own Project Management/Reporting Software

- Web/email ticketing system
- Measure and analyse time
- "on-click" project reports

History Display mode: [\[Brief headers\]](#) [\[Full headers\]](#)

Mon Feb 28 11:27:34 2005 **gpajor - Ticket 9734 MemberOf ticket 9662.**

Mon Feb 28 11:27:34 2005 **gpajor - Ticket created** [\[Reply\]](#) [\[Comment\]](#)

Subject: Make the build_mioc (debian repo refresh) script work without errors

login.cosylab.com:/home/cosylib/debian is the location. [Download \(untitled\)](#)
104b

Now it spews errors about permissions and stuff.

Mon Feb 28 15:14:54 2005 **kzagar - Given to pkolaric**

Mon Feb 28 15:14:54 2005 **kzagar - Comments added** 90 min [\[Reply\]](#) [\[Comment\]](#)

[gpajor - Mon Feb 28 11:27:34 2005]: [Download \(untitled\)](#)
417b

```
> login.cosylab.com:/home/cosylib/debian is the location.
> Now it spews errors about permissions and stuff.
```

You need to be in the miocdev group.

Then simply run build_mioc script. You will get only warnings about "Packages in archive but missing from override file", which is normal.

Primoz, please put here the effort you spent helping me. Then give ticket to gpajor to test.

Tue Mar 1 01:36:17 2005 **pkolaric - Given to gpajor**

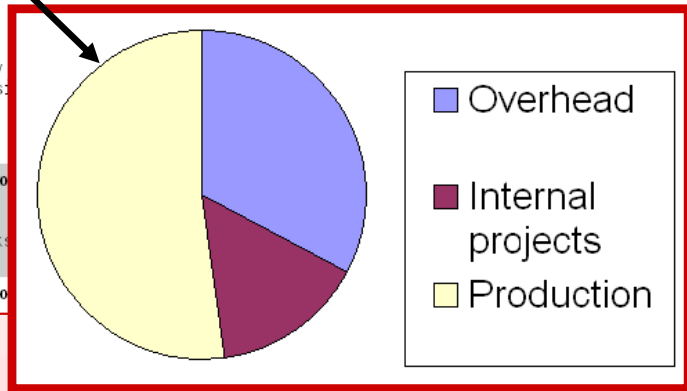
Tue Mar 1 01:36:17 2005 **pkolaric - Correspondence added** 40 min [\[Reply\]](#) [\[Comment\]](#)

- assisted Klemen
- fixed problems with miocdev
- fixed table definition so s

Tue Mar 22 16:14:36 2005 **gpajo**

Thank you Primoz. It now works

Tue Mar 22 16:14:37 2005 **gpajo**



1.3. Project Tasks

Ticket	Task name	Spent / total estimated / project task time (days)	weeks	spent / project	spent / total estimated	Responsible	Status	Activity
27	Requirements	0.12 / 0.10 / 5.00	0.02 / 0.02 / 0.03 / 1.00	2%	120%	projectmanager	open	View
28	Specification document	0.14 / 0.15 / 2.00	0.03 / 0.03 / 0.05 / 0.50	6%	92%	projectmanager	resolved	View
29	Prototype development	2.43 / 2.17 / 5.00	0.49 / 0.43 / 0.43 / 1.00	48%	112%	worker01	resolved	View
30	Testing&evaluation	0.00 / 0.00 / 3.00	0.00 / 0.00 / 0.00 / 0.60	0%	0%	worker01	new	View
31	Product development	0.14 / 0.10 / 2.00	0.03 / 0.02 / 0.0 / 0.40	6%	134%	projectmanager	resolved	View
32	Pilot production	0.02 / 0.04 / 15.00	0.00 / 0.01 / 0.1 / 3.00	0%	50%	unknown	new	View

1.1. Time

Project size: 125.00 md : 25.00 mw : 6.25 mm

Time spent: 67.63 md : 13.53 mw : 3.38 mm (54%)

Time spent (32461/60000)

Projected time to finish: 15.78 md : 3.16 mw : 0.79 mm

Project History

Effort [%]

Time

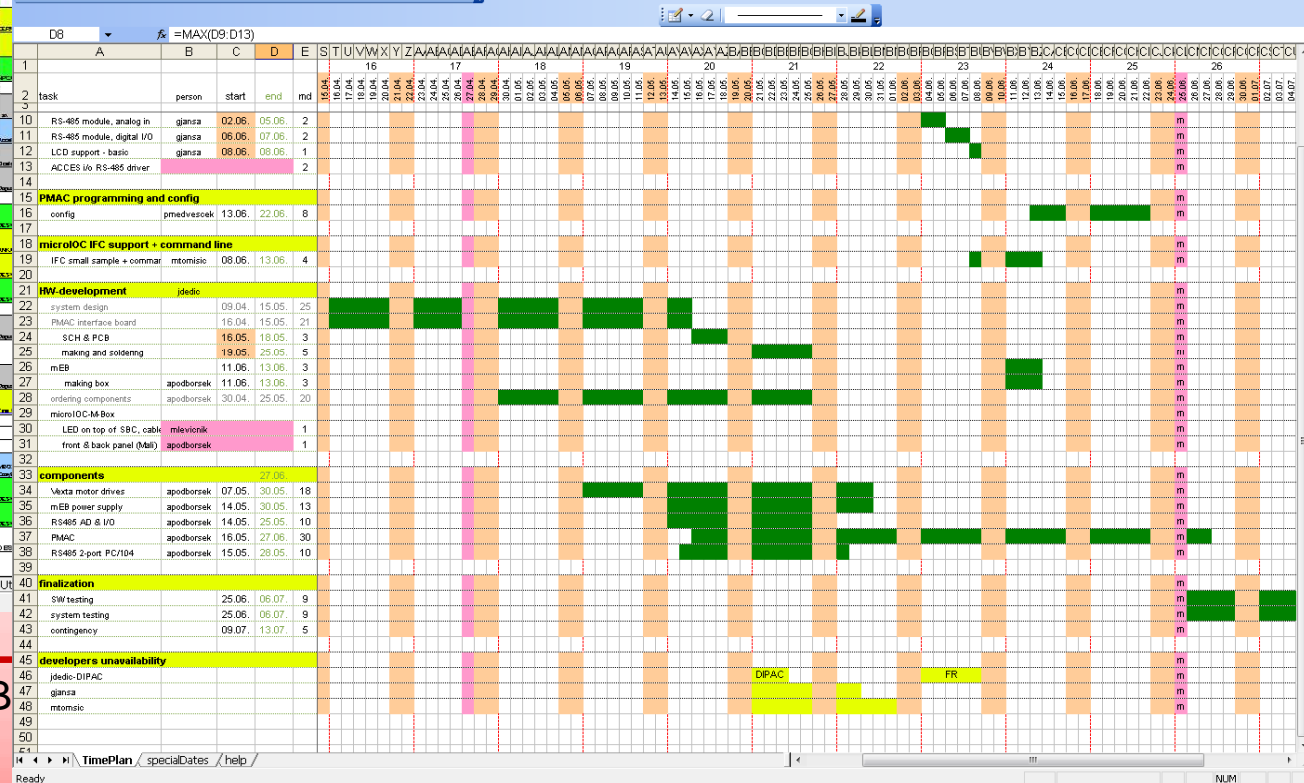
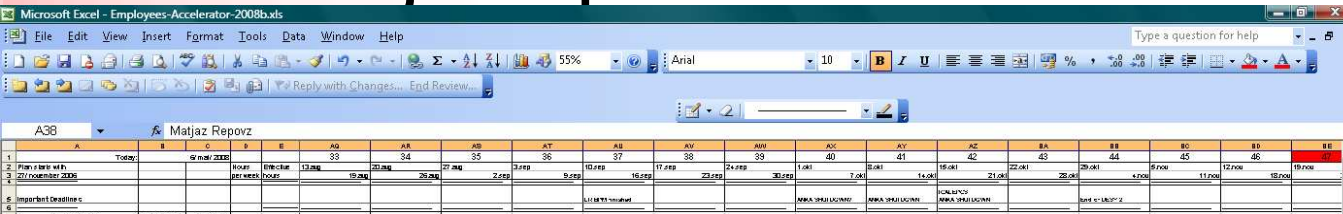
■ spent ■ estimated ■ estimated (interpolated) ■ 100%

weeks	months
0.3	0.1
0.3	0.1
0.1	0.0
0.0	0.0
0.6	0.1

Can Be Bought From Industry?

Realistic Planning and Execution

- Overview division-wide resource plan
- Project plans for individual projects



PART II: Can a Control System Be B

Real Problems

- It's faster to do it than to write specs
 - True, but if you don't write specs for yourself, you'll be in trouble later
- Specs, targets are not clear, can't control cost
 - True, but then also your own cost wouldn't be under control
 - Let's make a fixed price contract, if the effort deviates more than by 10-20%, we renegotiate the contract.
- In-house people can fix problems overnight
 - True: keep one person permanently at lab to collect requests and make quick fixes – FULL SERVICE MODEL

Conclusions

- What is a Control System?
 - Software and Control will go where other subsystems went
 - Even if not, it is wise to write specifications anyway
- Can the control system be bought from industry?
 - yes, but...
 - you must first choose the right company, one with good understanding of accelerators and with proven competence
- What's in the Future:
 - Software and Control will go where Electronics went

“Do what you do best
and leave to us the rest”