

LabVIEW and the LHC



The Large Hadron Collider



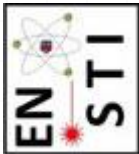
Rapid Application Development Environment



based on LabVIEW

Outline

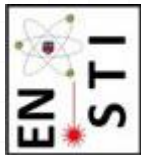
- MTA
- Why RADE?
- The challenge
- The Scope
- Coping with large applications
- RADE today
- Future



EN-STI-ECE-MTA

**Measurements
Tests &
Analysis**

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labview.support@cern.ch

Outline

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- RADE today
- Future

Why was RADE developed?

The Origin

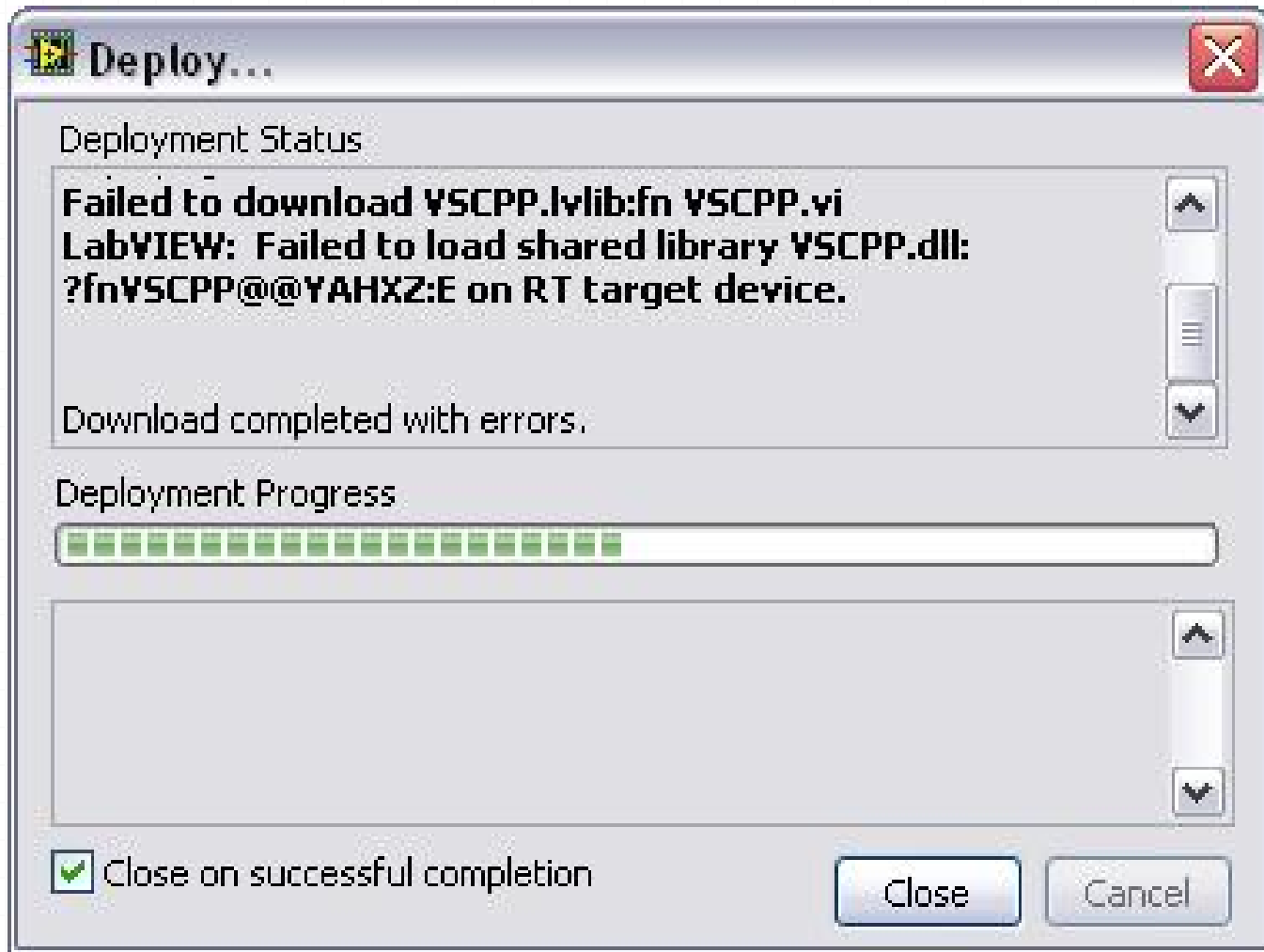


- 10.000+ Magnets
- 1750 Circuits
- 13000+ Tests

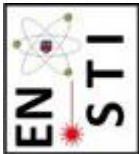
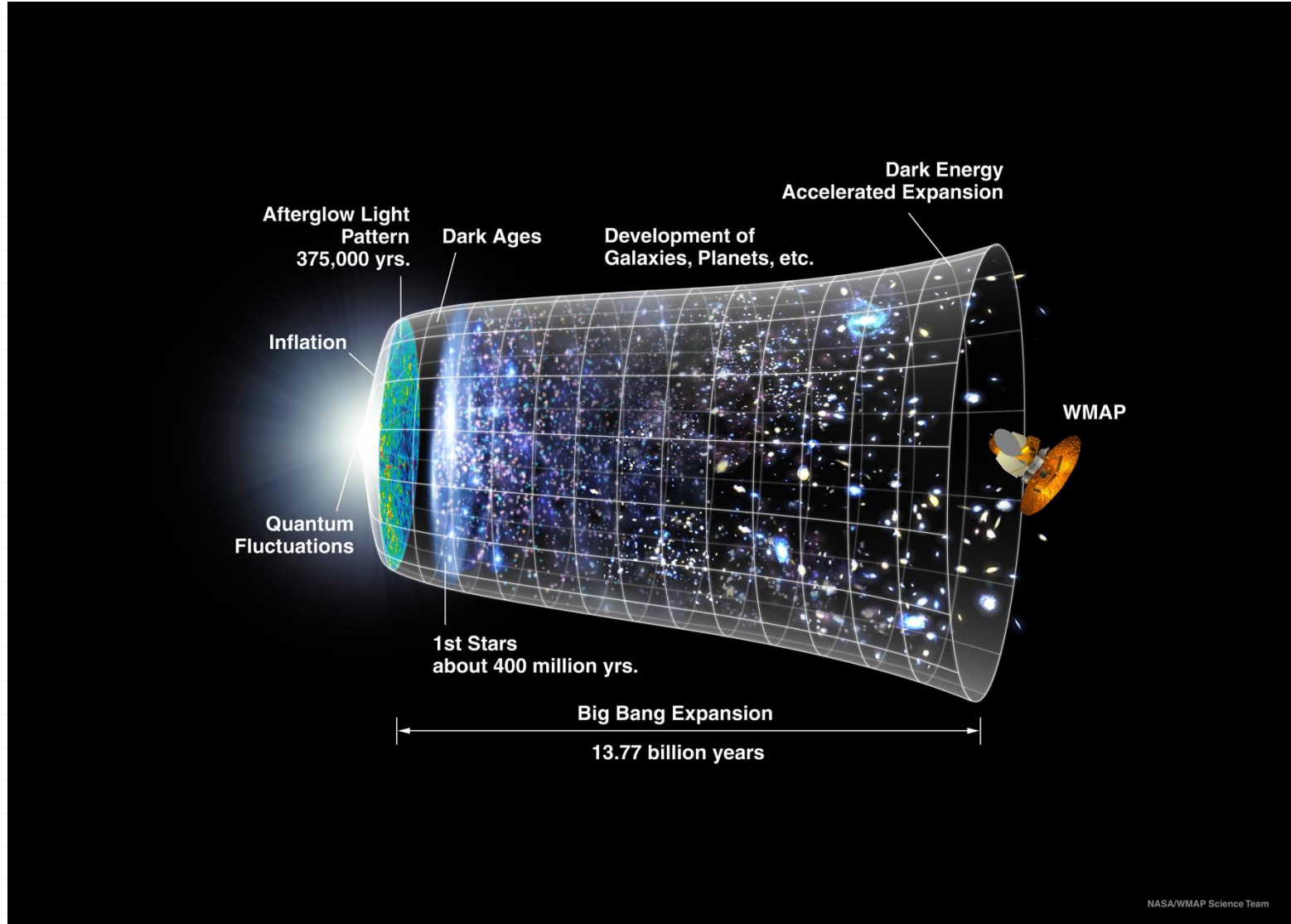
Outline

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- RADE today
- Future

The Challenge



The Challenge



The Challenge

Sources, Targets and Interactions



Linux

Windows

Mac

GPN

TN



DB

CM
W

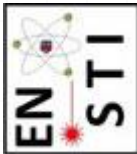
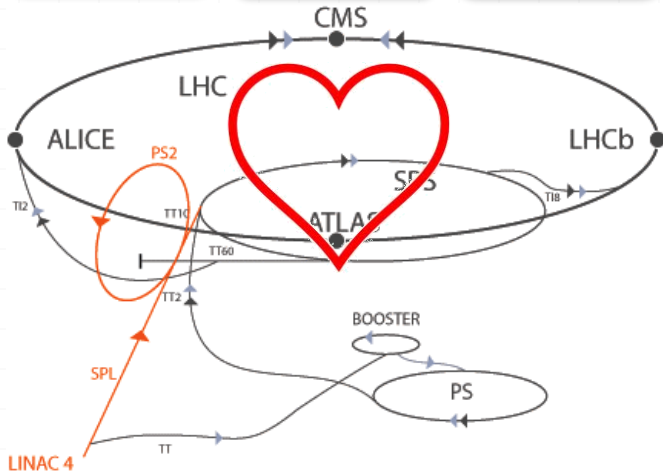
RBA
C

Timing

Files

PLC

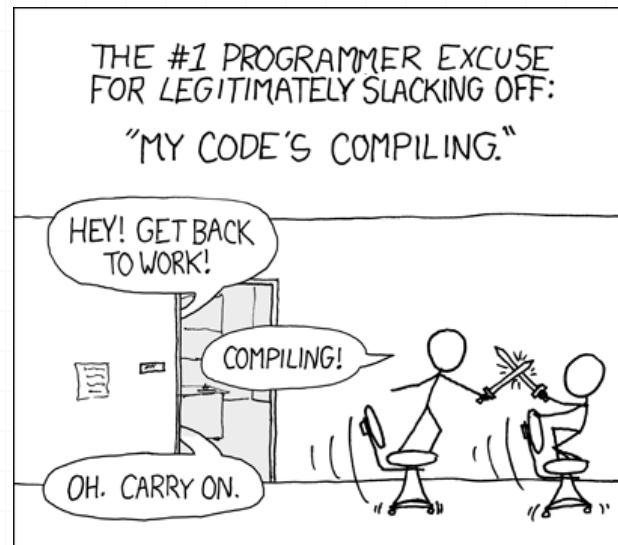
DAQ



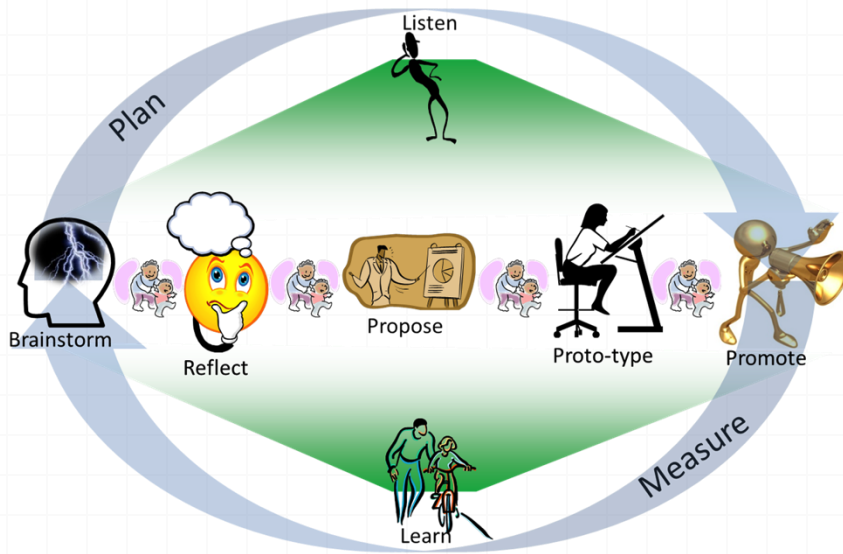
RAD(E)

RAD(E) (rapid application development) is a concept that products can be developed faster and of higher quality through:

- Gathering requirements
- Prototyping
- Defer design improvements to the next release
- Less formality in reviews and communication
- Re-use of software components



Development Methods

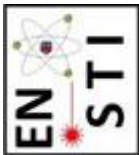


Extreme Programming methods

- Small increments
- Minimal planning
- Cross-functional team working on all aspects
- Demonstrated to the stakeholders frequently
- Minimizing risks
- Fast changes and adaptations.

Outline

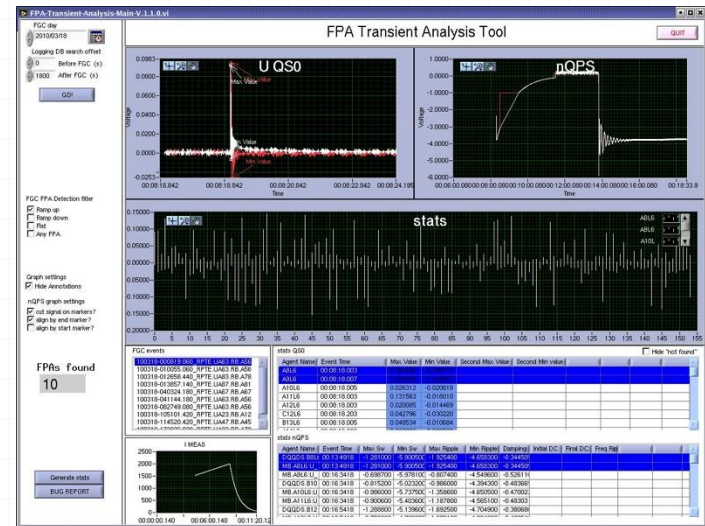
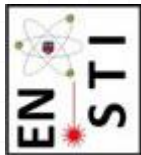
- MTA
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- The challenge
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The Scope

Application characteristics:

- Short development time
- Rapidly evolving
- Light and independent



Initial Requirements

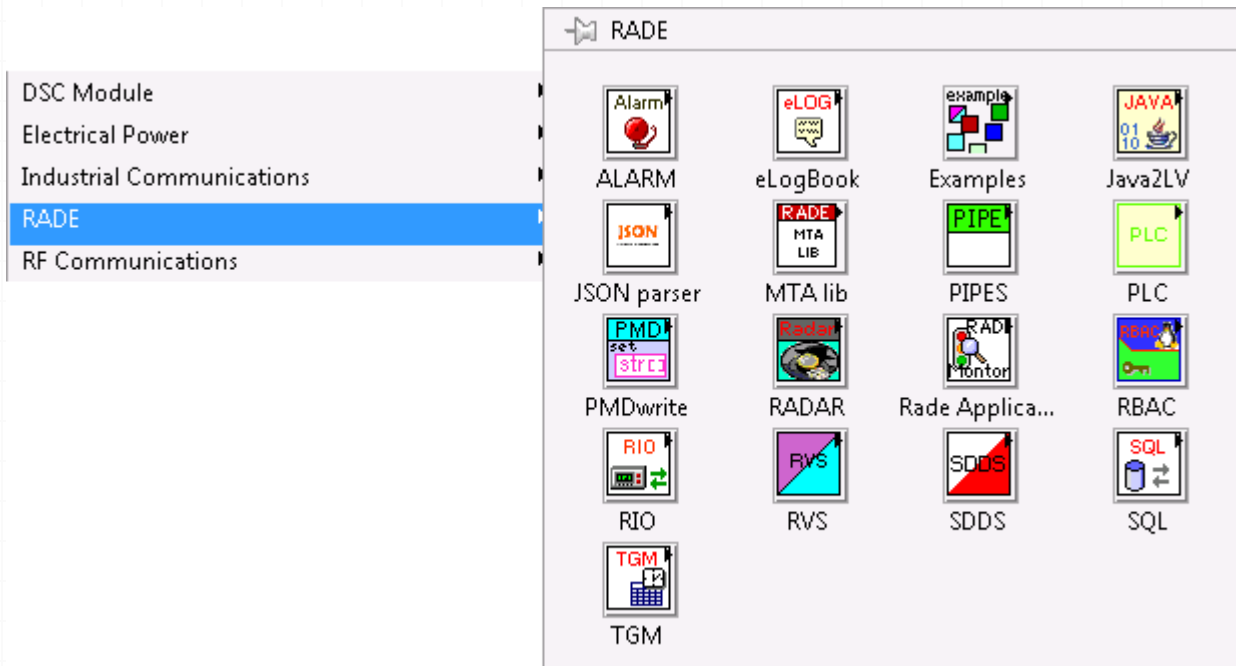
- Fast programming
- Rapid learning curve
- Drag and drop GUI development
- Wide range of analysis libraries
- Light/independent environment
- Integration with CERN infrastructures



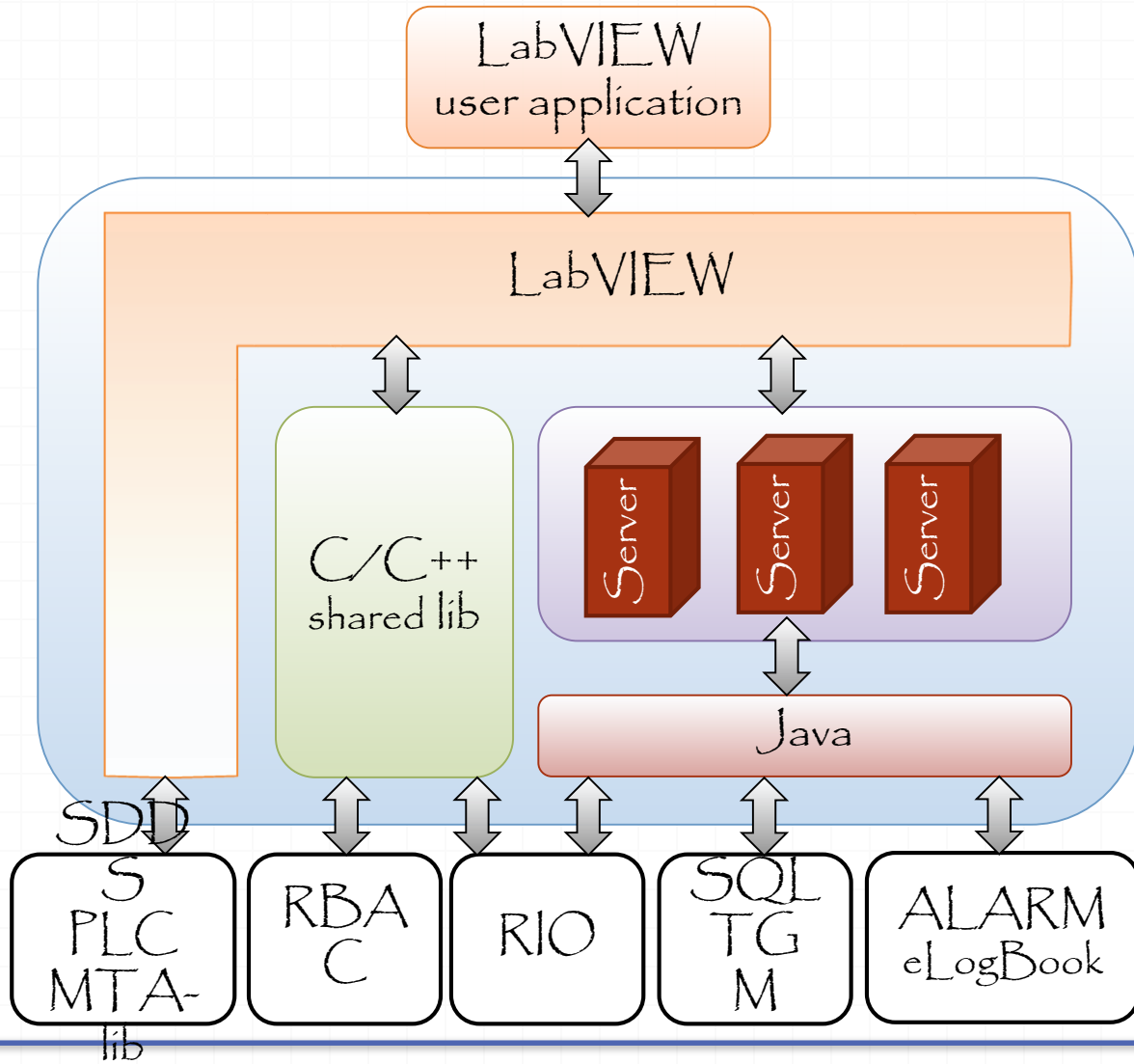
LabVIEW



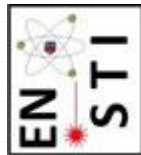
RADE Palette



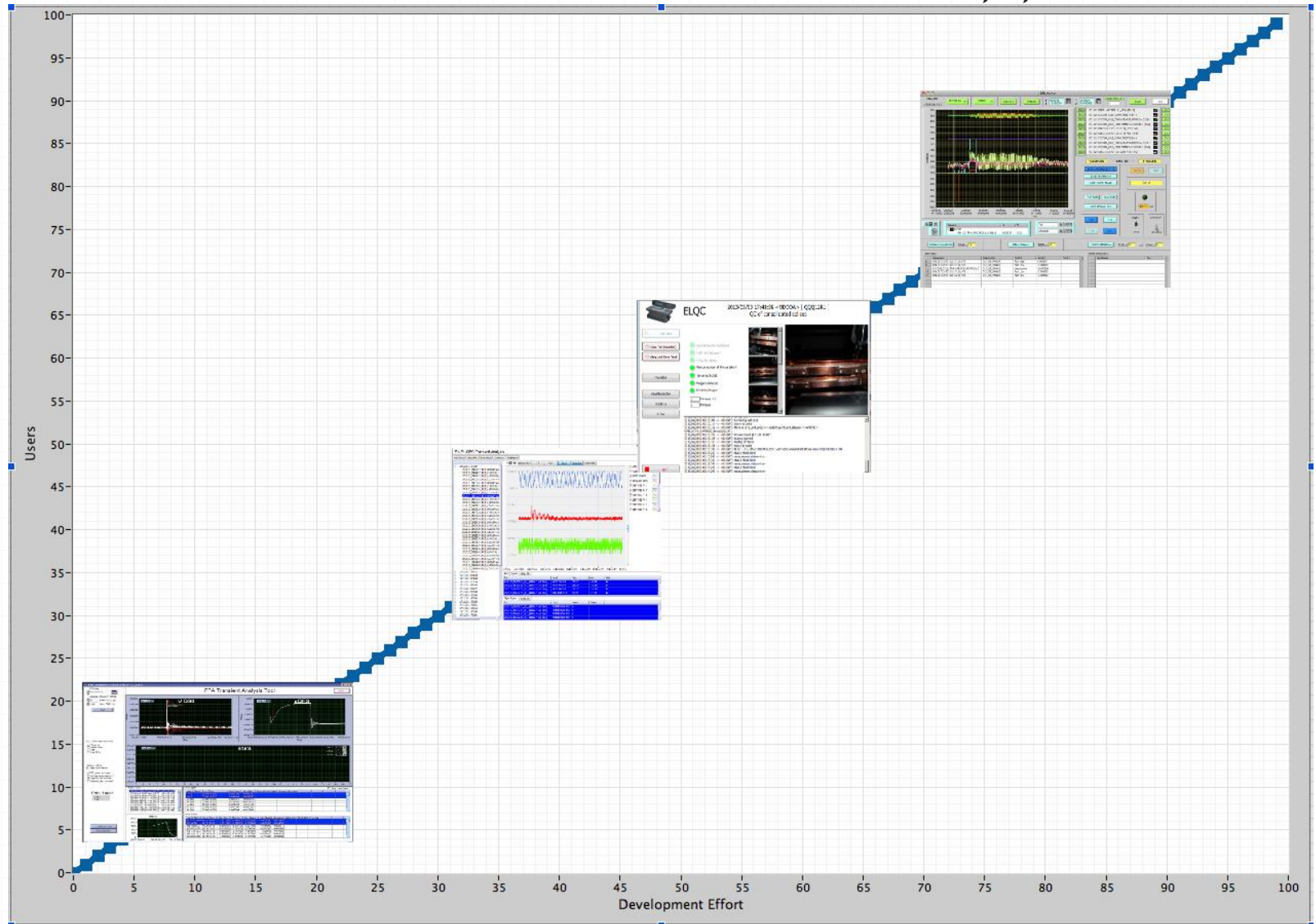
RADE Core Technology



Sources, Targets and Interactions

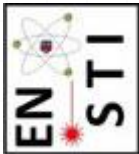


RADE Applications

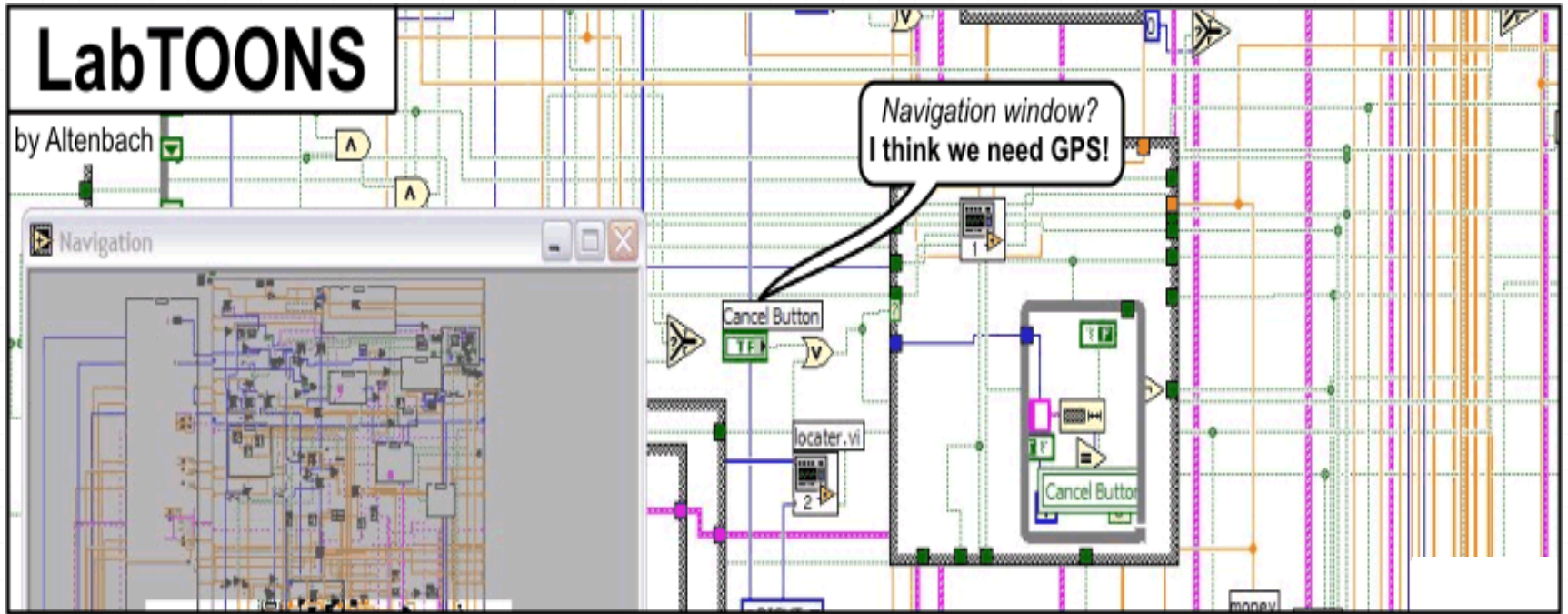


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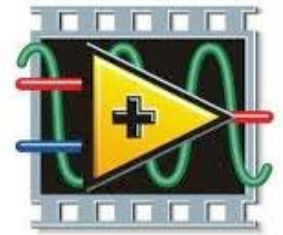
Coping With Large Applications



Large Application Requirements

Sources, Targets and Interactions

- Fast programming
- Rapid learning curve
- Drag and drop GUI development
- Wide range of analysis libraries
- Light/independent environment
- Integration with CERN infrastructures
- **Source control and distribution**
- **Instance generation**
- **Templates and documentation**
- **Automated tests and builds**



LabVIEW



Source Control

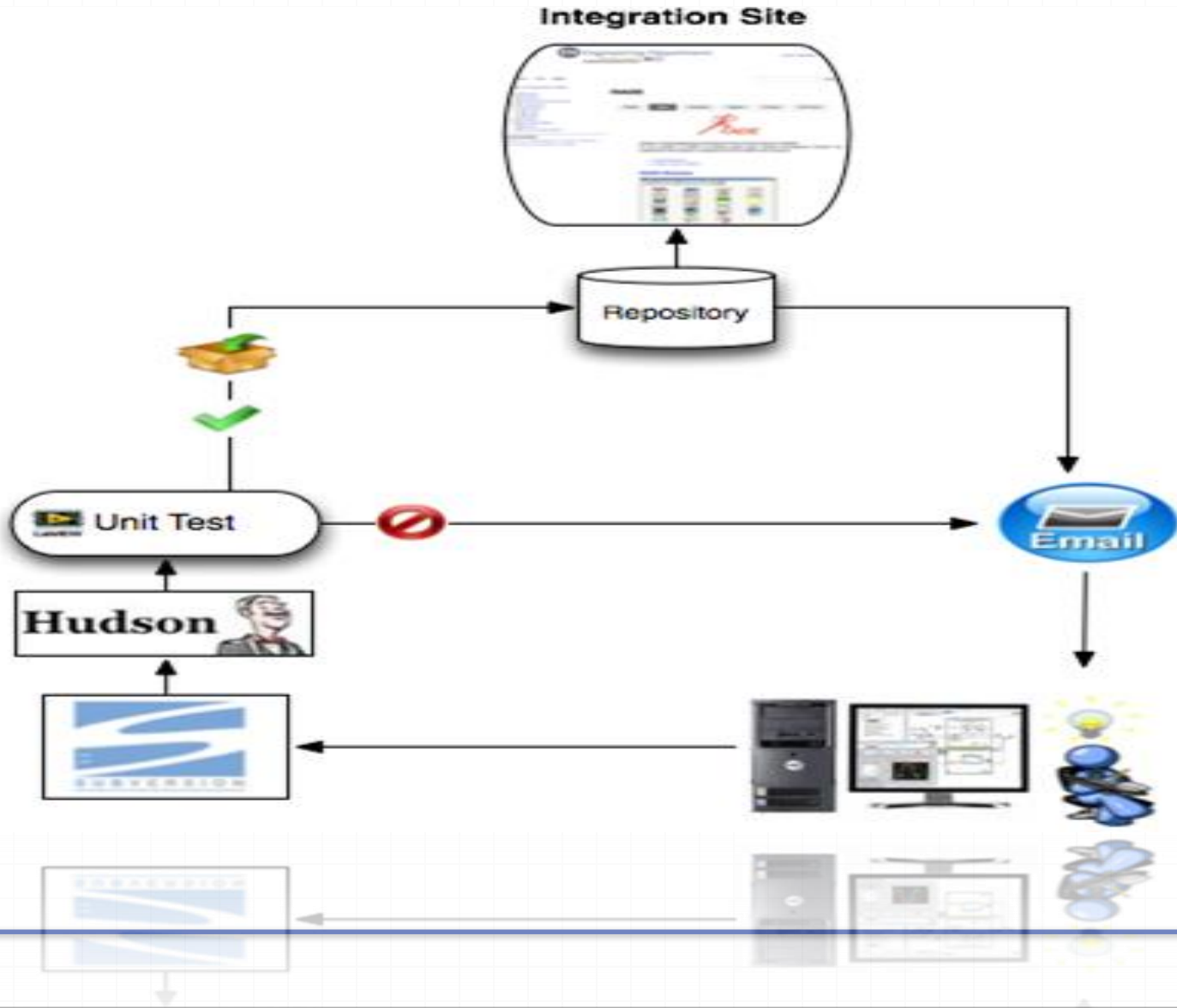


A screenshot of the LabVIEW development environment showing source control integration. On the left, three block diagrams are displayed in a 'Compare' view, with red circles highlighting differences. The central pane shows a 'Message' window with a list of changes. In the foreground, a context menu for 'My VI.vi Front Panel' is open, with a red arrow pointing to the 'Update...' option. The menu items include: File, Edit, View, Tools, Window, Help; Measurement & Automation Explorer...; Instrumentation; TortoiseSVN; VI Package Manager...; VI Tester; Advanced; Options...; Update...; Commit...; Update to Revision...; Revert...; Add...; Rename...; Delete...; Lock...; Unlock...; Show Log...; About JKI TSVN Tool...

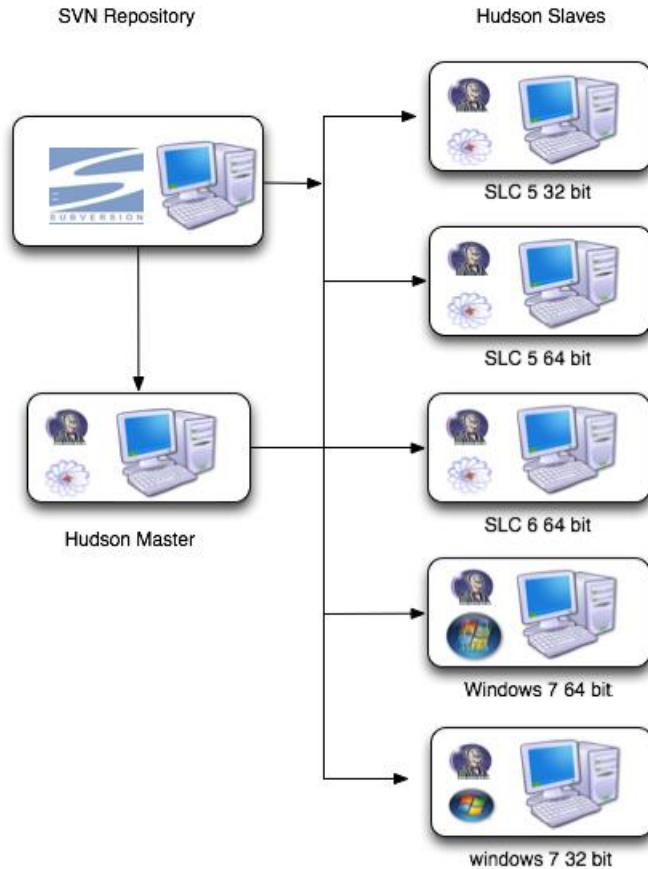
A screenshot of the TortoiseSVN context menu. The 'TortoiseSVN' menu item is selected, and a sub-menu is visible with the following options: Repo-browser; Export...; Create repository here; Import...; Settings; Help; About.



Continuous Integration



Continuous Integration



Linux Windows and Mac
Open stack and VPN



Continuous Integration

Hudson

search pma | log out

ENABLE AUTO REFRESH

add description

Hudson

New Job

Manage Hudson

People

Build History

New View

My Views

Build Queue


0-Build_RADE_Release_win	✖
0-Build_RADE_Release_mac	✖
cmww_win7_64	✖
Unittest-MI	✖
TGM-MI	✖
Templates-MI	✖
SQL-MI	✖
SDDS-MI	✖
RVS-MI	✖
RIO-DIMWrapper-MI	✖
RIO-CMWWrapper-MI	✖
RBAC-MI	✖
RADAR-MI	✖
PMDwrite-MI	✖
PLC-MI	✖
PIPES-MI-Template	✖
MTA-lib-MI	✖
JSON-MI	✖
Jars2LV-MI	✖
FESA-MI	✖
examples-MI	✖

<http://abcopm04-8080/hudson/queue/item/2860/cancelQueue>

All	Backup Hudson jobs	JavaBuilds	Linux library test	RADE builds	Windows library test	cpp builds	+
S	W	Job ↓	Last Success	Last Failure	Last Duration	Console	
●	☀	0-Build_RADE_all	6 days 20 hr (#24)	N/A	0.25 sec	📄	🔄
●	☀	0-Build_RADE_Release_linux	1 mo 4 days (#33)	20 days (#46)	50 min	📄	🔄
●	☀	0-Build_RADE_Release_mac	4 mo 5 days (#28)	20 days (#56)	12 min	📄	🔄
●	☀	0-Build_RADE_Release_win	1 mo 4 days (#17)	20 days (#29)	41 min	📄	🔄
●	☀	ALARM-MI	19 days (#489)	N/A	15 min	📄	🔄
●	☀	ALARM-Windows-MI	19 days (#223)	N/A	11 min	📄	🔄
●	☀	Backup-jobs	2 days 20 hr (#502)	20 hr (#504)	0.33 sec	📄	🔄
●	☀	cmww_SLC5	20 hr (#165)	N/A	2 min 3 sec	📄	🔄
●	☀	cmww_SLC6	19 days (#108)	N/A	8 min 38 sec	📄	🔄
●	☀	cmww_win7_64	N/A	1 day 20 hr (#44)	16 min	📄	🔄
●	☀	CO-MI	19 days (#443)	N/A	8 min 41 sec	📄	🔄
●	☀	CO-Windows-MI	19 days (#453)	N/A	54 sec	📄	🔄
●	☀	DBService-build	20 hr (#417)	N/A	16 min	📄	🔄
●	☀	DIPService_1_0_0-Build	20 hr (#387)	N/A	27 min	📄	🔄
●	☀	eLogBook-MI	19 days (#291)	N/A	16 min	📄	🔄
●	☀	eLogBook-Windows-MI	19 days (#225)	N/A	10 min	📄	🔄
●	☀	examples-MI	19 days (#421)	N/A	8 min 45 sec	📄	🔄
●	☀	examples-Windows-MI	19 days (#393)	N/A	59 sec	📄	🔄
●	☀	FESA-MI	19 days (#424)	N/A	9 min 8 sec	📄	🔄
●	☀	FESA-Windows-MI	19 days (#404)	N/A	2 min 5 sec	📄	🔄
●	☀	InCA-prev-build	20 hr (#378)	N/A	8 min 33 sec	📄	🔄
●	☀	InCa_1_0_1-Build	19 hr (#418)	N/A	20 min	📄	🔄
●	☀	JAPC_RDA_BLM_1_0_0-Build	3 days 19 hr (#450)	19 hr (#453)	10 min	📄	🔄
●	☀	Jars2LV-MI	19 days (#421)	N/A	8 min 41 sec	📄	🔄
●	☀	Java2LV-Windows-MI	19 days (#399)	N/A	59 sec	📄	🔄
●	☀	JSON-MI	19 days (#299)	N/A	13 min	📄	🔄
●	☀	LSA_1_0_0-Build	3 days 19 hr (#89)	19 hr (#92)	17 min	📄	🔄
●	☀	LVSservice-build	19 hr (#380)	N/A	9 min 0 sec	📄	🔄
●	☀	MTA-lib-MI	19 days (#419)	N/A	13 min	📄	🔄



Continuous Integration



[Logged in as: oddoa](#)
[Settings](#)
[Help](#)
[Submit a ticket](#)
[Sign Out](#)

Project


CURRENT PROJECT
EN Industrial Control...

Manage Compute


- Overview
- Instances
- Volumes
- Images & Snapshots
- Access & Security

Overview


Limit Summary




Instances
Used 28 of 100




VCPUs
Used 67 of 100



RAM
Used 134.0 GB of 250.0 GB



Available Volumes
Used 0 of 0



Available Volume Storage
Used 0 of 4.9TB

Select a period of time to query its usage:

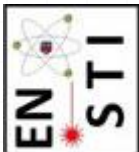
From: To: The date should be in YYYY-mm-dd format.

Active Instances: 29 Active RAM: 142GB This Period's VCPU-Hours: 575.17 This Period's GB-Hours: 34510.22

Usage Summary

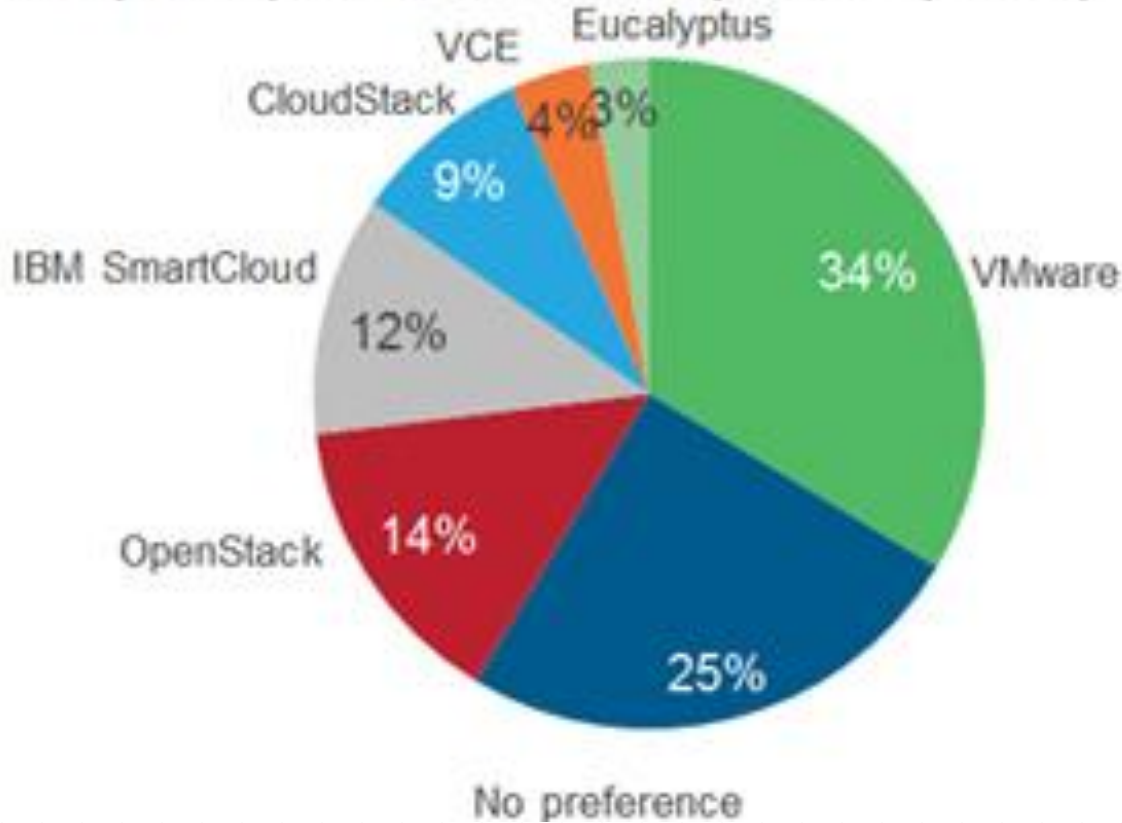
[Download CSV Summary](#)

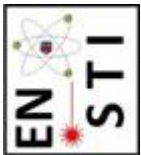
Instance Name	VCPUs	Disk	RAM	Uptime
cvl-analytics-svr	4	80	8GB	6 months
cvl-bip-fv	4	80	8GB	6 months
cvl-icenexus	2	40	4GB	5 months
cvw-piquet01	2	40	4GB	4 months, 1 week



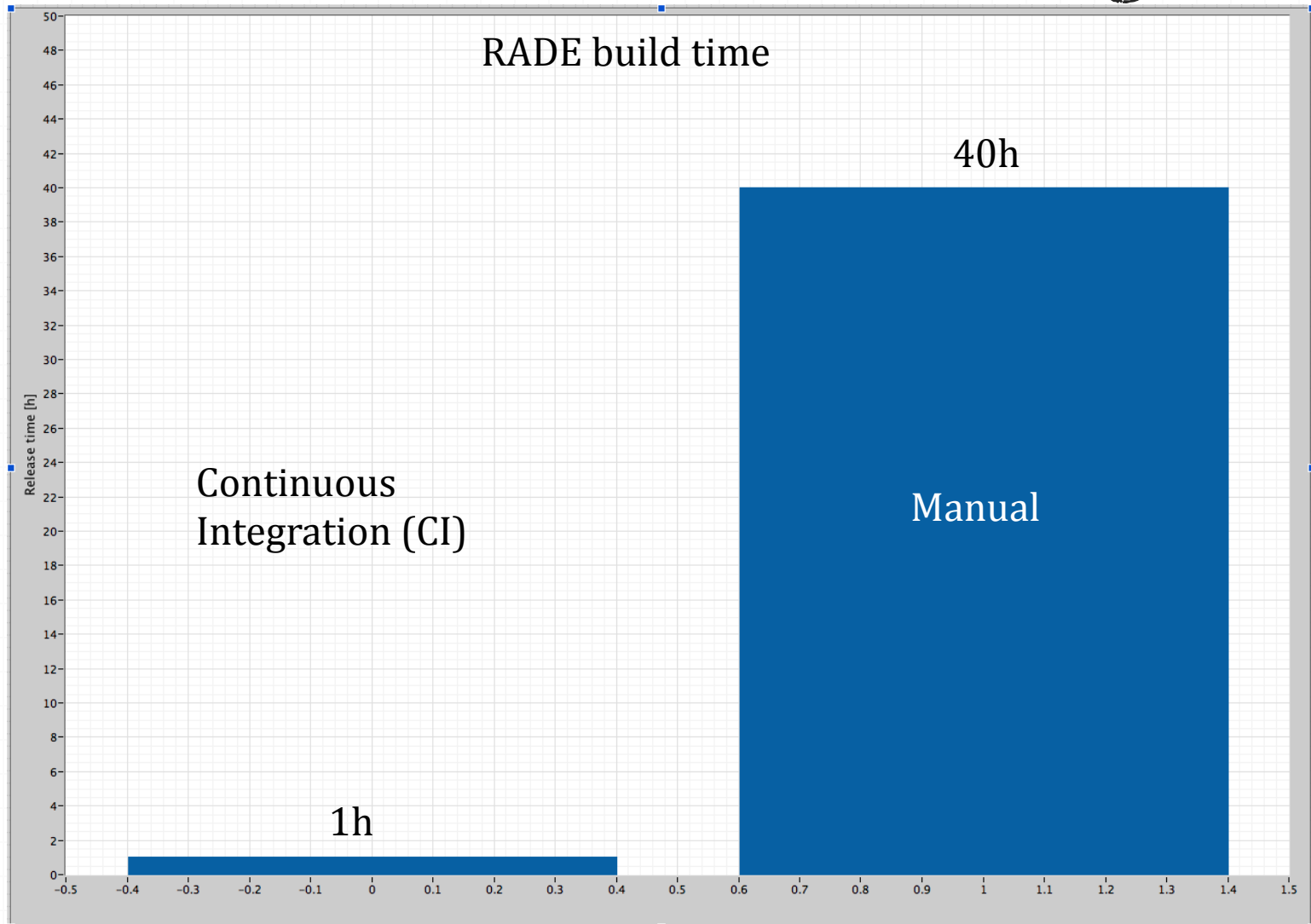
Continuous Integration

Preference for cloud platform
Buyer responses (cloud infrastructure implemented/planned)





Continuous Integration



Software repository

The screenshot displays the Nexus Repository Manager OSS interface. At the top, it says "Nexus Repository Manager OSS" and "Nexus Repository Manager OSS 2.12.0-01". The main area is titled "Repositories" and contains a table of repository configurations.

Repository	Type	Health Check	Format	Policy	Repository Status	Repository Path
Public Repositories	group	ANALYZE	maven2			http://rade-nexus-01:8081/nexus/content/groups/public
3rd party	hosted	ANALYZE	maven2	Release	In Service	http://rade-nexus-01:8081/nexus/content/repositories/thirdparty
Apache Snapshots	proxy	ANALYZE	maven2	Snapshot	In Service	http://rade-nexus-01:8081/nexus/content/repositories/apache-snapshots
Central	proxy	ANALYZE	maven2	Release	In Service	http://rade-nexus-01:8081/nexus/content/repositories/central
Central M1 shadow	virtual	ANALYZE	maven1	Release	In Service	http://rade-nexus-01:8081/nexus/content/shadows/central-m1
libraries	hosted	ANALYZE	maven2	Release	In Service	http://rade-nexus-01:8081/nexus/content/repositories/libraries
Releases	hosted	ANALYZE	maven2	Release	In Service	http://rade-nexus-01:8081/nexus/content/repositories/releases
Snapshots	hosted	ANALYZE	maven2	Snapshot	In Service	http://rade-nexus-01:8081/nexus/content/repositories/snapshots

Below the table, there is a "Releases" section with tabs for "Browse Index", "Browse Storage", "Configuration", "Routing", "Summary", and "Artifact Upload". The "Browse Storage" tab is active, showing a tree view of the repository structure:

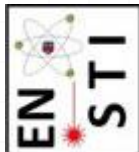
- Releases
 - rade
 - Installer
 - Library
 - Mac
 - 2015
 - CO
 - MTA-lib
 - archetype-catalog.xml

An artifact details window is open, showing the following information:

- Group: rade.Library.Mac.2015
- Artifact: CO
- Version: CO-1.1.0
- Extension: tar.gz
- XML: <dependency><groupId>rade.Library.Mac.2015</groupId>

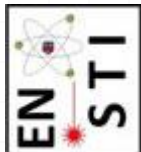
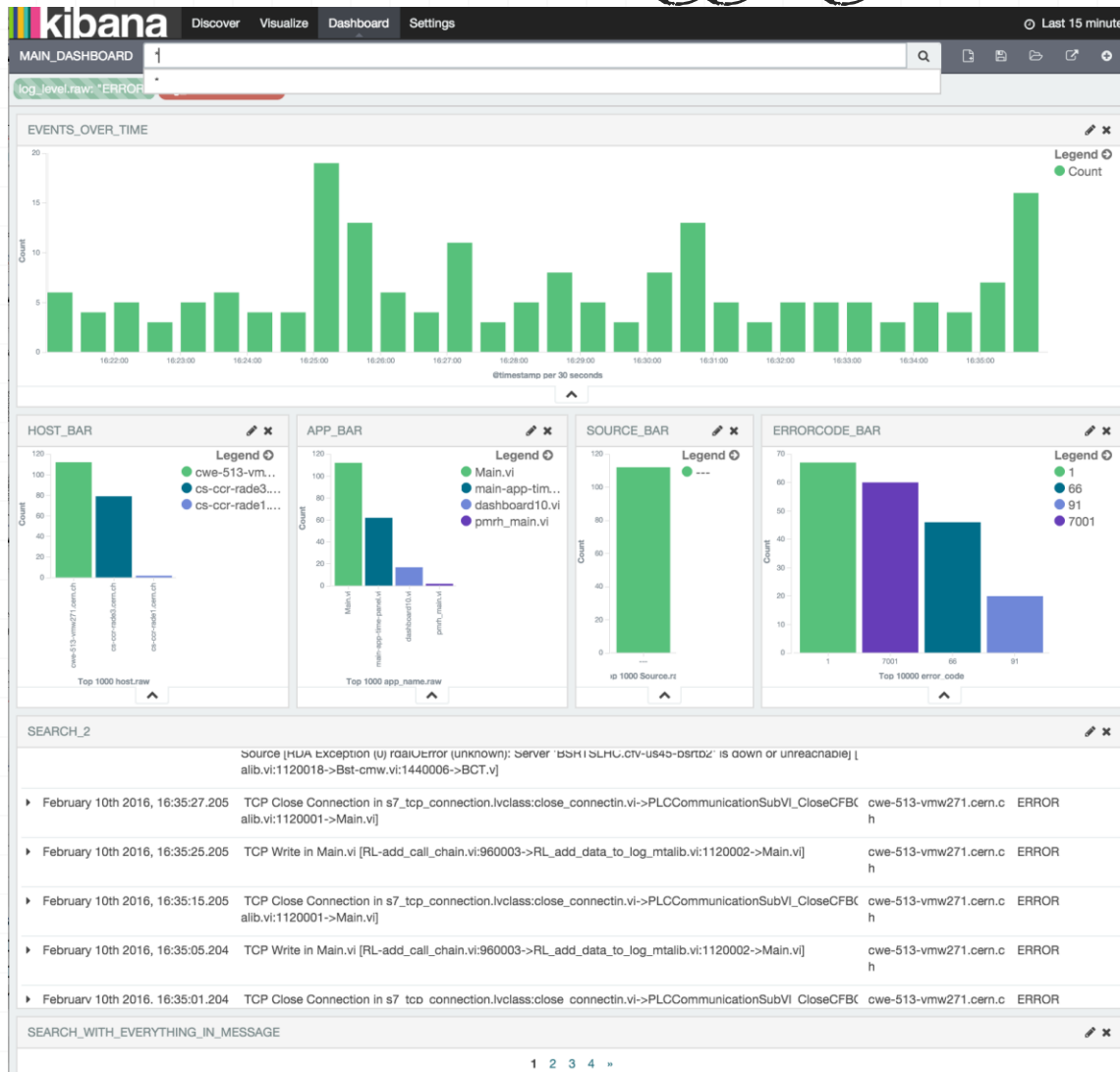


Nexus



Logging and diagnostics

("ELK")





Distribution

EN Home / Frameworks / RADE / RADE-Getting-Started / RADE-install Tools ▾

RADE-install

Added by Unknown User (atarasen), last edited by Odd Oyvind Andreassen on Feb 10, 2014 (view change)

Home Getting Started Libraries Download Support Glossary

RADE is available through CMF.

If your computer doesn't have the CMF agent installed you can get RADE from the locations linked below.

	Windows	Linux Local (64 bit)	Linux Local (32 bit)	Linux (NFS)	Mac OSX
LabVIEW 2010	RADE 10	RADE 10	RADE 10	RADE is installed centrally	RADE 10 OSX DMG
LabVIEW 2011	RADE 11	RADE 11	RADE 11	RADE is installed centrally	RADE 11 OSX DMG
LabVIEW 2012	RADE 12	RADE 12	RADE 12	RADE is installed centrally	RADE 12 OSX DMG
LabVIEW 2013	RADE 13	RADE 13	RADE 13	RADE is installed centrally	RADE 13 OSX DMG

- If the installation doesn't start automatically run RADE_13.exe from \\cern.ch\dfs\Services\PM\A\rade\builds\RADE_13.exe

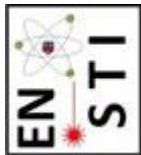
Beta-version of RADE for LabVIEW-2010

Windows	Linux
Windows version	RADE-10-beta.rpm

Installing on Mac



The mac package is not signed so in order to install the RADE framework on your machine you have to allow all applications in your security settings (Preferences >> Security & Privacy):



Online Installer





Distribution

RADE-Installer.vi rev. 145

Log In  Add  LabVIEW version

LV version  Remove 

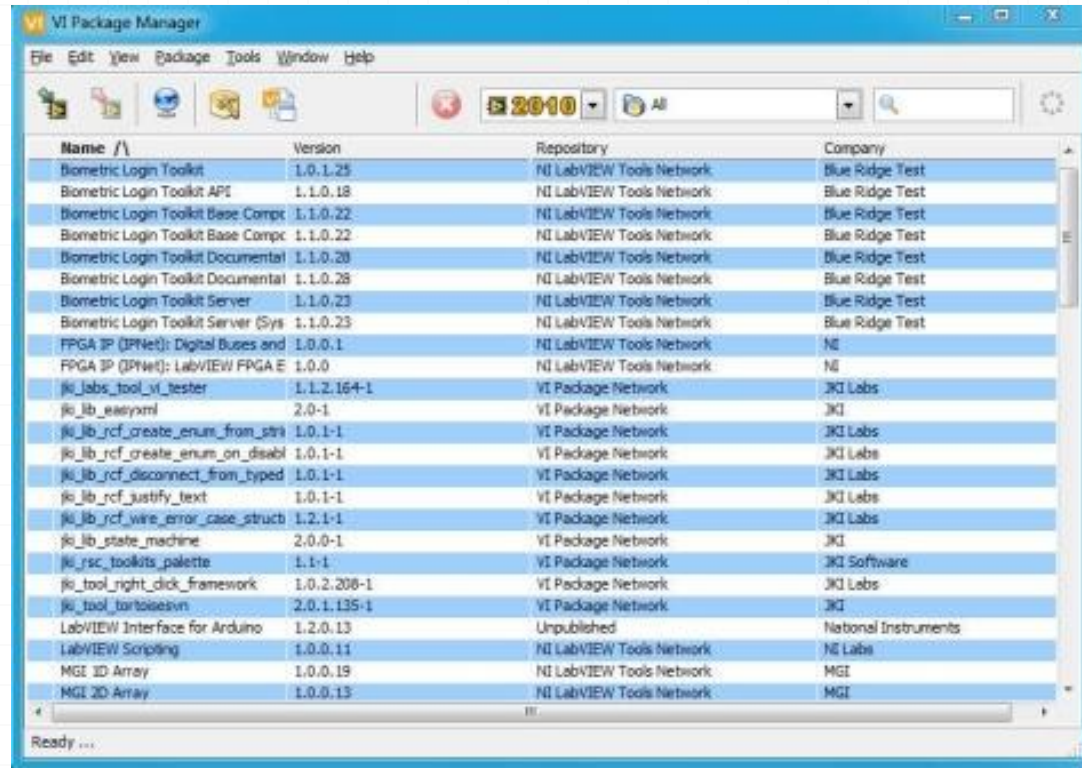
Name	Category	Local version	Remote version	Status	Developer	Source
MTA Lib				not installed	oddoa	
RBAC				not installed	oddoa	
JAPC				not installed	vshaipov	
RADAR				not installed	vshaipov	
CMW Wrapper				not installed	ostrue	

00:49:40.767 --> executing: core:idle

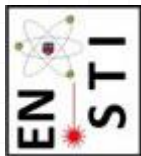
RADE Installer



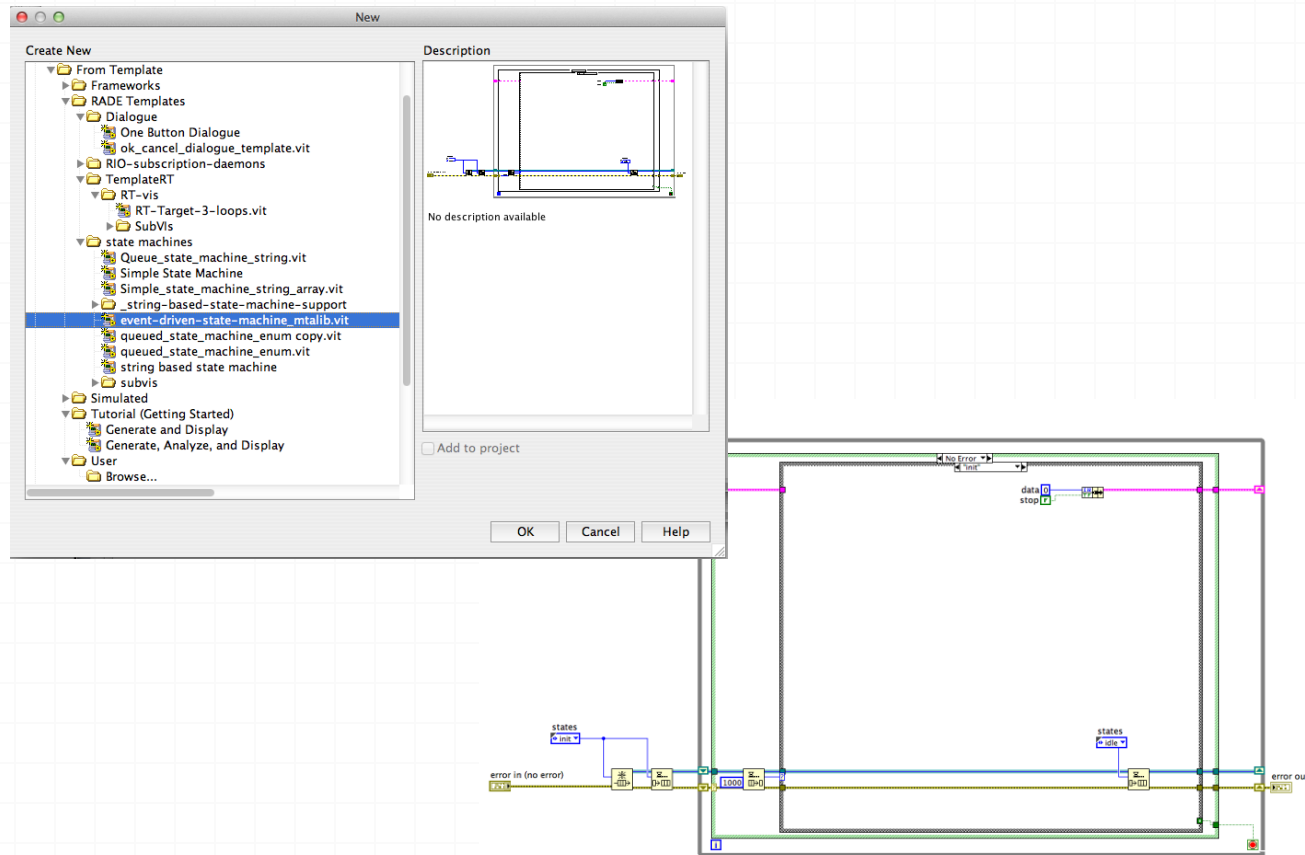
Distribution



Name \ /	Version	Repository	Company
Biometric Login Toolkit	1.0.1.25	NI LabVIEW Tools Network	Blue Ridge Test
Biometric Login Toolkit API	1.1.0.18	NI LabVIEW Tools Network	Blue Ridge Test
Biometric Login Toolkit Base Comp	1.1.0.22	NI LabVIEW Tools Network	Blue Ridge Test
Biometric Login Toolkit Base Comp	1.1.0.22	NI LabVIEW Tools Network	Blue Ridge Test
Biometric Login Toolkit Documental	1.1.0.28	NI LabVIEW Tools Network	Blue Ridge Test
Biometric Login Toolkit Documental	1.1.0.28	NI LabVIEW Tools Network	Blue Ridge Test
Biometric Login Toolkit Server	1.1.0.23	NI LabVIEW Tools Network	Blue Ridge Test
Biometric Login Toolkit Server (Sys	1.1.0.23	NI LabVIEW Tools Network	Blue Ridge Test
FPGA IP (IPNet): Digital Buses and	1.0.0.1	NI LabVIEW Tools Network	NI
FPGA IP (IPNet): LabVIEW FPGA E	1.0.0	NI LabVIEW Tools Network	NI
jki_labs_tool_vi_tester	1.1.2.164-1	VI Package Network	JKI Labs
jki_lb_easysmi	2.0-1	VI Package Network	JKI
jki_lb_rcf_create_enum_from_stri	1.0.1-1	VI Package Network	JKI Labs
jki_lb_rcf_create_enum_on_disabl	1.0.1-1	VI Package Network	JKI Labs
jki_lb_rcf_disconnect_from_typed	1.0.1-1	VI Package Network	JKI Labs
jki_lb_rcf_justify_text	1.0.1-1	VI Package Network	JKI Labs
jki_lb_rcf_wire_error_case_struct	1.2.1-1	VI Package Network	JKI Labs
jki_lb_state_machine	2.0.0-1	VI Package Network	JKI
jki_rsc_toolkits_palette	1.1-1	VI Package Network	JKI Software
jki_tool_right_click_framework	1.0.2.208-1	VI Package Network	JKI Labs
jki_tool_tartoisevsn	2.0.1.135-1	VI Package Network	JKI
LabVIEW Interface for Arduino	1.2.0.13	Unpublished	National Instruments
LabVIEW Scripting	1.0.0.11	NI LabVIEW Tools Network	NI Labs
MGE 3D Array	1.0.0.19	NI LabVIEW Tools Network	MGE
MGE 2D Array	1.0.0.13	NI LabVIEW Tools Network	MGE



Dedicated Templates



Project Generation

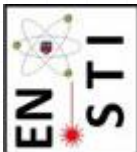
The screenshot displays the RADE Project Generator application window. The title bar reads "radegen-main.vi". The main window features the RADE logo on the left, the text "PROJECT GENERATOR" in large red letters, and the CERN logo on the right. Below the header, the "Project Type" is set to "Event driven state machine". There are "CREATE" and "CUSTOMIZE" buttons, along with a "Show Log?" checkbox.

A "Message" dialog box is open, showing configuration options for a project. The "Project Name" is "My-RADE-Project". The "Base Path" is "Macintosh HD:testproj". The "Project Name" field also contains "My-RADE-Project". There are "Cancel" and "Apply" buttons at the bottom of the dialog.

A "Project Explorer" window is also visible, showing a tree view of the project structure. The root is "Project: My-RADE-Project.lvproj", which contains "My Computer", "Dependencies", "Build Specifications", and "My-RADE-Project".

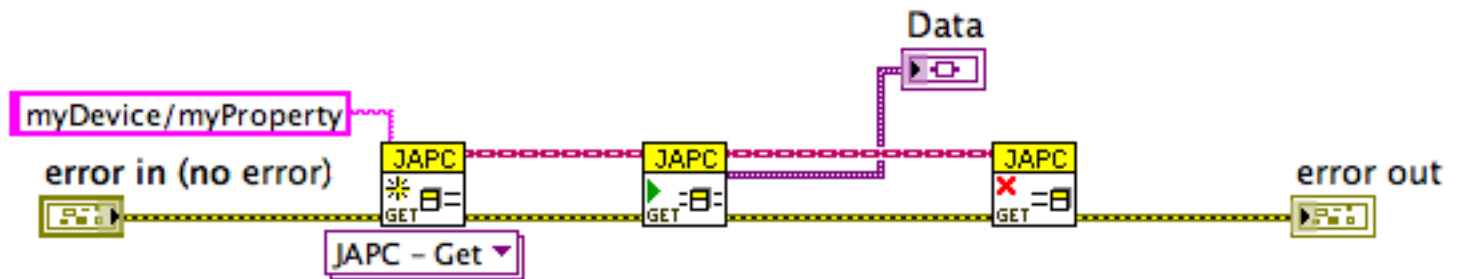
A log window at the bottom of the main application shows a series of messages:

```
11:33:55.833 --> #MSG resizing GUI
11:33:56.811 --> #MSG setting control attr
11:33:56.834 --> #MSG resizing GUI
11:33:57.933 --> #MSG setting control attr
12:10:05.415 --> #MSG setting control attr
12:10:05.417 --> #MSG resizing GUI
12:10:07.426 --> #MSG setting control attributes
12:10:07.427 --> #MSG resizing GUI
12:10:36.493 --> #MSG resizing GUI
12:10:37.376 --> #MSG setting control attributes
12:10:42.106 --> #MSG resizing GUI
12:10:42.952 --> #MSG setting control attributes
12:10:53.183 --> #PROMPT Select name and path
```



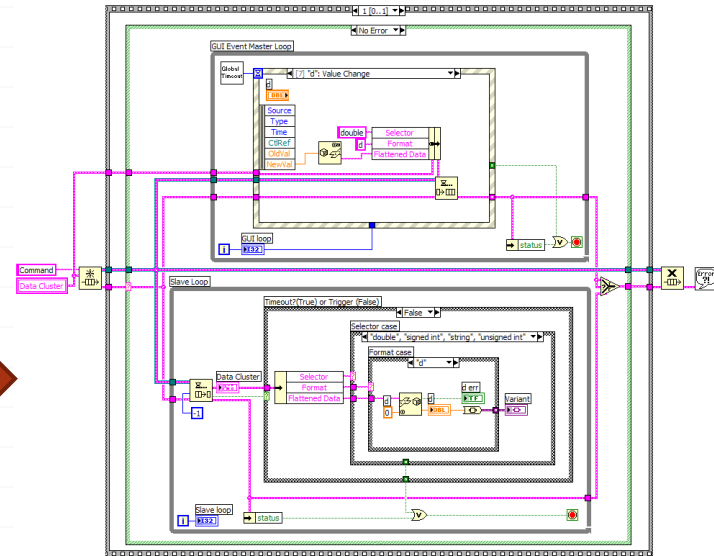
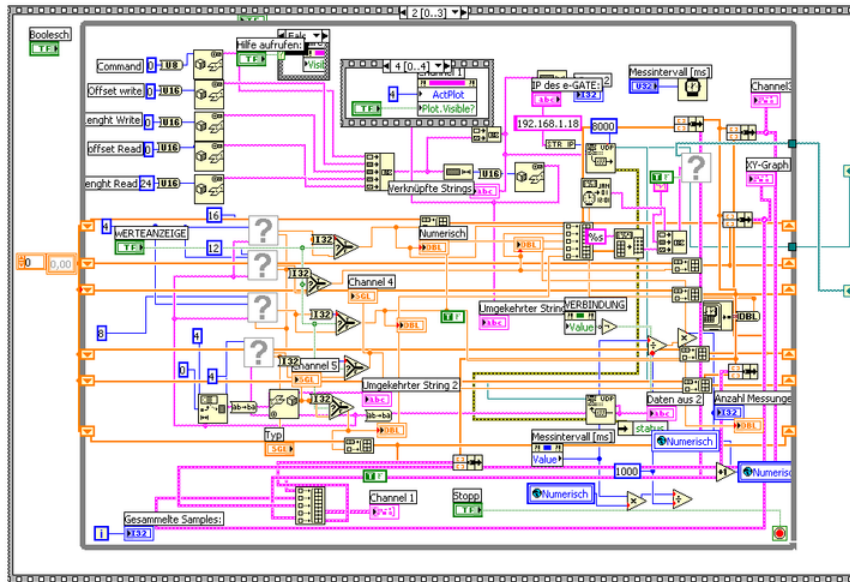
Typical design

Create, Use & Destroy

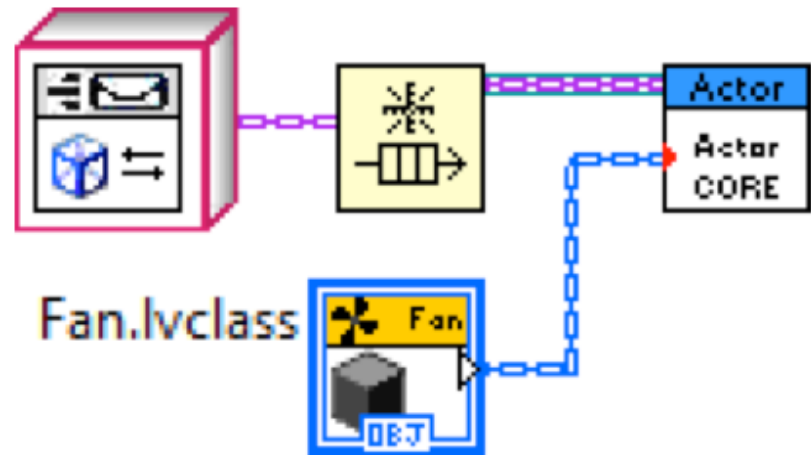
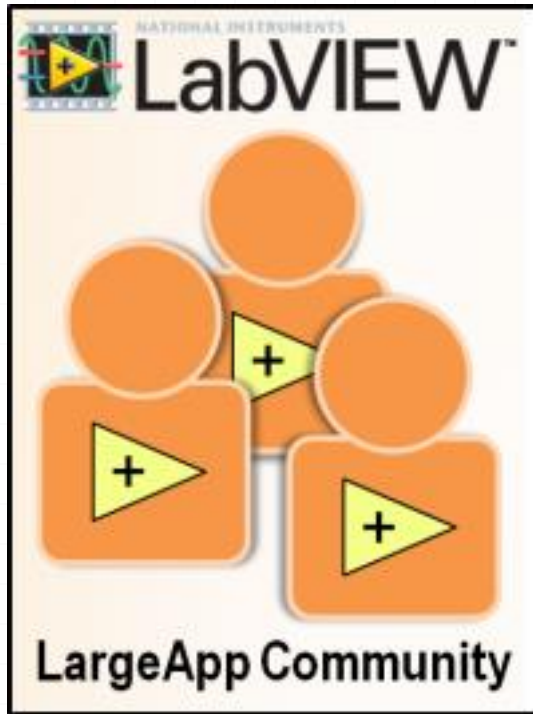


Development help

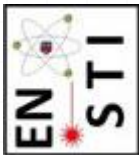
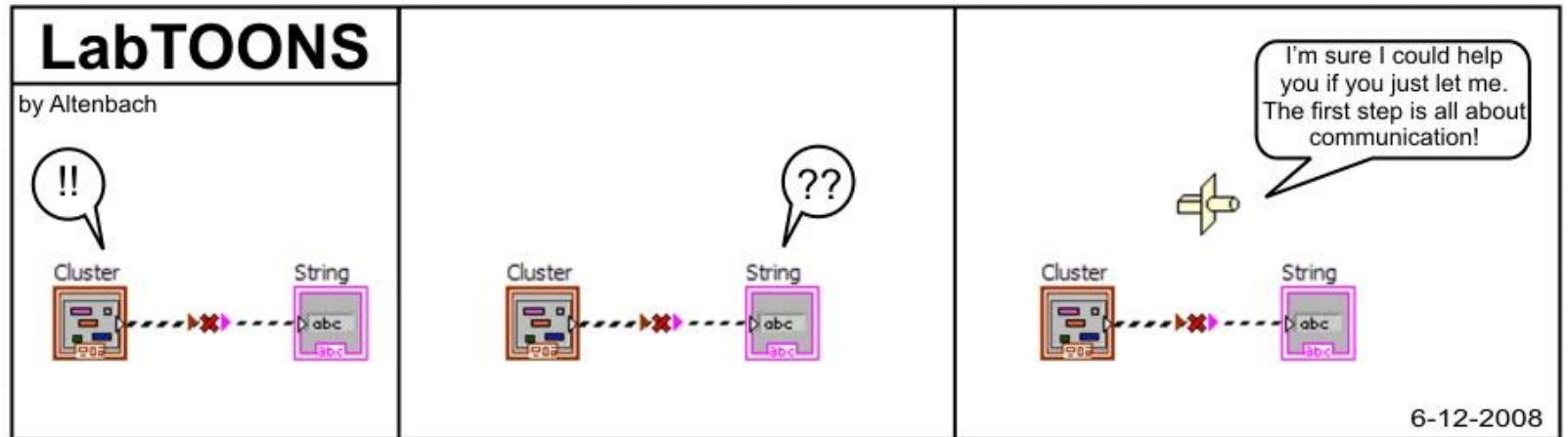
- Design patterns and templates in RADE
- LabVIEW Guides
<http://j2eeps.cern.ch/wikis/display/EN/LabVIEW+Guides>
- Code review: make maintainable, and performant



Peer Programming



The missing link



Middleware integration



Operators

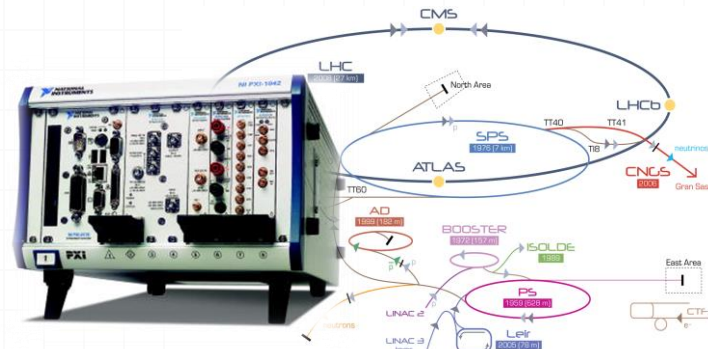
Clients

- RIO palette (Rade Input/Output)
 - Get, Set and Subscribe

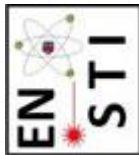


Server

- Device/property/field definitions

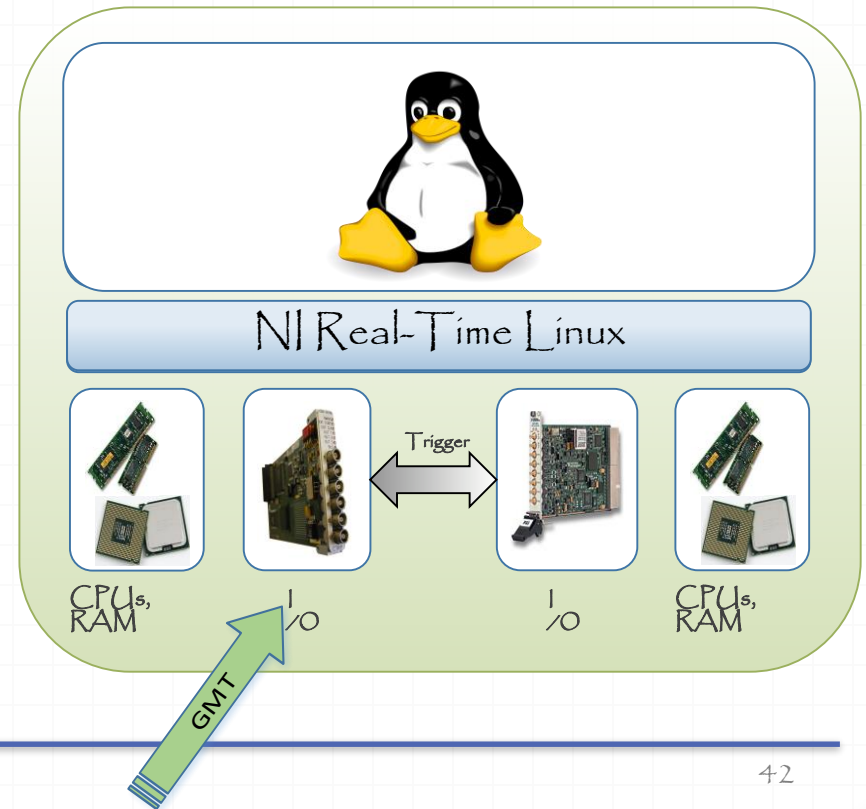
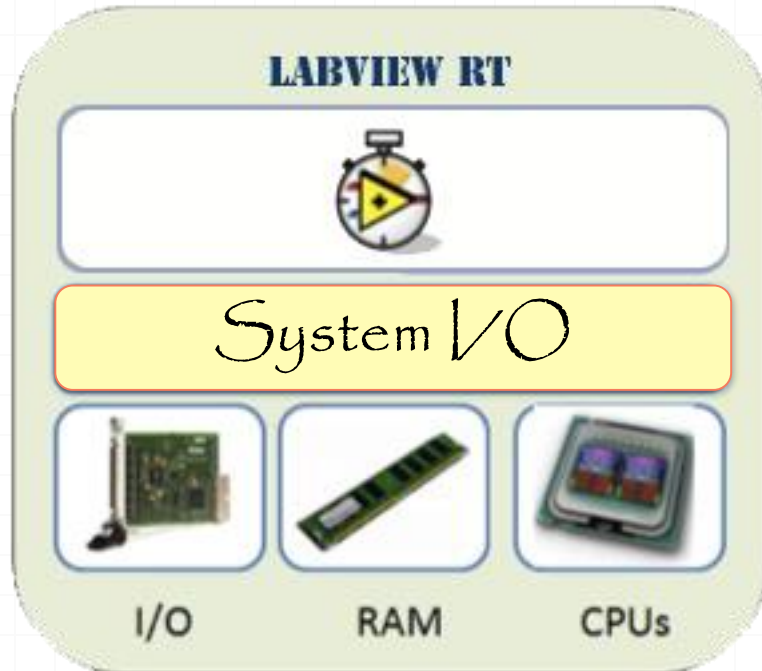


PXI on the accelerator complex





Distributed Architecture



Outline

- MTA
- Why RADE?
- The challenge
- The Scope
- Coping with large applications
- RADE today
- Future



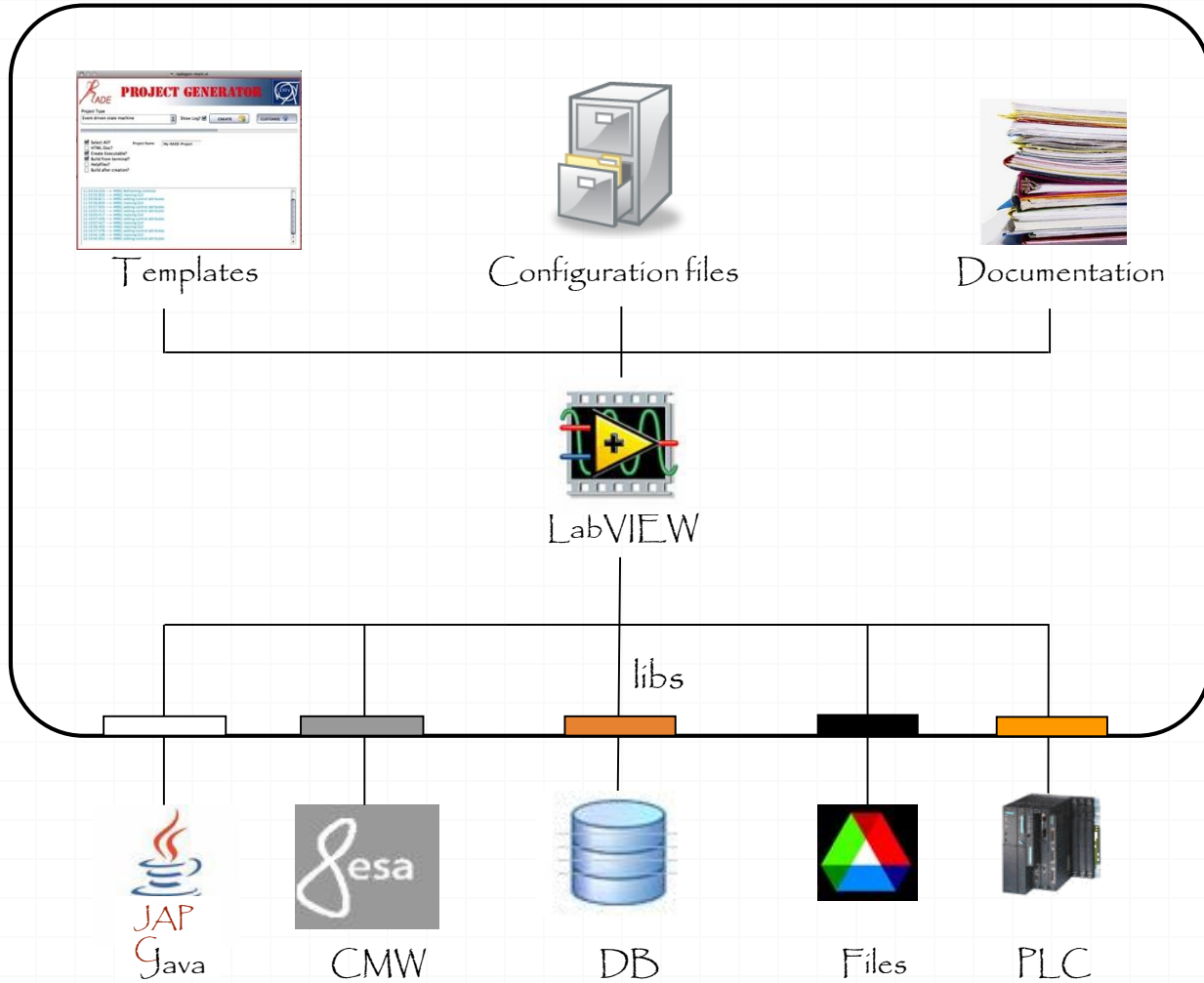
RADE today



- RADE has become adult
- LabVIEW has started getting out of the Lab
- Copes with the classical software development challenges
- Enables LabVIEW to be used for accelerator applications

The Framework

Sources, Targets and Interactions



Training



Support

Hardware Support



Hardware



- PXI
- CompactRIO
- DAQ

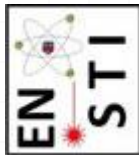


&

Software



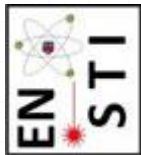
- LabVIEW
- TestStand
- DIAdem
- and other NI products



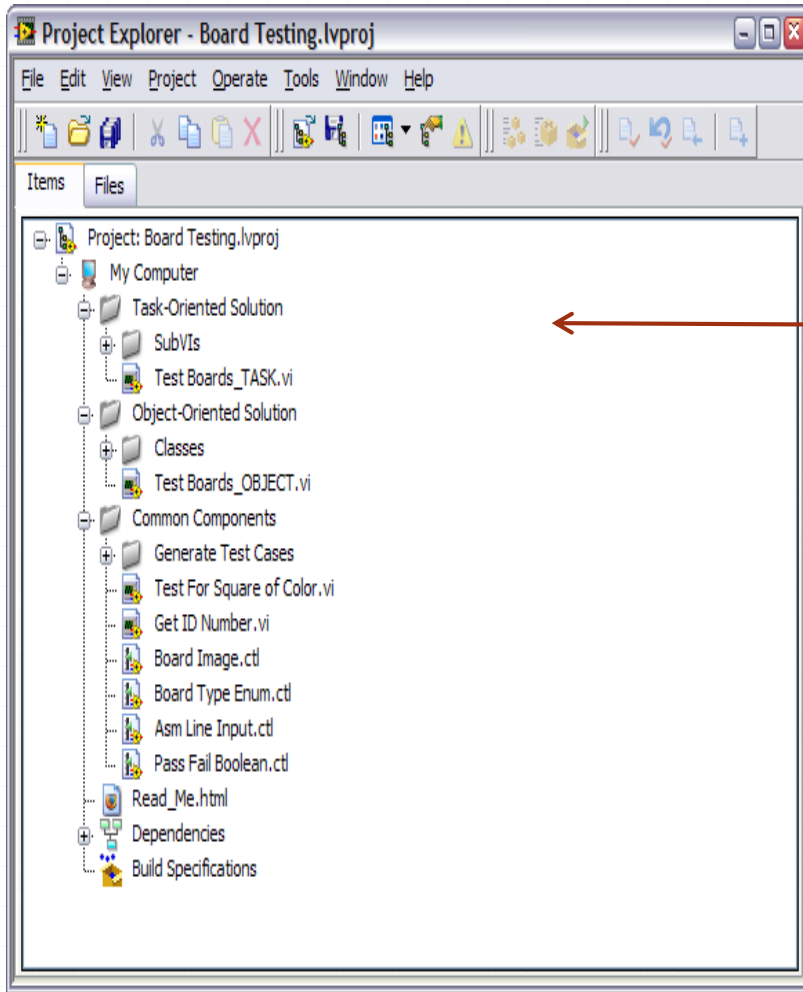
Outline

- MTA
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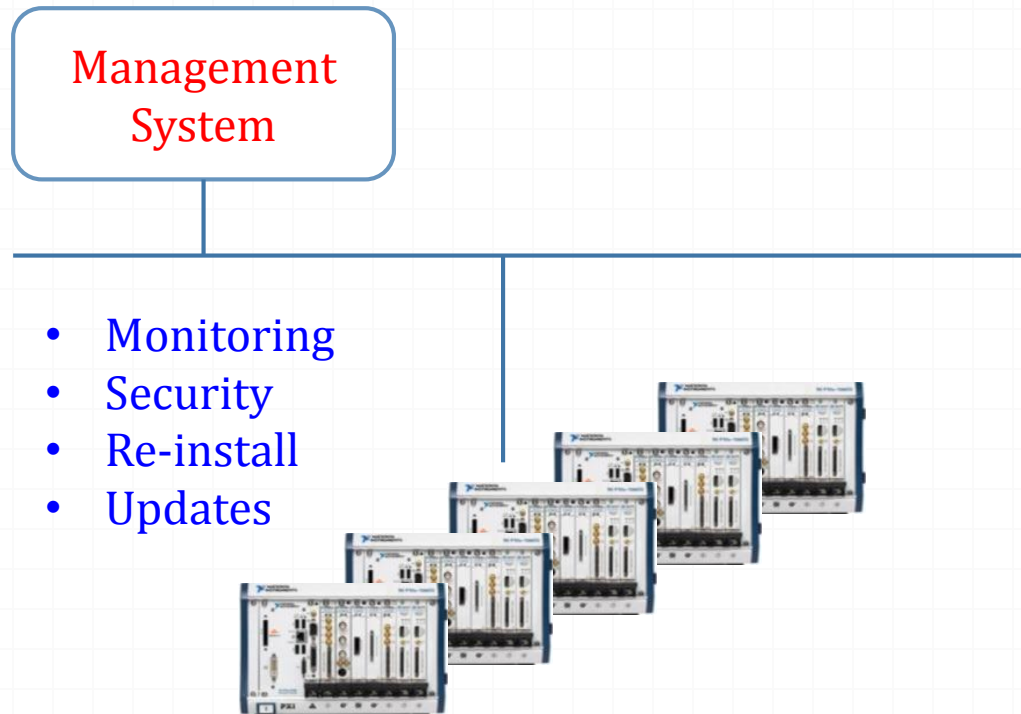


Future Challenges



Large system management

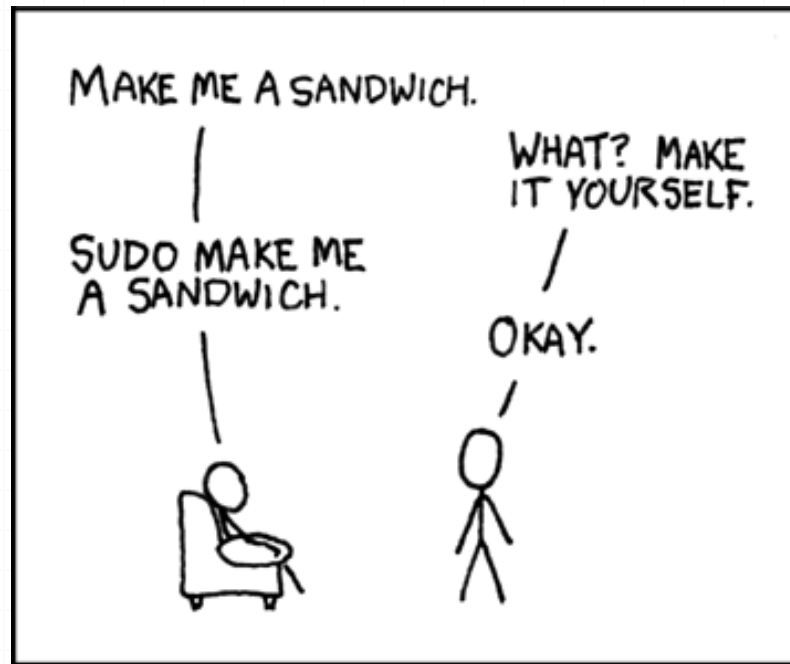
- How to manage a large installation?



Watch these!

- [The LHC](#) by Brian Cox
- [Extreme programming](#) by Elisabeth Hendrickson
- [What the agile manifesto left out](#) by Brian Marick
- [Practicing Continuous Integration](#) by David Cramer
- [The Actor Framework](#) by Stephen Mercer
- [ZMQ is the answer](#) by Ian Barber

Questions



www.cern.ch/RADE

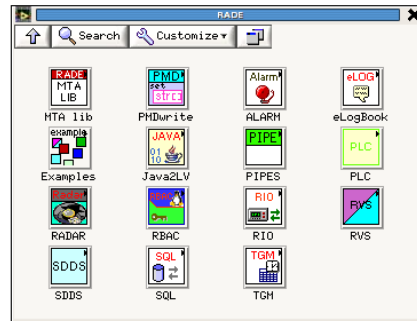
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RADE is a Rapid Application Development Environment based on LabVIEW.

It's the solution at CERN to develop expert tools, machine development analysis and independent test facilities in integration with the CERN control systems.

- [RADE Modules](#)
- [What is new in RADE?](#)

RADE Modules



Library	Icon	Description
MTALib		MTA library. Contains extensions of standard LabVIEW functions for Array, Boolean, Comparison and other palettes.
ALARM		Activating and terminating alarms for the LHC ALARM System.
eLogBook		Adding events and file-attachment to events into eLogBook.
RIO		RADE Input/Output provides an access to a live data from the front-ends. Provides GET, SET and Subscription possibilities for any RDA supported device. RIO is the combination of JAPC and FESA palettes of RADE's previous versions.
PIPES		Using pipes for Read and Write operations.