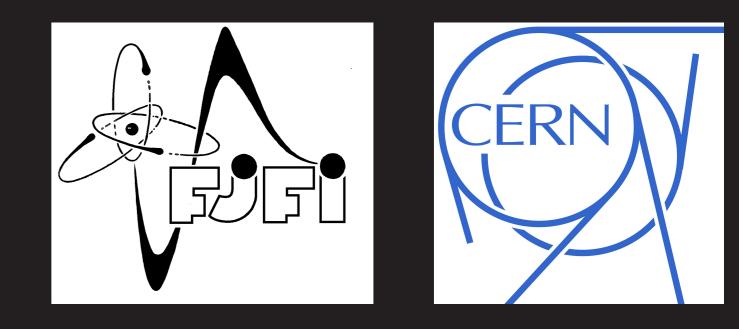
Monitoring tools of COMPASS experiment at CERN

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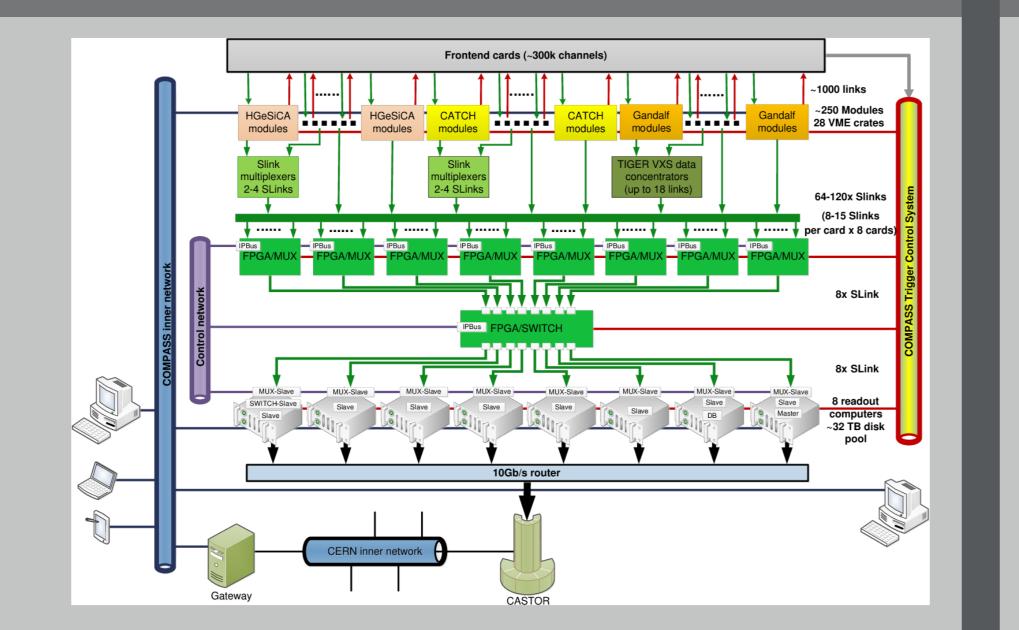
Introduction

Nowadays, all modern high energy physics experiments are substantially dependent on fast and reliable data acquisition systems that are able to collect large quantities of data supplied by various detectors. The COMPASS is a high energy particle experiment with a fixed target located at the SPS of the CERN laboratory in Geneva, Switzerland. This poster briefly introduces the data acquisition system of the COMPASS and is mainly focused on the part that is responsible for the monitoring of the nodes in the whole newly developed data acquisition system of this experiment.

DAQ overview

Upgrade of the old DAQ

- Obsolete PCI technology
- Insufficient capacity and speed



Message Browser

UI Design of the Message Browser application

 Qt GUI Application
 Displays messages from the database

		MessageBrowser						_ 0
Column sel		Sender 🗸 Run 🗸 Spill 🗸 Event 🗹 Message 🗸 Severity 🗸 Date +	Гime	Check All	Uncheck All	Default Filter settings		Hide filters
Spil	Event	Message		Severity	Date	From - To	M	essages, Page
0	0	data error word 3 found during parsing of 68 source ID - first	~	errR	2014/07/30	2014 07 29 10:56:09	•	1000
0	0	data error word 3 found during parsing of 68 source ID Error occured:3649, errR 201.			2014/07/30	2014 07 30 10:56:09	•	1
0	0	Received first event in cycle. infR 2014/07/30						
0	0	Received last event in cycle. infR 2014/07/30						
0	0	Evt 3599 size 3596 total 12.7177 average size 3703.48 in 4613ms with trigger rate 433.557Hz and average speed of 2.75479 MB/s infR 2014/07/30						
0	0	Received last event in burst. infR 2014/07/30 APPLY FILTER						
0	0	data error word 3 found during parsing of 68 source ID - first errR 2014/07/30						
0	0	data error word 3 found during parsing of 68 source ID Error occured:3638.		errR	2014/07/30	Message filter		

FPGA cards

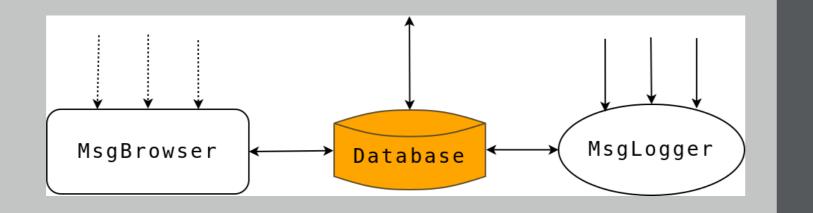
- Field-programmable gate array
- Load balancing, buffering (ROB) (18 GB/30 s)
- Event building

- Receives new messages via network
- Communicates via DIM library
- Independent from the other parts of DAQ (case of accident, ...)
- MVC design pattern

0	0	Received first event in cycle.	infR	2014/07/30	Sender
0	0	Received last event in cycle.	infR	2014/07/30	
0	0	Evt 3599 size 3568 total 12.7137 average size 3702.27 in 4613ms with trigger rate 433.557Hz and average speed of 2.75388 MB/s	infR	2014/07/30	
0	0	Received last event in burst.	infR	2014/07/30	✓ SR RE11 (56)
0	0	Received first event in cycle.	infR	2014/07/30	▼ 5K_KE11 (50)
0	0	data error word 3 found during parsing of 68 source ID - first	errR	2014/07/30	
0	0	data error word 3 found during parsing of 68 source ID Error occured:3601,	errR	2014/07/30	
0	0	Received last event in cycle.	infR	2014/07/30	✓ SC_RE11 (55)
0	0	Evt 3599 size 3588 total 12.7089 average size 3700.8 in 4612ms with trigger rate 433.651Hz and average speed of 2.75339 MB/s	infR	2014/07/30	
0	0	Received last event in burst.	infR	2014/07/30	
0	0	Received first event in cycle.	infR	2014/07/30	
0	0	Received last event in cycle.	infR	2014/07/30	Check All Uncheck All
0	0	data error word 3 found during parsing of 68 source ID - first	errR	2014/07/30	
0	0	data error word 3 found during parsing of 68 source ID Error occured:6796,	errR	2014/07/30	✓ Severity
0	0	event still attached Error occured:1,	warR	2014/07/30	
0	0	Evt 3599 size 3588 total 12.7139 average size 3702.31 in 4612ms with trigger rate 433.651Hz and average speed of 2.75451 MB/s	infR	2014/07/30	✓ Other
0	0	Received last event in burst.	infR	2014/07/30	
0	0	Received first event in cycle.	infR	2014/07/30	✓ Info
0	0	Received last event in cycle.	infR	2014/07/30	✓ Warning
0	0	event still attached	warR	2014/07/30	v warning
0	0	Evt 3599 size 3840 total 12.7059 average size 3699.97 in 4612ms with trigger rate 433.651Hz and average speed of 2.75277 MB/s	infR	2014/07/30	✓ Error
0	0	Received last event in burst.	infR	2014/07/30	
0	0	data error word 3 found during parsing of 68 source ID - first	errR	2014/07/30	✓ Fatal Error
0	0	data error word 3 found during parsing of 68 source ID Error occured:3654,	errR	2014/07/30	
0	0	Received first event in cycle.	infR	2014/07/30	Check All Uncheck All
0	0	Received last event in cycle.	infR	2014/07/30	
0	0	Evt 3599 size 3656 total 12.7269 average size 3706.04 in 4613ms with trigger rate 433.557Hz and average speed of 2.75669 MB/s	infR	2014/07/30	Run number
0	0	Received last event in burst.	infR	2014/07/30	Spill number
0	0	data error word 3 found during parsing of 68 source ID - first	errR	2014/07/30	
0	0	data error word 3 found during parsing of 68 source ID Error occured:3650,	errR	2014/07/30	Event number
0	0	Received first event in cvcle.	infR	2014/07/30	Message
				•	
				8 subscribed serv	vices 4034 msgs loaded Database Connected

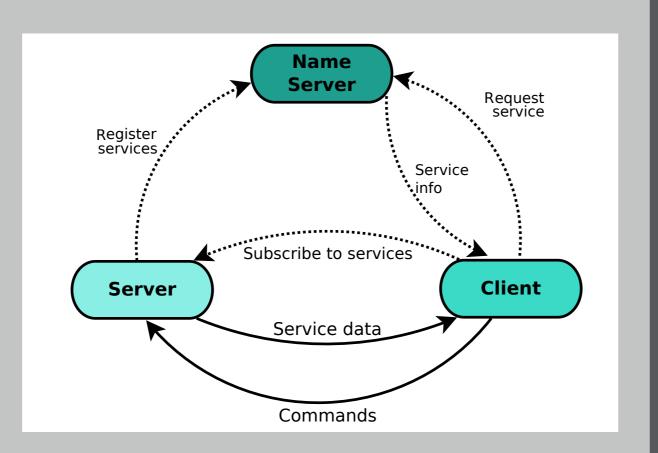
Message Logger

- Simple console application
- Receives messages via network (DIM library)
- Relevant messages are stored into the database



DIM Library

- A communication library originally developed for CERN
- Based on the client/server paradigm
- Extended by DNS (Dim Name Server)
 Service is a basic communication tool
 Service can contain data of any size
 Server publishes services
 Client subscribes to services, controls servers using commands

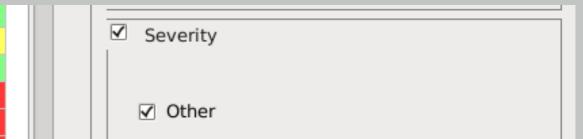


Filtering

	selector				
☑ ID ☑ Sender ☑ Run 🗌 Spill ☑ Event ☑ Message					
ID	Sender	Run ^	Event	Messa	
274	test2 (17)	100	102	Query test	
275	test2 (18)	100	102	Query test	
276	test2 (18)	100	102	Query test	
277	test2 (17)	100	102	Query test	
273	test (16)	29	85	moje entry join	
241	Test003 (3)	27	5	moje entry	
242	Test003 (3)	27	6	moje entry	
243	Test003 (3)	27	7	moje entry	

Magaza di ka		
Message filte	r	
Sender		
Severity		
Run num	ber	
Exact	Current	1000

Default	Hide filters			
Filter settings				
From - To	Messages, Page			
2014 07 29 10:56:09	- 1000 🗘			
2014 07 30 10:56:09	▼ 1 ‡			
Load Messages				
APPLY FILTER				



C EXACL	Curren	1000	
~ •):54
O Range	From	1000):54
	🗌 То	1500):52
):52
Spill nur	nber):49
 Exact 		55	3:00
Bango	From	25	7:46
Range	M HOIII	25	7:38
	🗌 То	55	7:38
			/:38
Event nu	umber		7:38
Exact		5	7:38
O Range	From	3	5:15
Range			5:15
	🗌 То	6	

L:34

L:12

):55

54		
54		✓ Info
52		
52		
19		✓ Warning
00		
16		✓ Error
38		
38		
38		✓ Fatal Error
38	≡	
38		
15		Check All Uncheck All
L5		

Database

- Message_log the largest table inside the DAQ database
- MyISAM storage engine optimized for heavy read operations
- Only one foreign key referential integrity is to be kept programmatically
- Currently stamp column is indexed for faster ordering
- Other tables InnoDB storage engine (foreign key support for referential integrity)

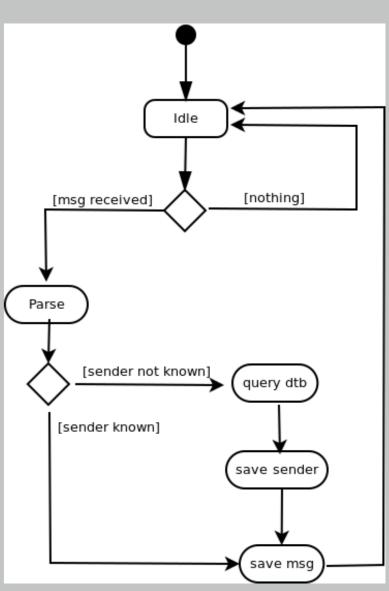
Message_log 🔻	Process 1
Id INT(10)	? Id INT(10)
process_id INT(10)	Name VARCHAR(32)
run_number INT(10)	Role INT(10)
<pre>\$\$ spill_number INT(10)</pre>	Pc INT(10)
event_number INT(10)	date_created TIMESTAM
text VARCHAR(255)	Live TINYINT(1)
severity VARCHAR(4)	Indexes 🕨
stamp TIMESTAMP	
Indexes 🕨	

Acknowldgement

The work on this project has been supported in part by the following grants: MSMT LA08015 and SGS 11/167. It is also being supported by the Maier-Leibnitz-Labor, Garching and the DFG cluster of excellence Origin and Structure of the Universe.

Online Mode

- Receives messages immediately from network
- ► No need to poll the database for new messages
- Usage of DIM library
- The same pricipal as in the MsgLogger, but the messages are only displayed, not stored to the database



References

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 Prague, Czech Technical University in Prague, June 2012
- [3] *J. Nový:* **COMPASS DAQ Basic Control System.** Prague, Czech Technical University in Prague, June 2012
- [4] M. Bodlak, V. Frolov, V. Jary, S. Huber, I. Konorov, D. Levit, A. Mann, J. Novy, S. Paul, and M. Virius: New data acquisition system for the COMPASS experiment
- [5] M. Bodlák, V. Jarý, J. Nový, J. Tomsa, M. Virius: Reporting Tool for the Data Acquisition System Ostrava, IT for Praxis, 2014

Tests

- Repeated loading of messages
- 100-50 000 messages loaded 100 times in a row
- Time needed to save the data into the data structure
- Time needed to complete the whole task
- ► Tests rerun at least 10 times.
- Storing of 100 msgs 1.17 ms
- ► Loading of 100 msgs 2.88 ms

