



Wir schaffen Wissen – heute für morgen

Accelerator Modelling and Message Logging with ZeroMQ

J. Chrin, M. Aibe, A. Rawat, Z. Wang
Paul Scherrer Institut

ZeroMQ @ ICALEPCS

- A. Dworak *et al.*, “Middleware Trends and Market Leaders 2011”, in *Proc. ICALEPCS’11*
- W. Sliwinski *et al.*, “Middleware Proxy: A Request-driven Messaging Broker for High Volume Data Distribution”, in *Proc. ICALEPCS’13*
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- A. Yamashita and M. Kago, “A New Message-based Data Acquisition Sysyem for Accelerator Control?”, in *Proc. ICALEPCS’13*
- K. Rehlich, “Recent Hardware and Software Achievements for the European XFEL”, presented at *ICALES’13*
- S.G. Ebner *et al.*, “Data Streaming – Efficient Handling of Large Small (Detector) Data at the Paul Scherrer Institute”, presented at *ICALES’15*, paper WED3O06
- S.G. Ebner *et al.*, “SwissFEL Beam Synchronous Data Acquisition – A Sneek Peek under the Hood”, presented at *ICALES’15*, paper MOPGF058

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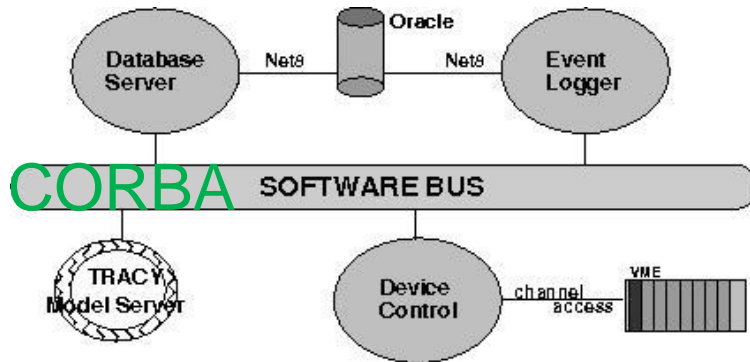
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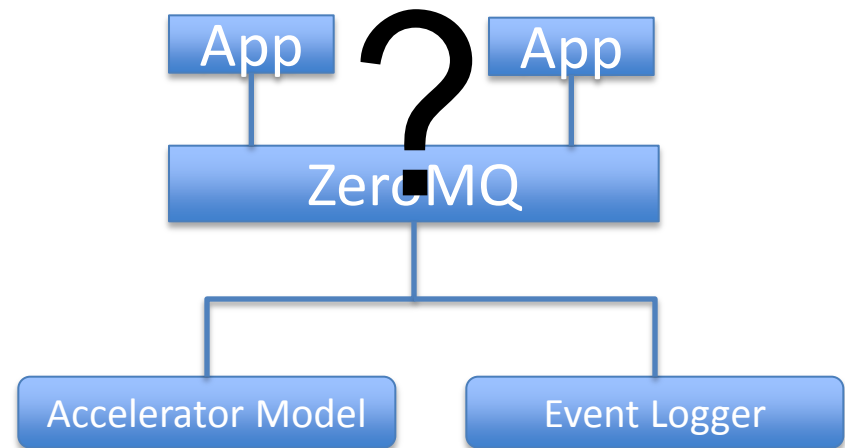
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ZeroMQ as middleware in HLA?

SLS 1999



SwissFEL 2016



cf. A. Götz *et al.*, "TANGO - Can ZeroMQ Replace CORBA?", in *Proc. ICALEPCS'13*

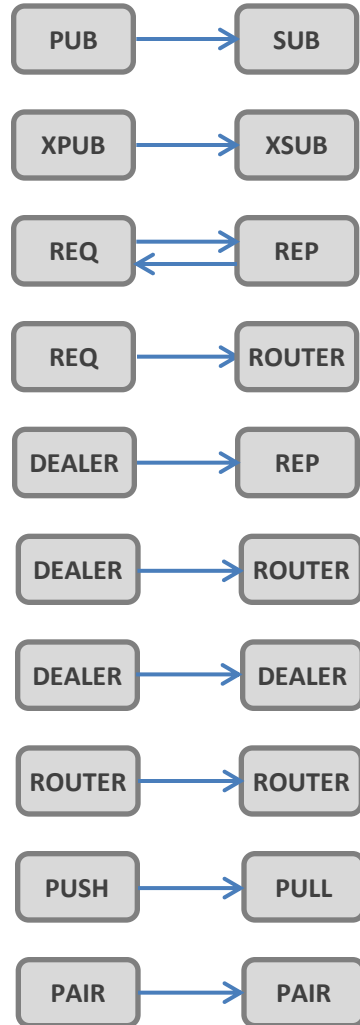
Distributed Computing with ZeroMQ

Distributed Computing with ZeroMQ

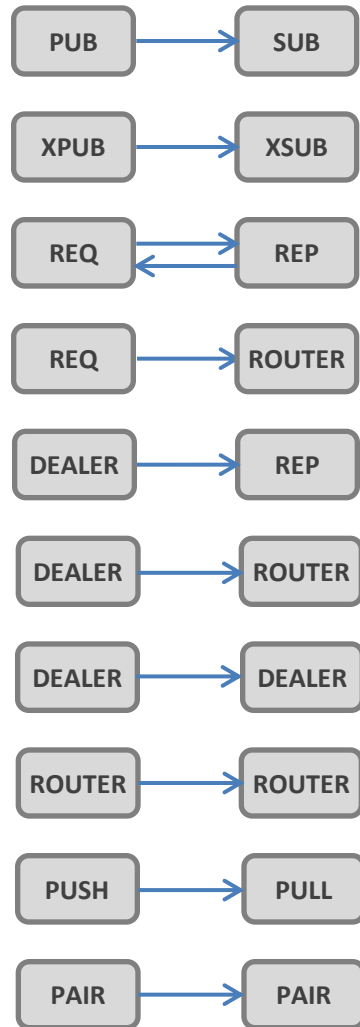
- ZeroMQ:
 - Lightweight
 - Socket-like
 - Asynchronousmessaging library
- Provides for the transport of “raw message buffers” in a scalable computing environment
- The **Zero** in **ZeroMQ**:
 - Maximize performance by minimizing:
 - Latency, copying, necessity for brokersLim = **0**

Distributed Computing with ZeroMQ

✓ Several messaging patterns

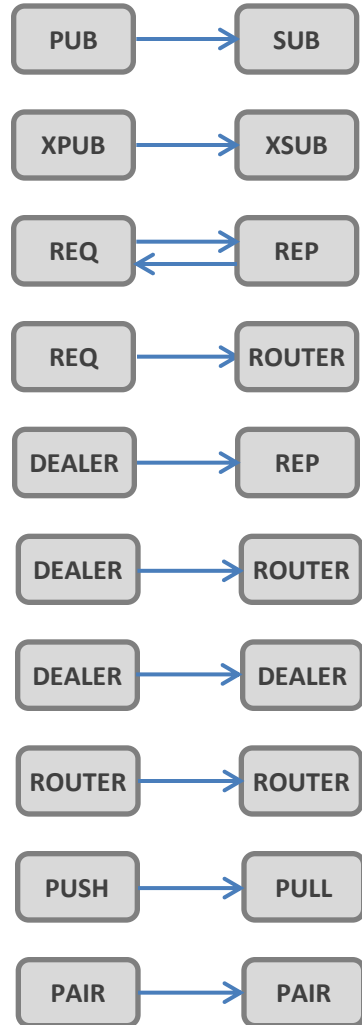


Distributed Computing with ZeroMQ

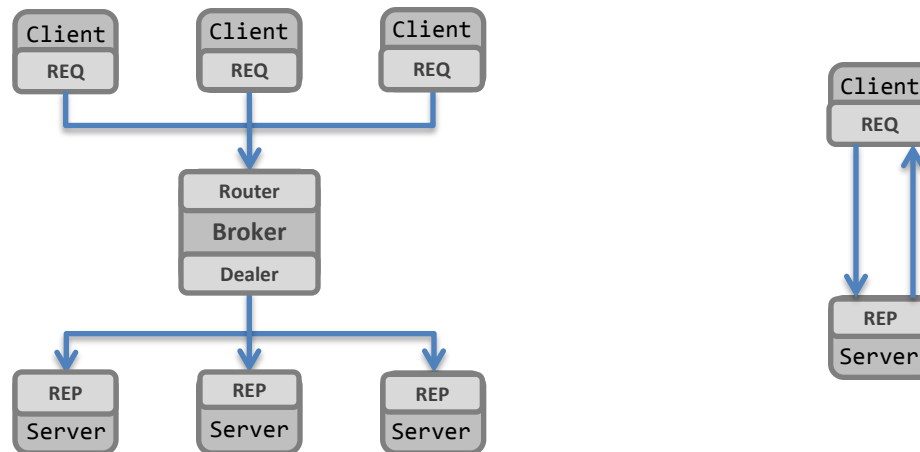


- ✓ Several messaging patterns
- ✓ Unicast (tcp) and multicast transport layers

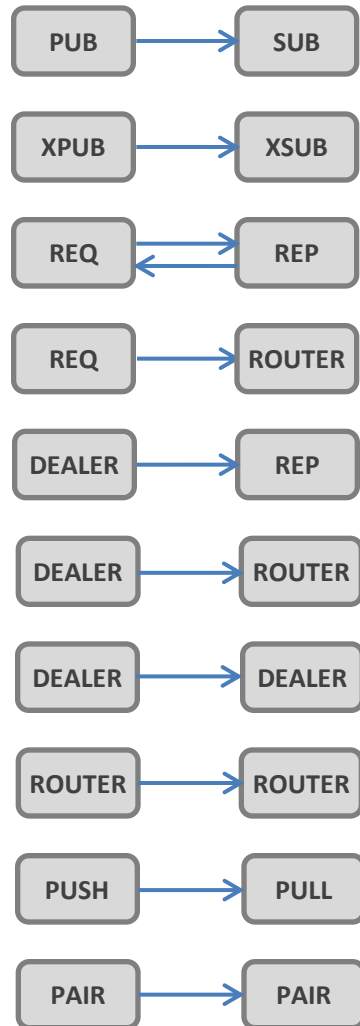
Distributed Computing with ZeroMQ



- ✓ Several messaging patterns
- ✓ Unicast (tcp) and multicast transport layers
- ✓ Patterns and transports can be used as building blocks to establish connections between processes, with/without brokers

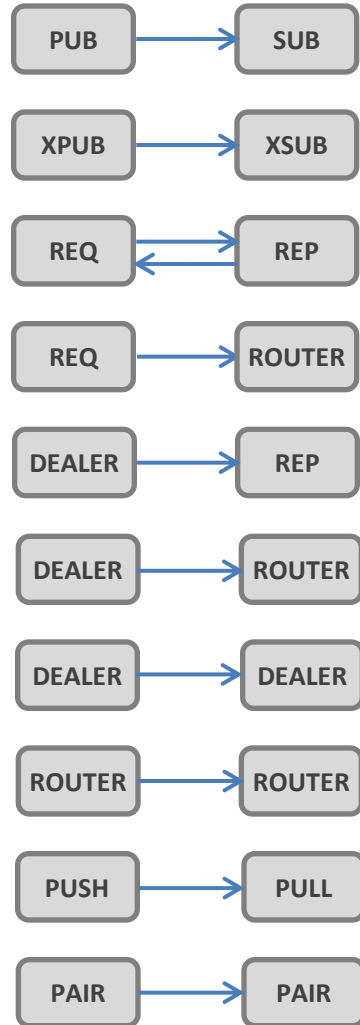


Distributed Computing with ZeroMQ



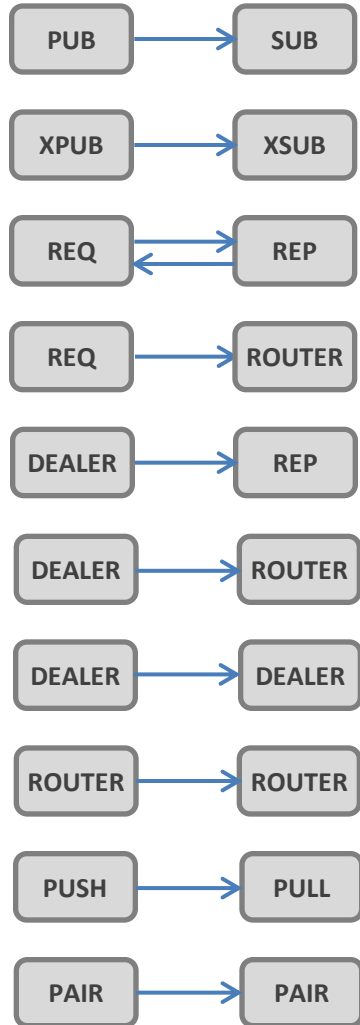
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Distributed Computing with ZeroMQ



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- ✓ Support for multipart messages
- ✓ Large user community provides support for several languages/platforms
- ☺ All available in a *single* library

- No Name Service
 - translates logical addresses into bind/connect endpoints

- No Implementation Repository
 - For the activation and reactivation of servers

- No Support for Object Serialization

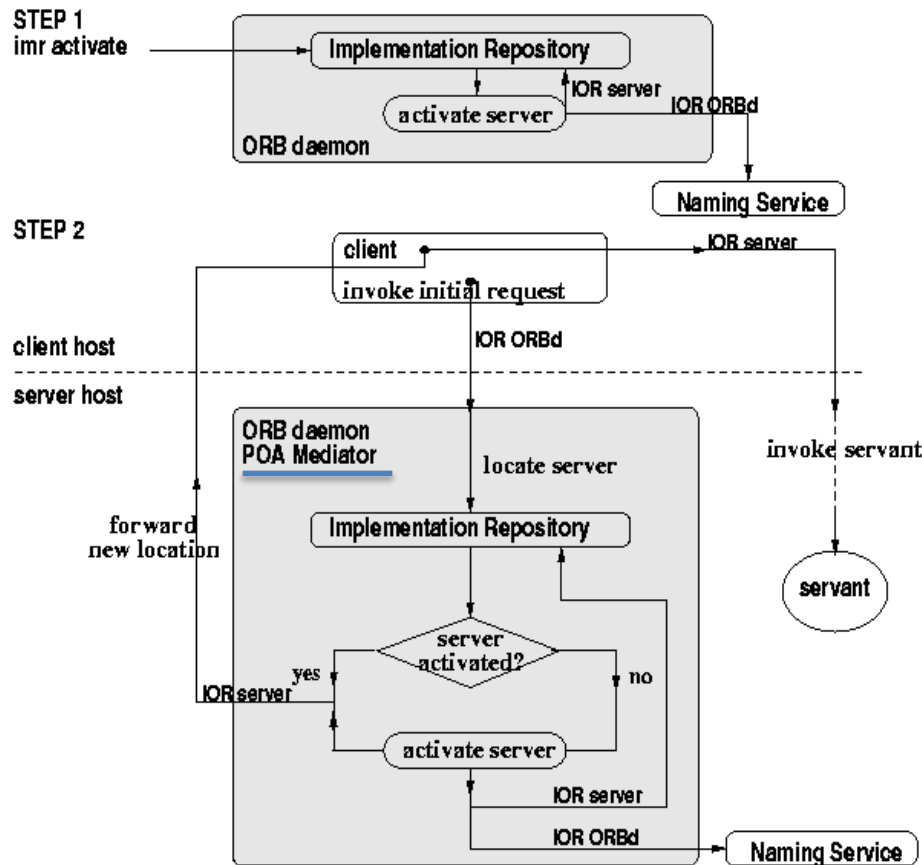
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What then are the remedies?

- ØMQns:
ZeroMQ Name Service in the pipeline
- May be developed from among ZeroMQ's architectural patterns
- JSON Configuration File:
 "bind":
 "tcp://129.129.145.206:5559"
 "connect":
 "tcp://129.129.145.206:5560"

Implementation Repository

CORBA



ØMQ

The Majordomo Protocol (MDP) defines a reliable service-oriented request-reply dialog between a set of client applications, a broker and a set of worker applications. MDP covers presence, heartbeating, and service-oriented request-reply processing

- Google Protocol Buffers
 - Binary encoding format
- MessagePack
 - Binary encoding in JSON
- ...
- Custom made

Interfacing Accelerator Models with ZeroMQ

Accelerator Models

- Allow developers to manipulate variables that determine particle beam dynamics in a *simulated* framework
- Most models were originally intended for use in isolation:
 - ASCII Input Files, lattice information and a set of directives to compute desired quantities
 - ASCII Output Files, post-processing analysis
- Certain models, code compiled into a shared object => accessibility from HLA can be anticipated

Advantages of the ZeroMQ Approach

- Lengthy and computer intensive initialization step need only be done once - where the long list of sequences that define the model are interpreted and loaded into memory.
- Numerous iterations (e.g. fitting procedures) can be undertaken without having to re-initialize with the same given model definition.
- Successive single tasks necessitate a newly created address space, a server-client configuration further gives confidence that the accelerator model is properly initialized on re-activation
- Procedures verified *offline* can be engaged *online*
- Incorporation into ZeroMQ => language neutrality
 - Resulting data interfaces are *structured*, data exchange requires *serialization*

Google Protocol Buffers: PyLiTrack

pylitrack.proto

```
syntax = "proto3";
package plt;
message pltInput {
  repeated string fileName=1;
  message ArrayElement {
    repeated float floatList=1;
    repeated int32 int32List=2;
    string strTag=3;
  }
}
message pltOutput {
  message ArrayElement { ... }
  message floatList {
    repeated float ele=1;
  }
  repeated ArrayElement BL=1;
  repeated floatList zpos=2;
  repeated floatList dE_E=3;
  repeated float Ebar=4;
  ...
  repeated float fcut=13;
}
```

\$protoc pylitrack.proto

--cpp_out

--java_out

--python_out

pylitrack.pb.h

```
class pltInput { ... }
class pltOutput { ... }
```

pylitrack_pb2.py

```
Descriptors ...
GeneratedProtocolMessageType
...
```

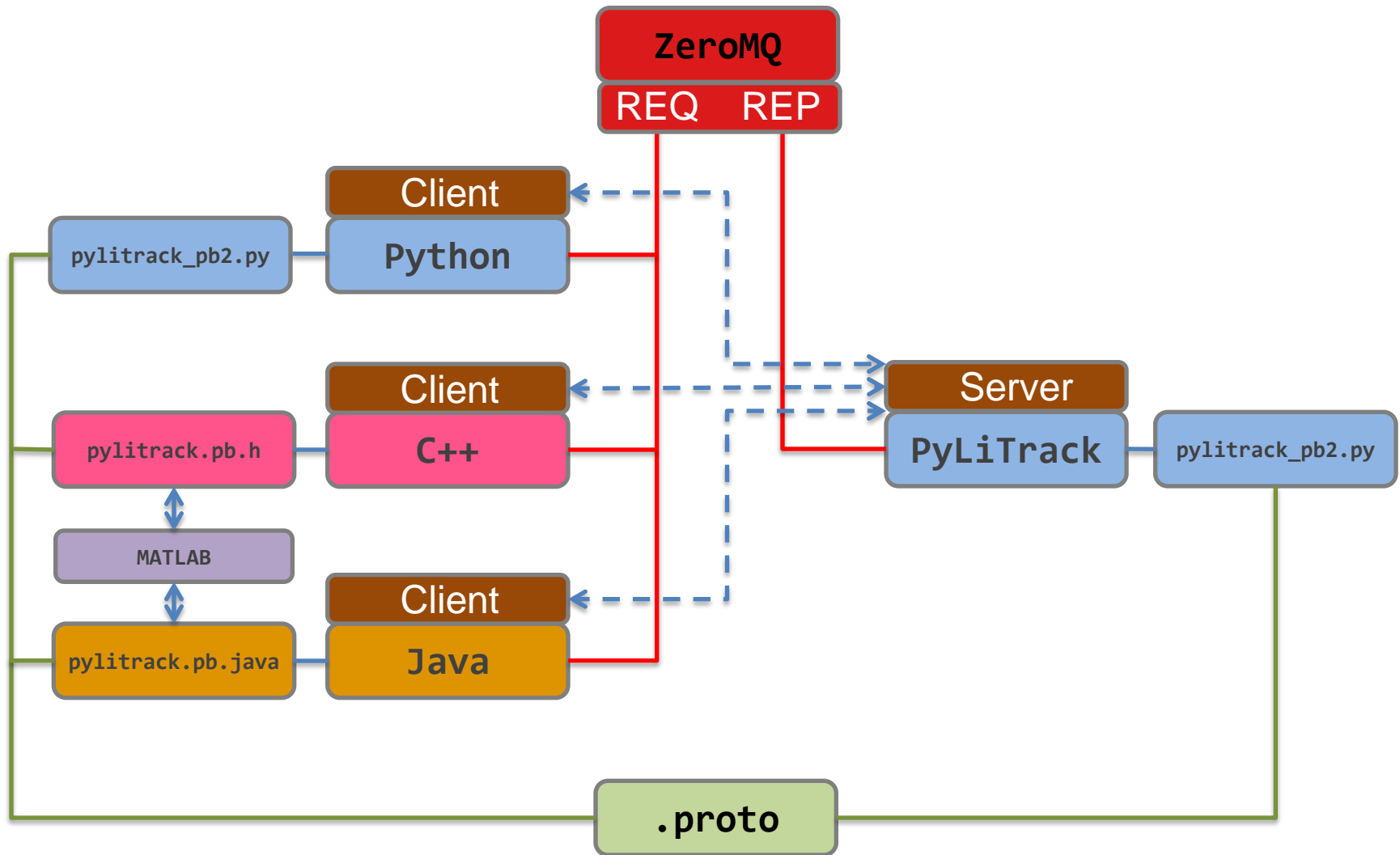
pylitrack.pb.cc

```
class pltInput { ... }
class pltOutput { ... }
```

pylitrack.pb.java

```
public final class pylitrack
{ ... }
```


ZeroMQ + Protocol Buffers: PyLiTrack



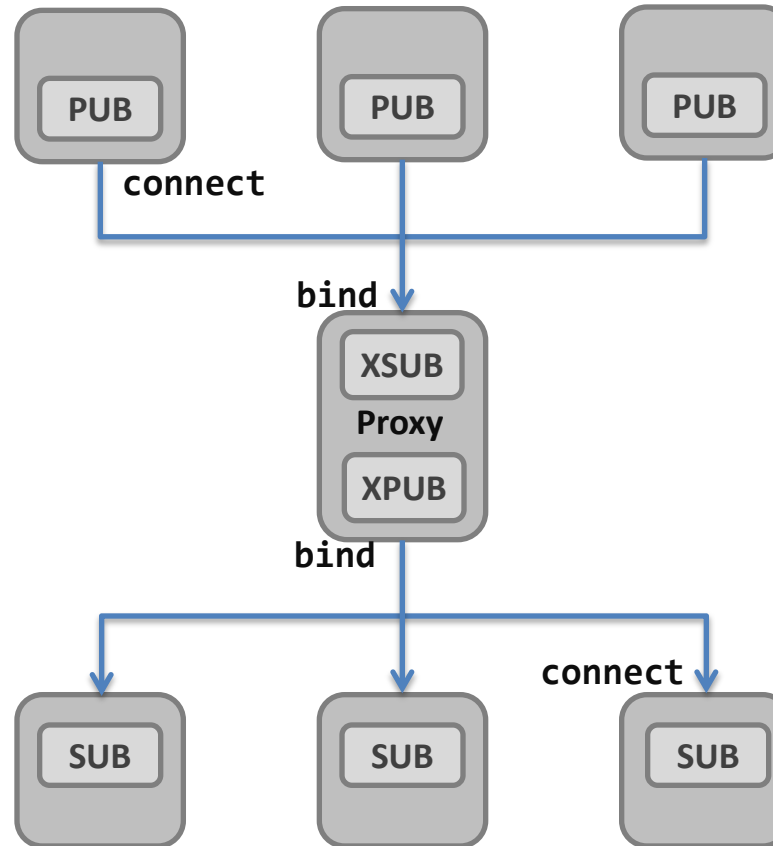
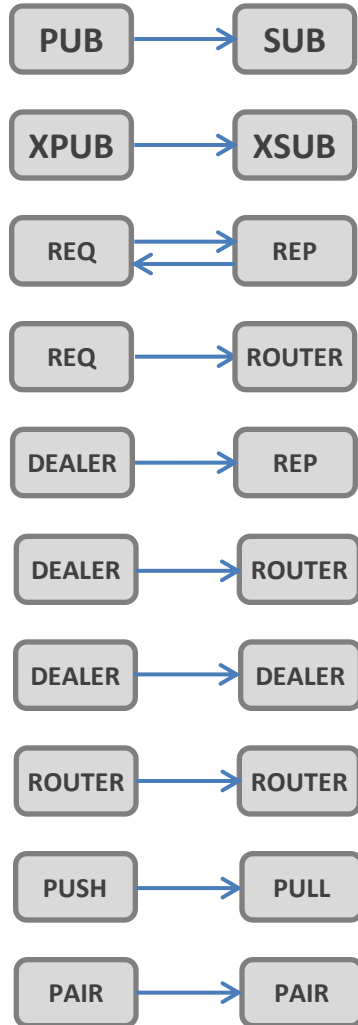
- Advantages:
 - IDL allows structured data schemas to be specified
 - Backward compatibility, validation and extensibility
 - Implemented in several languages
- `proto2 => proto3`
 - Simpler IDL structure, more accessible to a wider range of languages
 - Support for programming idioms, `any`, `map`, `oneof`
 - `proto3` not backward compatible with `proto2`
 - Migration from `proto2` to `proto3` was straightforward

- PyLiTrack
 - Python computations of LiTrack provides fast, two-dimensional, longitudinal single-bunch tracking
- MAD-X
 - Defacto standard for the computation of beam-optics parameters for a given accelerator lattice
- Applied to SwissFEL Virtual Accelerator

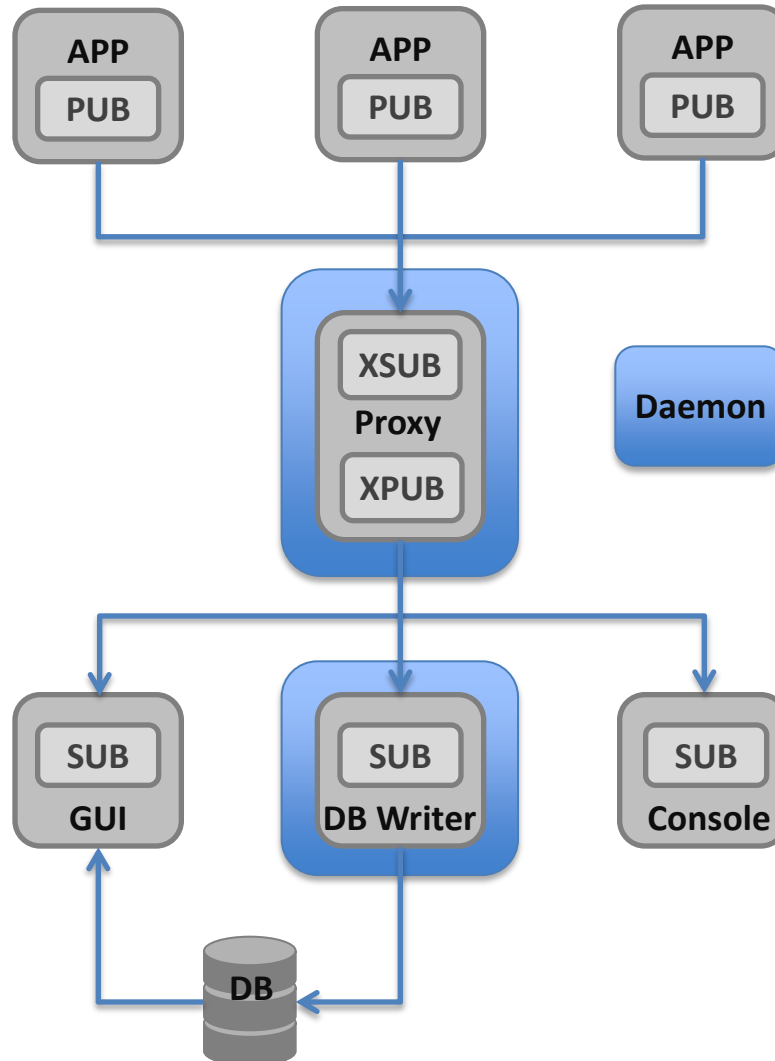
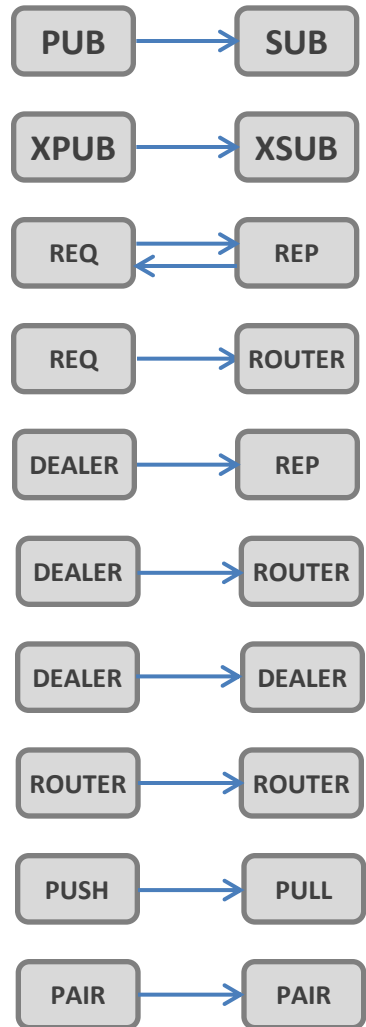
Message Logging with ZeroMQ

ZeroMQ's multipart message frames and the extended publish-subscribe pattern, respectively form the message envelope and communication layer

Extended Publish Subscribe



Extended Publish Subscribe

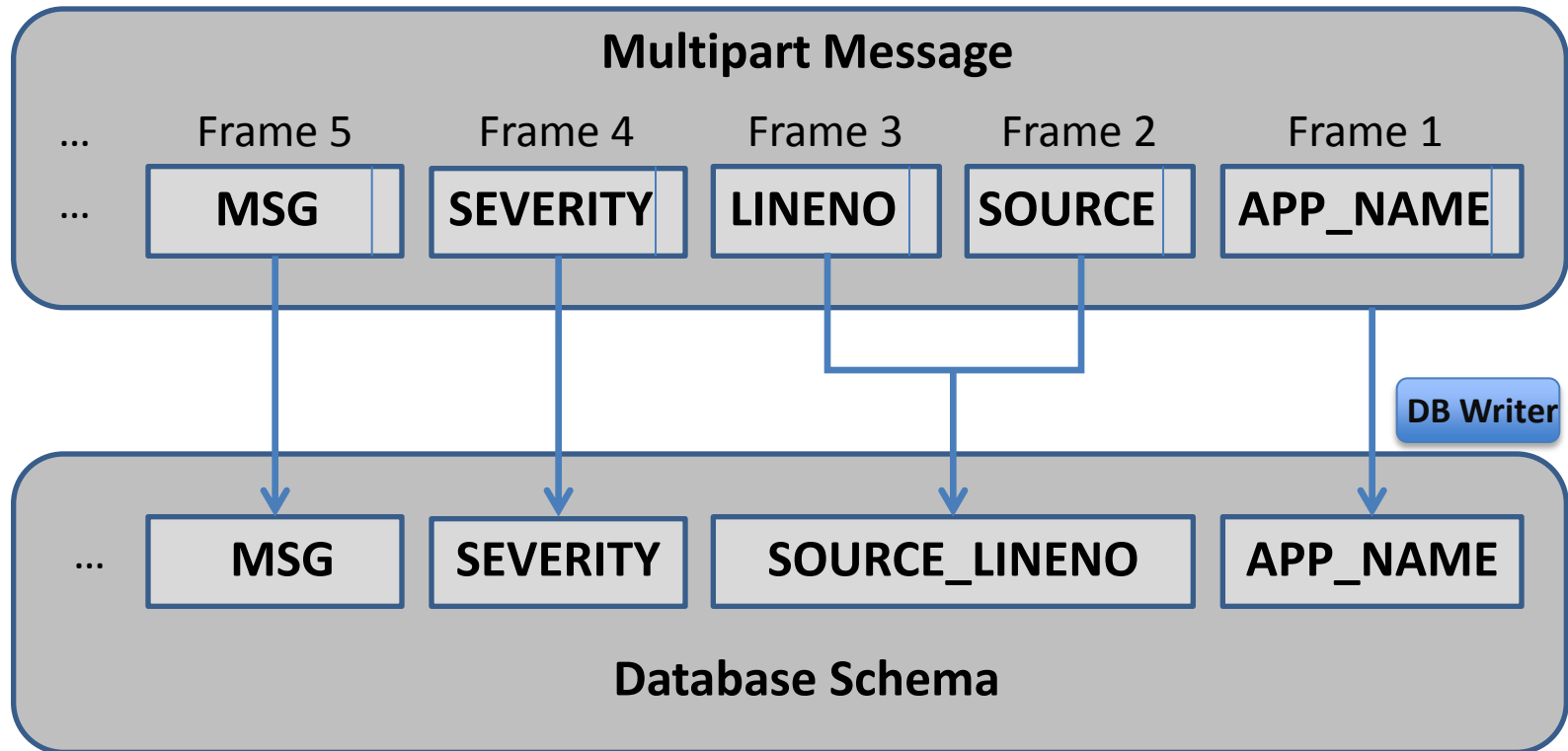


Message Content

- Specific details that comprise the message content require careful consideration
- For each message a consistent set of data should be evident:
 - Syslog protocol acts as a basis for deciding on the mandatory fields (TS: seconds + nanoseconds)
 - Supplemented by a number of optional fields that are filled at the discretion of the user (e.g. error codes, and *solutions!*)
 - The message content finalized in consultation with machine operation leaders
- Each message field is housed within a multipart message frame:
 - Resulting “multipart message” effectively adds a coarsely formed structure to the single message that is delivered to the network.
 - ***No need to marshal/unmarshall the data (!)***
 - ZeroMQ’s low-latency performance is not compromised

Multipart Message

DB writer maps multipart message frames to database columns on a near one-to-one basis



Framework profits from ZeroMQ's “zero-copy” capability in that buffers created by the publisher can be sent directly by the message

zmsglog: A Library for Publishers

Inherited Class (Severity=Error) Base Class

Python

```
errorMsg = MsgLog.CyErrorMsg(  
    "OrbitDisplay", "SFBD Group")  
...  
errorMsg.setMsg("freq. out-of-range")  
errorMsg.send(__file__, __LINE__())
```

MATLAB

```
msglog('setAppName', 'RF_Feedback')  
...  
msglog('setMsg', 'Invalid state')  
msglog('send', 'fatal', dbstack())
```

- **zmsglog:**
 - Composed messages follow a predefined format, required entries being filled automatically by the provided API
 - Message 'bursts' are cached by the API on the publisher-side and only a summary of their occurrence need be sent over the network

Graphical User Interface

PyQt

Messages
displayed
in real-time

SFEL_LOG (on gfa-ic6-64)

Live Message | Priority/Fatal Message | Message Retrieve

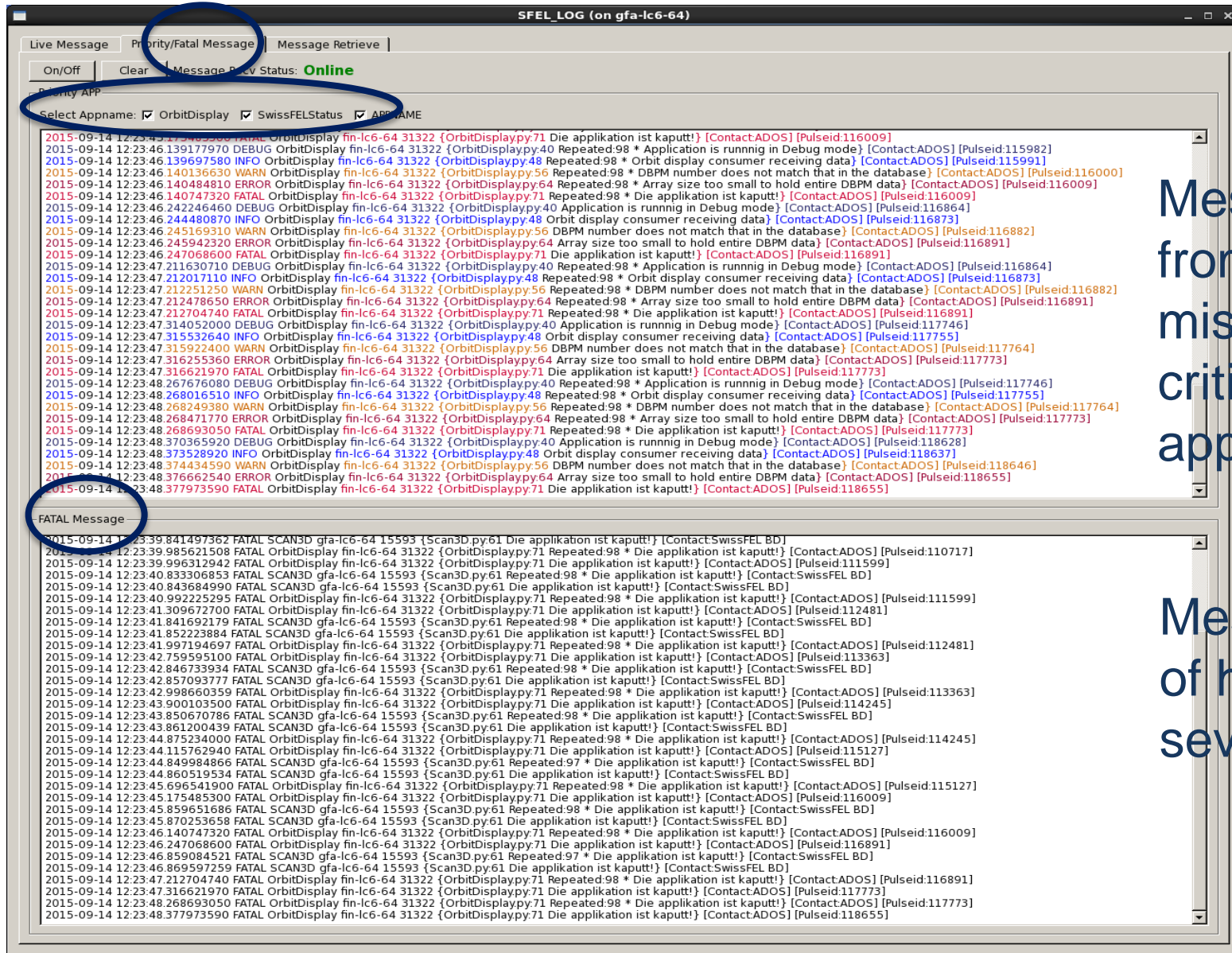
On/Off Clear Message Recv Status: **Online**

```

2015-09-14 12:23:44 113767390 WARN OrbitDisplay fin-ic6-64 31322 {OrbitDisplay.py:56 DBPM number does not match that in the database} [Contact:ADOS] [Pulseid:115118]
2015-09-14 12:23:44 114791300 ERROR OrbitDisplay fin-ic6-64 31322 {OrbitDisplay.py:64 Array size too small to hold entire DBPM data} [Contact:ADOS] [Pulseid:115127]
2015-09-14 12:23:44 115762940 FATAL OrbitDisplay fin-ic6-64 31322 {OrbitDisplay.py:71 Die application ist kaputt!} [Contact:ADOS] [Pulseid:115127]
2015-09-14 12:23:44 849852602 DEBUG SCAN3D gfa-ic6-64 15593 {Scan3D.py:38 Repeated:97 * Application is runnig in Debug mode} [Contact:SwissFEL BD]
2015-09-14 12:23:44 849897085 INFO SCAN3D gfa-ic6-64 15593 {Scan3D.py:44 Repeated:97 * All channels monitored for 3D Scan} [Contact:SwissFEL BD]
2015-09-14 12:23:44 849927347 WARN SCAN3D gfa-ic6-64 15593 {Scan3D.py:50 Repeated:97 * The number of readback channels does not match the number of set channels} [Contact:SwissFEL BD]
2015-09-14 12:23:44 849956244 ERROR SCAN3D gfa-ic6-64 15593 {Scan3D.py:56 Repeated:97 * Array size too small to hold 3D readback data} [Contact:SwissFEL BD]
2015-09-14 12:23:44 849984866 FATAL SCAN3D gfa-ic6-64 15593 {Scan3D.py:61 Repeated:97 * Die application ist kaputt!} [Contact:SwissFEL BD]
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2015-09-14 12:23:44 860314033 INFO SCAN3D gfa-ic6-64 15593 {Scan3D.py:44 All channels monitored for 3D Scan} [Contact:SwissFEL BD]
2015-09-14 12:23:44 860386196 WARN SCAN3D gfa-ic6-64 15593 {Scan3D.py:50 The number of readback channels does not match the number of set channels} [Contact:SwissFEL BD]
2015-09-14 12:23:44 860453071 ERROR SCAN3D gfa-ic6-64 15593 {Scan3D.py:56 Array size too small to hold 3D readback data} [Contact:SwissFEL BD]
2015-09-14 12:23:44 860519534 FATAL SCAN3D gfa-ic6-64 15593 {Scan3D.py:61 Die application ist kaputt!} [Contact:SwissFEL BD]
2015-09-14 12:23:45 685913600 DEBUG OrbitDisplay fin-ic6-64 31322 {OrbitDisplay.py:40 Repeated:98 * Application is runnig in Debug mode} [Contact:ADOS] [Pulseid:115100]
2015-09-14 12:23:45 689617500 INFO OrbitDisplay fin-ic6-64 31322 {OrbitDisplay.py:48 Repeated:98 * Orbit display consumer receiving data} [Contact:ADOS] [Pulseid:115109]
2015-09-14 12:23:45 692061500 WARN OrbitDisplay fin-ic6-64 31322 {OrbitDisplay.py:56 Repeated:98 * DBPM number does not match that in the database} [Contact:ADOS] [Pulseid:115118]
2015-09-14 12:23:45 694332500 ERROR OrbitDisplay fin-ic6-64 31322 {OrbitDisplay.py:64 Repeated:98 * Array size too small to hold entire DBPM data} [Contact:ADOS] [Pulseid:115127]
2015-09-14 12:23:45 696541900 FATAL OrbitDisplay fin-ic6-64 31322 {OrbitDisplay.py:71 Repeated:98 * Die application ist kaputt!} [Contact:ADOS] [Pulseid:115127]
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2015-09-14 12:23:45 173758550 WARN OrbitDisplay fin-ic6-64 31322 {OrbitDisplay.py:56 DBPM number does not match that in the database} [Contact:ADOS] [Pulseid:116000]
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2015-09-14 12:23:45 870253658 FATAL SCAN3D gfa-ic6-64 15593 {Scan3D.py:61 Die application ist kaputt!} [Contact:SwissFEL BD]
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2015-09-14 12:23:46 139697580 INFO OrbitDisplay fin-ic6-64 31322 {OrbitDisplay.py:48 Repeated:98 * Orbit display consumer receiving data} [Contact:ADOS] [Pulseid:115991]
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2015-09-14 12:23:46 869199198 DEBUG SCAN3D gfa-ic6-64 15593 {Scan3D.py:38 Application is runnig in Debug mode} [Contact:SwissFEL BD]
2015-09-14 12:23:46 869394125 INFO SCAN3D gfa-ic6-64 15593 {Scan3D.py:44 All channels monitored for 3D Scan} [Contact:SwissFEL BD]
2015-09-14 12:23:46 869465168 WARN SCAN3D gfa-ic6-64 15593 {Scan3D.py:50 The number of readback channels does not match the number of set channels} [Contact:SwissFEL BD]
2015-09-14 12:23:46 869532638 ERROR SCAN3D gfa-ic6-64 15593 {Scan3D.py:56 Array size too small to hold 3D readback data} [Contact:SwissFEL BD]
2015-09-14 12:23:46 869597259 FATAL SCAN3D gfa-ic6-64 15593 {Scan3D.py:61 Die application ist kaputt!} [Contact:SwissFEL BD]
2015-09-14 12:23:47 211630710 DEBUG OrbitDisplay fin-ic6-64 31322 {OrbitDisplay.py:40 Repeated:98 * Application is runnig in Debug mode} [Contact:ADOS] [Pulseid:116864]
2015-09-14 12:23:47 212017110 INFO OrbitDisplay fin-ic6-64 31322 {OrbitDisplay.py:48 Repeated:98 * Orbit display consumer receiving data} [Contact:ADOS] [Pulseid:116873]
2015-09-14 12:23:47 212251250 WARN OrbitDisplay fin-ic6-64 31322 {OrbitDisplay.py:56 Repeated:98 * DBPM number does not match that in the database} [Contact:ADOS] [Pulseid:116882]
2015-09-14 12:23:47 212478650 ERROR OrbitDisplay fin-ic6-64 31322 {OrbitDisplay.py:64 Repeated:98 * Array size too small to hold entire DBPM data} [Contact:ADOS] [Pulseid:116891]
2015-09-14 12:23:47 212704740 FATAL OrbitDisplay fin-ic6-64 31322 {OrbitDisplay.py:71 Repeated:98 * Die application ist kaputt!} [Contact:ADOS] [Pulseid:116891]
2015-09-14 12:23:47 314052000 DEBUG OrbitDisplay fin-ic6-64 31322 {OrbitDisplay.py:40 Application is runnig in Debug mode} [Contact:ADOS] [Pulseid:117746]
2015-09-14 12:23:47 315532640 INFO OrbitDisplay fin-ic6-64 31322 {OrbitDisplay.py:48 Orbit display consumer receiving data} [Contact:ADOS] [Pulseid:117755]
2015-09-14 12:23:47 315922400 WARN OrbitDisplay fin-ic6-64 31322 {OrbitDisplay.py:56 DBPM number does not match that in the database} [Contact:ADOS] [Pulseid:117764]
2015-09-14 12:23:47 316255360 ERROR OrbitDisplay fin-ic6-64 31322 {OrbitDisplay.py:64 Array size too small to hold entire DBPM data} [Contact:ADOS] [Pulseid:117773]
2015-09-14 12:23:47 316621970 FATAL OrbitDisplay fin-ic6-64 31322 {OrbitDisplay.py:71 Die application ist kaputt!} [Contact:ADOS] [Pulseid:117773]
2015-09-14 12:23:48 267676080 DEBUG OrbitDisplay fin-ic6-64 31322 {OrbitDisplay.py:40 Repeated:98 * Application is runnig in Debug mode} [Contact:ADOS] [Pulseid:117746]
2015-09-14 12:23:48 268016510 INFO OrbitDisplay fin-ic6-64 31322 {OrbitDisplay.py:48 Repeated:98 * Orbit display consumer receiving data} [Contact:ADOS] [Pulseid:117755]
2015-09-14 12:23:48 268249380 WARN OrbitDisplay fin-ic6-64 31322 {OrbitDisplay.py:56 Repeated:98 * DBPM number does not match that in the database} [Contact:ADOS] [Pulseid:117764]
2015-09-14 12:23:48 268471770 ERROR OrbitDisplay fin-ic6-64 31322 {OrbitDisplay.py:64 Repeated:98 * Array size too small to hold entire DBPM data} [Contact:ADOS] [Pulseid:117773]
2015-09-14 12:23:48 268693050 FATAL OrbitDisplay fin-ic6-64 31322 {OrbitDisplay.py:71 Repeated:98 * Die application ist kaputt!} [Contact:ADOS] [Pulseid:117773]
2015-09-14 12:23:48 370365920 DEBUG OrbitDisplay fin-ic6-64 31322 {OrbitDisplay.py:40 Application is runnig in Debug mode} [Contact:ADOS] [Pulseid:118628]
2015-09-14 12:23:48 373528920 INFO OrbitDisplay fin-ic6-64 31322 {OrbitDisplay.py:48 Orbit display consumer receiving data} [Contact:ADOS] [Pulseid:118637]
2015-09-14 12:23:48 374434590 WARN OrbitDisplay fin-ic6-64 31322 {OrbitDisplay.py:56 DBPM number does not match that in the database} [Contact:ADOS] [Pulseid:118646]
2015-09-14 12:23:48 376662540 ERROR OrbitDisplay fin-ic6-64 31322 {OrbitDisplay.py:64 Array size too small to hold entire DBPM data} [Contact:ADOS] [Pulseid:118655]
2015-09-14 12:23:48 377633560 FATAL OrbitDisplay fin-ic6-64 31322 {OrbitDisplay.py:71 Die application ist kaputt!} [Contact:ADOS] [Pulseid:118655]

```


Graphical User Interface



Messages from mission-critical applications

Messages of highest severity

Graphical User Interface

SFEL_LOG (on gfa-lc6-64)

Live Message | Priority/Fatal Message | **Message Retrieve**

Filter

TimeStamp: [L] 2015-09-14 11:23:10 2015-09-14 12:24:17

Severity: <= INFO

Hostname: ProcId: Appname: Source: Lineno: Pulseld: Msg: Action: Contact: TS_SEC: TS_NSEC: Status_Code: Status_Msg:

1-Hour Reset 1-Day Reset

Sort

Order: ☐ Unsort ☐ Ascend ☒ Descend

Sorted Value: Timestamp

Select

☒ TimeStamp ☒ Severity ☒ Hostname

☒ ProcId ☒ Appname ☒ Source

☒ Lineno ☒ Pulseld ☒ Msg

☐ Action ☒ Contact ☐ TS_SEC

☐ TS_NSEC ☐ Status_Code ☐ Status_Msg

All Subset Search

Line View Refresh Polling On/Off **Table View** Polling: Off

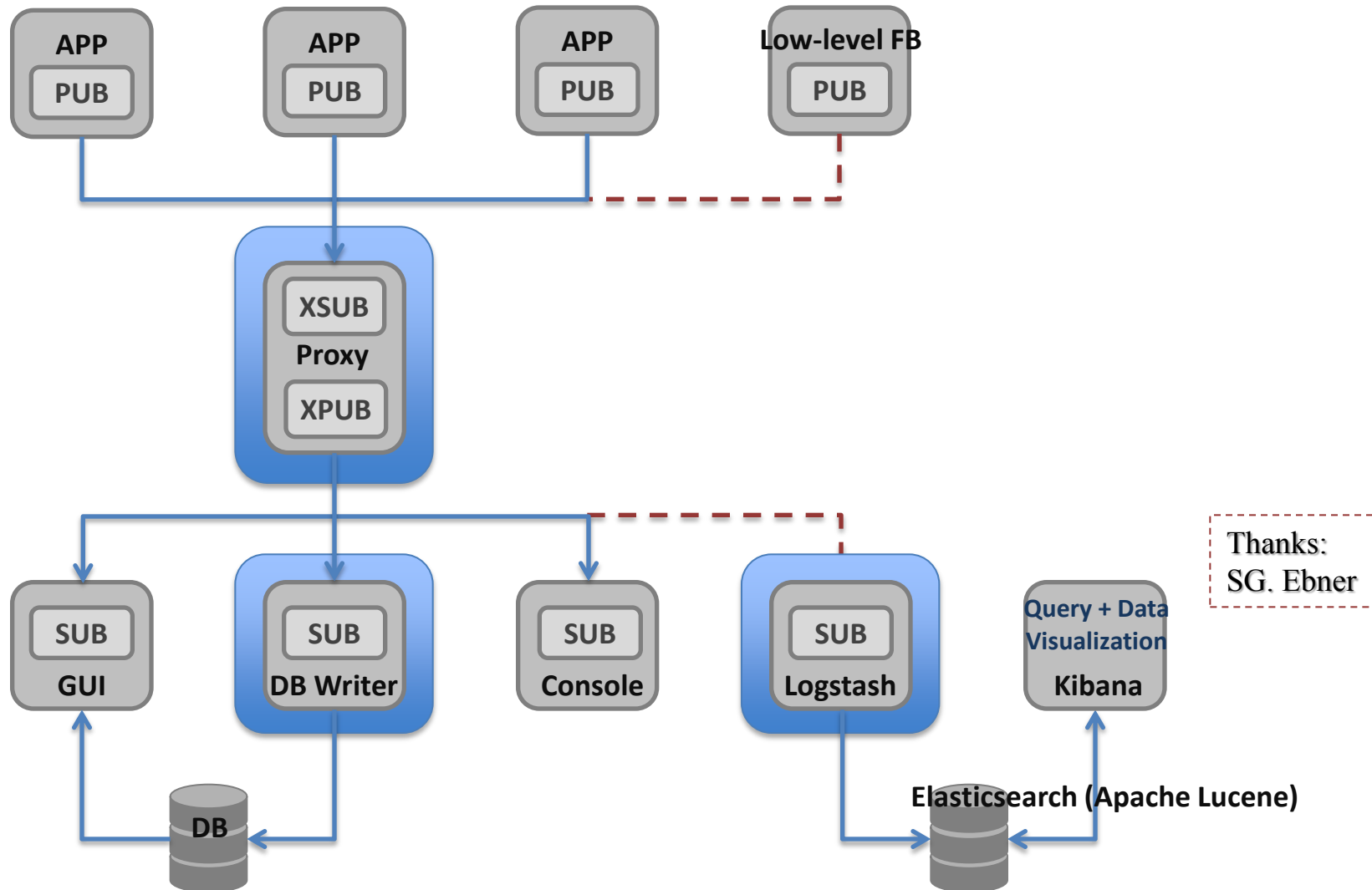
	Line	TimeStamp	Severity	Appname	Msg	Hostname	ProcId	Source	Lineno	Pulseld	Contact	N
1	2015-09-14T12:23:48.377973590Z	FATAL	OrbitDisplay	Die applikation ist kaputt!	fin-lc6-64	31322	OrbitDisplaypy	71	118655	ADOS	1	
2	2015-09-14T12:23:48.376662540Z	ERROR	OrbitDisplay	Array size too small to hold entire DBPM data	fin-lc6-64	31322	OrbitDisplaypy	64	118655	ADOS	1	
3	2015-09-14T12:23:48.374434590Z	WARN	OrbitDisplay	DBPM number does not match that in the database	fin-lc6-64	31322	OrbitDisplaypy	56	118646	ADOS	1	
4	2015-09-14T12:23:48.373528920Z	INFO	OrbitDisplay	Orbit display consumer receiving data	fin-lc6-64	31322	OrbitDisplaypy	48	118637	ADOS	1	
5	2015-09-14T12:23:48.268693050Z	FATAL	OrbitDisplay	Die applikation ist kaputt!	fin-lc6-64	31322	OrbitDisplaypy	71	117773	ADOS	98	
6	2015-09-14T12:23:48.268471770Z	ERROR	OrbitDisplay	Array size too small to hold entire DBPM data	fin-lc6-64	31322	OrbitDisplaypy	64	117773	ADOS	98	
7	2015-09-14T12:23:48.268249380Z	WARN	OrbitDisplay	DBPM number does not match that in the database	fin-lc6-64	31322	OrbitDisplaypy	56	117764	ADOS	98	
8	2015-09-14T12:23:48.268016510Z	INFO	OrbitDisplay	Orbit display consumer receiving data	fin-lc6-64	31322	OrbitDisplaypy	48	117755	ADOS	98	
9	2015-09-14T12:23:47.316621970Z	FATAL	OrbitDisplay	Die applikation ist kaputt!	fin-lc6-64	31322	OrbitDisplaypy	71	117773	ADOS	1	
10	2015-09-14T12:23:47.316255360Z	ERROR	OrbitDisplay	Array size too small to hold entire DBPM data	fin-lc6-64	31322	OrbitDisplaypy	64	117773	ADOS	1	
11	2015-09-14T12:23:47.315922400Z	WARN	OrbitDisplay	DBPM number does not match that in the database	fin-lc6-64	31322	OrbitDisplaypy	56	117764	ADOS	1	
12	2015-09-14T12:23:47.315532640Z	INFO	OrbitDisplay	Orbit display consumer receiving data	fin-lc6-64	31322	OrbitDisplaypy	48	117755	ADOS	1	
13	2015-09-14T12:23:47.212704740Z	FATAL	OrbitDisplay	Die applikation ist kaputt!	fin-lc6-64	31322	OrbitDisplaypy	71	116891	ADOS	98	
14	2015-09-14T12:23:47.212478650Z	ERROR	OrbitDisplay	Array size too small to hold entire DBPM data	fin-lc6-64	31322	OrbitDisplaypy	64	116891	ADOS	98	
15	2015-09-14T12:23:47.212251250Z	WARN	OrbitDisplay	DBPM number does not match that in the database	fin-lc6-64	31322	OrbitDisplaypy	56	116882	ADOS	98	
16	2015-09-14T12:23:47.212017110Z	INFO	OrbitDisplay	Orbit display consumer receiving data	fin-lc6-64	31322	OrbitDisplaypy	48	116873	ADOS	98	
17	2015-09-14T12:23:46.869597259Z	FATAL	SCAN3D	Die applikation ist kaputt!	gfa-lc6-64	15593	Scan3D.py	61		SwissFEL BD	1	
18	2015-09-14T12:23:46.869532638Z	ERROR	SCAN3D	Array size too small to hold 3D readback data	gfa-lc6-64	15593	Scan3D.py	56		SwissFEL BD	1	
19	2015-09-14T12:23:46.869465168Z	WARN	SCAN3D	The number of readback channels does not match the number of set channels	gfa-lc6-64	15593	Scan3D.py	50		SwissFEL BD	1	
20	2015-09-14T12:23:46.869394125Z	INFO	SCAN3D	All channels monitored for 3D Scan	gfa-lc6-64	15593	Scan3D.py	44		SwissFEL BD	1	
21	2015-09-14T12:23:46.859084521Z	FATAL	SCAN3D	Die applikation ist kaputt!	gfa-lc6-64	15593	Scan3D.py	61		SwissFEL BD	97	
22	2015-09-14T12:23:46.859055789Z	ERROR	SCAN3D	Array size too small to hold 3D readback data	gfa-lc6-64	15593	Scan3D.py	56		SwissFEL BD	97	
23	2015-09-14T12:23:46.859026653Z	WARN	SCAN3D	The number of readback channels does not match the number of set channels	gfa-lc6-64	15593	Scan3D.py	50		SwissFEL BD	97	
24	2015-09-14T12:23:46.858996413Z	INFO	SCAN3D	All channels monitored for 3D Scan	gfa-lc6-64	15593	Scan3D.py	44		SwissFEL BD	97	
25	2015-09-14T12:23:46.247068600Z	FATAL	OrbitDisplay	Die applikation ist kaputt!	fin-lc6-64	31322	OrbitDisplaypy	71	116891	ADOS	1	
26	2015-09-14T12:23:46.245942320Z	ERROR	OrbitDisplay	Array size too small to hold entire DBPM data	fin-lc6-64	31322	OrbitDisplaypy	64	116891	ADOS	1	
27	2015-09-14T12:23:46.245169310Z	WARN	OrbitDisplay	DBPM number does not match that in the database	fin-lc6-64	31322	OrbitDisplaypy	56	116882	ADOS	1	
28	2015-09-14T12:23:46.244480870Z	INFO	OrbitDisplay	Orbit display consumer receiving data	fin-lc6-64	31322	OrbitDisplaypy	48	116873	ADOS	1	
29	2015-09-14T12:23:46.140747320Z	FATAL	OrbitDisplay	Die applikation ist kaputt!	fin-lc6-64	31322	OrbitDisplaypy	71	116009	ADOS	98	
30	2015-09-14T12:23:46.140484810Z	ERROR	OrbitDisplay	Array size too small to hold entire DBPM data	fin-lc6-64	31322	OrbitDisplaypy	64	116009	ADOS	98	
31	2015-09-14T12:23:46.140136630Z	WARN	OrbitDisplay	DBPM number does not match that in the database	fin-lc6-64	31322	OrbitDisplaypy	56	116000	ADOS	98	
32	2015-09-14T12:23:46.139697580Z	INFO	OrbitDisplay	Orbit display consumer receiving data	fin-lc6-64	31322	OrbitDisplaypy	48	115991	ADOS	98	
33	2015-09-14T12:23:45.870253658Z	FATAL	SCAN3D	Die applikation ist kaputt!	gfa-lc6-64	15593	Scan3D.py	61		SwissFEL BD	1	

Message
retrieval
from
database

zmsglog: JSON Configuration File

- A number of properties of the message logger are kept separate from the application code and are managed through a JSON configuration file, enhancing flexibility and simplifying code maintenance
 - Setting ZeroMQ bind/connect endpoints
 - High Water Mark Limit: Size of cached buffer for message queuing
 - Declaring priority applications
 - Displaying the **display colours** for the **various** message **severity** levels

Extended Publish Subscribe + ELK Stack



Summary

- Aspects of ZeroMQ explored and usefulness within high-level applications recognized
- A ZeroMQ Framework + Google Protocol Buffer has been implemented for accessing accelerator models from different languages
- PUB-SUB pattern + multipart messaging framework
→ message logging and monitoring facility that displays live data in real time
- The relative ease with which to employ the various patterns (ZeroMQ does all the hard work!) releases time and effort to focus on the specific goals at hand



THANK YOU FOR YOUR ATTENTION