Real-Time Data Reduction Integrated Into Instrument Control Software
Outline

- Setting The Context
- Use-Case
- Solution
- Implementation’s Examples
- Evolution
Setting The Context

- C++
- CORBA
- Java
- Server
- Transport Layer
- GUI

NOMAD

[Image of NOMAD software interface]
Use-Case

NOMAD

PlotScreen generator

WEB Spy

Electronic log
Use-Case

Interaction with data reduction/analysis

NOMAD

- Multi-process
- Multi-environment
- Synchronization
- Crash management

Instrument Status

What To Do Next
Possible Solutions

- **Monolithic**
  - Every single Scientific method is included in NOMAD
  - Difficult to maintain
  - No freedom and flexibility for scientists

- **Microservices**
  - NOMAD
  - Flexible and scalable architecture
  - Better suited for scientific applications
What Is NAPPLI

- Lightweight application server
- Multiplatform (Linux, Mac, Windows)
- Manages the entire application lifecycle
  Start/Stop nicely
- Provides client API in C++ and Java
- Implements different communication patterns
  Request/response
  Publisher/Subscriber
  Return value at the end
NAPPLI Basics

Start

Subscribe
MATLAB Synchronous Server

Control

1: start RemoteMatlab
3: request
6: response
7: stop RemoteMatlab

Science Computer

NAPPLI
2: start
4: script
5: image
8: stop
11: 

REMOTE MATLAB
9: stop

MATLAB ENGINE
10:
12: success
Q Space Transformation

SCAN Raw Data

Q Space

copper
Data: 071210
$Q^\perp = 0$, Energy = 10.5 meV

$[0,0,1]$

$[1,1,0]$

Norm: M1=4000
Q Space Transformation

Q Space

SCAN Raw Data

Q^⊥ = 0, Energy = 10.5 meV

Norm: M1=4000
Q Space Transformation

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Norm: M1=4000
Q Space Transformation

SCAN Raw Data

Q Space

Norm: M1=4000
Q Space Transformation

SCAN Raw Data

Q Space

Copper
Data: 071210
$Q^2 = 0$, Energy = 10.5 meV

Norm: M1 = 4000
Q Space Transformation

SCAN Raw Data

Q Space

copper
Data: 071210
$Q^z = 0$, Energy = 10.5 meV

Norm: M1=4000
Q Space Transformation

SCAN Raw Data

Q Space

Data: 071210
$Q^x = 0$, Energy = 10.5 meV

[0,0,1]
[1,1,0]

Norm: M1=4000
Q Space Transformation

SCAN Raw Data

Q Space

copper
Data: 071210
Q\perp = 0, Energy = 10.5 meV

Norm: M1=4000
Coincidence Asynchronous Server

1: start RemoteNPP
2: start
3: publish data
4: publish data
5: publish results
6: stop RemoteNPP
7: stop
8: 
9: success
Coincidence Experiment Setup
Detector Layout

- 4 x Ge crystals
- 4 x NaI back-catcher
- 8 x BGO rear side shield
- 8 x BGO side shield

24 correlated detectors
Coincidence Asynchronous Server

- Average event rate ~ 1 MHz
- Event-mode file ~ 2 GB in less than 5 min.

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<th>Detector - Crystal</th>
<th>Raw Rate (kHz)</th>
<th>Clean Rate (kHz)</th>
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<td>XXX</td>
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<table>
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<th>Raw Rate (kHz)</th>
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<tr>
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</table>
Conclusion

NAPPLI

- Manage and organize the execution of different applications of the instrument control software.
- Easily distribute and run new/existing scientific computations over different computers.
- Flexible in term of platform and application’s interaction.
- Coming soon: decision taking within NOMAD workflow based on data analysis.

http://forge.ill.fr/projects/nappli