Real-Time Data Reduction Integrated Into Instrument Control Software
Setting The Context

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

NOMAD
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
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

Computer A
<<server>> Nappli A
<<application>> App1

Computer B
<<server>> Nappli B
<<application>> App2

Start

Computer A
<<server>> Nappli A
<<application>> App1

subscribe App2

Computer B
<<server>> Nappli B
<<application>> App2

publish
MATLAB Synchronous Server

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

2: start
4: script
5: image
8: stop
9: stop
11: 
10: 

Control
NOMAD
LOOP

Science Computer
NAPPLI
REMOTE MATLAB
MATLAB ENGINE
Q Space Transformation

SCAN Raw Data

Q Space

\(Q_{\perp} = 0\), 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
Q Space Transformation

SCAN Raw Data

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$Q^\perp = 0$, Energy = 10.5 meV

Norm: $M_1 = 4000$
Q Space Transformation

SCAN Raw Data

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Q Space Transformation

SCAN Raw Data

Q Space

copper
Data: 071210
Q⊥ = 0, Energy = 10.5 meV

Norm: M1=4000
Coincidence Asynchronous Server

**Control**
- NOMAD

1: start RemoteNPP
- 3: publish data
- 4: publish data
- 5: publish results
- 6: stop RemoteNPP
- 9: success

**Science Computer**
- NAPPLI
- NPP ENGINE

2: start
- 7: stop
- 8:
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.

<table>
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<tr>
<th>Detector - Crystal</th>
<th>Raw Rate (kHz)</th>
<th>Clean Rate (kHz)</th>
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<tbody>
<tr>
<td>1</td>
<td>XXX</td>
<td>xxx</td>
</tr>
<tr>
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<tr>
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<table>
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<th>Coincidence</th>
<th>Raw Rate (kHz)</th>
<th>Clean Rate (kHz)</th>
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<tr>
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<tr>
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<td>...</td>
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<tr>
<td>Fold n</td>
<td>ZZZ</td>
<td>zzz</td>
</tr>
</tbody>
</table>
Conclusion

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