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| **Summary report from Workshop**  **on**  **Neutron Instrument Architecture**  **for**  **Data Acquisition, Instrument Control, & Data Storage** |
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General introduction

This is an executive summary of the discussion and decisions made at the Workshop on Neutron Instrument Architecture for Data Acquisition, Instrument Control, & Data Storage.

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# Interested Parties

The workshop brought representatives from the “directly affected” level of interested parties to a common discussion with the intent of agreeing on a architecture for the Data Acquisition, Instrument Control, & Data Storage systems for the neutron scattering instruments of ESS. The groups represented were: the Integrated Controls System (ICS); the Instrument Scientists for the neutron scattering instruments; the Data Management and Software Centre (DMSC); the Neutron Detector Group; and the Electrical Engineering (EE) Group which also represented the remainder of the Neutron Technologies (NT) Groups. Also in attendance was Dr. Mark Hagen of the Spallation Neutron Source as a manager of computing and data acquisition systems for neutron instruments.

# Executive Summary

Below is the diagram representing the architecture, some support facts, and outstanding questions.

## Diagram of Architecture

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### Notes on diagram

* Bands represent “layers”
* Blue boxes indicate owners
* Connectors indicate connection and direction
* “?” indicates a connection the group was unsure was necessary or required
* PPS has a special connection to the control box

## Important Fact List

There are four types of timing:

* Time stamping in the control box with latency
* Time stamping in the control box with synchronicity to the T0 pulse
* Time stamping on the device with synchronicity to the T0 pulse
* Reading the sensor signals directly into the control box and time stamping there\*

EPICS has a built in “Engineering Screen” for every device plugged into a control box.

The Data Aggregator takes inputs from the Bulk Data Interface and EPICS and reformats it.

\*This fourth type of timing was communicated to Rob Connatser from Thomas Gahl in an email exchange.

## Future Actions

A brief description of the remaining work.

### Interface Control Documents

These documents need to be negotiated at the work package level to fully expand and capture all interfaces and responsibilities.

* DMSC-ICS
* DG-DMSC
* ICS-DG
* ICS-EE (includes other NT groups)
* ICS-Accelerator Support

### Service Level Agreement

After the broad outlines of the interface control documents are put together, a service level agreement between the Machine Directorate and the Science Directorate needs to be put in place to formalize the interfaces and responsibilities between ICS and all Science Directorate parties.

At this time, Thomas Holm Rod is responsible for handling this for the Science Directorate. He will be assisted by Anna Larsson, the NSS Systems Engineer.

This fourth type of timing was communicated to RC from TG in an email exchange.

## Error and Deliberately Unanswered Questions

One error was found in the preparation of this report. A small list of questions that were deliberately left for other discussions is included here.

### Error

In preparing this summary, it was discovered that connections to BLED were not included in the later discussions. A discussion needs to be held within the Science Directorate to determine if there needs to be such a connection and how it would be used. This action goes to the DMSC.

### Unanswered Questions

* We ignored all “direct access interfaces” where it is possible to directly plug into specific devices, bypassing everything else, and the implications thereof.
* There is significantly more depth at the Instrument Control and interfaces levels.
* We did not fully discuss the implications of a common server hall.
* The Detector Group has ideas and requirements for calibration and efficiencies that neutron instrument scientists will be uncomfortable with. The DG is responsible for communicating this and dealing with the aftermath.
* Security of the network and methods of remote access were not discussed.
* Access Control will need a connection to the User Office

## Questions and Answers from DMSC Presentation

* Is DMSC responsible for UI to NT? *Yes, this is the expert user interface.*
  + How does NT configure and test their systems? *Either through the expert user interface or by direct access interface.*
* Who does DMSC interface to with regard to neutron data? *Both ICS and DG*
  + Does ICS time stamp neutron data? *Some. See statement on timing.*
* Who are responsible for the requirements that DMSC needs to gather
  + Format of commands *ICS*
  + Metadata format *ICS/DG/EE*
  + ICS requirements *Gerry Trahern*
  + Scientists requirements *undefined, but see Ken Anderson*
  + NT requirements *NT groups as represented by EE*
* 10 questions from end of presentation

1. Is ICS involved in the data flow from detectors to DMSC computers? *Some.* Who should DMSC interact with? *See interface control document list.*

2. What are the "Device Commands" to be sent from DMSC control console to ICS control box? *Determine in direct discussion with ICS*

3. Should DMSC take care of all Science requirements towards ICS? *No.*

4. Who takes care of the engineering user interfaces? (CSS@control box OR engineering mode in DMSC user interface OR?) *DMSC in Expert User Interface*

5. Does the centralization of computer equipment cause problems? *Deliberately unanswered.*

6. Where does the NT groups find their historic data? *Not discussed.*

7. How can and should we use BLED? *Needs more discussion.* Will there be a (RESTful) API? *Question not understood.*

8. Where do we need Service Level Agreements? *Between Machine Directorate and Science Directorate.*

9. Who are responsible for cabling and network in operation and in construction phase? *Unanswered.*

10. What are the data formats? *Unanswered.* How do we agree? *Unanswered.*

## Clarifying Statements from presentations or group discussion

### Instrument Scientists

* Instrument staff need to be engaged continuously as the instrument control, etc. system is developed.
* Users need to be shown a prototype system once it has reached an 80% or so level of completion to test usability and ease of use.

### DMSC

* Discussion of the BLED and its role in this architecture
  + Instrument configurations may be stored in BLED
  + This may be a logical database to query to get the (or portions of the) “instrument state”

### Detectors

* Discussion point on calibration cycle proposed by detector group will cause significant consternation from instrument scientists
* Detector Group needs to carefully communicate its plans and reasoning to instruments scientists on this matter independently.

# List of Abbreviations

|  |  |
| --- | --- |
| Abbreviation | Explanation of abbreviation |
| ICS | Integrated Control System |
| DMSC | Data Management and Software Centre |
| EE | Electrical Engineering |
| NT | Neutron Technologies |
| IC | Instrument Control |
| DAQ | Data Acquisition |
| DA | Data Analysis |
| IC | Instrument Control |
| BLED | Beamline Element Design |
| NSS | Neutron Scattering Systems |
| UI | User Interface |

Document Revision History

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