Proposal: Dedicated Mantid core-framework sub-team

# Motivation

The Mantid project has become a mission critical part of the scientific work flow at the ISIS facility and at the SNS. The value of Intellectual Property (IP) in the Mantid project is high and thus the cost to change is high, therefore the maintainability and stability of Mantid should represent a risk to operating facilities. Most current and next generation neutron facilities propose Mantid as the facility supported data treatment and data reduction framework, as such all neutron users will be reliant upon the stability and maintainability of the Mantid project code.

The use of a single code base for a large part of a scientific is a result of the success of the Mantid project, with success comes responsibility and also an associated risk.

A recent review of the project, undertaken by the software sustainability institute (SSI) highlighted maintenance as an issue that should be addressed in the project in to improve stability and performance [[1]](#footnote-1).

The SSI report when taken in the context of Mantid as a large mission critical software project highlights the need for a change in the way the project is maintained by the development team, to ensure a long term sustainable project that continues to meet the needs of the facilities and their users.

The [SNS 5-year plan](https://github.com/mantidproject/documents/blob/master/Design/ORNL_Mantid_5yearplan.pdf) outlines a clear development strategy for the Mantid project that has been agreed by the collaborating project partners,

The European spallation source (ESS) is currently developing Mantid to meet the requirements of the ESS facility. For ESS improving the performance of the framework is essential to meet the requirement of low latency data reduction and visualization.

In both the SNS and ESS case not insignificant changes to the core structure of the Mantid are required. That said the cost to refactor core parts of Mantid are high, both because of the complexity of the project and because the project is used in production at operating facilities, i.e. changes must be made in a way as to not jeopardize operations.

We propose the formation of a cross-facility sub-team within the Mantid collaboration responsible for core-framework development in order to meet the core facility requirements of performance, stability and maintainability. The core team would be responsible for design, planning, and implementation of core Mantid framework development and importantly responsible for ensuring the core framework is sustainable.

The essence of the proposal could be summarized as *building software capital*.[[2]](#footnote-2)

# Key Benefits

We believe that the key benefits of having such a core-framework team are as follows. The *Responsibilities* section below justifies these beliefs.

* Correctness of scientific results
* Product stability
* Runtime performance
* Improved collaboration between facilities
* Cleaner interfaces and structure allowing faster development

Overall, a more modular team structure will yield a more modular software design and will mitigate the current knowledge silos within the collaboration. This is essential for long-term project success, adequate support of key concepts of neutron data processing, and reduction of duplicate functionality within the framework. Eventually this will enable faster development of facility/technique/instrument-specific functionality based on stable core functionality.

# Mantid framework core definition and Core – team scope.

It is proposed that the core-team have the following scope.

1. Definition of a maintainable core architecture for the Mantid project.
2. Prioritization for development of core architecture features.
3. Implementation and development planned in an aligned manner with the overall project development.
4. Responsibility for the core features of Mantid.

Mantid currently has only two major concepts, ‘Algorithms’ and ‘Workspaces’. It is essential to move towards more cohesive concepts that provide well-separated abstractions also on smaller scales.

The first objective of the core team should be to define the architecture of Mantid core framework.

An objective is to extract key concepts and functionality that are currently scattered and duplicated across many algorithms. These concepts would be moved into core libraries, with well-defined APIs. These libraries, and support thereof, are provided as a service for facility/technique/instrument-specific teams as well as users that require low-level interaction with the Mantid framework.[[3]](#footnote-3) Additional modularity should open up the Mantid Framework for other avenues of use, such as experiment control. These changes will also be the main driver in reducing times for new feature development.

The core framework team will ensure that prioritized development of common features is executed across facilities. This is to reduce the current excess of convergent functionality, implemented in disparate ways.

Examples that have already been started are the Mantid ‘HistogramData’ library for working with histograms, and the rewrite of instrument handling in Mantid to support much better performance and new features such as scanning. This work was driven by the priorities of a single facility. It is clear that with a core team in place such efforts would be better planned in line with the requirements of other facilities.

# Resourcing and project stages.

To deliver a functioning core team it is proposed that the effort be split into stages. The reason for this is at the time of writing there is no agreed scope or schedule for this proposal nor are there defined recourses allocated to it.

We propose that in the long term SNS, ISIS, and ESS nominate an amount of staff resource to be part of the long-term core framework team. The amount of resources available will define the scope of development that the team can accomplish at any given point.

To ensure success it is important that:

* The developers must be experienced developers.
* Key instrument team staff are consulted and informed prior and during development to ensure that progress is in-line with end user requirements and expectations.
* A long-term commitment and continuous and sustained effort is essential. The total effort from each facility should be maintained for a defined period that is commensurate with the agreed scope and schedule.
  + The proposal is a staged implementation to allow a degree of flexibility of staff from one stage to another given that most staff have other responsibilities.

To start the process of implementing a core-team the following stages are suggested (no schedule is defined at this stage as no resources are agreed).

**Stage 1**. Each facility nominates a defined amount of staff recourse to the project definition stage to form an initial core team.

**Stage 2**. Project definition. Shall define the scope of the core framework and core requirements along with an estimate of recourses required for implementation for each requirement. A phased implementation plan shall be proposed.

***Del 1***. Project definition report.

***MS1***. Scope setting and design review. A review will be made of the project definition report, at this stage a prioritization of requirements shall be made against available recourses and objectives.

**Stage 3.** Implementation

**MS2**. Staged Implementation of phase1 objectives & review.

**MS3.** Staged Implementation of phase2 objectives & review.

**Del2.** Development update report and review

**MS4**. Staged Implementation of phase3 objectives & review.

**MS5.** Staged Implementation of phase4 objectives & review.

**Del3.** Development update report and review

The technical steering committee TSC shall be used for technical review and technical oversight that is to say that the core framework team will not take over the responsibilities of the TSC.

Finally, we point out that the core framework team is not a replacement for the existing regular maintenance. The current maintenance period and effort must be kept and carried by everyone, not just the core framework team.

1. The SSI report recommends actions in this direction. We would particularly highlight the following sections: Collaborative Review 3: *“Increased effort for solving technical issues”*, Collaborative Review 5: *“Increased emphasis on community building”*, Collaborative Review 8: *“Improve the data access and processing speeds of Mantid to reduce time to results”*, Technical Review 2: *“Increase the effort available to manage and resolve longer term technical issues”*, Technical Review 3: *“Increase developer effort to improve the overall structure and maintainability of the Mantid Codebase”.* [↑](#footnote-ref-1)
2. This term is coined in the illuminating talk <https://youtu.be/ta3S8CRN2TM>. [↑](#footnote-ref-2)
3. This is in line with the SNS 5-year plan. [↑](#footnote-ref-3)