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Technical Specifications (In-Cash Procurement)

Call for Expertise for DAN audit

Technical specification for DAN audit. it consists of making an evaluation of the completess of the DAN API and its performance.

Table of Content

1 PURPOSE

This document is the technical specification for a call for expertise for auditing ITER DAN API on an existing t okamak.

2 SCOPE

The aim of this call for expertise is to audit DAN API on an existing tokamak. It aims at investigating the cove rage and performance of DAN API. The main objective is to quantify the performance of DAN API and asses s its completeness on “existing tokamaks” respective to the ITER needs. This call for expertise will be split in to 4 sub-tasks as mentioned below:

- Sub-task 1: Evaluate the completeness of DAN API regarding metadata support.
- Sub-task 2: Evaluate the performance and reliability of DAN API using diagnostics
- Sub-task 4: Assess the proposal for calibration modelling;
- Sub-task 3: Assess DAN data access in terms of completeness and performances.

3 DEFINITIONS

The following acronyms are used in this document

API	Application Programmable Interface
CPU	Central Processing Unit
CODAC	Control, Data Access and Communications
EPICS	Experimental Physics and Industrial Control System
FC	Fast Controller
I/O	Input/Output
N/A	Not Applicable
PON	Plant Operation Network
SCCB	Software Configuration Control Board
DAN	Data Archiving Network
SRS	Software Requirement Specification
TCN	Time Communication Network
TRO	Technical Responsible Officer
UDP	User Datagram Protocol

4 REFERENCES

1. [RD1] DAN User Manual
2. [RD2] Plant Control Design Handbook (3ZHL96)
3. [RD3] SEQA-45 - Software Engineering and Quality Assurance for CODAC(2NRS2K)
4. [RD4] CODAC Core System Tests (3ZHL96)

5. [RD5] CODAC C/C++ SDSD (A2FRVX v2.0)

This call for expertise is scheduled to be launched October 2015. T0 is the starting date. The total duration of this call for expertise shall not be longer **10 (ten) months** from its formal signature date by both parties.

5 WORK DESCRIPTION

Overall IO Technical Responsible Officer: Lana Abadie

5.1 Introduction

ITER CODAC is the integrated control, data access and communication system for the ITER facility. One of t he tasks of CODAC is to archive all data produced by the ITER Plant and to allow local and remote data acc ess from the archiving system [RD1, RD2].
In its lifetime ITER will create large amount of data. These data include raw data, processed data and metad ata. The sources of the data can be engineering design tools, simulation results, machine instrumentation an d experimental diagnostic devices. Accordingly, data format can vary, including text, scalar and multi-dimensi onal array values. Support for the data provenance, which provides information from the data acquisition to a nalysis to published papers, also will be needed.
In this technical specification, we will focus on the data acquisition part. DAN API has been included in CCS since v5.0. DAN API is at production. It consists of a set of libraries that allows data streaming over DAN net work. The data is archived via DAN archivers into HDF5 files. Basic data access libraries allow accessing dat a. This data access will be improved in next versions of CCS, namely by removing in the API, the need to sp ecify files.
Current DAN API supports metadata declaration.

5.2 Sub-Task 1 Evaluate the completeness of DAN API regarding metadata support

Liaison and Resource Tracking Officer

IO-RO: Lana Abadie

Description

- DAN API has modelled the transport of metadata at two levels stream and block. The I&C developer configures DAN via SDD. He has to declare the list of variables and their associated metadata. Meta data can be set both on stream and on block levels. SDD will generate the corresponding configurati on XML file. The I&C developer has then to implement the code to publish the data. Dynamic metad ata can be included in the code. These are then stored in HDF5 files as attributes of the correspondi ng group and dataset. There is DAN API included in 5.1 which allows retrieving data. The main obje ctive of this task is to get two plant system I&Cs (Infra-red camera, thermocouples or bolometers for i nstance) and try to use DAN API to stream data to the DAN archiver. It is important to get realistic us age of metadata to be transported along with archived data as for real Tokamak. Make sure that all t he information can be transported over DAN and that it is properly stored (no loss of samples and no altered (meta)data.
- The hardware will have to be set-up in advance for all the sub-tasks:
  - Configuration of the DAN/ACQ computers, DAN/Archivers, and DAN clients
  - Configuration of acquisition hardware (at least 1 FlexRio shall be used). Non-standard hardw are can be used.
  - Configuration of the camera capture streaming hardware, tee required signals

Signal and connectivity tests (using standard tools) shall be carried to assess the correctness of the set-up.

This task shall be performed using CCS v5.1.

Inputs to be provided by IO:

1. Support for using CCS (incl. DAN)
2. Exact configuration to be tested (number of channels, plant system I&Cs, sampling rate) to be communicated at the kick-off meeting. The metadata is excluded.
3. Background information
4. 1 set of FlexRIO (card and adapter module)

Milestones and deliverables from the Contractor

Deliverables Id	Description	Milestone
D1.1	- Successful hardware set-up for all the sub-tasks - An evaluation report describing the completeness of DAN API including metadata usage (both on stream and block level). It also shall report on missing functionalities and gives feedback for improvement if required. If necessary a second version of the report which includes reviewers' comment may be required. - All source codes required to make the report have to be included in SVN	**Start : T0** **Duration : 5months**

5.3 Sub-Task 2 Evaluate the performance and reliability of DAN API using diagnostics

Liaison and Resource Tracking Officer

IO-RO: Lana Abadie

Description

DAN has performance and reliability requirements. It shall be able to reliably (with no loss) stream data up to few GB/sec for several hours. The purpose of this task is to take a diagnostic which produces a lot of data like infra-red cameras or reflectometry data and try to simulate GB/sec of data for archive purposes for more than 1 hour.

The test is first to be performed with no redundancy and then with redundancy (i.e. redundant DAN STREAMER and redundant DAN archiver). The criteria of success being that there is no loss of samples and no altered data.

Most Tokamaks are not a continuously pulsed machine. We propose two approaches for testing continuous streaming. The first approach is to stream live data throughout the day, including data obtained during plasma discharges covering a short 10 second window in addition to live streaming of data between shots when no

plasma is present. The second approach involves streaming the live data during discharges and streaming s imulated discharge data between shots when no plasma is present.
This task shall be performed using CCS 5.2.

Inputs to be provided by IO

1. Background information
2. Support for DAN and CCS

Milestones and deliverables from the Contractor

Deliverables Id	Description	Milestone
D2.1	- Performance report describing the result of the tests (incl. reliability tests). The report shall also include the native performance of the hardware (i.e. max. disk speed, max. throughput) using standard tools. It also shall report on missing functionalities and gives feedback for improvement if required. If necessary a second version of the report which includes reviewers' comment may be required. - All source codes required to make the report have to be included in SVN	**Start : T0 +5 months** **Duration: 3 months**

5.4 Sub-Task 3 Assess the proposal for calibration modelling

Description
One of the key components of Data Archiving is calibration. In DAN, we introduce support for calibrations. It is required at early stage as calibration will be one of the first things that plant systems will have to perform.
The test for calibration support will be based on two use cases (ECH and Thomson scattering). In this task, it shall be reviewed based on the selected tokamak experience.
This task shall be performed using CCS 5.2.

Inputs to be provided by IO

1. Background information
2. Support for CCS and DAN
3. Calibration background for ITER

Milestones and deliverables from the Contractor

Deliverables Id	Deliverables description	Milestone
D3.1	- An evaluation report of the DAN API calibration model and strategy proposed by IO. It also shall report on missing functionalities and	**Start : T0 +6 months** **Duration : 1 month**

	gives feedback for improvement if required. If necessary a second version of the report which includes reviewers' comment may be required. - All source codes required to make the repor t have to be included in SVN	

6 Sub-Task 4 Assess DAN data access in terms of completenes s and performances

Liaison and Resource Tracking Officer

IO-RO: Lana Abadie

Description

Finally it is important to assess the DAN data access based on current tokomak experiences. In CCS we pro vide data access for raw data including its metadata.
Thus based on the selected tokamak experiences, make sure that the Data access API is complete, its perfo rmance is acceptable, and the data analysis yields the same result. Simulations of concurrent users will be re quired (~10). Perform a test to generate analyzed results (such as Thomson temperatures and Densities an d/or MHD instabilities) from raw data and calibrations stored in DAN.
This task shall be performed using CCS 5.2.

Inputs to be provided by IO

1. Background information
2. Support for DAN and CCS

Milestones and deliverables from the Contractor

Deliverables I d	Description	Milestone
D4.1	- Test report on the performance and complet eness of the DAN data access API and the validity of the results. It also shall report on missing functionalities and gives feedback f or improvement if required. If necessary a s econd version of the report which includes r eviewers' comment may be required. - All source codes required to make the repor t have to be included in SVN	**Start : T0+7 months** **Duration : 3 months**

7 RESPONSIBILITIES

N/A

8 LIST OF DELIVERABLES AND DUE DATES

The deliverables and due dates for this Call for expertise is summarized below:

Sub-tasks	Deliverables	Due date (End of)	Estimated approve date
Sub-task 1 Evaluate the completeness of DAN API regarding metadata D 1.1 support		T0+5 months	T0+5 months + 3 weeks
Sub-task 2 Evaluate the performance and reliability of DAN API using diagnostics	D 2.1	T0+7 months	T0+7 months + 3weeks
Sub-task 3 Assess the proposal for calibration modelling	D3.1	T0+6months	T0+6months + 3 weeks
Sub-task 4 Assess DAN data access in terms of completeness and performances	D4.1	T0+9 months	T0+9 months+ 3 weeks

9 ACCEPTANCE CRITERIA

The following criteria shall be the basis of the acceptance of the successful accomplishment of the Work

9.1 Delivery date criteria

On-time delivery of deliverables according the dates defined in Section 7.

9.2 Report and Document Review criteria

Reports as deliverables shall be stored in the ITER Organization's document management system by the Co ntractor for acceptance. A named ITER Organization's Contract Technical Responsible Officer is the Approv er of the delivered documents. The Approver can name one or more Reviewers(s) in the area of the report's expertise. The Reviewer(s) can ask modifications to the report in which case the Contractor must submit a n ew version. The acceptance of the document by the Approver is an acceptance criterion.

9.3 Software delivery criteria

Software source code shall be delivered in the ITER Organizations software repository (SVN) by the Contrac tor for acceptance. A named ITER Organization's Contract Technical Responsible Officer is the Approver of t he delivered software source code. The acceptance is based on successful execution of Test Plans and, opti onally, code review. The acceptance of the software source code by the Approver is an acceptance criterion.

10 SPECIFIC REQUIREMENTS AND CONDITIONS

The recommendations that are described in the CODAC Software Engineering and Quality Assurance docu ment [RD3] shall apply to the deliverables. Test plans and test reports have to be recorded in the dedicated a rea [RD4].
In particular, the CODAC C/C++ rules and recommendations, as defined the CODAC C/C++ SDSD document [RD5] shall apply to the deliverables, incl. monthly delivery of the source to IO version control repository as well as support for pa ckaging of the runtime deliverables in the form of RPM, as per section 2.8
of [RD5].
Criteria to be satisfied by the company shall be as follows:

1. Experience in Tokamak operation, data access patterns for physicians and operators : at least 5 yea rs
2. Experience in building high speed data acquisitions: at least 5 years
3. Necessary hardware to execute the tasks in due time
4. Experience in software QA and fault analysis: at least 5 years (necessary certif

11 WORK MONITORING / MEETING SCHEDULE

Risks, issues and progress shall be regularly monitored by means of Progress Meetings and/or formal exchange of doc uments transmitted by emails which provide detailed progress.
Progress Meetings will be called by the ITER Organization, once per month, to review the progress of the wo rk, the technical problems, the interfaces and the planning.

The main purpose of the monthly Progress Meetings is to allow the ITER Organization and the Contractor Te chnical Responsible Officers to:

- Allow early detection and correction of issues that may cause delays;
- Review the completed and planned activities and asses the progress made;
- Permit fast and consensual resolution of unexpected problems;
- Clarify doubts and prevent misinterpretations of the specifications.

In addition to the monthly Progress Meetings, if necessary, the ITER Organization and/or the Contractor may request additional Progress Meetings to address specific issues to be resolved.

For all Progress Meetings, the minutes of the meeting shall be drafted by the Contractor within five (5) workin g days following the meeting. The ITER Organization will review the draft version or the minutes within five (5) working days after the issuing date by the Contractor.

Every month, the Contractor shall submit to ITER Organization a Monthly Progress Report to be issued five (5) working days before the Monthly Progress meeting so that the report can be reviewed prior to, and discus sed at this Meeting.

The Monthly Progress Report shall illustrate the progress against the baseline work plan and indicate varianc es that should be used for trending. Performance indicators suitable to measure the progress of the work as compared to the approved work plan shall also be reported in the Monthly Progress Report.

On request and by agreement, meetings will be organized by videoconference. The Contractor shall facilitate proper tools for the videoconference in accordance with the Associated Framework Contract.

12 DELIVERY TIME BREAKDOWN

The table below defines bundles of deliverables with dates and cost. This defines the invoice breakdown.

Deliverables	Estimated approved dates	Cost
D1.1	End of (T0+5 months) +3 w eeks	40%
D2.1	End of (T0+7 months) +3 w eeks	25%
D3.1	End of (T0+6) months +3 w eeks	10%
D4.1	End of (T0+9) months +3 w eeks	25%

13 QUALITY ASSURANCE (QA) REQUIREMENTS

The organisation conducting these activities should have an ITER approved QA Program or an ISO 9001 acc redited quality system.
The general requirements are detailed in ITER Procurement Quality Requirements (ITER_D_22MFG4).
Prior to commencement of the task, a Quality Plan must be submitted for IO approval giving evidence of the above and describing the organisation for this task; the skill of workers involved in the study; any anticipated sub-contractors; and giving details of who will be the independent checker of the activities (see Procurement Requirements for Producing a Quality Plan (ITER_D_22MFMW)).
Documentation developed as the result of this task shall be retained by the performer of the task or the DA or ganization for a minimum of 5 years and then may be discarded at the direction of the IO. The use of comput er software to perform a safety basis task activity such as analysis and/or modelling, etc. shall be reviewed a nd approved by the IO prior to its use, in accordance with Quality Assurance for ITER Safety Codes (ITER_D _258LKL).

14 CAD DESIGN REQUIREMENTS (IF APPLICABL E)

NOT APPLICABLE FOR THIS CALL FOR EXPERTISE

For the contracts where CAD design tasks are involved, the following shall apply:
The Supplier shall provide a Design Plan to be approved by the IO. Such plan shall identify all design activiti es and design deliverables to be provided by the Contractor as part of the contract.

The Supplier shall ensure that all designs, CAD data and drawings delivered to IO comply with the Procedure for the Usage of the ITER CAD Manual (2F6FTX), and with the Procedure for the Management of CAD Work & CAD Data (Models and Drawings 2DWU2M).
The reference scheme is for the Supplier to work in a fully synchronous manner on the ITER CAD platform (see detailed information about synchronous collaboration in the ITER GNJX6A - Specification for CAD data production in ITER Contracts.). This implies the usage of the CAD software versions as indicated in CAD Manual 07 - CAD Fact Sheet (249WUL) and the connection to one of the ITER project CAD data-bases. Any deviation against this requirement shall be defined in a Design Collaboration Implementation Form (DCIF) prepared and approved by DO and included in the call-for-tender package. Any cost or labour resulting from a deviation or non-conformance of the Supplier with regards to the CAD collaboration requirement shall be incurred by the Supplier.

15 SAFETY REQUIREMENTS

ITER is a Nuclear Facility identified in France by the number-INB-174 (“Installation Nucléaire de Base”).
For Protection Important Components and in particular Safety Important Class components (SIC), the French Nuclear Regulation must be observed, in application of the Article 14 of the ITER Agreement.
In such case the Suppliers and Subcontractors must be informed that:

- The Order 7th February 2012 applies to all the components important for the protection (PIC) and the activities important for the protection (PIA).
- The compliance with the INB-order must be demonstrated in the chain of external contractors.
- In application of article II.2.5.4 of the Order 7th February 2012, contracted activities for supervision purposes are also subject to a supervision done by the Nuclear Operator.

For the Protection Important Components, structures and systems of the nuclear facility, and Protection Important Activities the contractor shall ensure that a specific management system is implemented for his own activities and for the activities done by any Supplier and Subcontractor following the requirements of the Order 7th February 2012.