Model Use Case

Ocean Observatory Initiative: Integrated Observatory

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Summary:

Source of use cases:

Customers;

**Primary Actor:**

The scientist performing the remote experiment

**Secondary actors:**

• Marine observatory equipment operator (on-site at shore station)

• Infrastructure and instrument technicians/maintenance engineers

• Site security manager

• Instrument/infrastructure owner

• Instrument interface engineer

• Instrument representative

• Input provider

• Observer of the observatory data (could be a scientist, a member of the public, or a student from Kindergarten through graduate school)

**Scope:**

The Remote Instrumentation Infrastructure (RII), also known as the Integrated Observatory (IO) as composed by:

• The instruments

• The network

• The computing and storage resources

• The enabling middleware and the post-processing software

**Stakeholders and interests:**

• The scientist performing the experiment has an interest in concluding it successfully and retrieve reliable measurements (or other results). This execution of the experiment must be as economic and technically complete as possible. Additionally, the scientist has an interest performing the experiment in a secure environment, which guarantees that access to results (and the input) is restrained to well-specified entities.

• Owner of the equipment and infrastructure. The owner has an interest in ensuring that the equipment is working properly and is not damaged as a consequence of the experiment. If the owner is also the manufacturer (possible in the case that vendors are leasing their equipment or providing it for testing purposes), the owner needs to ensure that the performance of the equipment is appropriate, in order to improve the equipment’s reputation and therefore gain a competitive advantage. The owner has an interest in maximizing use of the equipment through efficient scheduling of the experiments.

• Instrument interface engineer(s). The instrument interface engineer(s) are responsible for providing (and/or verifying) the hardware and software that connects a scientific oceanographic instrument to the observatory

•Instrument Representatives. The instrument representatives monitor instrument data/metadata quality, processing and operation. They work with Instrument Interface Developer to define requirements for the instrument interface. They are responsible for Pre-deployment validation

• Infrastructure and instrument technicians/maintenance engineers. The engineers of the infrastructure and of the instrument equipment have an interest in ensuring the proper operation of both, for reasons of professional reputation.

• Site security manager. The site security manager has an interest in ensuring that any access policy changes on the network and the software infrastructure will not affect negatively the overall site security, and will not increase an intruder’s chances to access the site.

• Input provider (if any). The quality of the input may affect an experiment, when input is relevant. The provider has an interest in improving their reputation through quick delivery of quality input and successful completion of experiments.

• Observer of the observatory data (could be a scientist, a member of the public, or a student from Kindergarten through graduate school). It is the mission of the observatory to have “real-time” data available to the general public, students in schools, and general scientific community. There may be situations in which these actors are permitted to input requests for experiments or particular measurements (to support classroom projects, for example).

**Preconditions:**

• The RII (as defined in *Scope*) must be operational.

• The user has appropriate access rights to the infrastructure.

• When exclusive access is required, or there is a restriction in the number of concurrent users, the infrastructure must offer this functionality.

• It must be possible to verify at all times that the RII is functioning properly, either remotely or with the assistance of a local collaborator.

• It must be possible to define access policies that restrict access to some or all of the experimental process and results.

• If remote control of the instrument is not possible, a local collaborator must be on site.

**Minimal guarantee:**

• The RII must remain operational, without the security measures being affected in any way.

**Success guarantee:**

• The experiment was conducted in full; partial instrument output has been obtained and post-processed to extract the final output data.

**Main success scenario:**

1. If needed, schedule the experiment for a specific timeslot, indicating exclusive access or concurrent access limitations.

2. If needed, prepare the input.

3. If needed, switch on instruments, check and prepare processing infrastructure.

4. If needed, define access policies for the access of additional entities to the experiment and the output produced.

5. If needed, provide the input to the instrument(s) (directly or through marine operator).

6. If needed, calibrate the instrument(s), by modifying its settings and parameters.

7. Execute the experiment performing measurements and control of the instrument(s).

8. Evaluate the output of the specific measurement.

9. If additional runs are required, jump to step 4 and repeat onwards.

10. If needed, perform cleanup activities, such as deleting intermediate data and switching off the instrument(s) and other relevant equipment.

**Extensions:**

1a. The instrument(s) are not available for exclusive access at that time and day, or maximum number of concurrent users has been reached.

*1a1.* Try another day and/or time.

1b. Operation of one instrument would conflict with concurrent experiment using another instrument*.*

*1b1.* Reschedule experiment.

*1b2.* Negotiate with operator of conflicting instrument to resolve interference between the instruments.

2a. Input is not of acceptable quality or has been destroyed.

*2a1.* Contact input provider and receive new input.

*2a2.* Reschedule experiment.

3a. Instrument or other part of the infrastructure is not available for technical reasons.

*3a1.* Contact corresponding engineers to fix the problem(s).

3a. Instrument or other part of the infrastructure is not available for technical reasons.

*3a1.* If fixing the problem is a lengthy process, reschedule experiment.

4a. It is not possible for the user to define access policies.

*4a1*. Contact the site security managers and ask them to append new policies.

*4a2.* If addition of new policies is a lengthy process, reschedule experiment.

5a. It is not possible to provide the (digital) input to the instrument.

*5a1.* Contact the site infrastructure engineers.

*5a2.* If fixing the problem is a lengthy process, reschedule experiment.

5b. It is not possible to collaborate efficiently with the local assistant.

*5b1.* Contact instrument owner to arrange for another local collaborator.

*5b2.* Reschedule experiment according to availability of alternative collaborator.

6a. Calibration of the instrument fails.

*6a1.* Contact the site infrastructure engineers.

*6a2.* If fixing the problem is a lengthy process, reschedule experiment.

7a. The instrument or other part of the infrastructure is malfunctioning during experimentation.

*7a1.* Contact the site infrastructure engineers.

*7a2.* If fixing the problem is a lengthy process, reschedule experiment.

8a. The instrument cannot be switched off, or other technical problem has occurred.

*8a1.* Contact site infrastructure engineers.

Additional requirements:

• *Selection services* (scheduling and reservation, also including computational, storage

and networking resources) – Optional;

• *Input management* (identification, preparation processes) – Optional;

• *Instrument virtualization / Service provider* (representation as manageable resource) –

Obligatory;

• *Policy decision and enforcement* – Optional;

• *Data management of input* – Optional, applies to digital input only;

• *Local operator* (shore side) – Optional if remote control of instruments is possible. Can be assistive to input management as well;

• *Visualization devices* – Optional;

• *Software for post-processing* – Optional; Includes ability to merge data (extracted from local instrument storage unit after recovery from remote site) with incomplete/summary data transmitted in real-time from instrument.

• *Workflow management –* Optional;

• *Accounting and Monitoring* – Obligatory;

•*Instrument representative* – Obligatory. Each instrument has an individual tasked with monitoring the data stream and accessing the quality of that data

Non-functional requirements:

•Security considerations

•The observatory assets and instruments must be protected against damage that could be caused by unauthorized access

•Each user must be authenticated to allow access to data

•Some authorized users allowed to access restricted data

•Some authorized users allowed to control specific instruments or processes

•Operators must be authenticated to allow additional operations (change parameters, turn instruments on or off, do maintenance, etc.)

•Performance considerations (incl. real-time properties)

•Strict QoS requirements on data flow from instruments to shore station under operator control

•Expectation of near-real-time data delivery from community instruments (expectation varies depending upon the instrument and the platform type [cabled vs coastal moored vs global moored vs underwater autonomous])

Involved resources:

•Incl. available interfaces for the specific instrument(s)

•Individual ocean science instruments (no current standards)

•Instrument interface software (proprietary, SIAM, IEEE1451, JDDAC)

•Instrument controllers / data loggers on individual platforms

•Communication interfaces between controllers and shore station

•Real-time data network (IP)

•Intermittent wireless networks (satellite)

•Command and control network

•Shore side station (operators, local data storage, monitoring, etc)

•“Campus” compute center (compute facilities, data storage, streaming services)

•Virtual laboratory at user site

Related work / Experience in the field:

•Extensive experience from smaller ocean observatories (LEO-15, MVCO, MOOS, H2O, VENUS, MARS etc) and terrestrial observatories (Earthscope, ROADNET, etc).

•Leveraging experience in other scientific fields and environmental monitoring fields

References:

•Ocean Observatories Initiative Cyberinfrastructure:

•<http://forge.gridforum.org/sf/docman/do/listDocuments/projects.risge-rg/docman.root.meeting_materials.ingrid08>

•<http://www.joiscience.org/ocean_observing>

•RingGRID Deliverable 6.2 Report on requirements verification

<http://www.ringrid.eu/public/deliverables/RINGrid-WP6-D6_2-2008-04-20-1-GRN-Report_on_requirements_verification.pdf>

•OOI CI Requirements and Design Workshops

•<http://ooici.ucsd.edu/spaces/display/WS/Home>

•ROADNet

•<http://roadnet.ucsd.edu/>

•Earthscope

•<http://www.earthscope.org/>

•MVCO

•<http://www.whoi.edu/mvco/>

•MOOS

•<http://www.mbari.org/moos/>

•MARS Cabled Observatory User Requirements

•<http://www.mbari.org/rd/sensors/documents/2300002_User%20Requirements.pdf>

•LEO-15

•<http://marine.rutgers.edu/mrs/LEO/LEO15.html>

•VENUS

•<http://www.venus.uvic.ca/>

•H2O

•<http://www.soest.hawaii.edu/h2o/>

•MARS

•<http://www.mbari.org/mars/>

•SENSORS: Ocean observing system instrument network infrastructure Workshop Report

•<http://www.mbari.org/rd/sensors/2004workshop.htm>

Yet to do:

•Open Grid Services Architecture (OGSA) capabilities and services utilization

•To be determined

•Matrix: Use case / functionalities (essential, optional)

•To be done



Engineering environment: