Operations and Management Component CG-CI Interface Control Document (ICD)

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Document Control Sheet

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1 Introduction

1.1 Identification

This Interface Control Document defines the Ocean Observatories Initiative (OOI) system interfaces between the Coastal/Global Scale Nodes (CGSN, or CG) and Cyberinfrastructure (CI) components resident at the three Operations and Management Component (OMC) sites.

1.2 OOI Operations and Management Component (OMC) System Overview

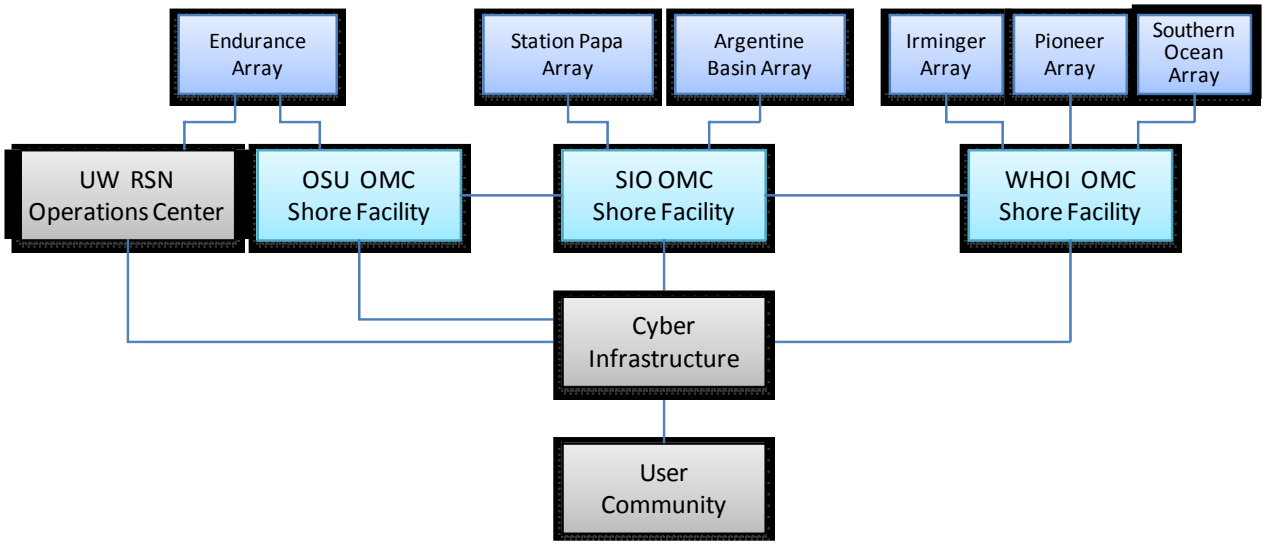
The Ocean Observatories Initiative (OOI) consists of sensors, networks, and support systems that will collect and make available ocean and seafloor data in a coordinated fashion to provide persistent observations over ranges of minutes up to years and decades. OOI will enable researchers to make simultaneous, interdisciplinary measurements to investigate a spectrum of phenomena including episodic, short-lived events (tectonic, volcanic, oceanographic, biological, and meteorological), and more subtle, longer-term changes and emergent phenomena in ocean systems (circulation patterns, climate change, ocean acidity, and ecosystem trends). The OOI Final Network Design (FND) document provides additional information on OOI.

The CGSN Operations and Management Components (OMCs) are the shore resident components of the CGSN network. There will be three OMC shore facilities to support CGSN operations and maintenance. These facilities are located at the Woods Hole Oceanographic Institution (WHOI), Woods Hole, Massachusetts; Scripps Institution of Oceanography (SIO), La Jolla, California; and Oregon State University (OSU), Corvallis, Oregon. The OMC facilities provide the infrastructure to support CGSN system operations, field operations, and data operations.

The CGSN Block Diagram shown in Figure 1 depicts the interconnections between the CGSN Arrays, CGSN OMCs, the RSN Observatory Management System (OMS) Operations Center, and the Cyberinfrastructure (CI). There are also links (not shown) directly from some array assets to CI that are not routed through the CG shore facilities and are not within the scope of this document.

The primary roles of the OMC are to manage the deployed fixed and mobile CGSN platforms and to ensure that data produced by these platforms are captured and made available to CI, such that CI can in turn make these data available to the OOI user community. To fulfill these management and data collection roles, the OMC must support the preparation for and deployment of CGSN platforms (moorings and vehicles), the operation of those platforms while at sea, and their subsequent recovery including

Figure 1 – CGSN System Block Diagram



collection of all data captured by the platforms during their deployment. Remote control interfaces with the platforms provide the ability to alter mission profiles, obtain operational status, diagnose problem root causes, and implement corrective actions to maintain optimal mission performance.

To support deployment and recovery operations at sea, elements of the OMC capabilities may be deployed shipboard. The specific components and capabilities deployed for any given mission will depend on the specific needs of that mission. If used at sea, these capabilities will allow at-sea platform monitoring, control, and data collection to follow many of the same processes and workflows as employed in shore based operations.

In many cases, only the front-end elements of the OMC systems (those that interact directly with telemetry and platforms) will be deployed shipboard. Therefore, interfaces internal to the CG elements of the OMC, and interfaces between CG and CI elements, must be designed and built to support potentially slow/intermittent SatCom links and to suspend data exchanges between shipboard and ashore components until a suitable data link is available (in some cases, until the deployed components are physically returned to their home shore facilities).

As defined by OOI operating policy, the quantity of data passed to shore from deployed platforms may be limited to manage the cost of satellite data link transfers and conserve available power. The full data set is collected and retained by the platforms and is extracted upon recovery of the platforms.

As described above, the OOI system includes three physically distinct shore-based OMC instances and may include additional OMC instances deployed shipboard to support field operations. Each of the three shore instances provides all OMC capabilities but may be tailored to the specific needs of the OMC instance, depending primarily on the types and numbers of deployed platforms supported by each. A shipboard deployed OMC instance may provide all OMC capabilities or some subset of those capabilities, as determined by the needs of the specific cruise.

The OMC software is implemented as two Computer Software Configuration Items (CSCIs) each of which is hosted on an associated server hardware component:

- CG Mooring Platform Shore Server (CG PSS) CSCI hosted on a CG PSS server
- Operations Management System / Data Server (OMS/DS) CSCI hosted on a CG OMS server

1.3 Document Scope and Organization

This document is organized into the following four sections:

Section 1, Introduction, provides the scope, document organization, and change control procedure for this document.

Section 2, Related Documentation, cites other documents that provide input and reference for this ICD.

Section 3, Description of Interfaces, describes the logical, electrical, and mechanical interfaces.

Section 4, Notes, contains general information that aids in the understanding of this document.

Appendix A, CG-CI Interface Use Cases, provides summary use cases that illustrate how the defined interfaces are employed.

Appendix B, Related CG-CI Interactions, provides for reference a discussion of various interfaces and interactions defined in other documents that are closely related to the OMC CG-CI interfaces defined by this ICD.

Appendix C, Exchanged Data File Directory Structure, defines the data structure/tree that will be used in providing data files from the CG Data Server to CI Dataset Agents running in the CI Acquisition Point Servers.

Appendix D, Reference System Diagrams, provides additional system descriptive diagrams for reference.

1.4 Change Control

This Interface Control Document is subject to the policies and procedures called out in the OOI Configuration Management Plan, 1000-00000, section 3. Changes to the released version of this document may only be made via an Engineering Change Request (ECR) that has been approved by the System Level Change Control Board (SL-CCB).

The most recent document revision of this ICD maintained in the OOI Document Management System (DMS) is the authoritative version, as printed hard copies are not controlled. Prior revisions of this document may be maintained in the OOI DMS for reference reasons, but are not authoritative.

2 Related Documentation

2.1 Parent Documents

The following documents are the parents from which this document's scope and content derive:

Document ID	Document Title
	NSF Cooperative Agreement No. 0957938
DOORS	L3 CG System Requirements (Section 5)
DOORS	L3 CI System Requirements (Section 5)
DOORS	L3 CG-CI Interface Requirements Specification (Section 3.3)
DOORS	L4 CI External Observatory Integration (Section 5)
DOORS	L4 CG Operations and Management Component (Section 5)
DOORS	L4 CI Terrestrial CyberPoP-Network (Section 5)
DOORS	L4 CI Marine CyberPoP-Network (Section 5)

2.2 Reference Documents

The following documents or drawings are referenced herein and are directly applicable to this document.

Document ID	Document Title
1001-00000	OOI Project Execution Plan (PEP)
1101-00000	Final Network Design (FND)
1000-00000	OOI Configuration Management Plan (CMP)
1100-00000	OOI System Engineering Management Plan
2130-00010	UX Functional Design Specification – R2
2130-00011	UX Workflows and User Stories – R2
1152-02001	CI Acceptance Scenarios https://confluence.oceanobservatories.org/display/CIDev/Release+2+Acceptance+Scenarios
1132-00001	CI-CG Platform Controller ICD

2.3 Informational Documents

The following documents amplify or clarify the information presented in this document, but are not binding.

Document ID	Document Title
3102-10001	Platform Controller – Radio Telemetry ICD
1012-00000	Cybersecurity Plan
DOORS	L2 Reference Module

2.4 Precedence of Requirements

In the case of conflicting requirements, the following order of precedence shall be observed:

- OOI DOORS database requirements
- OMC CG-CI Interface Control Document (ICD; DCN 1132-00002)
- OMC Software Requirements Specification (SRS; DCN 3311-00007)
- Software Design Description (SDD; DCN 3311-00008) or Hardware Design Description (HDD; DCN 3311-00009) as appropriate
- All other documents

3 Description of Interfaces

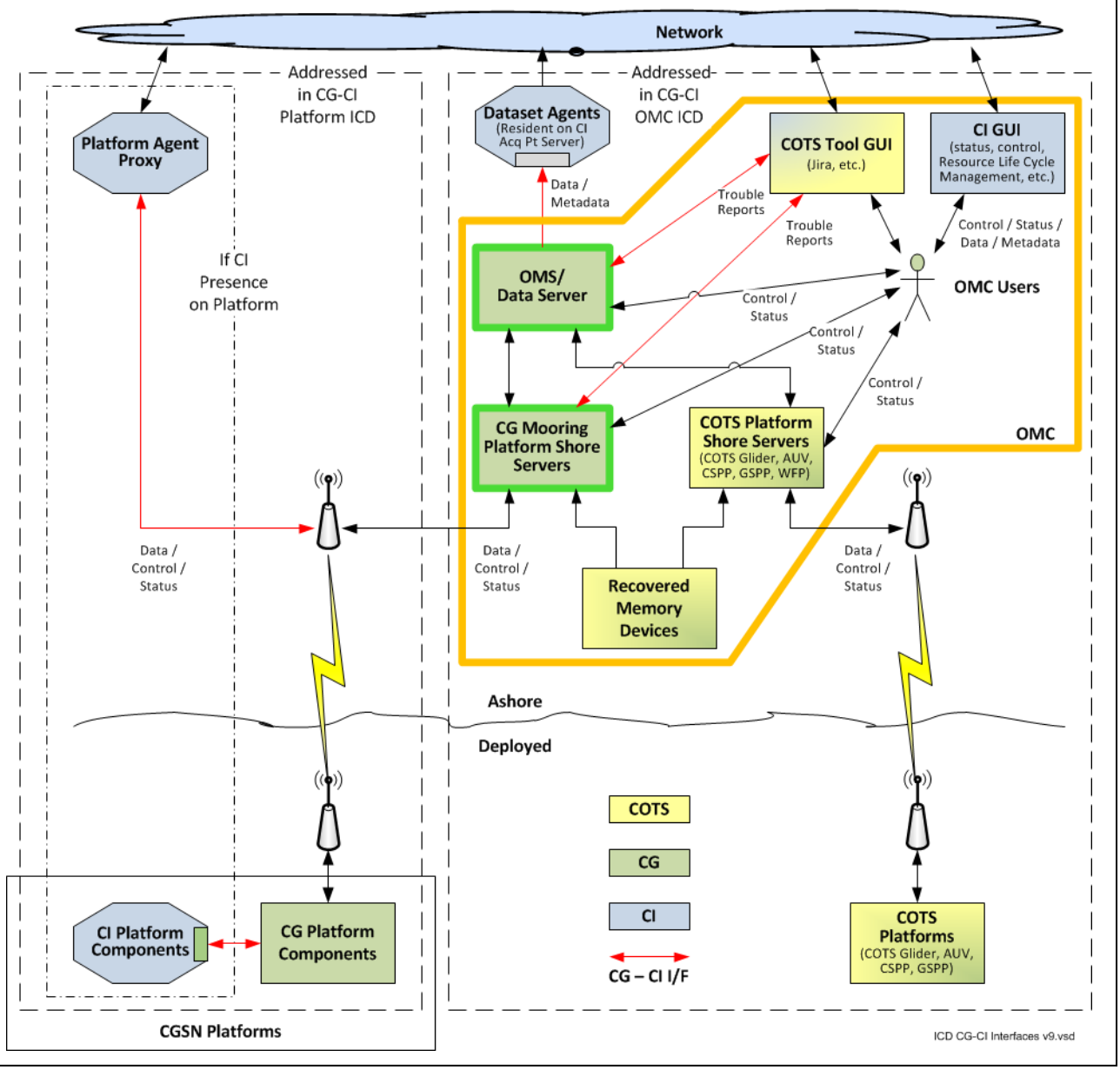
3.1 Overview

This ICD documents/describes the various interfaces between CGSN (Coastal and Global Scale Nodes, generally shortened in this document to simply CG) and CI (Cyberinfrastructure) systems located at the Operations and Maintenance Component (OMC) sites.

CG-CI interfaces are summarized in Figure 2 below and described in detail in the following subsections.

The content of this document reflects interfaces that are consistent with CI Software Release 2. Later releases will bring automated mission planning and execution capabilities that may require revision and/or extension to align the interfaces with each release's capabilities.

Figure 2 – CG-CI Interface Summary



Much of the detailed information defined by this ICD is included in referenced Interface Data Description (IDD) documents that define the various file types exchanged based on their source platforms/ instruments/components. These documents are incorporated by reference into this ICD and are readily available to users, configuration managed/archived, and subject to the same review and approval process as the ICD document as a whole. Refer to the following link for IDDs:

https://confluence.oceanobservatories.org/display/CICG/Home

3.1.1 General Notes

The following general notes apply to all of the remainder of this document.

- The scope for OOI as implemented with CI software Release 2 includes automated control of some OOI assets through command and control software systems provided by CI, and operated by marine operators. Most control of OOI CG developed assets includes human marine operators in the loop.
- In future software and system development, CI will add the capability for closed-loop mission planning and control of OOI assets through command and control software systems provided by CI, and operated by marine operators and other authorized users. This may extend down to individual OOI assets such as gliders, AUVs, subsurface moorings, and shore-side OMC infrastructure.
- Where the following sections refer to data file exchanges to define platform/component descriptive data or command data, these files are generally (but not always) text based, listing attribute keyword-value pairs, delimited in some simple way (e.g. comma separated text or spreadsheet). The format and content of these files are documented in this ICD (either directly or by reference to other documents).
- All networked OMC components reside on the common OOI network and in common facilities provided by the various host institutions. Because resources (e.g. network, power, cooling, and the NTP service) in these facilities and on these networks are common across all resident systems, they fall outside the scope of this ICD. If some specific electrical or mechanical characteristic is required for an interface defined in this ICD, that specific capability will be identified. In general however, mechanical and electrical interface characteristics will be defined in each of the three OMC Facility Specifications.

3.1.2 Data Types

This ICD refers to several classes of data shared between CG and CI. The following define each of these classes.

- Resource/platform/component descriptive data – Description of the platform/component configuration including instrument types, serial numbers, depth on mooring, calibration parameters; and associated attributes such as who developed the data and state of the data (proposed, complete but not implemented, implemented in lab, deployed).
- Command data – Commands, command scripts, and associated attributes such as when a command is scheduled to be implemented and who issued the command.
- Instrument data – Data produced by the platform instruments, associated time tags, and attributes identifying the specific source instrument.
- Engineering data – Data describing the operational status of the system components; most of this is generated by the system, but some will be generated by humans.
- Metadata – Data describing the data. Metadata are data describing a resource, whether this is a physical resource like an instrument or an information resource. These are generated internally by the CI, though often mined/derived from data passed from CG to CI.

3.1.3 Related CG-CI Interfaces and Interactions

Various interfaces and interactions defined in other documents are closely related to the OMC CG-CI interfaces defined by this ICD. These are discussed briefly below and in Appendix B of this ICD.

3.1.3.1 Platform Embedded CG-CI Data Interfaces

Interfaces between CG and CI developed hardware and software components embedded in the relevant surface platforms are defined in the CI-CG Platform Controller ICD (1132-00001).

3.1.3.2 Telemetry Link – CI Shore Components Interface

The transfer of data (instrument data, engineering data, and control data) between CI components deployed in CG-managed platforms and CI components ashore is accomplished via CG-managed telemetry links (such as FleetBroadband and WiFi). In all cases, the logical links established via these telemetry links are either CI-to-CI or CG-to-CG and as such these links are outside the scope of this ICD. Physical and electrical interfaces do exist between CI and CG components as indicated in Figure 2, but these are IP network interfaces that are also outside the scope of this ICD. The interfaces are described briefly in Appendix B of this ICD for reference.

3.1.3.3 CG Marine Operator – CI Software Tools

OMC-resident Marine Operator(s) interact with CI-provided software tools to:

- Manage platforms that contain CI embedded components and monitor all platforms
- Provide data that describe platform/component configuration
- Accomplish management/administrative tasks (e.g. Jira for trouble ticket management and Confluence for wiki document management)

These tools implement CG-CI interaction (CG operator using CI tools), but implementation of these interactions is entirely within CI scope (although marine operators play a role in defining the interfaces through the UX development process). The CI tools are described in the R2 User Experience Functional Design Specification (2130-00010) and R2 Workflow and User Stories (2130-00011) documents.

As an alternate to the CI GUI based control of CI-enabled platforms, command data and descriptive data can be provided from CG to CI in the form of Command/Mission Data files and Descriptive Data files. Submission of and access to these files are managed via CI GUIs using native operating system file access services.

Note – Additional COTS tools (e.g. Asset Management) are provided for in the scope of the Operations and Maintenance component of the OOI Program Management Organization. Related interactions are similar to interactions with CI provided COTS GUIs, and thus are likewise outside the scope of this ICD.

3.2 CG Data Server – CI Dataset Agent Interface

The CG Data Server – CI Dataset Agent Interface is the primary data interface between CG and CI at the OMC. All automatically generated platform related data files and many manually generated data files that are to be ingested, processed, and distributed by CI – including both near-real-time collected data (except those previously ingested by CI on marine platforms with a CI presence) and post-recovery collected data – are passed via this interface. For each data file type passed from CG to CI, a CI software Dataset Agent, running in a CI Acquisition Point CyberPoP server, is provided to ingest that file type.

3.2.1 Electrical

Does not apply (the physical interface is implemented using the common Ethernet network).

3.2.2 Mechanical

Does not apply (the physical interface is implemented using the common Ethernet network).

3.2.3 Logical/Data

CG provides to CI data files/streams that are collected from various sources as defined in the following subsections. CG collects all such data files/streams in the Data Server software component that runs in the Operations Management System/Data Server (OMS/DS) server at each OMC.

CG shall define a directory structure that is consistent with the range of data files to be provided and structured according to source platform, deployment, and component/instrument (see Appendix C). Where data files are collected from a Platform Shore Server provided by a COTS supplier, the subdirectory structure for those data files will mirror the directory structure defined by the COTS PSS software. Once defined, the file structure will be placed under formal configuration management.

CI shall define a location in their Acquisition Point Server file structure to serve as the root location for this data directory structure. CI shall provide non-root user write access for CG to this location such that CG can write to all elements of the data directory structure using generic Linux system capabilities (e.g. rsync).

When a new data file becomes available to the CG Data Server, that file is written by CG to the file structure in the Acquisition Point Server. CI will ingest those data and distribute them to subsequent users/processes.

The following subsections describe the various data sources and the classes of data files that are exchanged. The format, interpretation, and syntax of these files and any associated attributes (e.g., file names, timestamps, and tags) are documented in Interface Data Description (IDD) documents. These documents are incorporated by reference into this ICD and are readily available to users, configuration managed/archived, and subject to the same review and approval process as the ICD document as a whole. Refer to the following link for IDDs:

https://confluence.oceanobservatories.org/display/CICG/Home

3.2.3.1 COTS Platform Data Interface

Transfer of data files (instrument data, engineering data, and control data) to and from COTS platforms (glider, AUV, and profilers) is managed via vendor-supplied COTS software running on CG managed/ subcontractor implemented COTS Platform Shore Servers (PSS). Data files sent to or received from these platforms are collected by the PSS and made available to the CG Data Server.

3.2.3.2 CGSN Platform Data Interface – No CI Presence

Transfer of data files (instrument data, status data, and control data) to and from CGSN developed and managed platforms that do not incorporate embedded CI components are managed via CG developed and managed Platform Shore Servers (PSS). Data files sent to or received from these platforms are collected and made available to the CG Data Server.

3.2.3.3 Recovered Device Data Interface

In many cases, when deployed platforms/components are recovered, portable data storage devices (e.g. flash disks and USB flash drives) are physically removed from the recovered devices. Logged data (instrument data, control/status data, and engineering data) are extracted from those devices via COTS I/O devices, COTS software, and/or CG software running in the source platform type PSS. These data files are collected and made available to the CG Data Server.

3.2.3.4 CG Status Reporting to CI

A specific class of engineering data provided by CG is OMC system status. This status includes current operational state and any known/planned down-time/failures for all CG managed OMC components.

3.2.4 Error Handling and Recovery

All data file types provided by CG to CI via the CG Data Server–CI Dataset Agent Interface are delivered as received from the source (i.e. no reformatting, scaling, or error correction except as noted below). The intent is to provide data as received without alteration of any kind (the exception being error detection and correction inherent to the telemetry data links and shared networks).

If a consumer of data received from a currently deployed, active platform cannot resolve issues in a given received data file/data set, they have the option to request re-transmission of those data. In the case of platforms with a CI presence, the user may request CI to re-send those data. Whether CI can in turn request the data from a deployed platform depends on the policy governing telemetry to it. In the case of CG platforms with no CI presence, the CG Marine Operator can request re-transmission from the source

platform controller when an appropriate telemetry link is available. In the case of COTS platforms, re-transmission capability is dependent on the COTS system capabilities and appropriate telemetry link availability. In all cases, the data will be available from the source components after recovery.

3.2.5 Privacy and Security

This Interface is implemented via TCP/IP links using Virtual Private Network (VPN) tunnels designed to minimize external aggression risks. VPN tunnels are established from each OMC Data Server instance to each CI Acquisition Point Server. These VPNs are established by firewall appliances installed at each OMC site and each CyberPoP site.

The network, VPN tunnels, and firewall devices are managed by CI such that their configuration, management, and use are consistent with other such secure links in the ION network. System and user access to the interface and the data passed are managed according to the policies implemented in the OOI network. These management policies are outside the scope of this ICD.

User access to the systems at either side of the interface is managed according to policies imposed by the hosting facility/organization. These management policies are outside the scope of this ICD.

3.3 Direct CG Software Interaction with CI COTS Trouble Ticket Management

In addition to human interaction with the CI managed COTS Trouble Ticket Management tool, this tool and/or associated CI workflows provide a direct software interface to allow CG automated components to directly submit trouble tickets.

3.3.1 Electrical

Does not apply (the physical interface is implemented using the common Ethernet network).

3.3.2 Mechanical

Does not apply (the physical interface is implemented using the common Ethernet network).

3.3.3 Logical/Data

Any system with access to the OOI common network can submit a trouble ticket by sending an email to: helpdesk@oceanobservatories.org. The JIRA Trouble Ticket Management system will create a ticket using the subject line as the ticket subject, and text from the body of the email into the body of the ticket. JIRA then notifies appropriate individuals that the ticket has been created. The sender will receive a confirmation email message from JIRA. Subsequent emails to helpdesk@oceanobservatories.org with a subject line containing the assigned trouble ticket number will add new comments to the open ticket.

Note: CI plans to define a CGSN-specific email address and implement an appropriate workflow.

3.3.4 Error Handling and Recovery

Does not apply to this interface.

3.3.5 Privacy and Security

System and user access to the Trouble Ticket Management System interface and the data passed are managed according to the policies implemented in the OOI Network. These management policies are outside the scope of this ICD.

User access to the systems at either side of the interface is managed according to policies imposed by the hosting facility/organization. These management policies are outside the scope of this ICD.

4 Notes

Appendix A provides a collection of summary use case descriptions that illustrate how the interfaces documented in this ICD are employed. These use case descriptions do not constitute binding requirements, but rather are included to provide background on why the interfaces are defined as they are.

Appendix B provides for reference a discussion of various interfaces and interactions defined in other documents that are closely related to the OMC CG-CI interfaces defined by this ICD.

Appendix C, defines the data structure/tree that will be used in providing data files from the CG Data Server to the CI Acquisition Point Server.

Appendix D provides additional related system diagrams for reference.

Appendix A

A. CG-CI Interface Use Cases

The following use cases describe interactions between CG and CI components at the OMC sites. They address operation of platforms/components and handling of associated data files as enumerated in this ICD.

Note – We assume that the Ocean Observatories Initiative as a whole will develop at some point a comprehensive set of policies and procedures that describe the product life cycle of deployable platforms/components and the data associated with them. We further assume that these policies and procedures will identify specifically what data files are collected from what platforms/components at what stage(s) of the product life cycle of each (e.g. which data/metadata are collected during assembly/test/burn-in, deployment, operation, and recovery). This definition will drive the enumeration of platforms/components and associated data file types to be enumerated in this ICD.

A.1 User Definition of Platform/Component Descriptive Data and/or Control Data

Summary – Each time a deployable platform/component is assembled, tested, calibrated, and prepared for deployment; a detailed description of the platform/component is assembled and made available to all potential users of data from that platform/component. This descriptive information includes platform and deployment specific data such as instrument serial numbers, firmware versions, physical configuration of the platform/mooring, DCL instrument port configurations, calibration coefficients, default sampling strategies, and suchlike. Once the initial descriptive data set has been defined, whenever a platform/component configuration is changed, the descriptive data must be updated and made available.

When commands are to be issued to platform/component controllers in the deployed systems, command information is defined, packaged appropriately in a command/mission file, and transmitted to the platform to be interpreted and executed.

When OMC engineering data is to be reported by CG to CI, the data are assembled into a data file and made available.

In each of these cases, CG is responsible for providing descriptive, command/mission, or engineering data files. CI is responsible for ingestion and maintenance of this information and distribution to end users, including upload to platforms where CI components are embedded in the platform. Creation of these files can be accomplished either via CI managed GUIs (information is entered via the GUI and configuration files are produced using that information) or by direct editing of the files.

Note – In CI software release 2, platform/component command interactions via CI are limited to CGSN developed platforms with embedded CI components. In CI software releases 3 and 4, such command interactions will be extended to other platform types. To support such additional scenarios, this use case will need to be modified.

Note – Platform/component descriptive data associated with a component or set of components may be time-invariant or time-variant (relatively speaking; none of the descriptive data are completely invariant). Both classes can be associated with a specific component or set of components (i.e., a set defined by the unique identifier/serial number of each component). Invariant data are associated with the base characteristics of the component(s) and only change when component characteristics change in some significant/persistent way (e.g. a new version of embedded software is installed or an instrument is recalibrated). Variant data are associated with runtime configuration (e.g. data that describe the sampling strategy in use at some specific time) and as such may change relatively frequently. This use case addresses handling of both types of data.

Assumption – The format/structure of data files are as defined in this ICD (either directly or by reference to other documents).

Assumption – When configuration or command data are defined, those data may be retained in draft form, available for further update/editing. Such data are not released to the system and users until such release is approved by an authorized user.

Assumption – Descriptive data will initially be defined early in the platform/component life cycle and updated/modified/maintained over the entire life cycle. Any data collected from the associated platform/component will be identified/recognized and associated with appropriate metadata, including the associated platform/component descriptive data. Given that these data will change many times over the life cycle, such changes may relate to data that have already been collected and cataloged. Data/metadata management must be flexible enough to change data-metadata associations dynamically over time. CG is responsible for providing these descriptive data as they are defined or changed. CI is responsible for managing these data/metadata and maintaining data-metadata associations over the entire platform/component/metadata/data life cycle.

Actor – CG Marine Operator (MO)

Actor – CI GUIs

Actor – CI data, marine facility, and instrument management capabilities

Precondition – All required configuration/control information is available to the Marine Operator.

Precondition – All associated components are functioning normally and network connections are established.

Trigger – The configuration of a given platform/component has been completed prior to deployment, some change has been made to a platform/component that affects descriptive data previously provided to CI, or control data has been defined that must be transmitted via CI to embedded control components in the platform/component.

Step – The MO either creates a platform/component descriptive data file or control data file and provides this file to CI, or the MO enters descriptive/control data into the appropriate CI GUI. In the case where data files are used to access/edit/provide descriptive or control data, the GUI is used to identify files to be opened, saved, or copied via standard operating system mechanisms.

Step – CI ingests the data.

Step – The MO designates the data as releasable.

Step – CI releases the data for appropriate processing, logging, association with other data, transmission to the appropriate deployed platform/component, and/or use by authorized users.

Post condition – CI has received descriptive data and/or control data from CG as required to support platform operations and ingestion/processing of data from the described platform/component.

Variant – The descriptive/control data defined are initially identified as draft. The data are retained and the user may edit them via either the CI GUI or other appropriate file editing tools. When the data are ready for release, an authorized user declares the data releasable and they are released for action/distribution.

A.2 CG Provides Platform Data Files to CI

Summary – A new data file associated with a CGSN platform with no CI presence on the platform, or a COTS platform, is received by the CG Data Server. This new data file is transferred to CI.

Note – This method also serves as an alternate path for CGSN platforms with CI components present in the platform.

Note – Creation and transfer of data files happens at many points in the platform/component life cycle (e.g. development, test, calibration, deployment, upgrade, recovery, and decommissioning). Data may be collected at any stage and linked to the appropriate platform/component(s), associated data/metadata, collection date/time, and collection mechanism (e.g. direct collection in a lab, real-time collection via telemetry links, or collection from recovered memory devices after the end of a deployment).

Assumption – The format/structure of all data file types are as defined in this ICD (either directly or by reference to other documents).

Assumption – An OMC may be instantiated at either ashore site or shipboard. In either case, data files are collected by CG and transferred to CI as described below. In the shipboard case, the data files may be collected shipboard and forwarded later when appropriate network connectivity is available. In all cases, the data will be associated with the original source, the collection time, and the collection mechanism.

Actor – CG Data Server

Actor – CI Dataset Agent

Precondition – Required descriptive data are defined as documented in this ICD (either directly or by reference to other documents) and have been provided by CG to CI.

Precondition – CI has made available space in the CI Acquisition Point Server for all expected data for all active platforms and missions to be filed in a consistent structure based on their source, function, and date/time of generation. CG has access to write data to that directory structure.

Precondition – All associated components are functioning normally and network connections are established.

Trigger – A new data file becomes available on the Data Server. A new file becomes available when a platform data file is received by a PSS from a telemetry link or when a control data file is provided to the PSS to be forwarded to the platform. In either case, the data file is copied from the PSS to the Data Server.

Step – The CG Data Server identifies the newly received data file and provides it, as received from the source, to the CI Acquisition Point Server.

Step – For system diagnostic purposes, the Data Server checks the data file for correctness/consistency. If any data errors/degradations are detected/suspected, the problem and the scope of the data affected are reported to the OMC operators and to the CI to be logged and distributed.

Note – Any CG processing of platform data is for CG diagnostics only. The authoritative source for data distribution to end users, including those at CG and the OMCs, is CI. CI has responsibility for ingestion and distribution of data, including validation of data quality, calibration adjustments, and any required conversion to alternate formats to meet user needs.

Step – The Dataset Agent forwards the data file to subsequent CI processing as appropriate.

Post condition – CG and CI each have received and validated the original data file.

A.3 CG Provides Recovered Platform Data to CI

Summary – One or more platform/component(s) are retrieved from deployment. Through various means, data files recovered from these platform/component(s) are forwarded to CI.

Assumption – The format/structure of all data file types are as defined in this ICD (either directly or by reference to other documents).

Assumption – An OMC may be instantiated at either ashore site or shipboard. In either case, data files are collected by CG and transferred to CI as described below. In the shipboard case, the data files may be collected shipboard and forwarded later when appropriate network connectivity is available. In all cases, the data will be associated with the original source, the collection time, and the collection mechanism.

Actor – CG Data Server

Actor – CI Dataset Agent

Precondition – Required descriptive data describing the source platform(s) for the recovered data are defined as documented in this ICD (either directly or by reference to other documents) and have been provided by CG to CI.

Precondition – All associated components are functioning normally and network connections are established.

Trigger – One or more data-bearing platform/component(s) is/are recovered from deployment.

Step – Any data files extracted before or after recovery from retrieved platform/component(s) by the shipboard recovery team are copied to the CG Data Server from the appropriate PSS.

Step – For recovered platform/component(s) without a native external communication capability, portable data storage devices (e.g. flash disks and USB flash drives) are physically removed from the recovered devices.

Step – Logged data files (instrument data, engineering data, and control data) are extracted from those devices via the appropriate PSS and copied to the Data Server.

Step – The CG Data Server identifies the newly received data file and provides it, as received from the source, to the CI Acquisition Point Server.

Step – For system diagnostic purposes, the Data Server checks the data file for correctness/consistency. If any data errors/degradations are detected/suspected, the problem and the scope of the data affected are reported to the OMC operators and to the CI to be logged and distributed.

Note – Any CG processing of platform data is for CG diagnostics only. The authoritative source for data distribution to end users, including those at CG and the OMCs, is CI. CI has responsibility for ingestion and distribution of data, including validation of data quality, calibration adjustments, and any required conversion to alternate formats to meet user needs.

Step – The Dataset Agent forwards the data file to subsequent CI processing as appropriate.

Post condition – CG and CI each have received and validated the original data file.

A.4 Trouble Ticket Creation – Manual

Some condition is identified by an operator that must be reported as an alert to system users and maintainers or reported to initiate corrective action. A user creates an email using a CG-provided email client, enters the relevant information, and submits the trouble ticket for action by sending the email to the JIRA Trouble Ticket Management system.

A.5 Trouble Ticket Creation – Automated

Some condition is identified by an automated system component (e.g. OMS) that must be reported as an alert to system users and maintainers or reported to initiate corrective action. The system component that identified the condition feeds the relevant information to the trouble ticket system via email, resulting in the submission of a trouble ticket for action.

A.6 OMC Fail-over

Some event occurs which causes all or part of an OMC to go off-line, breaking the nominal data collection path for one or more platforms. Both CG and CI systems/operators recognize the failure and reconfigure data paths and processing chains to restore full system functionality. The CG OMC components report the failure and reconfiguration as engineering data to CI along with any available estimate of data loss or corruption.

A.7 Joint CG/CI Mission/Cruise Planning

While not yet defined in CI software release 2, software releases 3 and 4 will add capabilities to support mission and/or cruise planning. These capabilities will likely require interaction between CG and CI people/tools. In some future release, this ICD will be updated to include additional use cases to describe this interaction.

A.8 CI Initiation of Unscheduled Telemetry Link

In normal operation, all IP links between CI shore components and CI components embedded in a platform are initiated by the platform-embedded components. If for some reason a CI user needs to initiate an unscheduled link via the telemetry system, the user will have to request establishment of such a link manually. At present, there is no plan to implement an automated/programmatic path to request such a link. The CI user will have to contact the CG operator manually and the operator will have to request manually (via Short Burst Data (SBD) message) the platform to power-up the telemetry link and establish contact with shore components. The SBD message is initiated via an email to the Iridium telemetry ground station and so, if policy allows, could be initiated directly by the CI user.

Appendix B

B. Related CG-CI Interactions

Various interfaces and interactions defined in other documents are closely related to the OMC CG-CI interfaces defined by this ICD. These are discussed here briefly for reference.

B.1 Telemetry Link – CI Shore Components Interface

The transfer of data (instrument data, engineering data, and control data) between CI components deployed in CG-managed platforms and CI components ashore is accomplished via CG-managed telemetry links (FleetBroadband and WiFi). In all cases, the logical links established via these telemetry links are either CI to CI or CG to CG and as such they are outside the scope of this ICD. Physical and electrical interfaces do exist between CI and CG components as indicated in Figure 2, but these are IP network interfaces that are also outside the scope of this ICD as discussed below.

The primary link used in normal operations is the FleetBroadband satellite link. This link supports a nominal maximum rate of 128 kb/s. In practice however, the maximum usable throughput is significantly less than this due to weather and other operational limitations, limits on available power, and financial constraints. In normal operation, this link is scheduled to operate on a part-time basis and is physically powered-off when not in use to save power.

A WiFi link is used when the platform is physically close enough to the shore/ship based system components (e.g. during lab testing, deployment, and recovery). The usable throughput of this link is limited only by link characteristics and physical environment conditions (e.g. distance between transmitter and receiver and shielding effects of the ship hull).

The net data throughput is a scarce resource that must be managed. It is important for CI and CG to coordinate use of the available throughput for these interfaces. CG and CI must establish in their respective operations plans some approach to allocation of this critical resource as constrained by the available bandwidth, connection time, and payload budget. These operating policies are outside the scope of this ICD.

The hardware and software interfaces between CG telemetry links and the CI components embedded in the deployed platforms are defined in the CI-CG Platform Controller ICD (1132-00001).

The hardware and software interfaces between CG telemetry links and the CI components ashore (in the OMC and elsewhere) are implemented via IP on the common OOI network.

B.2 CG Marine Operator – CI Software Tools

The OMC-resident Marine Operator(s) interact with CI-provided software tools to:

- Manage platforms that contain CI embedded components and monitor all platforms
- Provide data that describe platform/component configuration
- Accomplish management/administrative tasks (e.g. Jira for trouble ticket management and Confluence for wiki document management)

These tools implement CG-CI interaction (CG operator using CI tools), but implementation of these interactions is entirely within CI scope (although marine operators play a role in defining the interfaces through the UX development process). The CI tools are described in the R2 User Experience Functional Design Specification (2130-00010) and R2 UX Workflows and User Stories (2130-00011) documents.

As an alternate to the CI GUI based control of CI-enabled platforms, command data and descriptive data can be provided from CG to CI in the form of Command/Mission Data files and Descriptive Data files. Submission of and access to these files are managed via CI GUIs using native operating system file access services.

Note – Additional COTS tools (e.g. Asset Management) are provided for in the scope of the Operations and Maintenance component of the OOI Program Management Organization. Related interactions are similar to interactions with CI provided COTS GUIs, and thus are likewise outside the scope of this ICD.

B.2.1 Platform Command and Platform Status Monitoring via CI GUIs

The OMC resident Marine Operator(s) interact with CI provided GUI tools to manage platforms that contain CI embedded components and to monitor all platforms. Development of this interaction is entirely within CI scope (although marine operators play a role in defining the interfaces through the UX development process). The CI GUIs are described in User Experience Functional and Detailed Design Specifications, UX Workflows, Wireframe, and User Stories documents.

These platforms can also be monitored and managed via CG assets. This capability is entirely within CG scope and is not discussed in detail in this ICD. It is the responsibility of CG to ensure that all relevant command and status data exchanged via CG assets are logged and forwarded to the CI to be ingested and distributed. Similarly, if an operator makes any changes to the system configuration via CG assets that affects the platform data streams, the operator is responsible for reporting any changes in the corresponding Platform Descriptive Data if those changes are not reflected in the automatically collected and reported command and engineering data.

B.2.2 CG Provision of Platform Commands to CI via Command/Mission Files

As an alternate to the GUI based control of platforms that contain CI embedded components described in section B.2.1 above, command data can be provided from CG to CI in the form of Command/Mission Data files.

B.2.3 CG Provision of Platform/Component Descriptive Data to CI via CI GUIs

The OMC resident Marine Operator(s) interact with CI provided GUIs to provide data that describe platform/component configuration. Development of this interaction is entirely within CI scope. The CI GUIs are described in User Experience Functional and Detailed Design Specifications and in UX Workflows and User Stories documents.

B.2.4 CG Provision of Platform/Component Descriptive Data to CI via Data Files

As an alternate to the GUI based definition of data described in section B.2.3 above, data can be provided from CG to CI in the form of data files.

B.2.5 CG Marine Operator Use of CI COTS Software Tools

The OMC resident Marine Operator(s) interact with CI managed COTS software tools to accomplish management/administrative tasks (e.g. Jira for trouble ticket management and Confluence for wiki document management).

Appendix C

C. Exchanged Data File Directory Structure

As described in Section 3.2, CG will define a directory structure for data files to be passed from CG to CI and CI will define a location in their Acquisition Point Server file structure to serve as the root location for this data directory structure. This Data File Directory structure is defined in:

Attachment A, 1132-xxxxx_OMC_CG-CI_ICD_Attachment_A (latest released version)

This structure is expected to mature and evolve as the system design matures. This data file directory structure is incorporated by reference into this ICD, configuration managed/archived, and subject to the same review and approval process as the ICD document as a whole.

C.1 Directory Structure Notes

The data tree structure is organized by platform. Each individual instance – individual in space and time – of each platform type will have an associated branch of the tree. In its current form, the structure for each platform type is given once with the names of the several platforms of that type listed after the generic form at the top of the list. As an example, for CPM/DCL based surface moorings (the first class of platforms listed), a generic platform name of platform_nnnn is listed, followed by CP01CNSM and the 11 other names of the specific instances of this platform type.

In addition to the deployable platforms, the data tree definition includes entries at the platform level for each of the OMCs to allow for collection of engineering, status, log, and alert data files produced by the OMCs. Similarly, the structure includes branches that include “ad hoc” data collected by users of the system. This ad hoc data space allows users to collect and document any data that is not automatically collected (lab notes, photos, ship logs, etc.) and define how these files should be linked to the other collected data.

Each platform type includes three sub-branches; Dnnnnn, Rnnnnn, and Xnnnnn. These are included to allow for separation of the data collected while the platform is operationally deployed (Dnnnnn); data collected after the platform is recovered (Rnnnnn); and data collected while the platform is being built-up, calibrated, and tested prior to deployment and reconditioned after deployment (Xnnnnn). It is important to note that data in each of these three groups may be very similar or even identical. For example, it is generally true that all data sent to shore during deployment is also saved on the platform and collected manually from the platform after recovery. While the data in these two cases may be identical, they may be captured in files with different formats and names and will be saved in different branches of the data tree.

The names of many file types listed include date/time information tags. The resolution of these tags depends on the collection mechanism and rate. For example, if a data log is saved hourly, then the name will contain date and time in hours. If the log file is saved daily, the name will include only date, and so on.

Use of nnnn in file names below is a placeholder for a unique identifier/serial number.

yyyy is a placeholder for year.

mmdd is a placeholder for month and day.

hhmmss is a placeholder for hours minutes seconds.

Appendix D

D. Reference System Diagrams

The following figures provide additional reference background information for the implementation and operation of the OMC and the associated CG-CI interfaces.

Figure 3 describes the OMC resident component class structure and describes the high-level information flow.

Figure 4 describes the primary data flows through across the OMC resident components and the associated platforms.

Figure 5 summarizes the telemetry link types and interconnects.

Figure 6 describes the overall OOI interconnect structure, including description of which platforms interact with which OMC.

Figure 3 – OMC Product Hierarchy

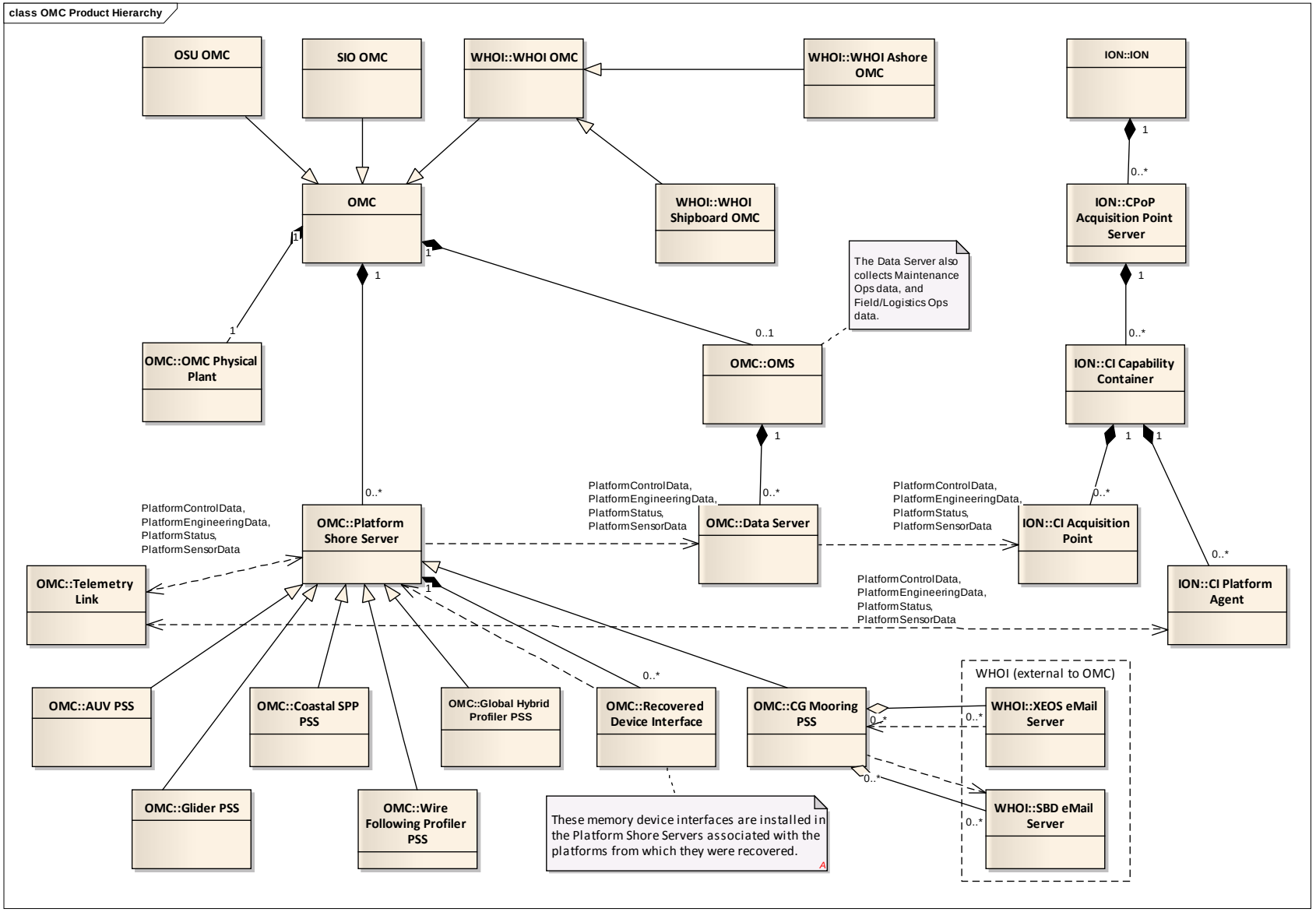


Figure 4 – CG-CI Interface Data Interactions

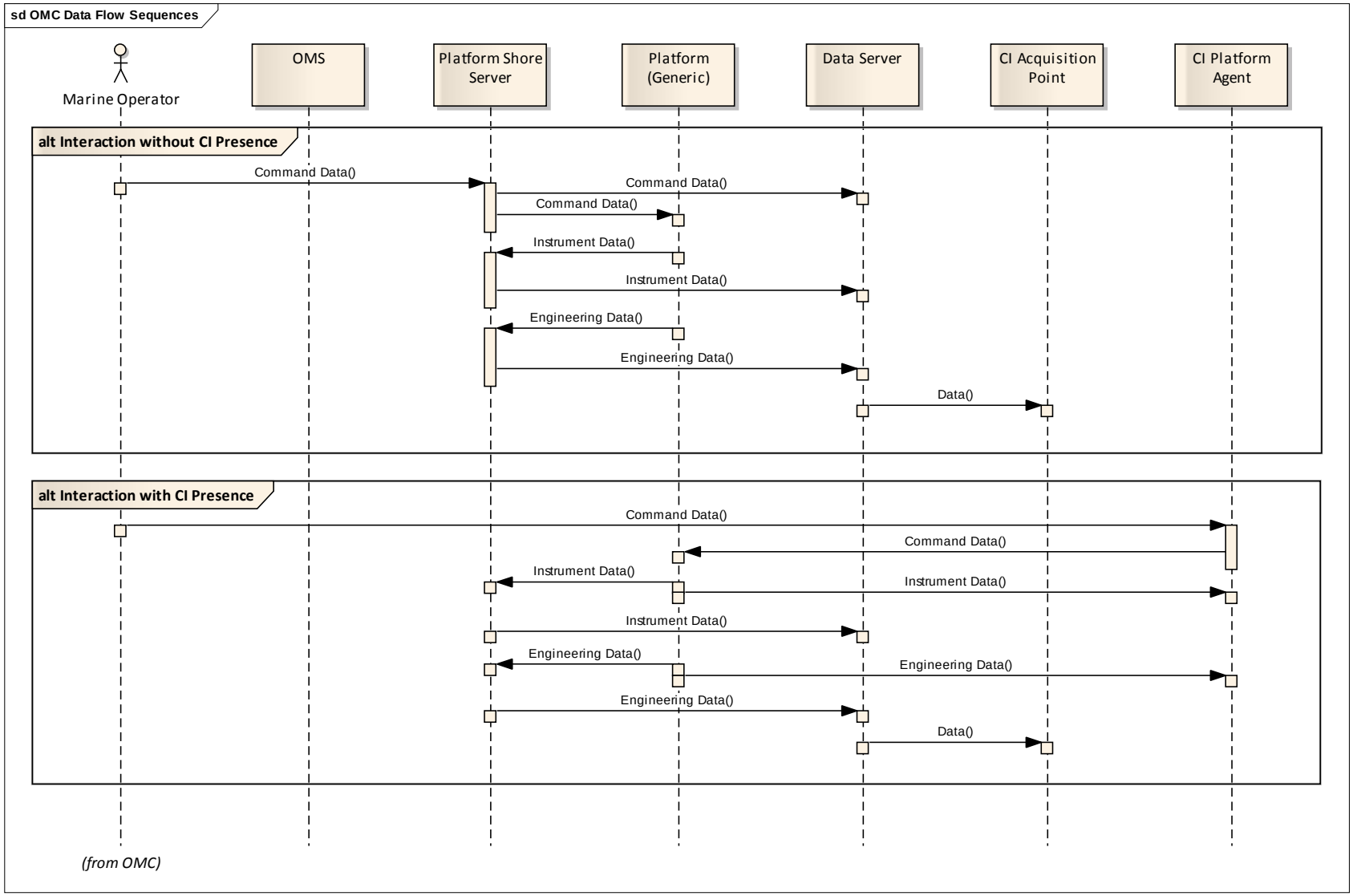


Figure 5 – Telemetry Link Summary

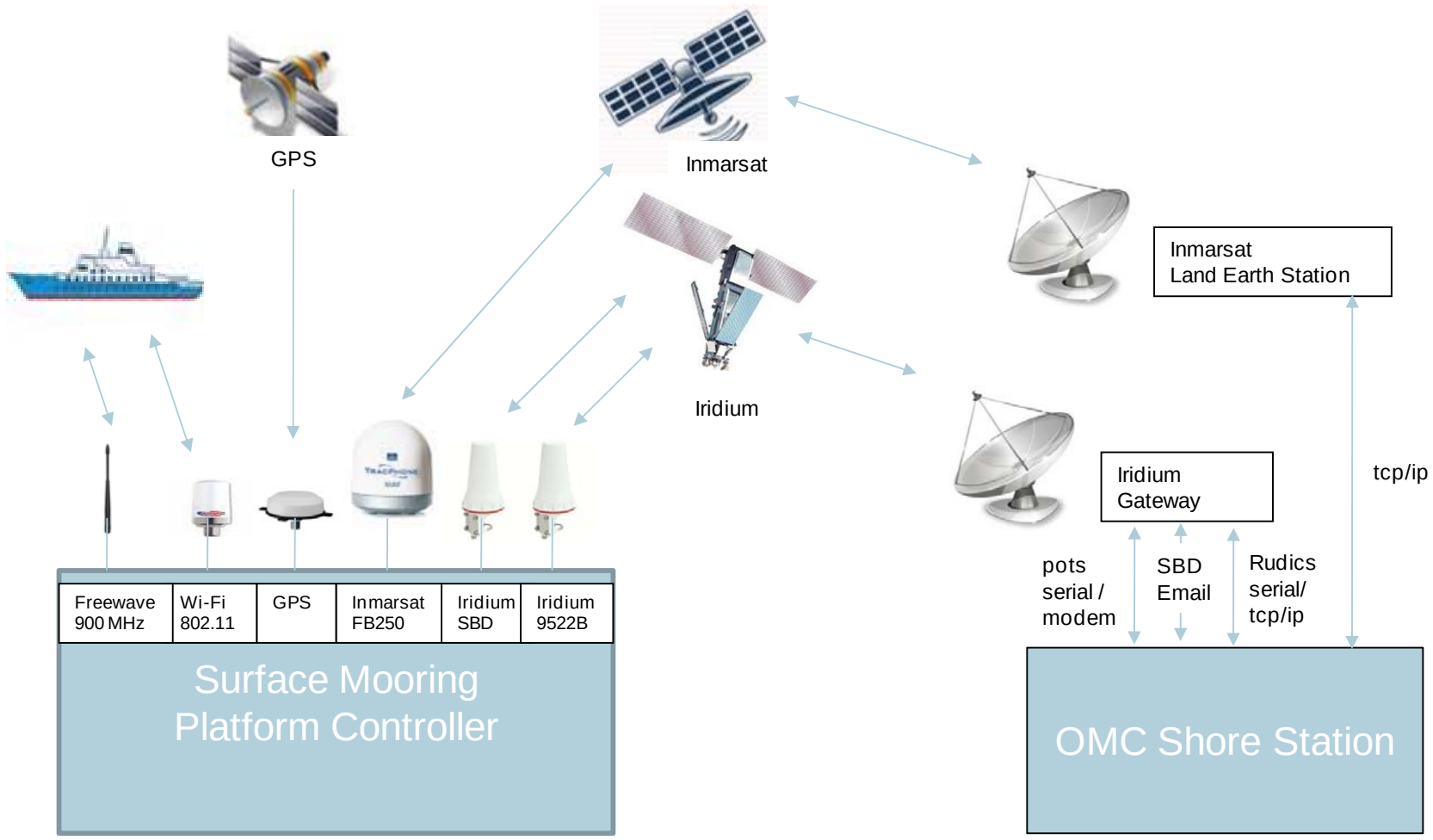


Figure 6 – WHOI OMC Configuration Summary