OOI CyberInfrastructure
Conceptual and Deployment Architecture

• CI
Overview

- Goals and Objectives
- From Requirements to Architecture
- OOI-CI Services Architectural Pattern
- Logical Architecture
- Domain Models
- Example Deployment Scenario
**Goals and Objectives**

- Provide a consistent, structured, up-to-date representation of the OOI CI architecture and design
  - include operational views, as required by users and decision makers,
  - include deployment and process views, required by CI implementers and subsystem architecture and design teams.
- Establish a common terminology and integrated architecture
- Provide a preliminary design as a decision point for the OOI about future program development
- Establish a basis for implementation of the CI subsystems
  - In compliance with stakeholder requirements
  - As expressed by the User Requirements Document, System Requirements Document and Concepts of Operations
  - Cost-effective scalable solution
Integrated Requirements and Architecture Design Process

- Business Processes, Use Cases, User Stories, Requirements, Risks
- Domain-Driven Architecture Design
- Architecture Document DoD Af
- Implementation

OCEAN OBSERVATORIES INITIATIVE
Requirements

Req. Categories:
• Integration and Interfacing
• Resource Management, Data Storage and Data Management
• Data Analysis, Modeling and Dissemination
• Presentation and User Interfaces
• Documentation and Development Process
• Security, Safety and Privacy Properties
• Quality Properties
Requirements to Architecture

OOI System Requirement

1. OOI will enable powerful new scientific approaches by transitioning the community from expedition-based data gathering to persistent, controllable observations from a suite of interconnected sensors.
# Requirements to Architecture

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Design

- Persistence:
  - Data Services Network
- Control:
  - Control Services Network
  - Common Operating Infrastructure
- Observations:
  - Modeling Services Network
  - Control Services Network
  - Data Services Network
- Networked Sensor Grid:
  - Instrument Services Network
  - Common Operating Infrastructure
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Requirements to Architecture

1. OOI will enable powerful new scientific approaches by transitioning the community from expedition-based data gathering to persistent, controllable observations from a suite of interconnected sensors.

b) A migration path shall be established, from expedition-based data gathering to persistent, controllable observations from a networked sensor grid

Design
- Open SOA based architecture
- Stepwise introduction of capabilities over staged releases
DoD Architecture Framework

AV - All Views  OV - Operational Views  SV - Systems Views  TV - Technical Views

**Architecture & Design**

- AV-1: Overview & Summary
- AV-2: Dictionary

**Conceptual Architecture**

- OV-1: High Level Concept Graphic
- OV-2: Operational Node Connectivity
- OV-3: Operational Information Exchange Matrix
- OV-4: Organizational Relationships Chart
- OV-5: Operational Activity Model
- OV-6: Operational Activity Sequence and Timing Descriptions
- OV-7: Logical Data Model

from AV-1
DoD Architecture Framework

**AV**-All Views  **OV**-Operational Views  **SV**-Systems Views  **TV**-Technical Views

- **SV-1**: Systems, Nodes & Interfaces
- **SV-2**: System Communications
- **SV-3**: Systems-Systems Matrix
- **SV-4**: Systems Functionality Description
- **SV-5**: Operational Activity to Systems Function Traceability Matrix
- **SV-6**: Systems Data Exchange Matrix
- **SV-7**: Systems Performance Parameters Matrix
- **SV-8**: Systems and Services Evolution Description
- **SV-9**: Systems Technology Forecast
- **SV-10**: Systems Functionality Sequence and Timing Description
- **SV-11**: Physical Schema

**Network Design**

from AV-1
Highlights of OOI CI Capabilities

• Common Operating Infrastructure (COI)
  – Integration platform, communication conduit, orchestration, cross-cutting issues including identity/policy/governance
• Common Execution Infrastructure (CEI)
  – Transparent execution environment on flexible compute infrastructure
• Data Network
  – Federated data, metadata and its preservation via data streams, repositories and catalogs
• Control Network
  – Management of stateful and taskable resources
• Modeling Network
  – Coherent frameworks for modeling, analysis, and consumption of data
• Processing Network
  – Resource access & scheduling of computations/execution
• Instrument Network
  – Interactive and coordinated access to instrument platforms & instruments
OOI-CI Services Architectural Pattern
Instrument Services Network (high-level & in context)

Adapted from Figure 4 of OV2
Detailed Model of an Instrument Platform

Source figure: Exhibit 13 of Ov7 - Instrument Platform
Candidate Deployment for CI

Geographical Location
- Water
- Shore Side
- Land

Candidate Sites for Cyber Points of Presence
- Operational Authority
- Cyber Operator

Instrument Platforms
- Instrument Interface
- Observatory Node

Shore Side Operations
- Marine Net
- INTERNET

Research Laboratory
- Teragrid and OSG Provider

Individual
- Team
- Community
Candidate Deployment for CI

Instrument Platforms
Instrument Interface
Observatory Node

Shore Side Operations

Research Laboratory

Geographical Location
- Water
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Candidate Sites for Cyber Points of Presence
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Teragrid and OSG Provider
Cyberinfrastructure Operations

Marine Operator

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INTERNET

Researchers
Thank you
Internals of a CyberPoP Network Design Scenario

Deployment Concerns:
- Security
- Performance
- High-availability
- Scalability
- Offsite Mgmt
- Scheduling
- Resource Mgmt