An Approach for Establishing and Managing Strike and Battle Group Compositions Across Disconnected, Intermittent and Limited (DIL) Naval Networks

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Provide an Integrated ASW Common Tactical Picture hosted in the CANES Common Computing Environment

The Common Tactical Picture (CTP) is defined as providing situational awareness with such timeliness and accuracy that would facilitate an overt action on the part of a commander up to and including engagement with weapons.

Operational Need
Provide an ASW Common Tactical Picture Across the ASW Enterprise which:

- Increases Situational Awareness
- Reduces Operator Workload
- Enables Improved Mission Planning, Search Execution, ASW Track Management and ASW Battle Management

*Capt. Davis & PEO-IWS5 Briefing, Jan 2009

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Definitions

Platform = an installation of USWDSS on a ship or shore site

Composition = set of ships that are not only aware of one another’s platforms and specific IP addresses but also share a single AOI

Compositions logically map to battle groups, strike groups, tactical federations, etc...

Area of Interest (AOI) = Area of Responsibility (AOR)

Force Management (FM) = Common IP Management (CIPM)
The Need for Force Management

- Duplication of IP addresses throughout subsystems
  - Increased human error
  - Unnecessary labor
  - Reduced usability

- Lack of ability to associate an Area of Interest with a composition

- Uncoordinated cross-hull communications
  - Initial, incremental step

- Transition from a system-of-systems to an integrated solution
Force Management Basics

- Each ship has a platform
- Each platform has a set of subsystems
- Each subsystem has an IP address

FM allows the creation and management of compositions and their IP addresses
FM allows the association of an AOI to a composition and subsequent management

1 FM is focused on cross-hull communicating subsystems
2 In most cases
Force Management Capabilities

- Enables subsystems to ask an authoritative software service for:
  - Peer IP information
  - AOI
  - Network and composition connectivity status

- FM is **not** involved with **how** or **why** subsystems communicate

- SOAP-based web service

- User interface for real-time management

- Initially Developed for USWDSS Build 2
Architecture Overview

USWDSS Platform

Tomcat

FM Web Application

USWDSS Subsystem 1

USWDSS Subsystem 2

USWDSS Subsystem 3

Swing-based

Axis2 SOAP Interface

Java

FM Web Application

USWDSS Subsystem 1

ADNS
Architecture Details

- Three-Tier Architecture (Presentation, Business Logic, Data)
- Multithreaded
  - Heartbeats
  - Synchronization
  - Acknowledged Message Responses
- Supports both synchronous and asynchronous communications
- Event-driven notifications for clients
- Role-based design; finite state machine
  - Composition Controller
  - B1 Participant
  - B2 Participant
  - Theater
  - Non-USWDSS Participant

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Role-Based Details

- Composition Controller (CC)
  - Manager of the group. This platform gathers information on each participant and shares it with the other composition members. Information is considered impeccable; it is consumed without question.

- B1 Participant (B1P)
  - Supported for Mission Planning subsystem; there are no other communications.

- B2 Participant (B2P)
  - Standard composition member. Most participants will utilize this role.

- Theater (T)
  - Enables membership in multiple compositions.

- Non-USWDSS Participant (N)
  - Used for logical inclusion of additional ships/shore sites; there are no actual communications
Representative Use Case and Scenarios

• User is tasked with creating a composition

• User enters single controller, $n$ participants and AOI

• FM subsystems on each platform share IP, AOI information

• GUI is updated with network, composition connectivity

• Notify clients as:
  • Participants are added, deleted
  • Controller changes ownership
  • AOI changes
  • Composition is disbanded
Benefits

- Ability to logically group ships/shore sites together
  - Simple user interface for administration, maintenance
- Remove duplicative IP, AOI information
- Clients are able to improve their own capabilities, such as track management, readiness data sharing
- Move toward unified cross-hull communications
  - Improved information exchange within DIL networks
Challenges and Resolutions

- No framework for fault tolerant cross-hull communications
  - Implemented robust message passing verification techniques
- Broad-spectrum method for asynchronous events
  - Incorporated web service callbacks to clients
- Unit and Integration testing was time consuming, complex, error-prone
  - Instituted JUnit and automated builds; over 1000 tests
Next Generation Capabilities

• Decompose roles into fine-grain privileges
  • Current design cannot separate tactical vs. topological concerns

• Automatically detect and cache peer USWDSS platforms
  • Identify based on trigraph, location
  • Sensitive to DIL network issues

• Improve AOI visualization
  • Shared Geo interface

• Operate as a consumer of a new cross-hull comms management subsystem
  • Intelligent information management (e.g. App-level compression)
Potential Future Technologies

- Web-based GUI
  - GWT, Ruby on Rails
- RESTful Web services
- Semantic Web
- Service Oriented Architecture (SOA) Components
  - Enterprise Service Bus (ESB)
Thank You

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