NORTH ATLANTIC TREATY ORGANIZATION
SCIENCE AND TECHNOLOGY ORGANIZATION

Multi-INT Simulation for the Hybrid Threat

Steven Webster

KINEX, INC.

James L. Bowman III

Software Engineering Directorate, Joint Technology Center / System Integration Laboratory

Kirby Thomas

Headquarters Department of the Army, G-2

Douglas Paul

Night Vision and Electronic Sensors Directorate

Hybrid Threat Simulation Challenge

- **Hybrid Threats: "posed by adversaries, with the ability to simultaneously employ conventional and non-conventional means adaptively in pursuit of their objectives"**

- **Few Malicious Actors in Large Populations**

- **Kinetic and Non-Kinetic Activities**
  - ➢ Maneuver and Electro-Magnetic Signatures
  - ➢ Cyber Content

- **Activities Masked by Patterns of Life**

- **Extended Engagement Times**

- **Discrimination of Intent**

Simulation Applied to Intelligence Process
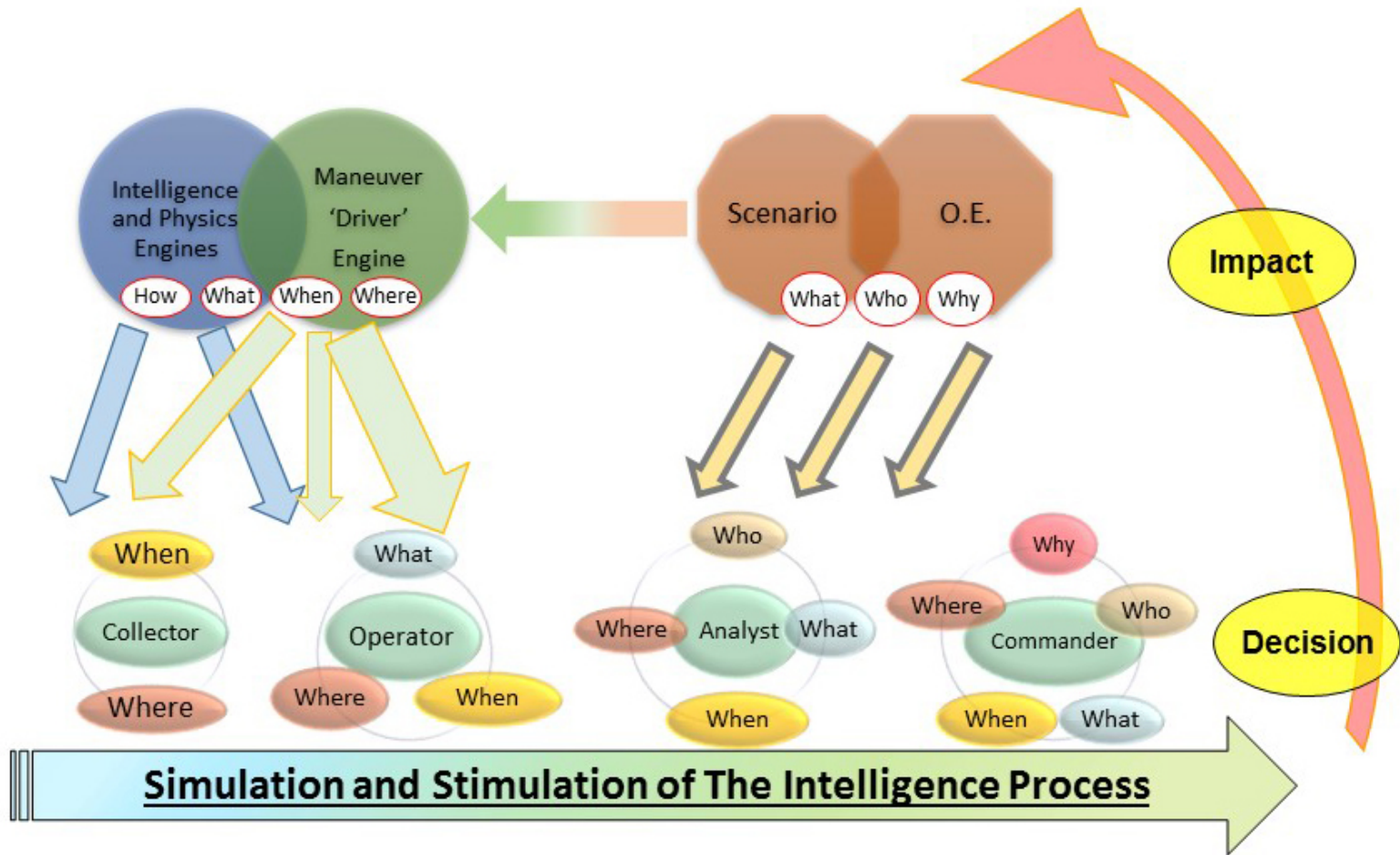
Multi-INT Simulation

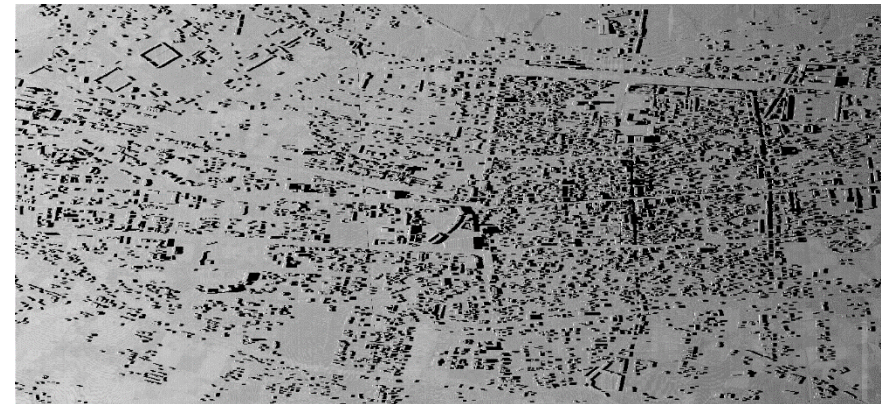- **Configurable Aerial Platforms**
  - ➤ Unattended: (MUSE)
  - ➤ Manned: Commercial Crew Procedural Trainer (CPT)
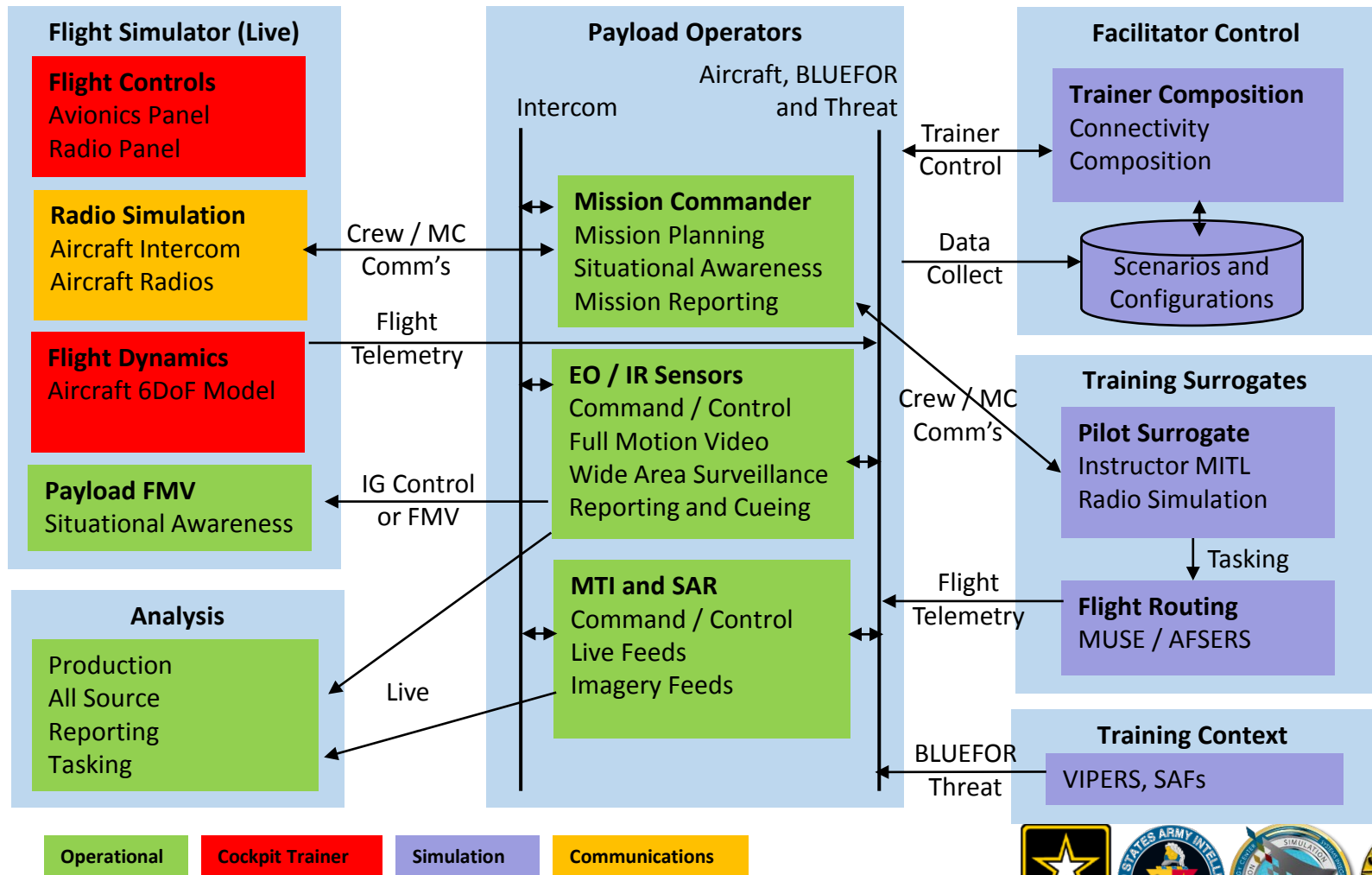
- **Configurable Sensor Payloads**
  - ➤ EO/IR (NVIG): STANAG 4609
  - ➤ GMTI (MUSE) and Tracks: STANAG 4607 / NATO-EX
  - ➤ LiDAR (In Progress): LAS / LAZ
  - ➤ SAR (NVIG): NITF

- **Standard Maneuver "Drivers"**
  - ➤ SAFs, VIPRS, …

Collective Training Use Case

Flight Simulator (Live)

| Flight Controls |
| Avionics Panel |
| Radio Panel |

Radio Simulation
Aircraft Intercom
Aircraft Radios

Flight Dynamics
Aircraft 6DoF Model

Payload FMV
Situational Awareness

Analysis

Production
All Source
Reporting
Tasking

Payload Operators

Aircraft, BLUEFOR
and Threat

Intercom

Mission Commander
Mission Planning
Situational Awareness
Mission Reporting

EO / IR Sensors
Command / Control
Full Motion Video
Wide Area Surveillance
Reporting and Cueing

MTI and SAR
Command / Control
Live Feeds
Imagery Feeds

Crew / MC Comm's

Flight Telemetry

IG Control or FMV

Live

Facilitator Control

Trainer Composition
Connectivity
Composition

Trainer Control

Data Collect

Scenarios and Configurations

Crew / MC Comm's

Training Surrogates

Pilot Surrogate
Instructor MITL
Radio Simulation

Tasking

Flight Routing
MUSE / AFSERS

Flight Telemetry

Training Context

VIPERS, SAFs

BLUEFOR Threat

| Operational | Cockpit Trainer | Simulation | Communications |

Intelligent Software Design

- **Ease of Use**

- **Reduced Configuration Time**

- **Open Architecture**

- **Interoperable Protocols**

- **Distributed Control**

- **Industry Standard SW Processes**

- **Load Distribution**

- **Componentization**

- **Service Oriented Architecture**

- **Correct Transport Protocols**

NORTH ATLANTIC TREATY ORGANIZATION
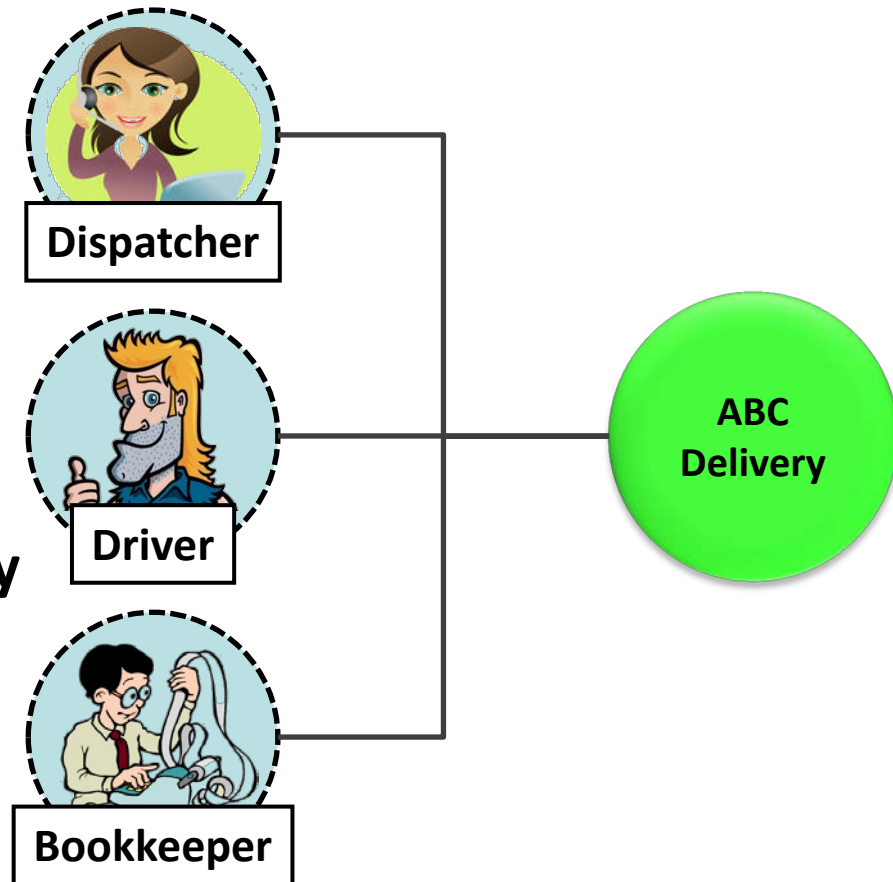SCIENCE AND TECHNOLOGY ORGANIZATION

Why SOA?

- **Design Principles**
  - ➤ Service Contracts
  - ➤ Loose Coupling
  - ➤ Reusability
  - ➤ Autonomy
  - ➤ Discoverability
- **Facilitates Remote Accessibility**
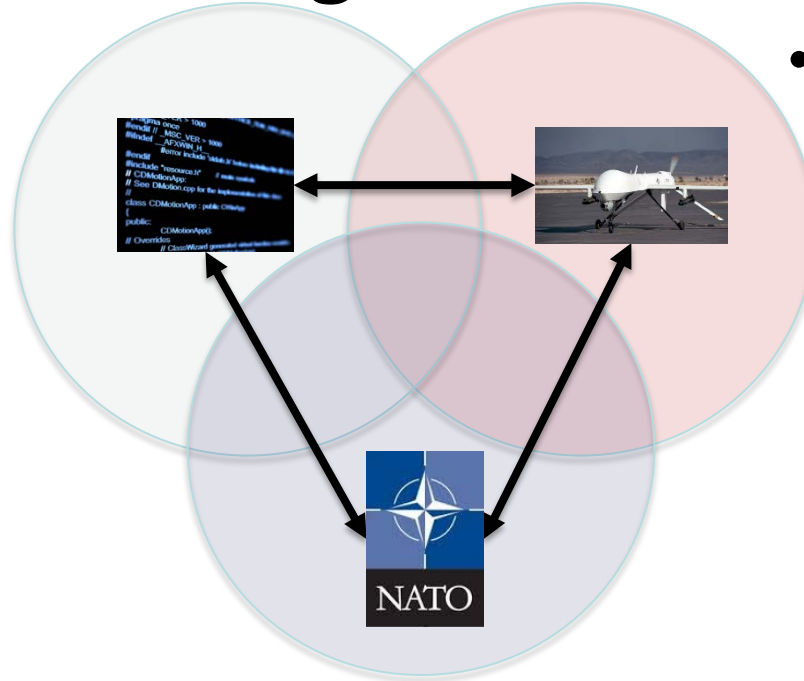 - ➤ Application
  - ➤ Web Interface

Dispatcher

Driver

Bookkeeper

ABC Delivery

Adapted from *SOA: Principles of Service Design* (Erl, 2007)

NORTH ATLANTIC TREATY ORGANIZATION
SCIENCE AND TECHNOLOGY ORGANIZATION

Technological Intersection

Design Principles

➢ SOA

➢ Reqs & Repos

➢ Components

➢ GOTS Net Tools

➢ COTS Tools

Operational

➢ Exercises

➢ UAS Trainers

➢ R&D

➢ FMS

➢ DMO

➢ Command & Staff Training

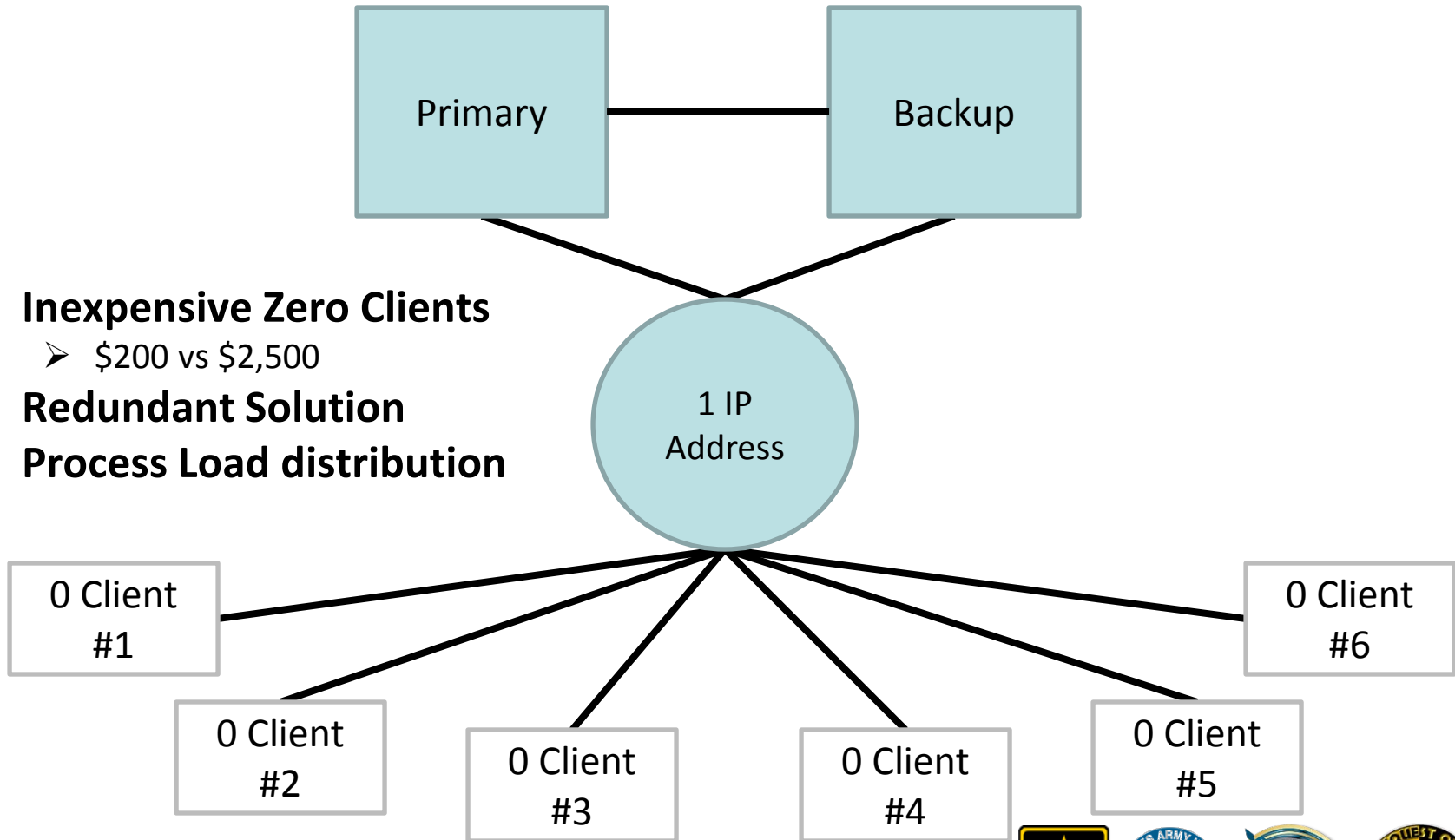**Standards**

➢ 4609 (FMV w/KLV)

➢ 4586 (C2)

➢ 4607 (GMTI)

➢ 4545 (NITF)

NORTH ATLANTIC TREATY ORGANIZATION
SCIENCE AND TECHNOLOGY ORGANIZATION

Virtualization: VDI

Primary

Backup

- **Inexpensive Zero Clients**
  - ➤ $200 vs $2,500
- **Redundant Solution**
- **Process Load distribution**

1 IP Address

0 Client #1

0 Client #2

0 Client #3

0 Client #4

0 Client #5

0 Client #6

Large Packet Processing Mitigation

DIS Input

>1.3 million entities

Entity State PDUs

Entity State PDUs

NetLink

WES Server

WES Client

PDUs

Aggregate RoI

- *TCP/UDP*
- *PDU Routing*
- *Load distribution*
- *PDU debugging*
- *PDU archive/playback*

Organic RoIs

Entity State PDUs

NetLink Archive

Sensor Operators

Non-Entity State PDUs