Incorporating C2-Simulation Interoperability Services Into an Operational C2 System

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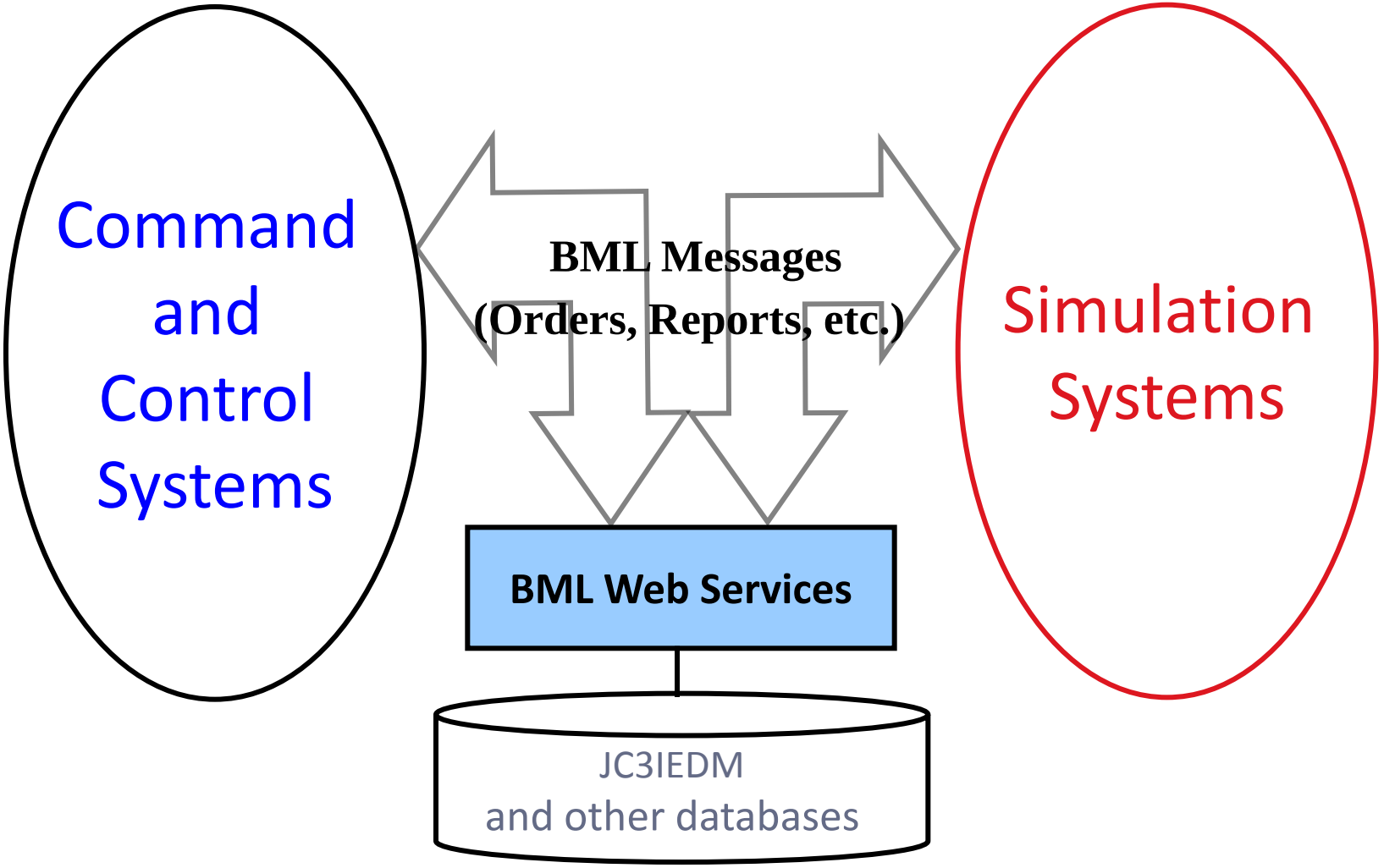
Presentation Overview

- Introduction/overview
- Standards for C2-Simulation Interoperation
- Scripted BML Server
- WISE
- C2 for Initial Demonstration
- Simulation for Initial Demonstration
- Conclusion

Introduction/Overview

- Goal: interoperation of C2 systems with simulations
  - Shown by MSG-048 to have high potential value
  - Coalition training, COA evaluation, mission rehearsal
  - A focus of Simulation Interoperability Standards Organization
- Growing standards base for C2-sim interoperation
  - Military Scenario Definition Language (MSDL): initialization
  - Coalition Battle Management Language (C-BML): tasking and reporting
  - Intended to work together for use by international coalitions
- Adopted model requires a server
  - All systems push initialization, orders and reports into server
  - Server distributes them to systems that subscribe
  - Supports late joiners by responding to queries

Generic BML Architecture



BML: Definition

BML - an unambiguous language to:

Command and control live and simulated forces conducting military operations, and

Provide for situational awareness and a shared, common operational picture.

Shared Semantics between C2 and M&S via a Common Tasking Description

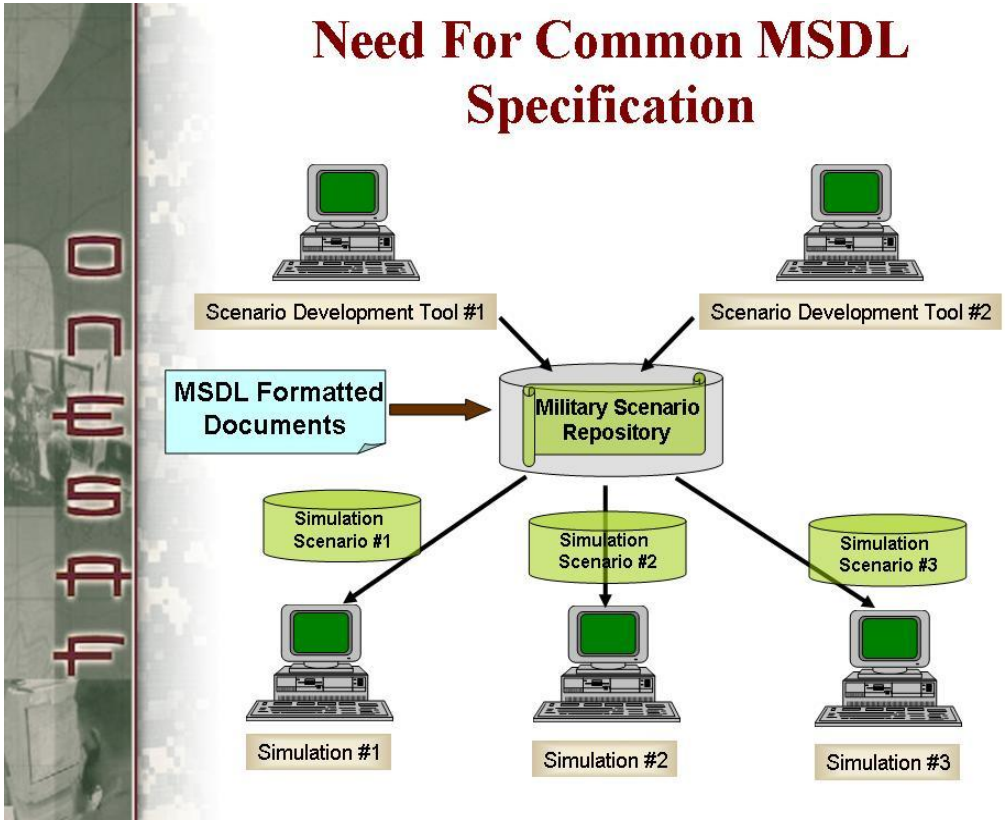
MSDL Background

- Grew out of need in US Army OneSAF program
  - Reduce scenario development time
  - Re-use resulting scenarios
- XML-based military scenario format
  - Designed for use by current and evolving simulations
  - Prototyped within OneSAF 2001-2004
  - Spawned SISO Study Group
  - Product Development Group chartered 2006
  - SISO MSDL v1.0 standard approved 2008

Why Use MSDL

Import Format versus Native Format

- **Allows MSDL and specific simulation initialization native formats to evolve at their own appropriate pace.**
- **Allows simulations to define specific information needs.**
- **Allows consistent scenario starting point for specific simulation initialization**



MSDL Data Components

- Geographic Region of Interest
- Force/Sides
- Units
- Equipment
- Installations
- Overlays
- Graphics
- Military Operations Other Than War

C-BML Background

- Purpose: provide a common, agreed-to format for exchange of Orders/Requests/Reports between C2 and simulation systems
- Implemented using a repository where participating systems post and retrieve XML documents
  - Extended to publish/subscribe for efficiency
- SISO study group 2005
- Product development group chartered 2007
  - Phase 1 Standard package balloting completed 2013
- Development informed by NATO Technical Activities MSG-048 and MSG-085

MSDL/C-BML Convergence

- Task Organization definition
  - Also called Order of Battle (ORBAT)
  - Multiple competing formats exist
    - Including MSDL and C-BML
  - MSDL has a standard and implementations
  - C-BML does not address in Phase 1 Standard
    - Could use MSDL standard
  - Alternative: define units in JC3IEDM
- Requirements:
  - Name and type of each unit (including map icon)
  - Identify superior/subordinate unit relationships

MSDL/C-BML Convergence

- Tasking definition
  - Describes actions to be carried out
  - With their interrelations
  - And control measures
- C-BML has well-developed draft based on MSG-048 experience
  - MSDL has only a placeholder; could use C-BML
- Tactical Graphics: icon and descriptive data
  - Existing MIL STD 2525C and NATO APP-6C are adequate - can support MSDL and C-BML

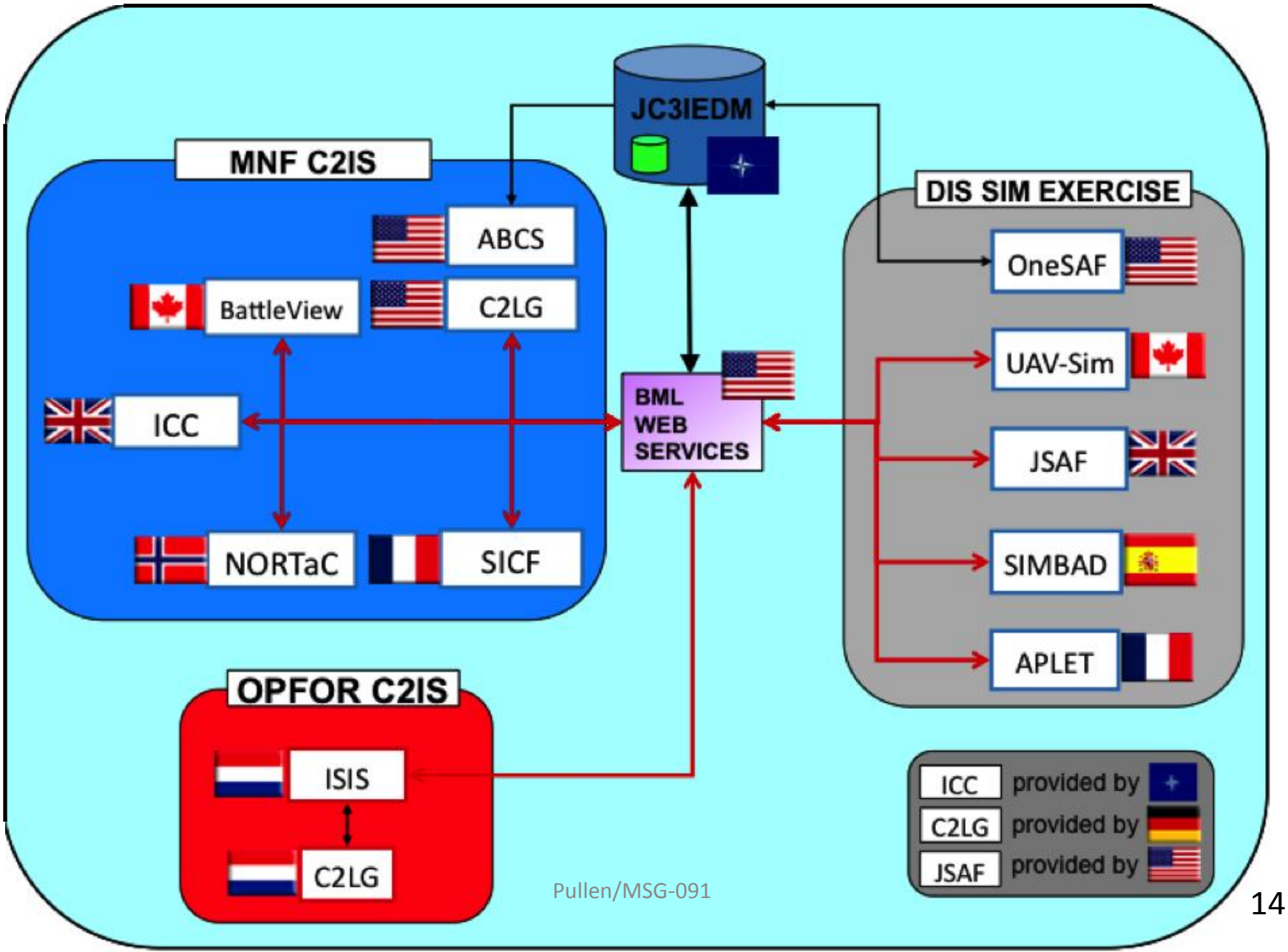
General Referencing Approach

- Defined across MSDL & C-BML development groups
- Evaluated in simulation federates (e.g. OneSAF)
- MSDL unique identifier that also is usable in C-BML and tactical Graphics
- Used in all C-BML expressions:
  - Orders, follow-on FRAGOs, Tasks, Requests, Reports
- MSDL instance document provides key for all references
- Initial results: approach works well

BML in NATO
Modeling and Simulation Group

- MSG has been nexus for BML cooperation
- US Joint BML project with France Aplet
  - Early demonstration 2006
  - Led to Exploratory Team 16
- MSG-048 Technical Activity started 2007
  - Demonstrations at I/ITSEC 2007 and 2008
  - One-week experimentation 2009 (9 nations)
- MSG-085 Technical Activity started 2010
  - Goal: operational use of MSDL/C-BML (11 nations)
  - Good progress toward final demonstration Dec 2013

MSG-048 2009 Architecture



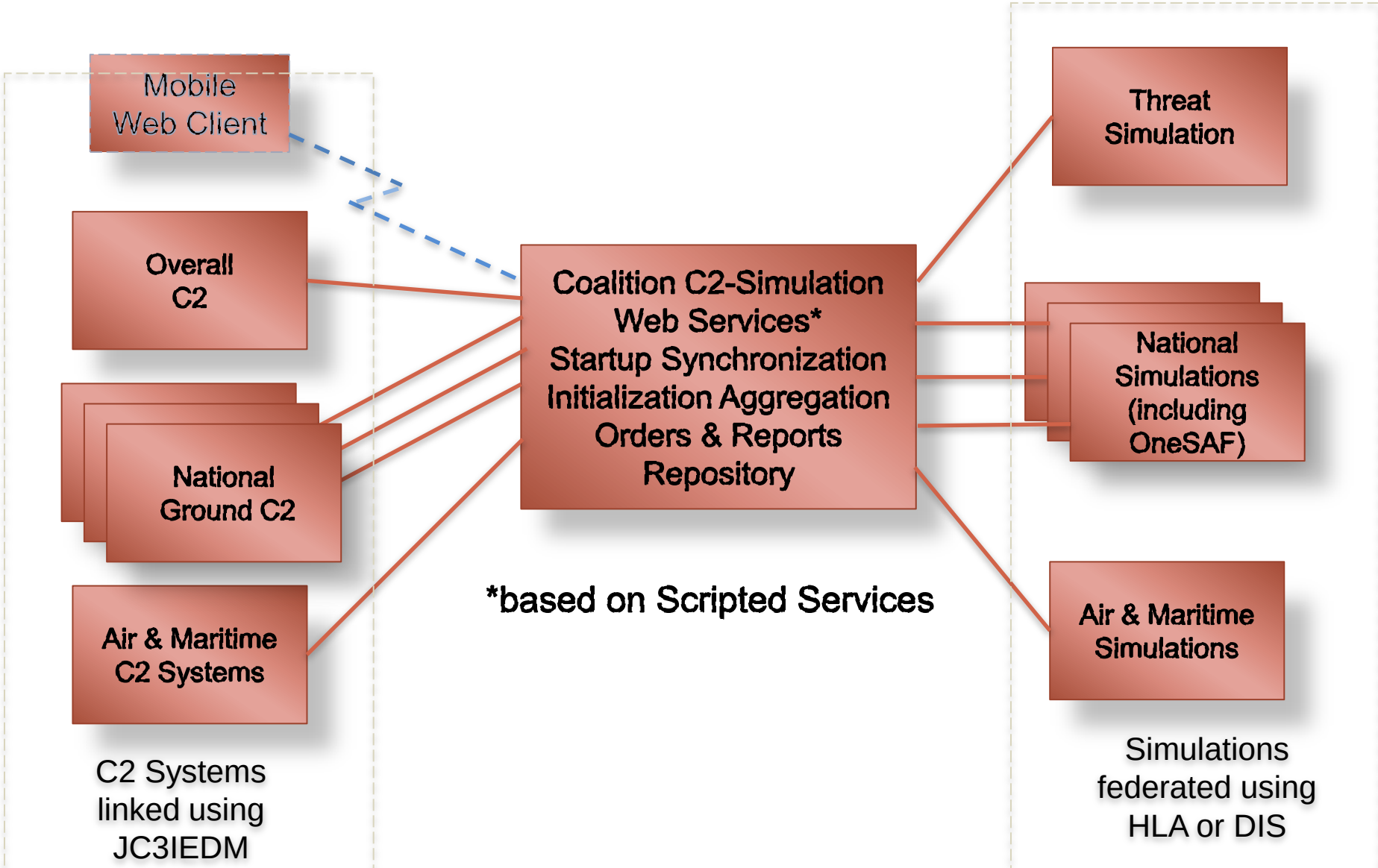
MSG-085 Mission Statement

*"Assess the **operational relevance** of *C-BML while contributing to C2-Simulation standardization and assist in increasing the **Technical Readiness Level** of *C-BML technology to a level consistent with **operational employment** by stakeholders."*

**Including the complementary use of MSDL for initialization*

Supporting Server Software

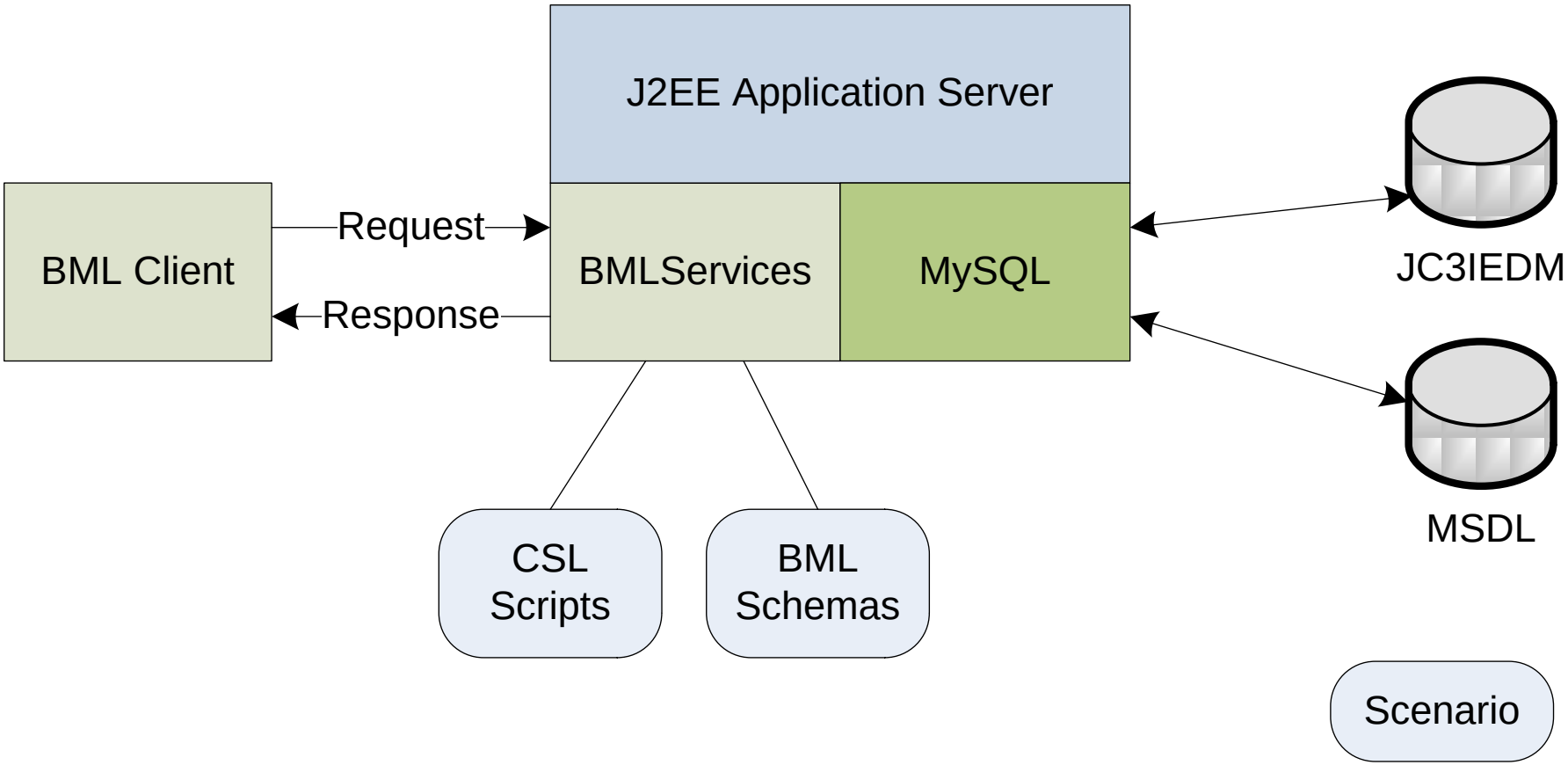
Coalition C2-Simulation Architecture



Scripted BML (SBML) Server

- Developed by GMU C4I Center to support coalition activities such as MSG-048
  - Open source
  - Offered reference implementation for SISO C-BML
- Scripted server concept
  - New constructs can be implemented rapidly
  - Changes to BML and JC3IEDM applied quickly
  - Reduced cost for experimentation prototyping
  - Script provides a concise definition of BML to data model mappings

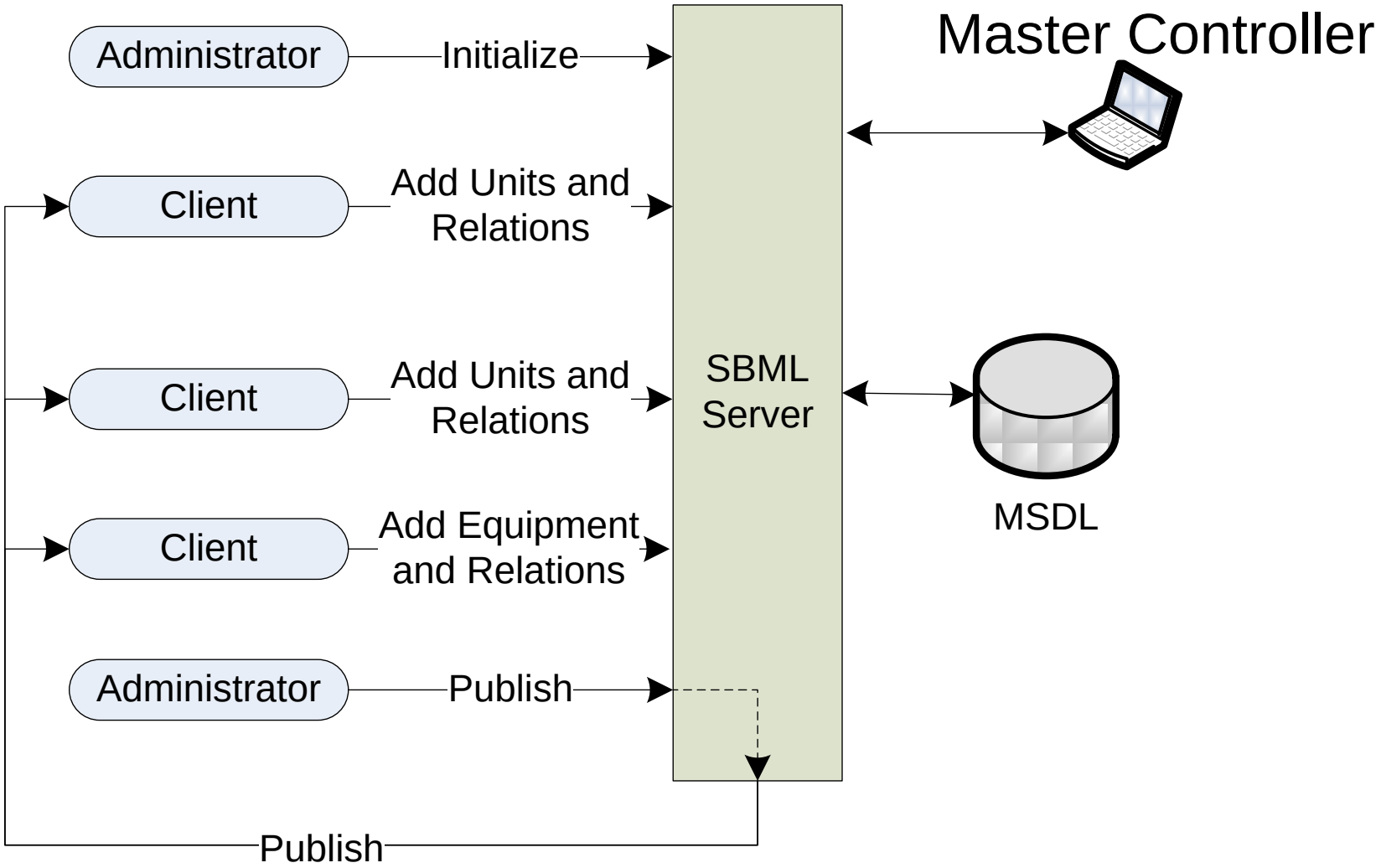
SBML Architecture



Adapting SBML to Support MSDL

- When multiple systems participate in a coalition their MSDL files must be merged
- Previously this has been done by hand
- GMU C4I team created a script to do it
  - Required one new script primitive
- Participating systems submit their MSDL prior to initialization
- Server merges it and publishes on command

MSDL Server Operation



New Demands on SBMLserver from MSG-085

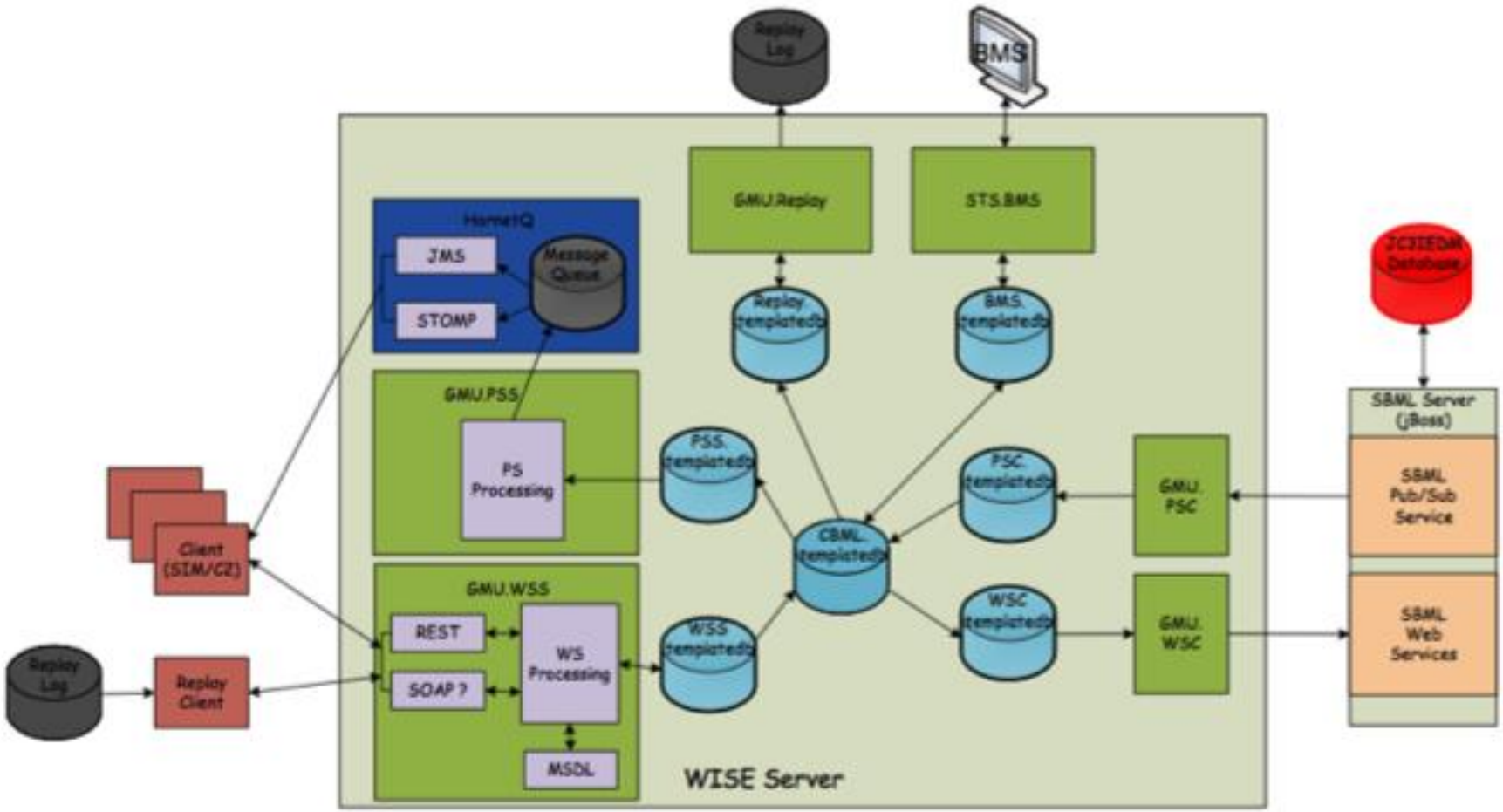
- Publish/subscribe for C-BML and MSDL
- Dynamic publish/subscribe based on XPATH
- Multithreaded RESTful service for increased performance
- Translation among dialects of BML
  - MSG-048 IBML and SISO C-BML
  - Others possible using common JC3IEDM database
  - Performance penalty: throughput divided by N

Implementing SBML in WISE

- Widely Integrated Systems Environment (WISE)
  - Generalized, high-performance commercial integration environment for C4ISR
  - Based around high-performance, in-memory database (not persistent)
- Integrating a system through WISE requires developing a software "driver" to interface it
- WISE contains supporting software and a graphic editor to accomplish buffering and distribution
- Drivers written in C++ for performance

Implementing SBML In WISE

- Saab is supporting GMU C4I Center research to show how to use WISE as BML server
  - And helpful advice when needed
- Architecture derived from SBMLserver
- WISE-SBML throughput at least 10x SBML
  - Makes schema translation practical
- Persistence achieved by logging inputs
- Logging also supports replay and checkpoint/restart
- Results will be posted as open source software
- Saab provides free WISE license for development



WISE Drivers

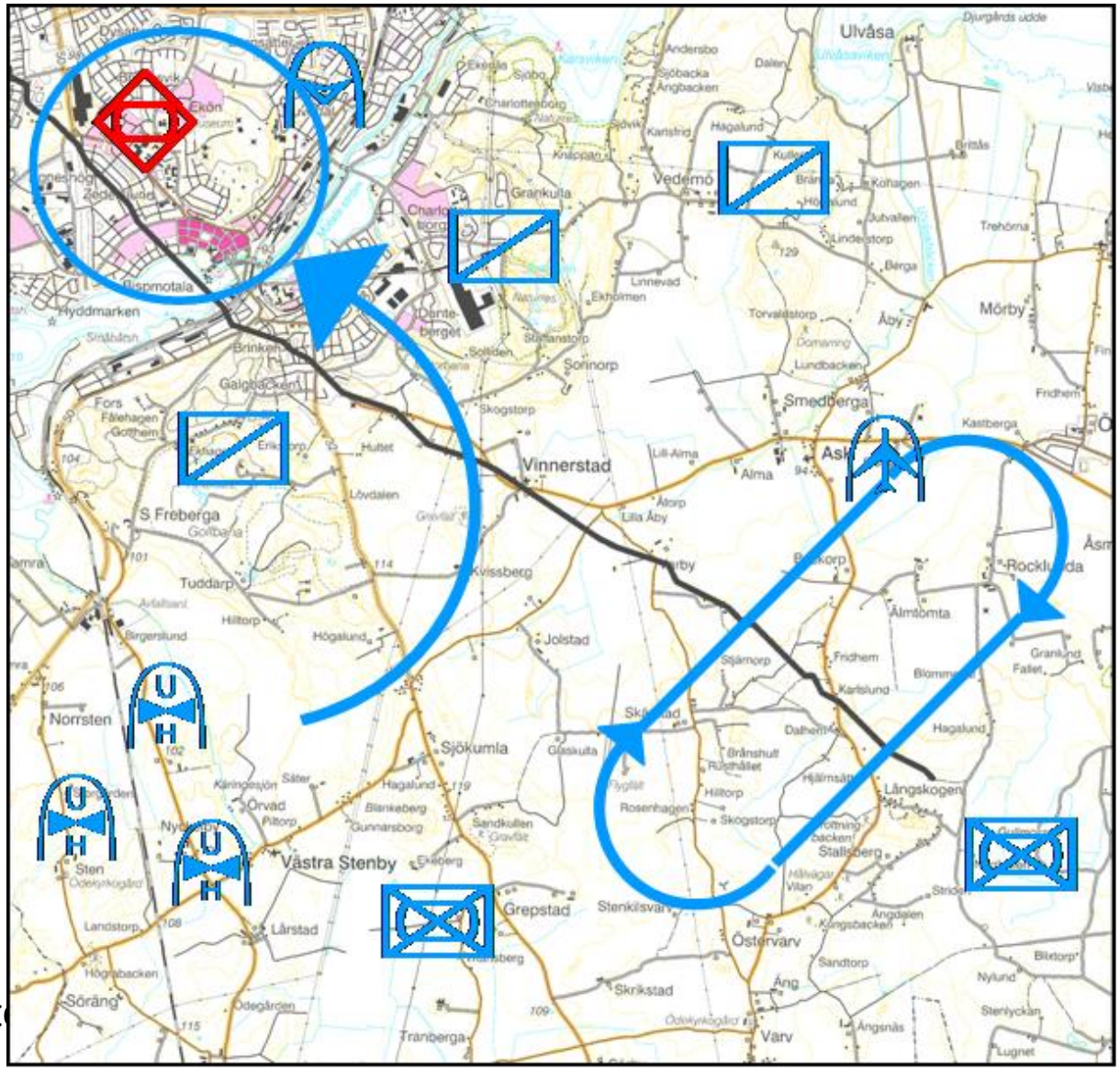
WISE Template DBs

PSS	Publish/Subscriber Server Driver
WSS	Web Services Server Driver
PSC	Publish/Subscriber Client Driver
WSC	Web Services Client Driver
JMS	Java Messaging Service
STOMP	Simple Text Oriented Message Protocol
REST	Representational State Transfer
BMS	SAAB 9LandBMS Battle Management System

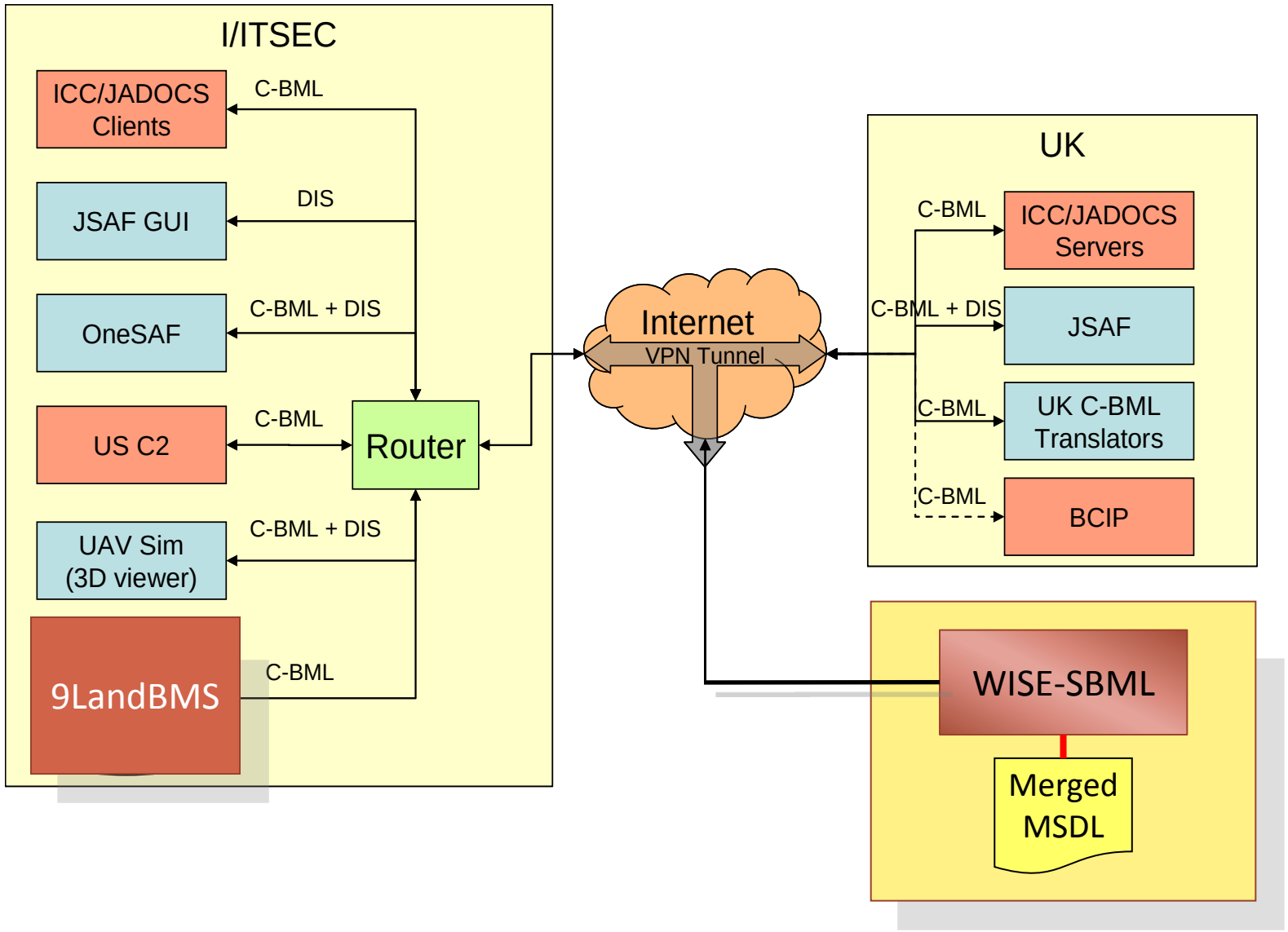
DSC
12/20/2012

Initial Demonstration of WISE-SBML NATO Booth – I/ITSEC 2012

MSG-085 I/ITSEC'12
Recce Vignette: Operational View



MSG-085 I/ITSEC 2012 DEMONSTRATION



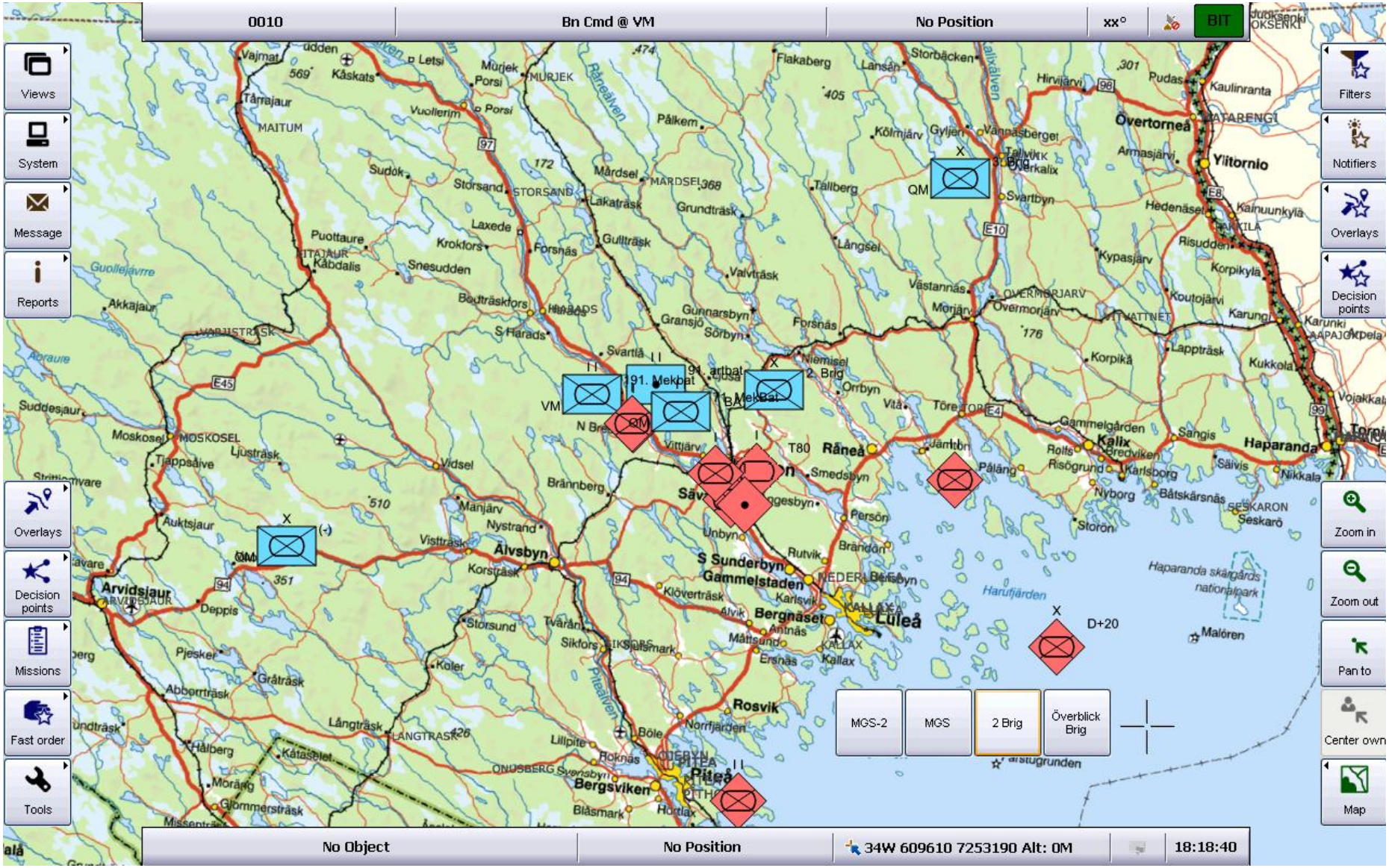
UK Operated Systems

- Located in Farnborough, England
- NATO Integrated Command and Control System (ICC)
  - Air component C2
- Joint Automated Deep Coordination System (JADOCS)
  - Joint battlespace C2 (linked to MSDL)
- JSAF entity level constructive simulation
  - Air simulation and perceived truth sensor

9LandBMS C2 System

- Saab commercial product intended for military market at battalion/brigade level
- Strong focus on agility and collaboration
- Supports theories of Integrated Dynamic C2 (Joseffson) and Planning Under Time Pressure (Thunholm)
- User perspective based on operational role
- Usable in wide range of environments from HQ to field deployment wearing gloves
- Previously interfaced to WISE
  - As result of WISE-SBML: MSDL/C-BML capable

9LandBMS C2 System



Simulation System: OneSAF

- US Army standard entity-level simulation with integrated command agents
- Enhancements for MSG-085 MSDL/C-BML:
  - Enhanced MSDL integration and 2525B code use
  - C-BML tasking capability
  - Ability to export orders from mission editor
  - Ability to connect to GMU Web-based coordination
  - Ability to send/receive MSDL to/from servers

Conclusions

- Operational deployment of BML requires industrial-strength infrastructure/performance
- Re-implementing SBMLServer in WISE is a big step toward meeting that requirement
- Combining GMU C4I Center experience and software skills with Saab integration technology has provided an important new capability for MSG-085
  - And ultimately for NATO coalitions