Advances in Systems and Technologies Toward Interoperating Operational Military C2 and Simulation Systems

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Presentation Overview

- Introduction: the need for C2SIM
- Early prototypes
- NATO MSG-048
- NATO MSG-085
- Future work
- Conclusions

NOTE: This is about capabilities, not experiments.

Introduction: The Need for C2SIM

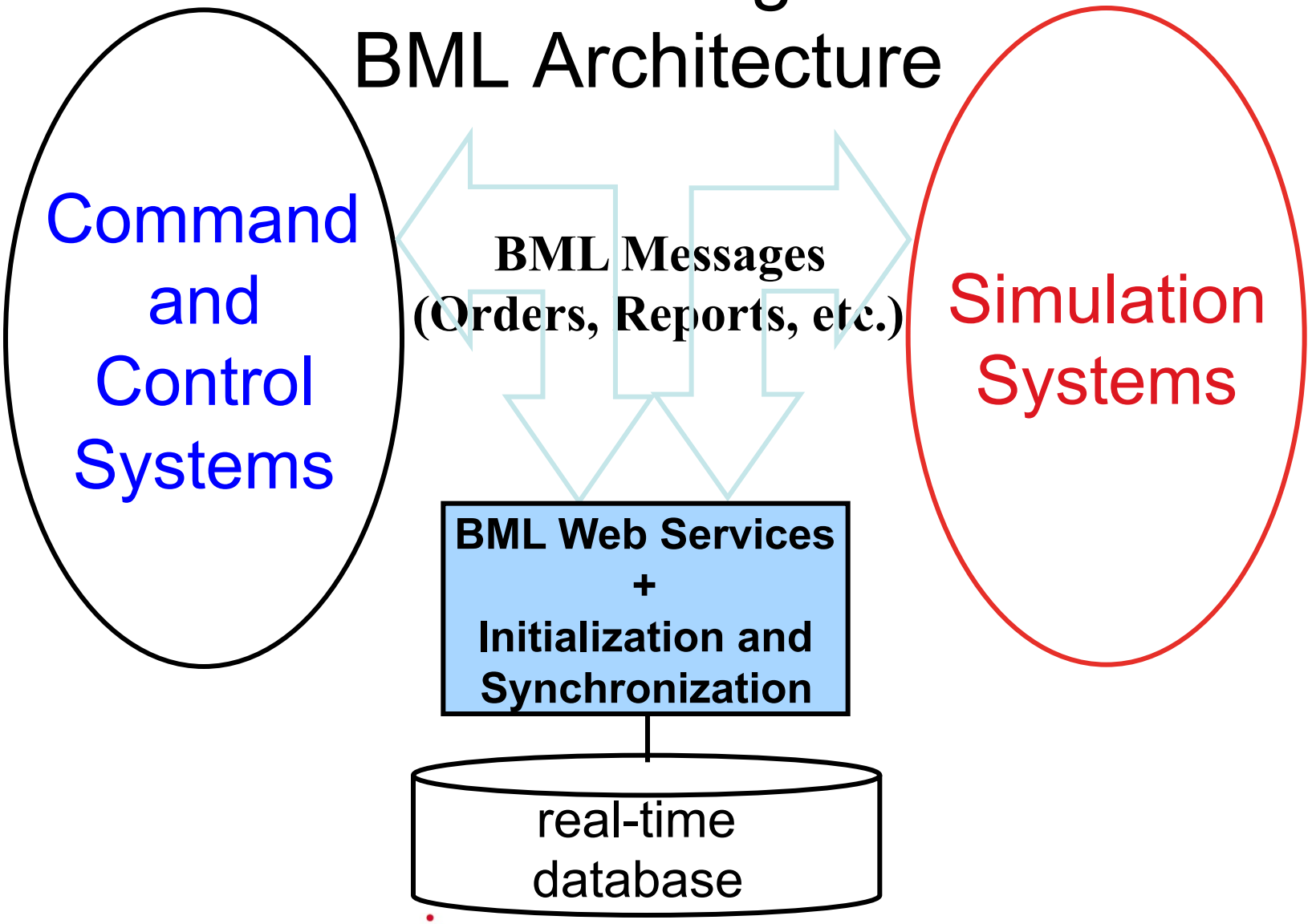
Vision

- We are working toward a day when the members of a coalition interconnect their networks, command and control (C2) systems, and simulations simply by turning everything on and authenticating, in a standards-based environment.
- This will be major step forward in C2 for coalition agility.

BML Purpose and Operation

- Facilitates C2-Simulation interoperation
  - Exchange of Orders and reports in standard format
- Current architecture uses a repository service to hold state submitted by client C2 and Simulation systems
  - Web service with XML input – Network Centric
  - Real-time database enables schema translation
- Now using SISO Coalition BML (C-BML) Phase 1 standard
- Mechanism for shared initialization of all systems required

Evolving BML Architecture



Roots of C-BML

USA

- "Train as you fight" requires using operational C2 systems as interface to simulations
  - Implemented with human "puckster" or "stove pipe" computer interface
- US Army SIMCI conducted a successful experiment to remove ambiguity at the C2SIM interface by replacing the free text of military orders and reports with a standardized vocabulary
- US Defense M&S Office supported a broad effort in Web technologies for interoperation
  - Including C2SIM based on MIP C2IEDM (now JC3IEDM)

Scope of SIMCI Experimental BML

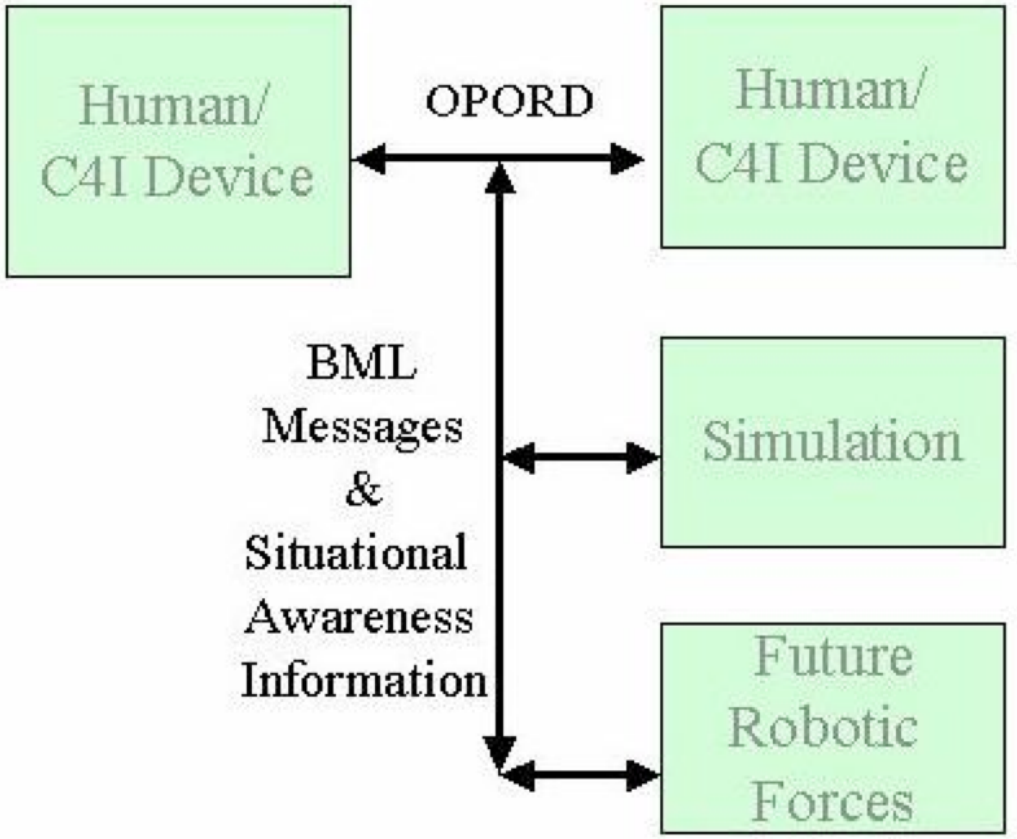


Figure 1: Scope of SIMCI Experimental BML in 2003

Roots of C-BML
Multinational

- France DGA developed C2SIM capability using
  - APLET simulation for mission planning
    - faster than real time
  - SICF C2 system
- NATO ET-016: France and USA
  - Interoperation of national prototypes stimulated NMSG interest
- SISO
  - Convened a Study Group to consider standardizing BML

Proof of Principle: MSG-048

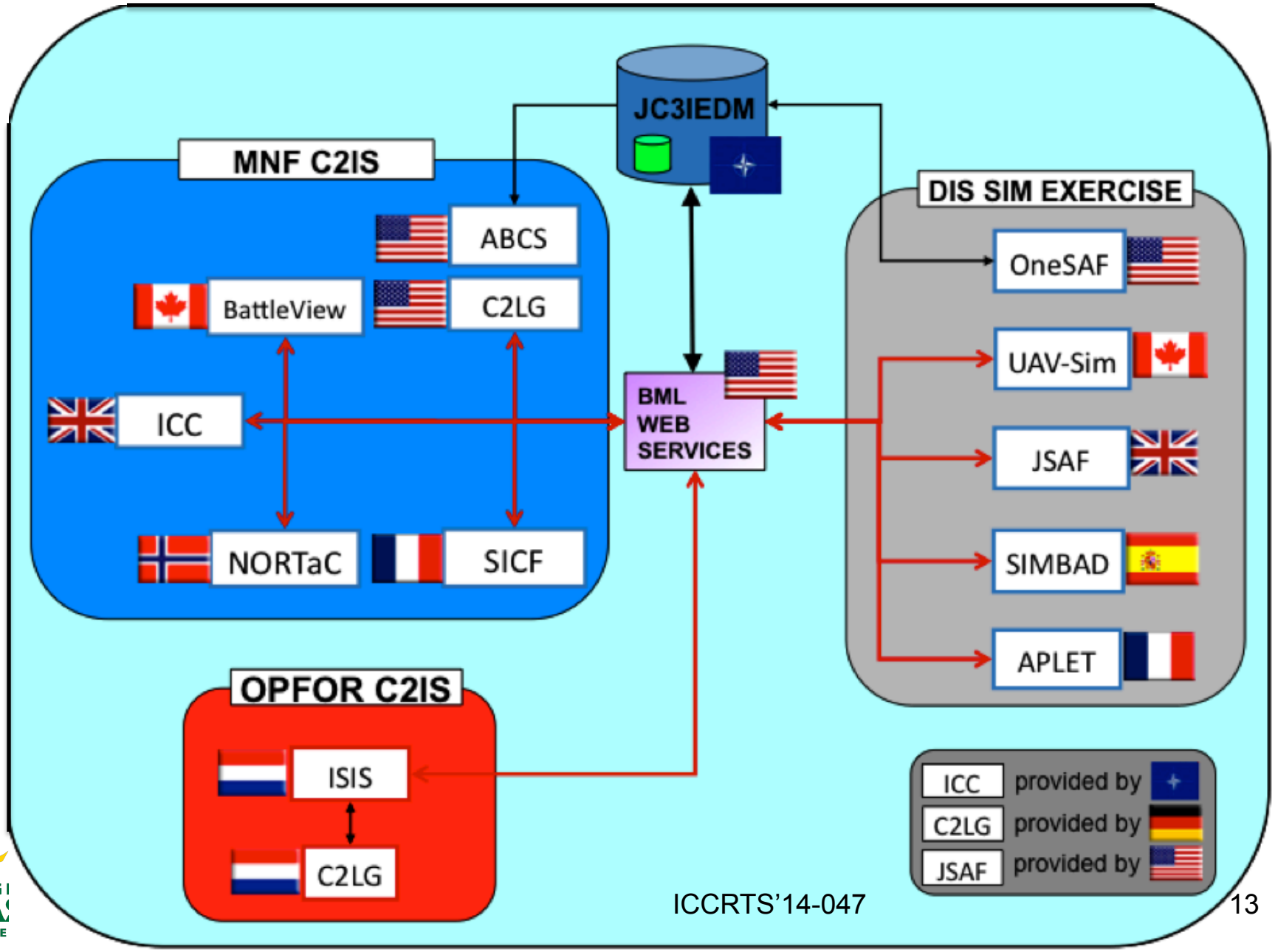
NATO MSG-048

- ET-016 stimulated a multinational effort to show technical feasibility of Coalition BML (C-BML)
  - Canada, Denmark, Germany, the Netherlands, Norway, Spain, Turkey, UK and USA
  - Open framework to establish coherence between C2 and M&S
  - New open, system-independent, community standards and protocols.
- Work areas:
  - Establish requirements for the C-BML standard
  - Assess its usefulness and applicability of C-BML in support of coalition
  - Educate and inform the C-BML stakeholders

MSG-048 Technologies

- Server-based architecture
  - Simplifies development environment - each client can be tested individually
  - Provides a measure of fault-tolerance - does not require that all C2SIM system-of-systems are constantly available
- C2 systems
  - Battle View (Canada), SICF (France), ISIS (Netherlands), NORTaC-C2IS (Norway), ICC (UK), ABCS (USA)
- Simulation systems
  - UAV-SIM (Canada), APLET (France), SIMBAD (Spain), JSAF (UK), OneSAF (USA)
- Supporting software
  - C2LG GUI (Germany), SBMLserver (USA)

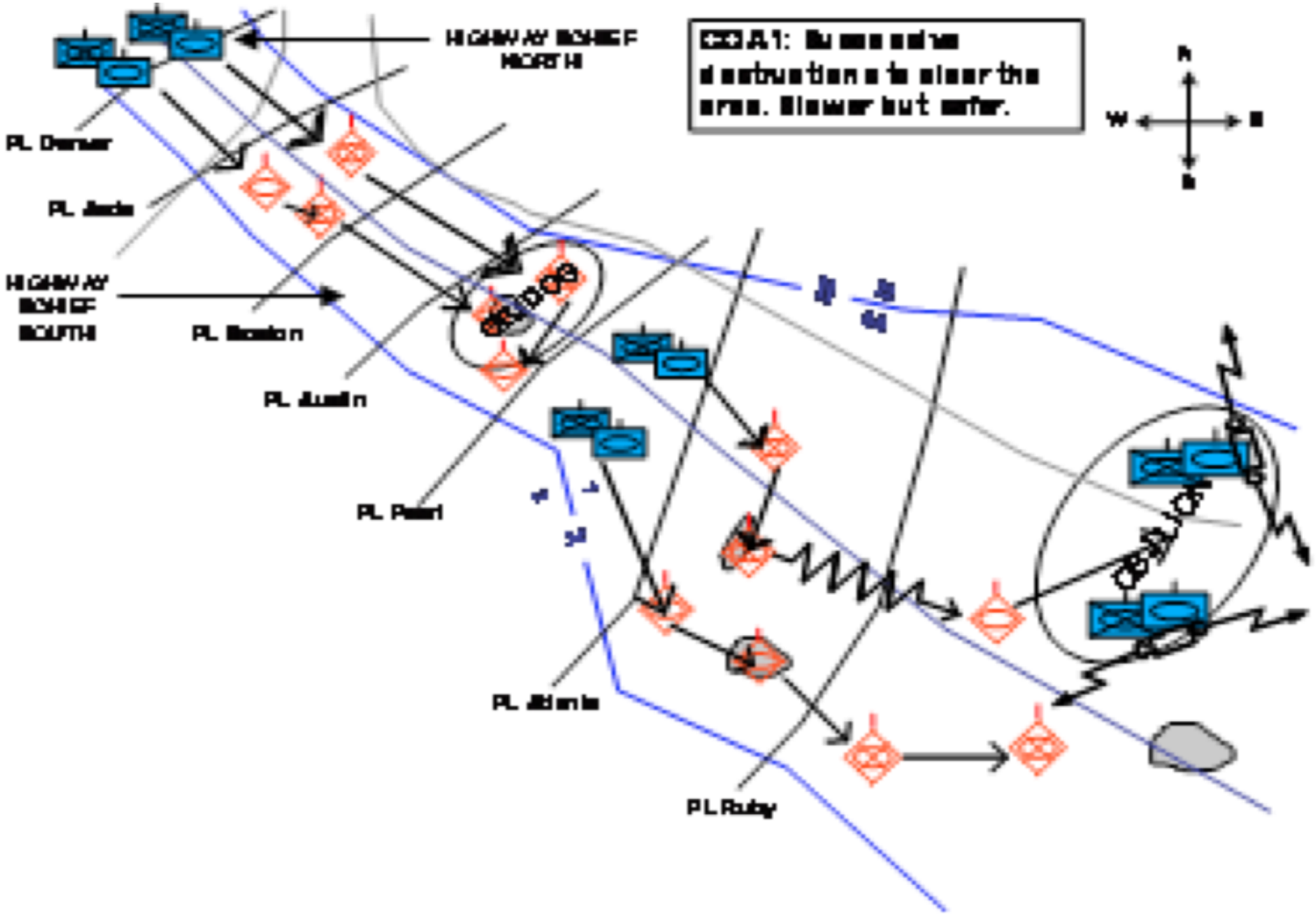
MSG-048 2009 Architecture



MSG-048 Results

- Parallel activity by SISO C-BML PDG to define a standard
  - Progress made but not as smoothly
  - Slower than most stakeholder found satisfactory
  - Produced results during following phase
  - MSG-085 used schema from a US effort
- Final Experimentation 2009
  - Work with operational military SMEs acting as brigade staff
  - Intensive preparation over Internet (new approach at the time)
  - Integration events in Portsmouth, UK and Paris, France
  - Counter-insurgency scenario with Canadian, French, Norwegian, UK, USA simulated units
- Succeeded as Proof of Principle despite difficulties
- Won NATO Scientific Achievement Award 2013

MSG-048 Example: French COA



Proof of Concept: MSG-085

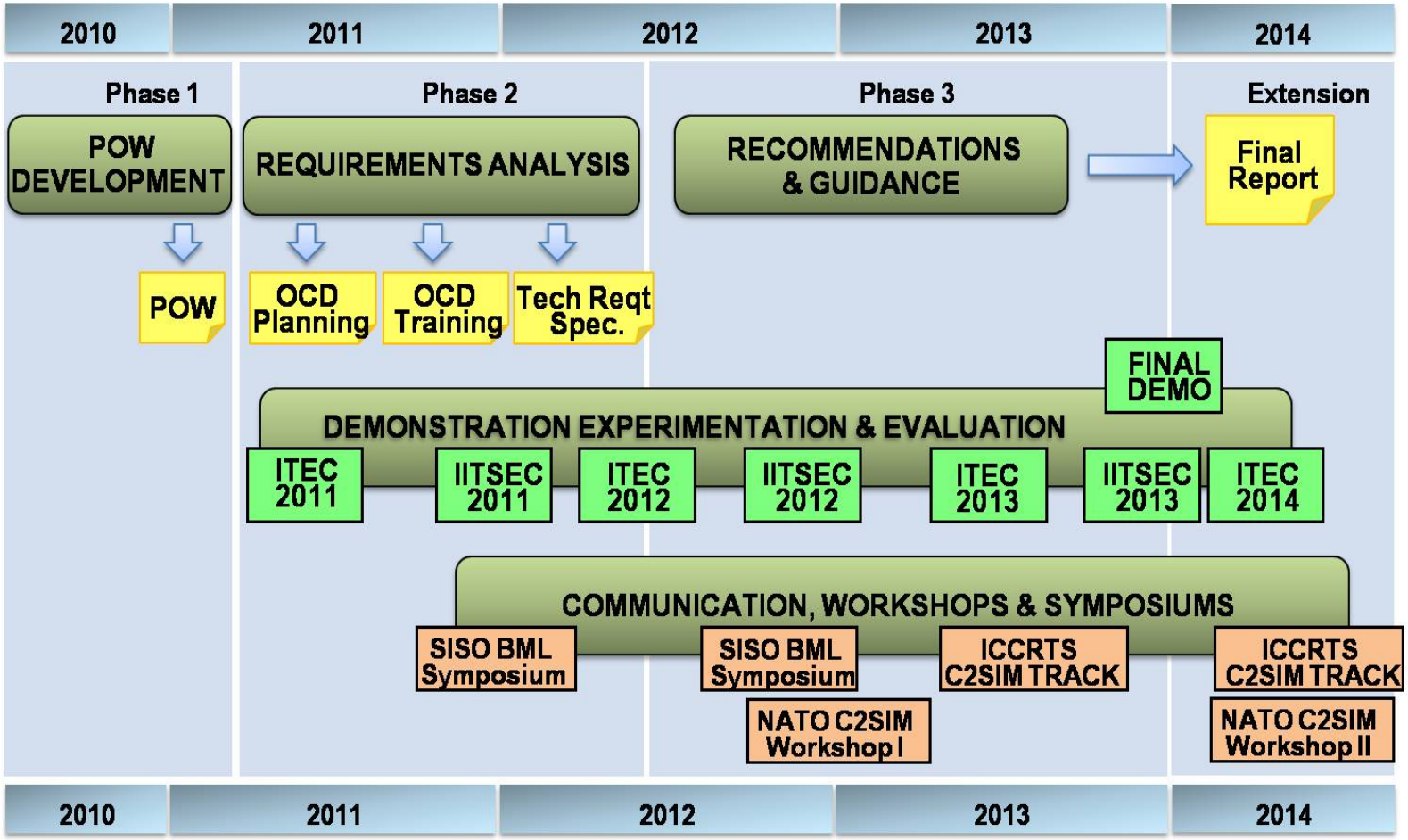
NATO MSG-085

- Chartered near end of MSG-048 due to high promise
  - To support standardization and show operational relevance
  - Added participating nations: Belgium and Sweden (also interest by Italy and Australia)
  - Also added operational military expertise
- Organized into Technical and Operational Subgroups
  - Also, orthogonally, Common Interest Groups:
  - Autonomous/Air, Land, and Maritime Operations; Joint Mission Planning, and Infrastructure
- Recognized need to add MSDL to C-BML
  - In first year (2010), participants implemented MSDL
  - Which in turn showed MSDL/C-BML incompatibility

MSG-085 and SISO

- MSDL standard was approved in 2009
- In 2012 SISO completed balloting C-BML Phase 1
- Two versions approved:
  - "full" intended to address very wide range that can be represented by the JC3IEDM
  - "light" facilitates rapid implementation
- Standard approved May 2014
- Delays in approval resulted in MSG-085 nations having 4 different schemas implemented

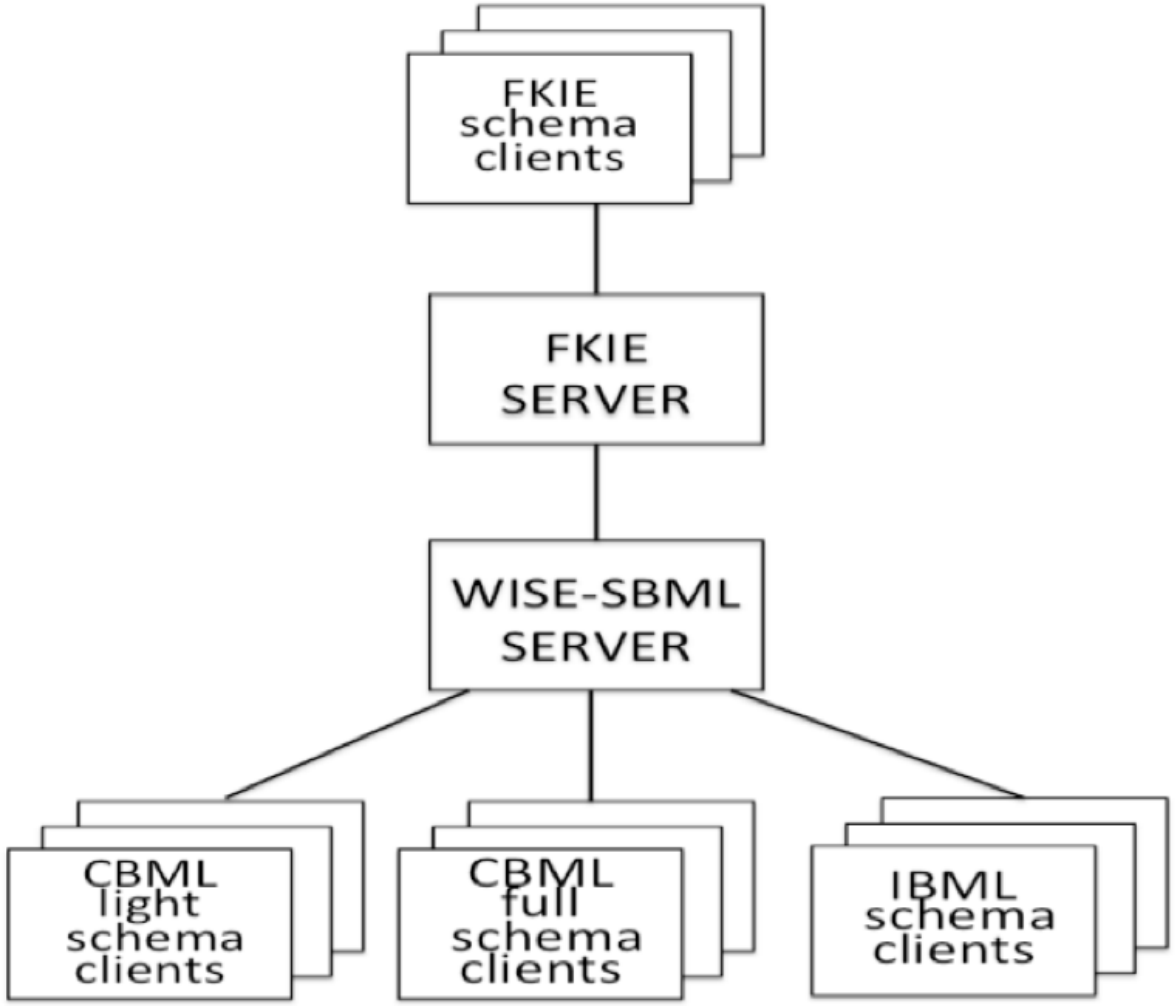
MSG-085 activities and events



Multiple Server Implementations

- MSG-048 Scripted BML (SBML) server from GMU had added features:
  - integrating multiple MSDL scenario files
  - translating among various semantically-equivalent schema
  - web-based coordination
- VMASC developed high-throughput CBMS document-based server
- FKIE implemented document-based server independently
- Commercially based WISE-SBML server builds on SBML (10x or better performance)
- FKIE and WISE-SBML servers interoperate to distribute communications and load

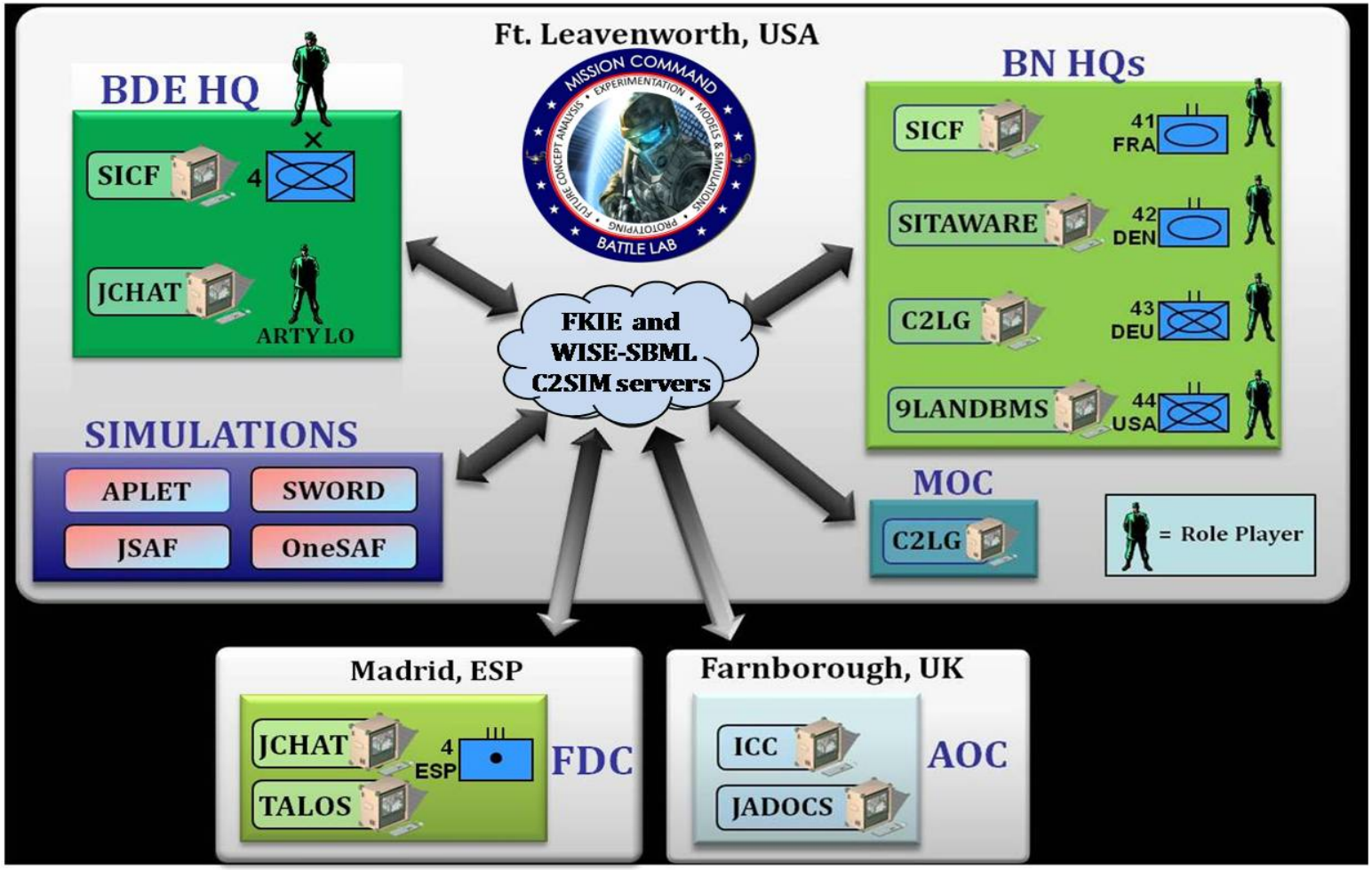
Linked Server Architecture



MSG-085 Final Demonstration

- Conducted at Fort Leavenworth Kansas
  - In collaboration with Mission Command Battle Lab
- Featured Joint and Combined Mission Planning
- Complexity similar to MSG-048 but with major differences:
  - Network sophistication: two linked servers; three schemata; two sites participated via Internet
  - Setup process: MSG-048 was chaotic; MSG-085 “just worked”
  - Audience impression: MSG-085 worked very well
- Proved the concept that C2SIM in the form of MSDL and C-BML is ready to be tested in real coalition operations.

MSG-085 Final Demonstration Architecture



Conclusions / Way Forward

- C2SIM concept has made steady progress over the last decade
- Both NATO and SISO have continued progress toward the day when military coalitions will be able to “plug in” their C2 and simulation systems to interoperate
- However, much remains to be accomplished:
  - Engage the operational military community as users
  - Expand the compatibility and scope of MSDL and C-BML