

A NATO Success Story in C2-Simulation Interoperability

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Session 3: Agile IT Acquisition and Plugfesting

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MITRE Corporation

Coalition C2-Simulation History and Status

(selected material presented at NATO Modeling and Simulation Symposium 2014)

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Presentation Overview

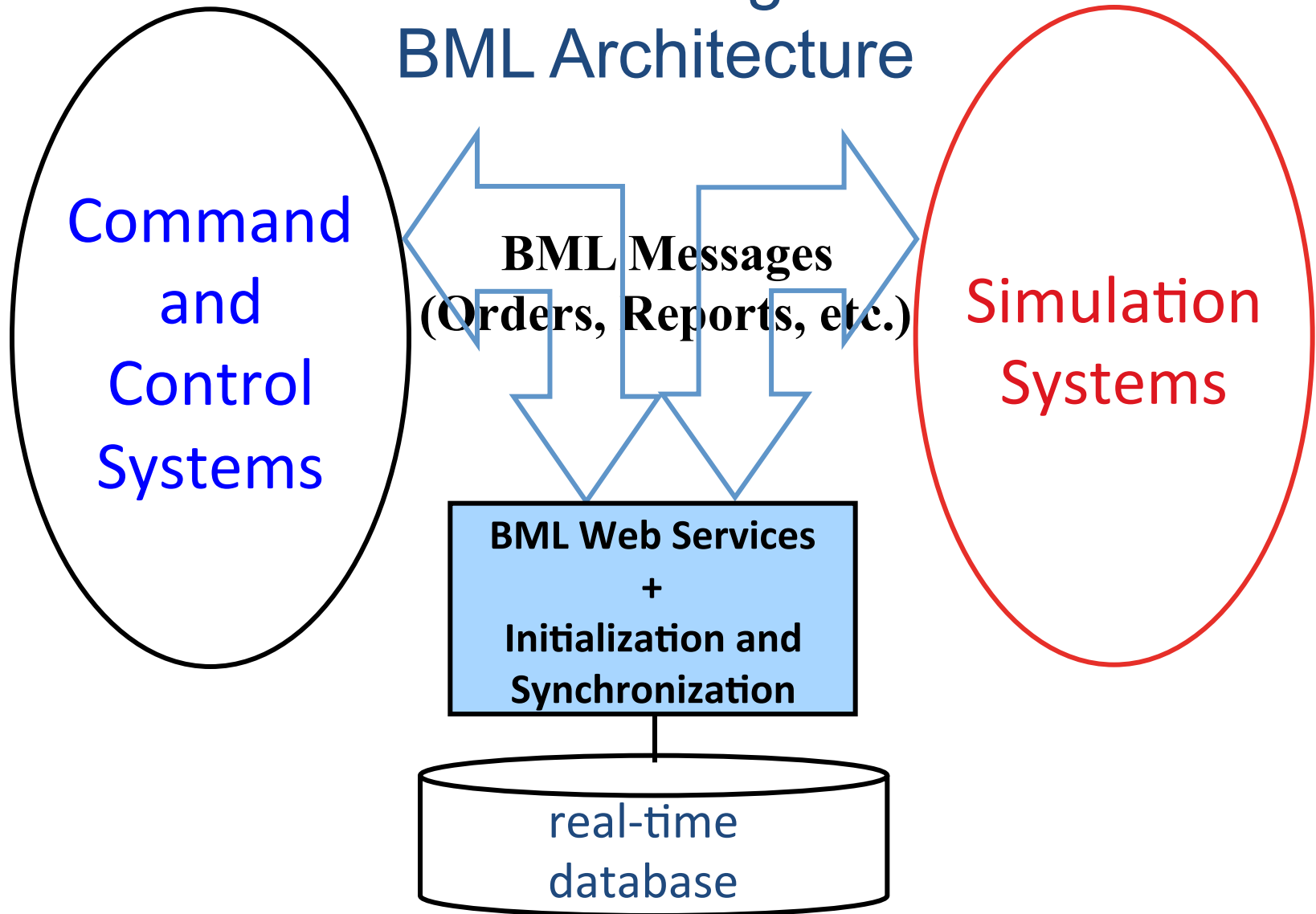
- Introduction and vision
- NATO and SISO
- History of C2SIM in NATO
- Operational Validation in NATO
MSG-085
- Conclusions

Introduction: The Need for Command and Control/Simulation Interoperability (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.

Evolving BML Architecture



NATO and SISO

NATO M&S Technical Activities

- NATO MSG charters Technical Activities conducted by groups of nations
- Exploratory Team 16 to determine potential for C2SIM Technical Activity
- MSG-048 to explore technical feasibility of C2SIM in operations
- MSG-085 to determine operational utility of C2SIM and advance its technical maturity
- Now under consideration: new activity to operationalize results
- All of this work has collaborated with SISO

MSG Technical Activities and SISO

- Most nations see established technical standards as necessary to incorporating C2SIM in acquisition
- Relevant standards are:
 - SISO Military Scenario Definition Language (MSDL) for initialization
 - SISO Coalition Battle Management Language (C-BML) for tasking and situational awareness
- SISO organizes volunteers to create consensus standards
 - Doesn't have resources to develop technology
 - Or to validate military relevance
 - Relies on NATO and national activities for those

History of C2SIM in NATO

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

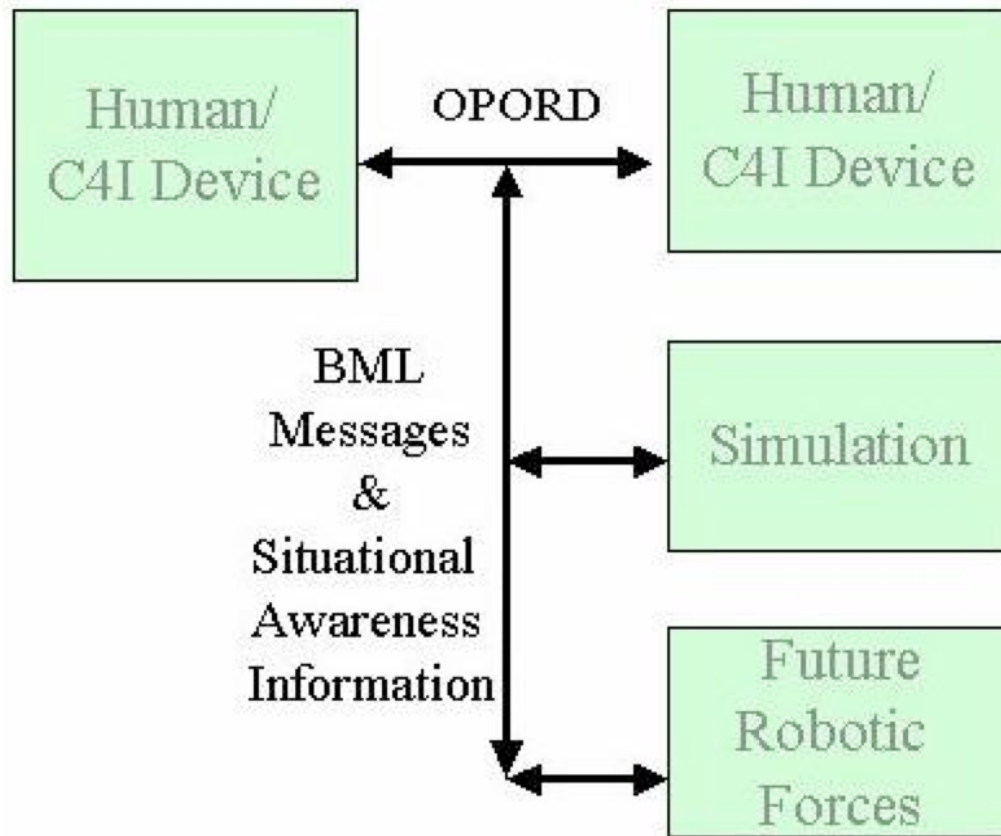


Figure 1: Scope of SIMCI Experimental BML in 2003

Roots of C-BML

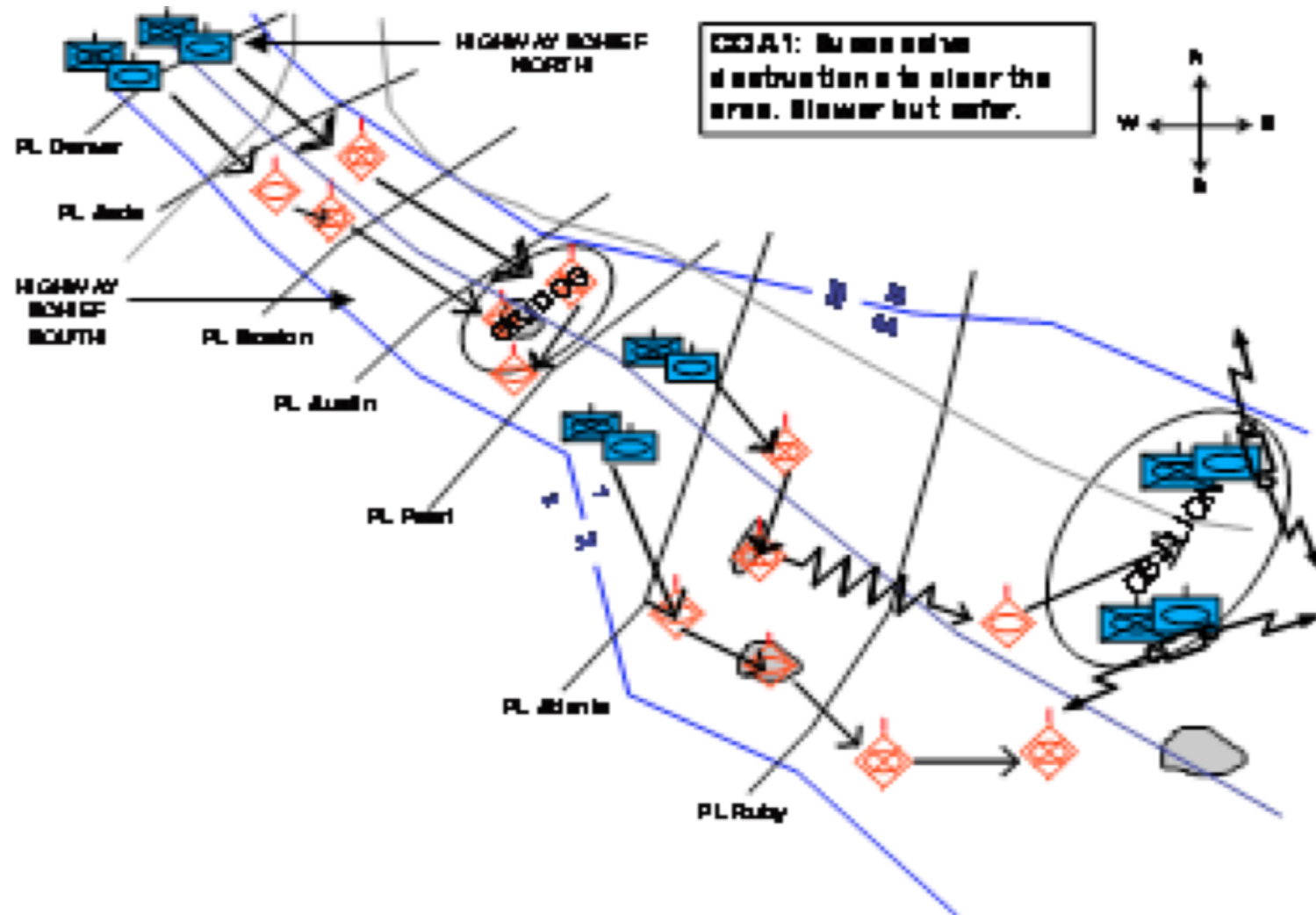
Multinational

- 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

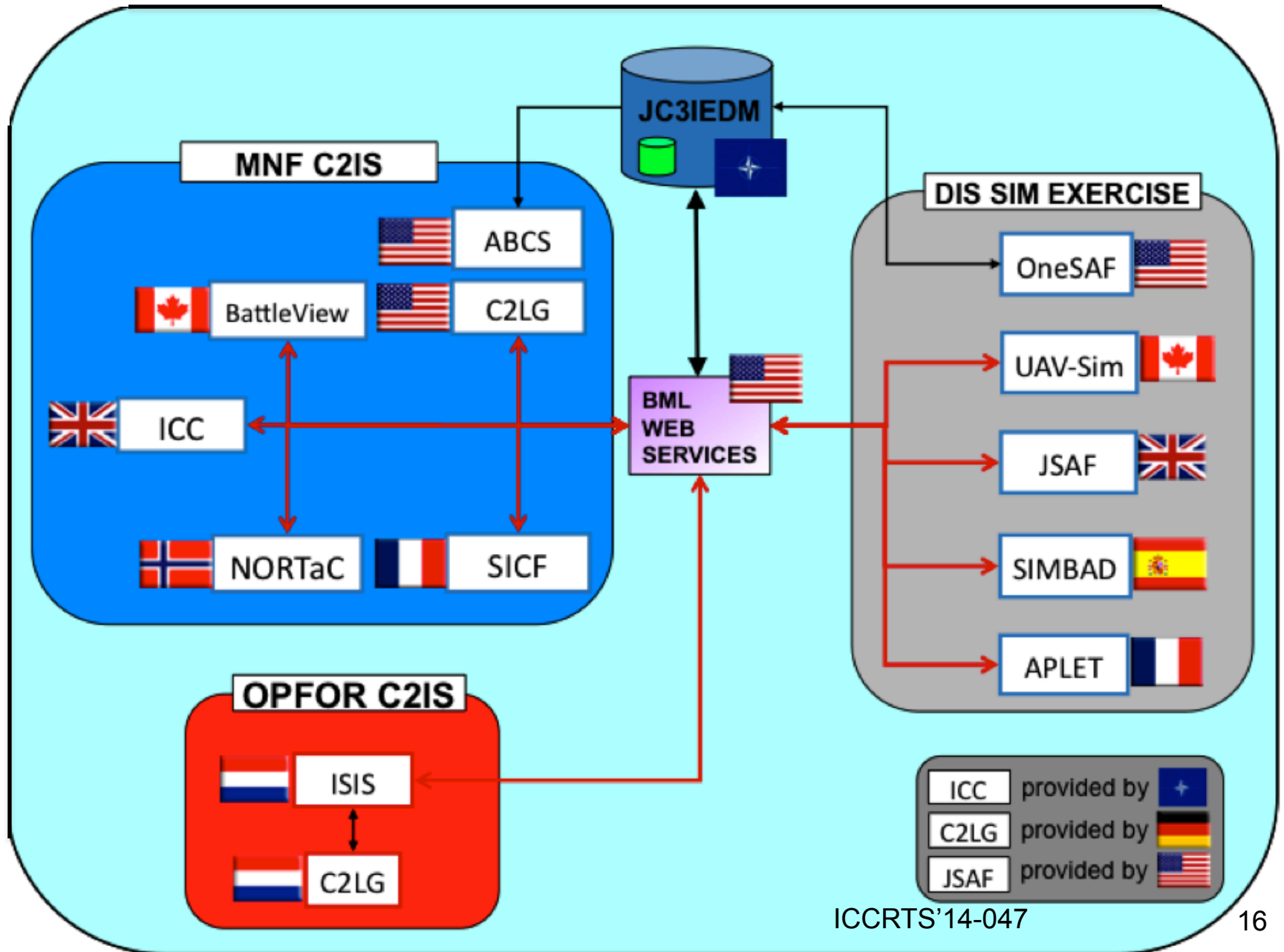
Proof of Principle: NATO MSG-048

- 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 Example: French COA



MSG-048 2009 Architecture



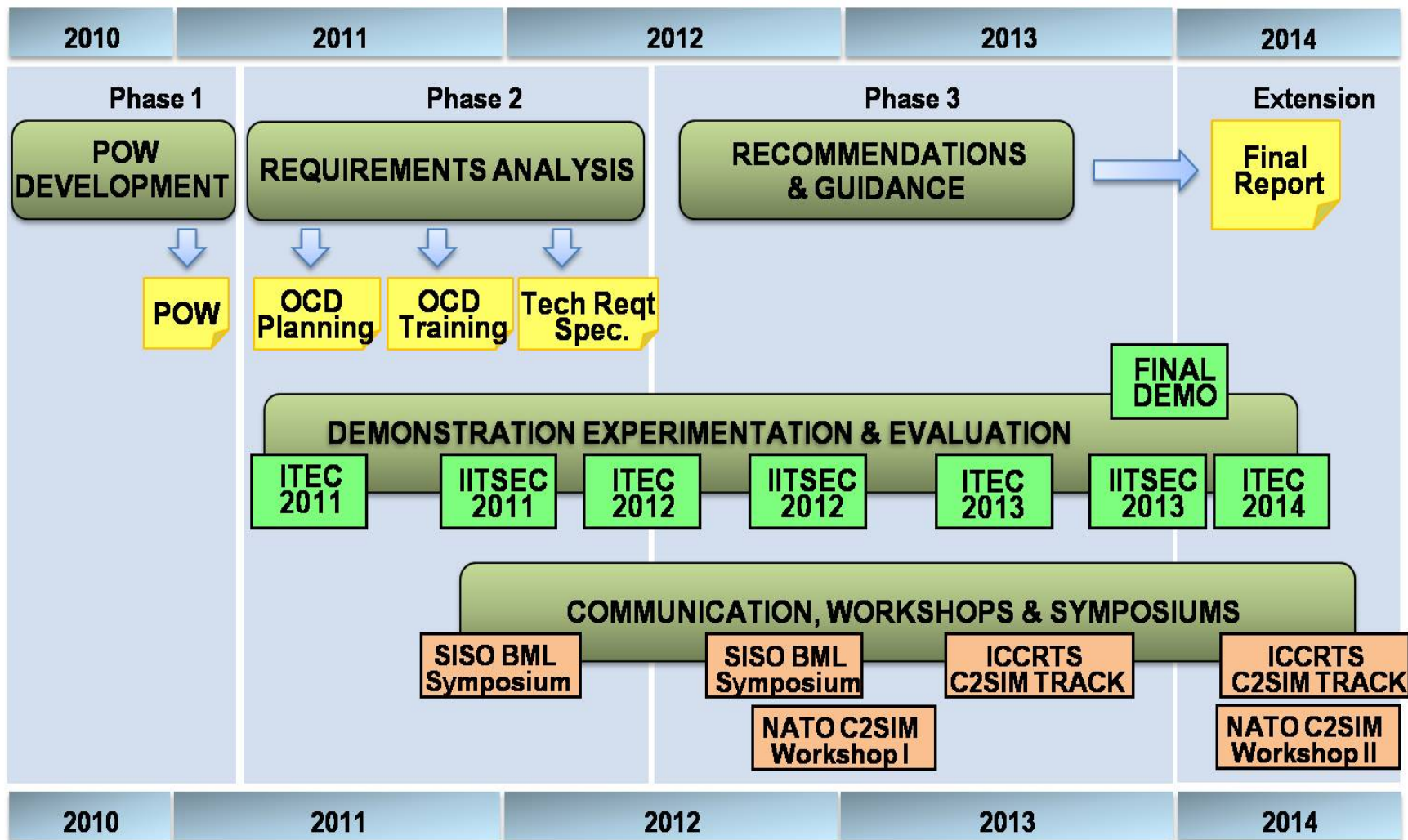
MSG-048 Results

- 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

Proof of Concept: 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 Activities and Events

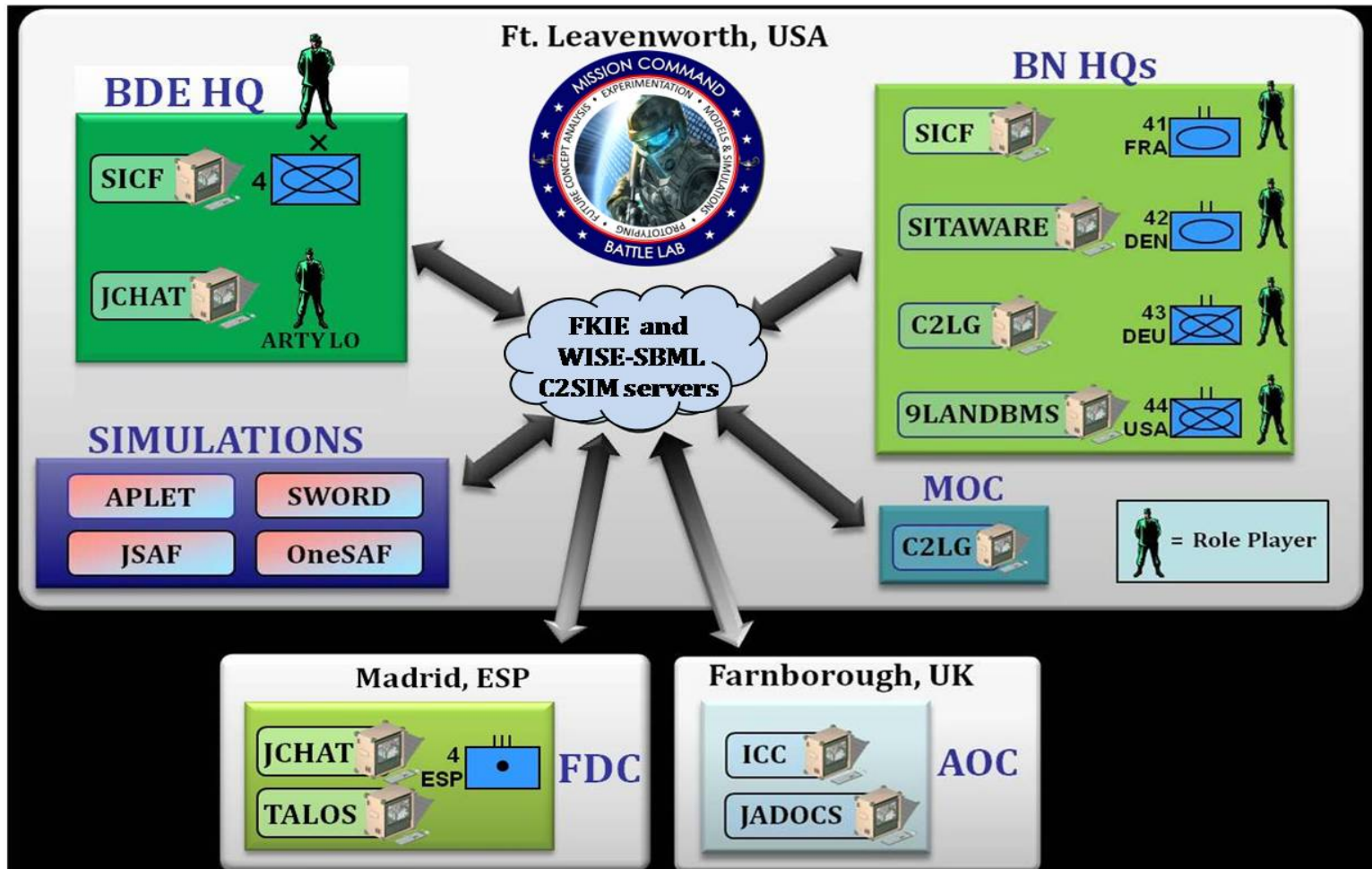


Operational Validation in MSG-085 Final Demonstration

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 System of Systems

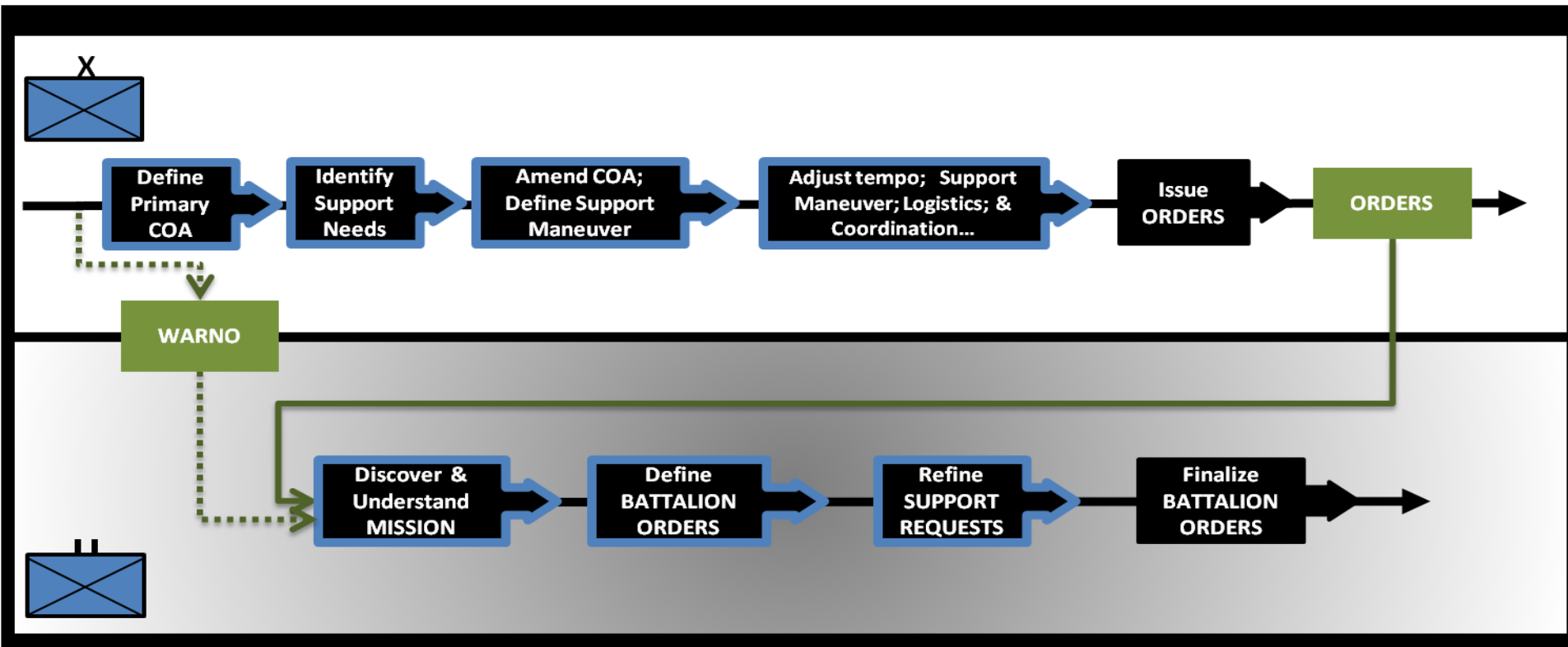


Final Demonstration Goal

Show that C2-Simulation Interoperability
can contribute to increased
collaboration among Brigade and
Battalion Commanders, and their staffs,
during COA Development

Demonstration Context: Military Decision Making Process (MDMP)

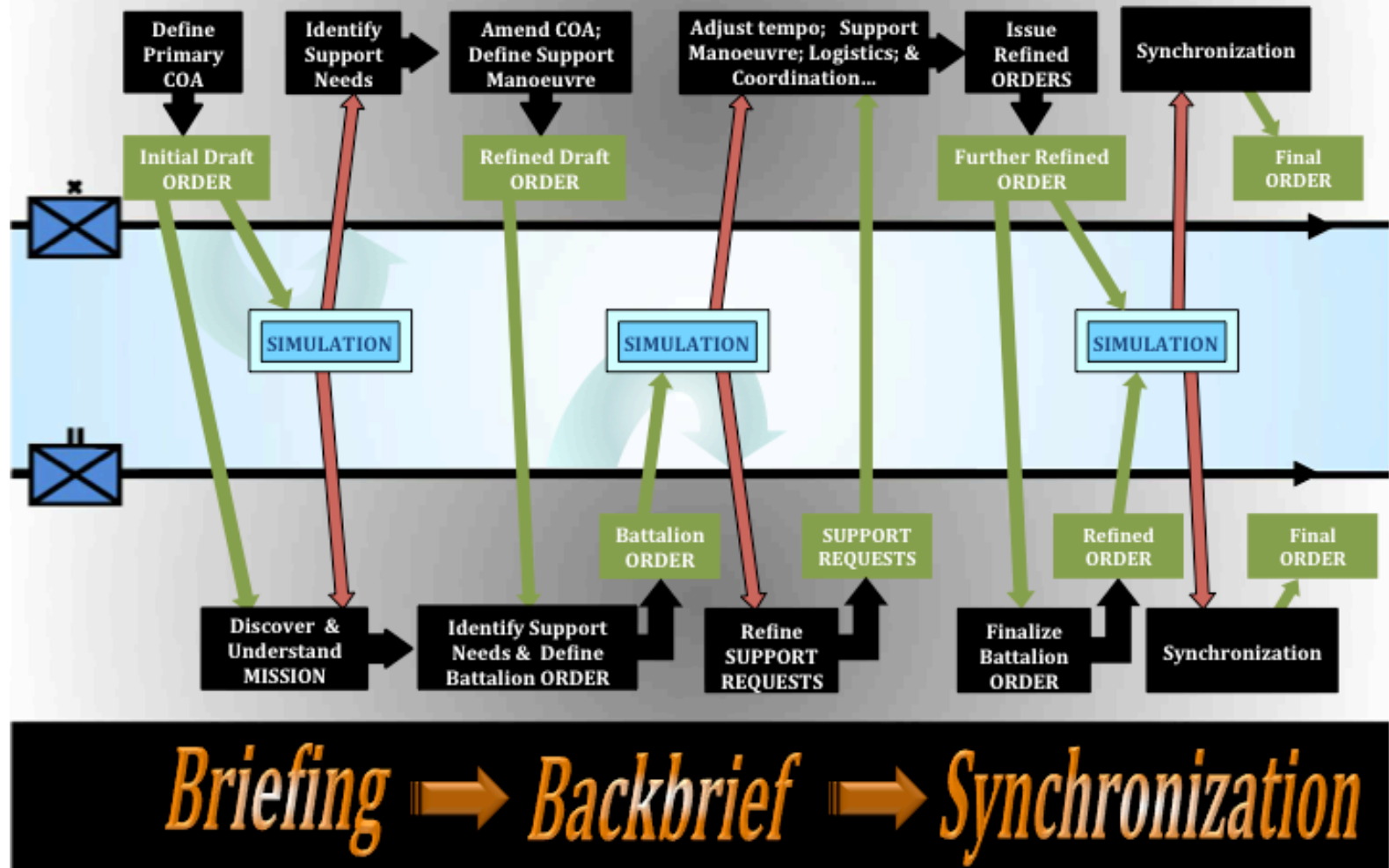
- Receipt of mission
- Mission analysis
- COA Development
- COA Analysis (Wargame)
- COA Comparison
- COA Approval
- Orders Production



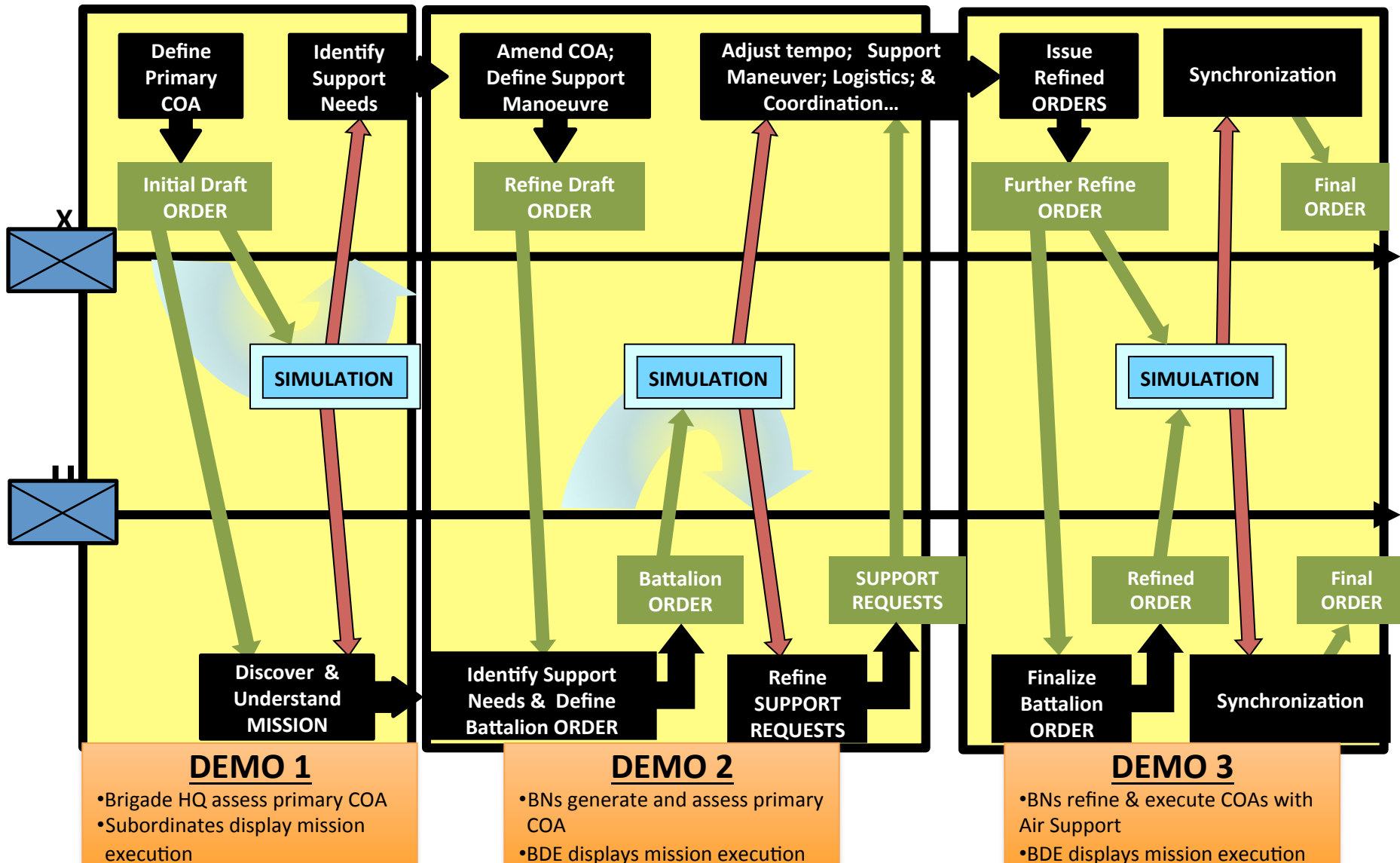
*Current COA development is essentially a **LINEAR, SEQUENTIAL** process...*

Demonstration Overview

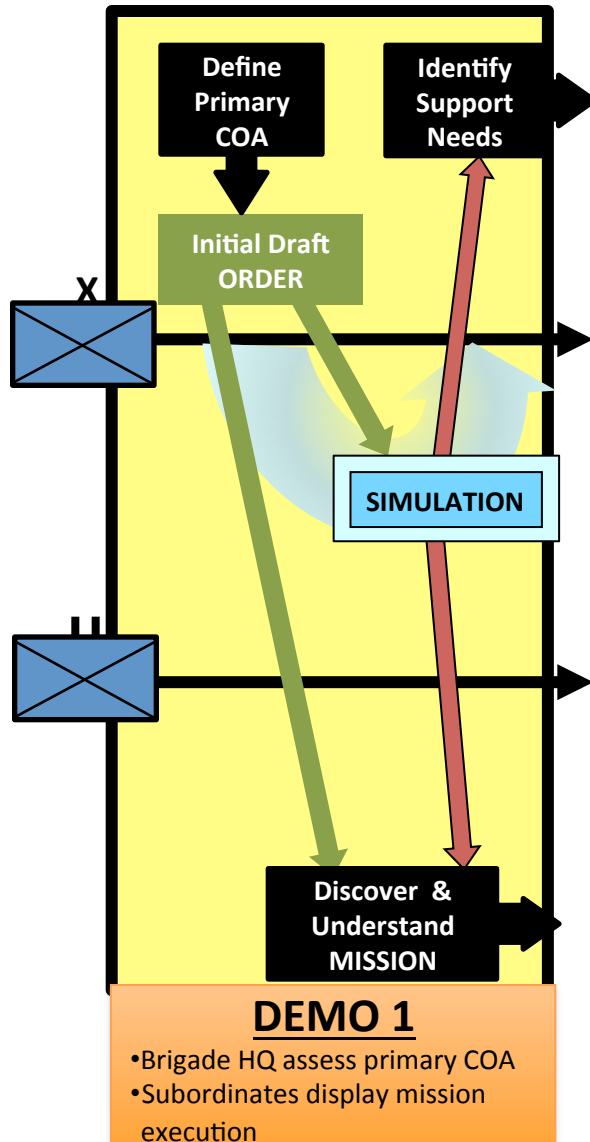
Joint & Combined Mission Planning



Demonstration Phases



Observations & Lessons Learned



- SME Feedback (Demo 1)

- Positive

- Visualization of Brigade graphics
 - Collaborative modification of plan
 - Initial stages of synchronization matrix supported

- Improve

- Control of the simulation

Observations & Lessons Learned

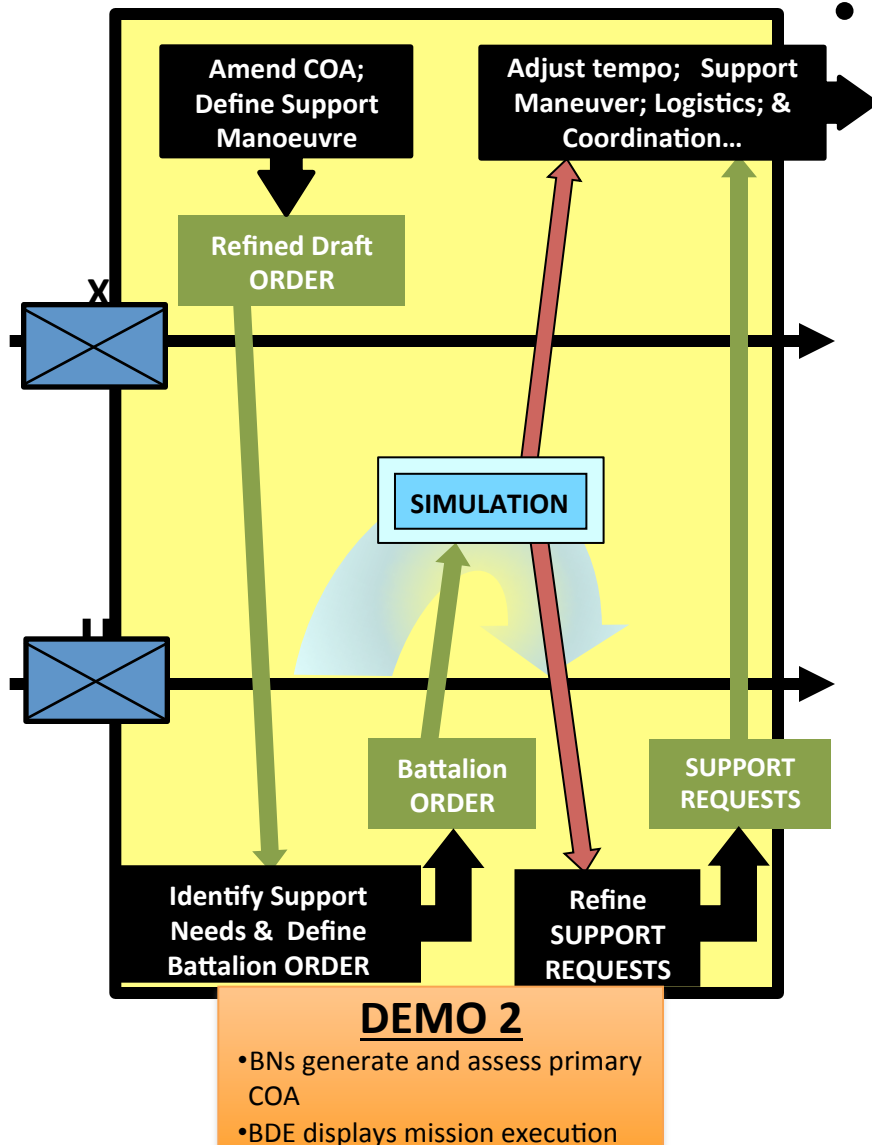
• SME Feedback (Demo 2)

– Positive

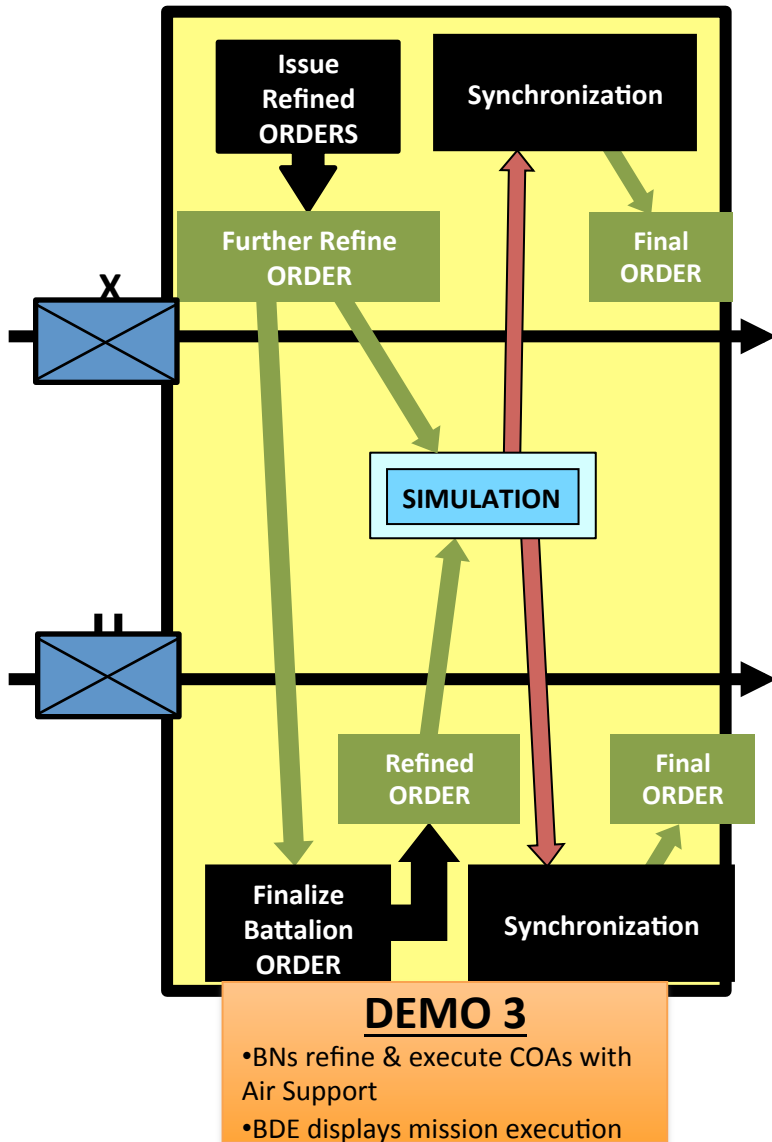
- Able to better control speed of the simulation
- Battalion Commanders were able to
 - achieve a better understanding of Brigade plan
 - express their requirements to Brigade, and
 - modify plans with immediate coordination with other Battalions and Brigade across the coalition
- Visualization of other Battalion sectors

– Improve

- Battalion Commanders ability to synchronize support for their plans



Observations & Lessons Learned



• SME Feedback (Demo 3)

– Positive

- Shared Common Operating Picture (COP) allowed for collaboration
- Battalion Commanders interactively exchanged information with the Brigade Commander and adapted their plans in coordination with the Brigade planners
- Using simulation gave the opportunity to question why things might not happen as planned
- Brigade Commander visualized the Battalion Commanders' sectors with a focus on high priority events

– Improve

- Accurate portrayal of Warfighting Function for better analysis
- Perception of enemy engagement and combat power in C2 and simulation systems

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
- MSG-085 Final Demonstration demonstrated potential for positive outcomes through operational employment based on improved technology readiness level

In Reserve

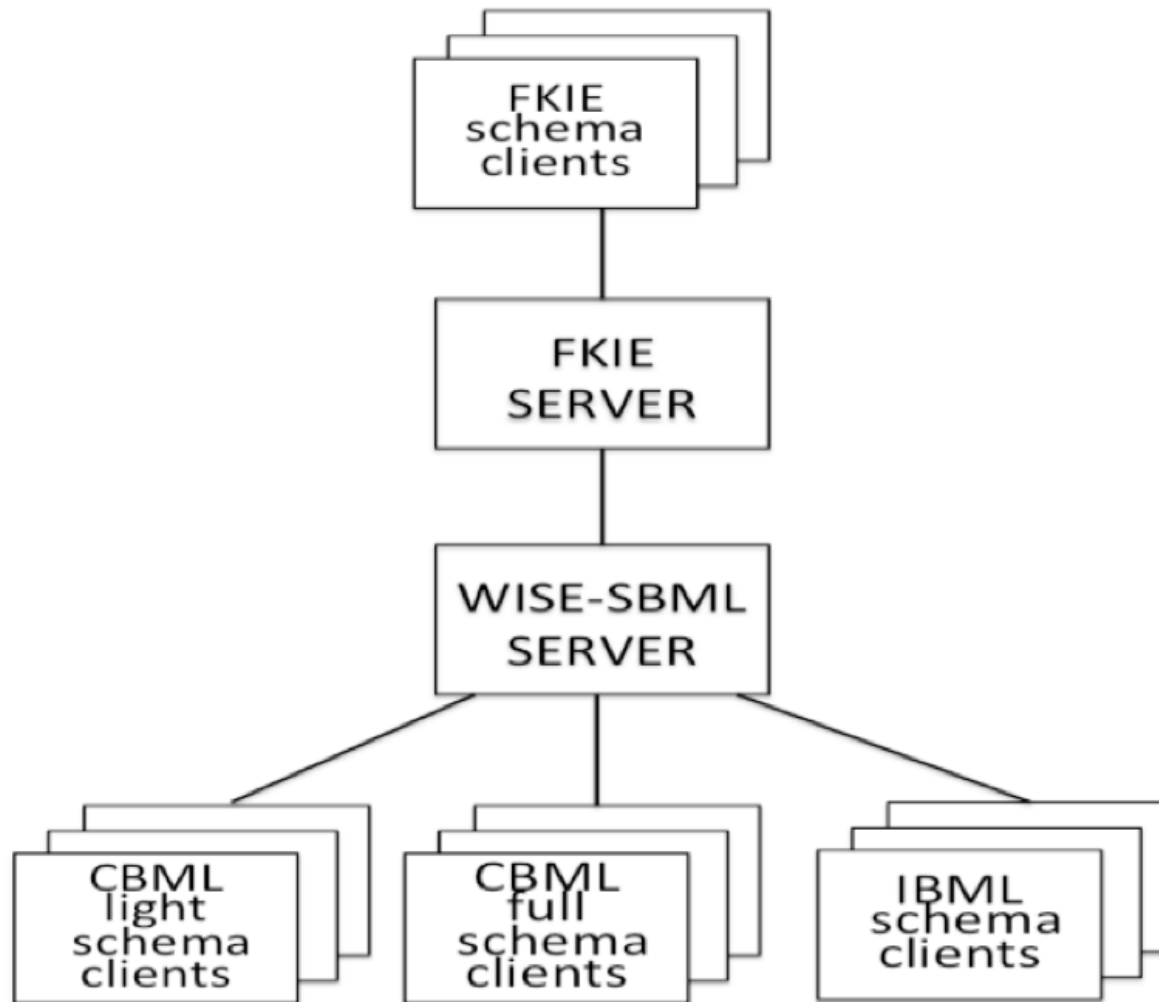
BML Purpose and Operation

- 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

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-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)

Early Simulation Implementation

SISO MSDL and C-BML

- US Army OneSAF led in this area
- Right-sized integration with Mission Command (MC) systems to support training, experimentation, mission planning, mission rehearsal
- New capabilities stimulated by MSG-048 and MSG-085
 - Mission Planning and Rehearsal
 - Automated Course of Action Analysis/Wargaming
 - Deployed Command Staff Training and After Action Review
 - Commanders Critical Information Requirements (CCIR) Identification and Tracking