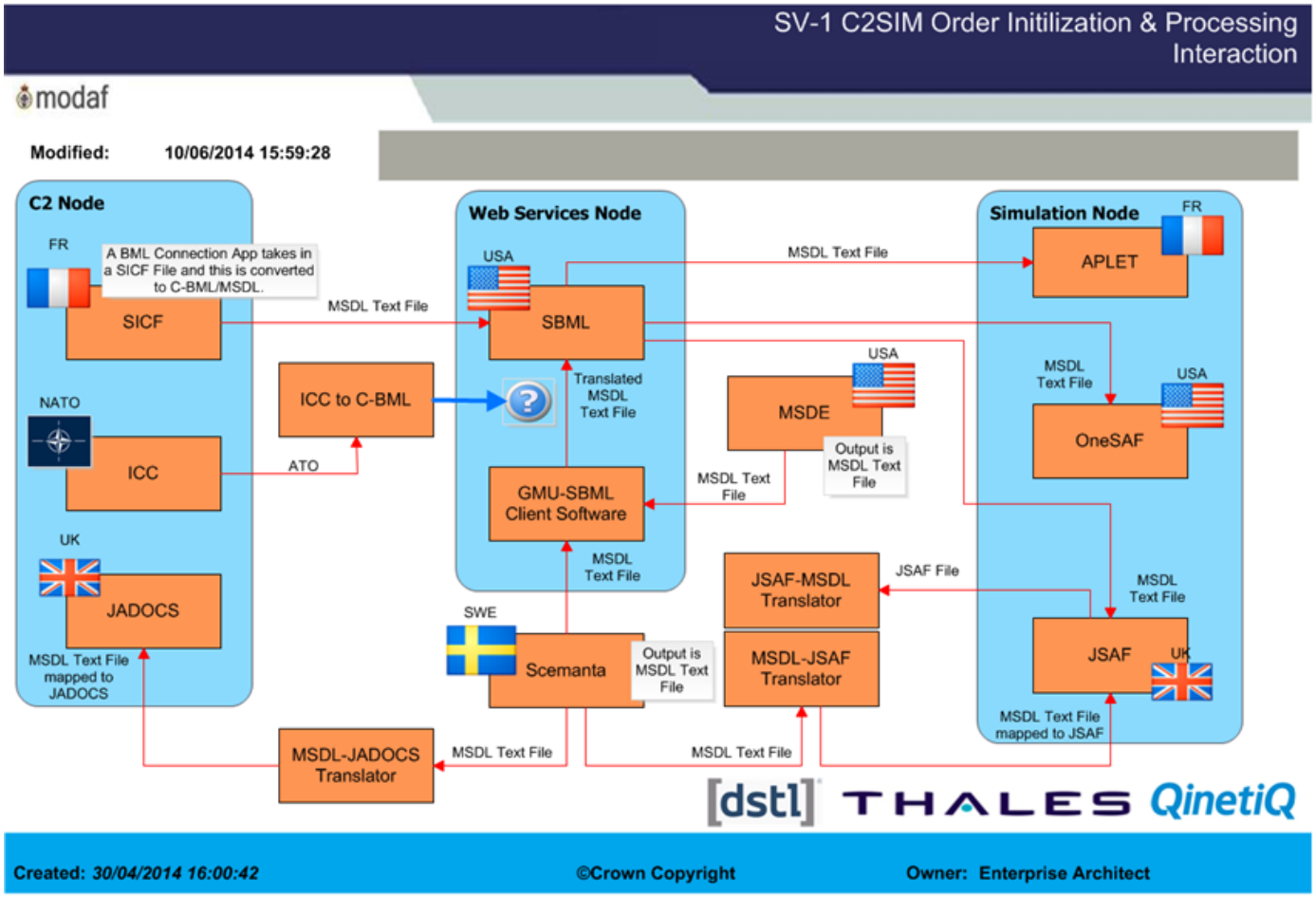
C2 AND SIMULATION SYSTEMS WHICH HAVE BEEN IMPLEMENTED

APPROVED FOR PUBLIC RELEASE

Example Systems

- **SAFIR**
  - C2: SIR, SICF, BCIP 5.4
  - M&S: APLET, SWORD, JSAF
- **COMELEC FRA-DEU**
  - C2: SICF, FIS-H
  - M&S: SWORD, KORA
- **MSG Experimentation**
  - C2: SICF, ICC, 9LANDBMS, SITAWARE, ESRI COP Viewer, JADOCS, ISIS, CAPES, C2PC, JCHAT, TALOS
  - M&S: APLET, JSAF, OneSAF, VBS2

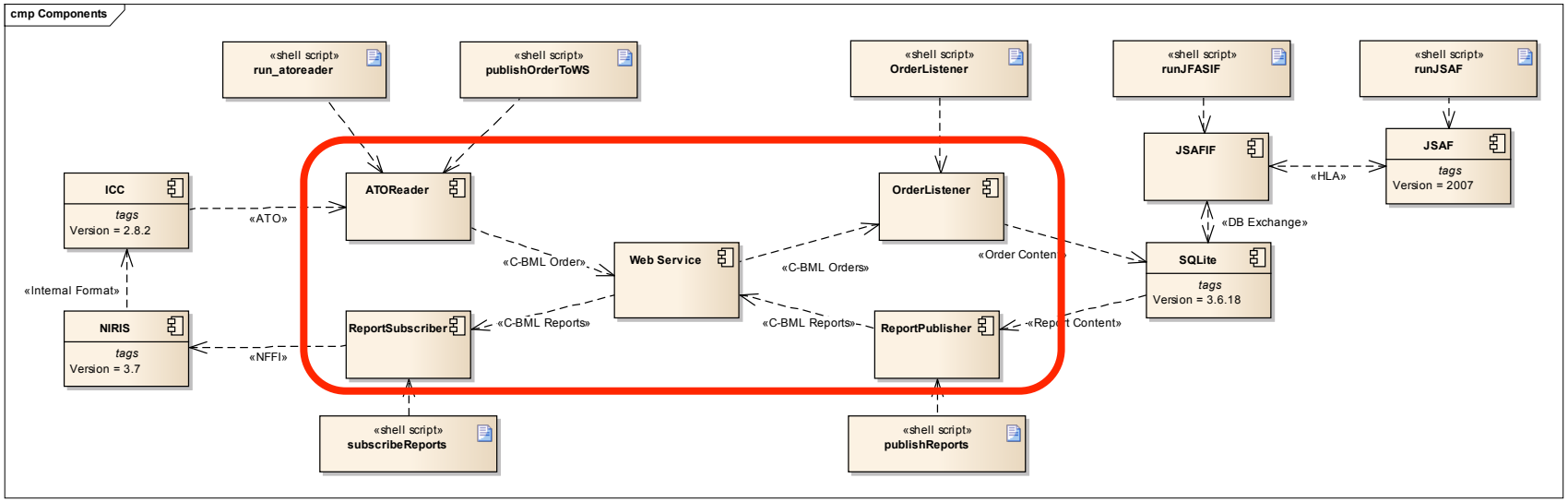
Architectural Framework Model



Specific Examples

- ICC – JSAF
  - ICC
  - JSAF
- System overview for each of the chosen systems
- System interface
- Specifics for C2Sim, e.g. bolt-on translator, i/f to WS, message sets, etc
- Video

UML View

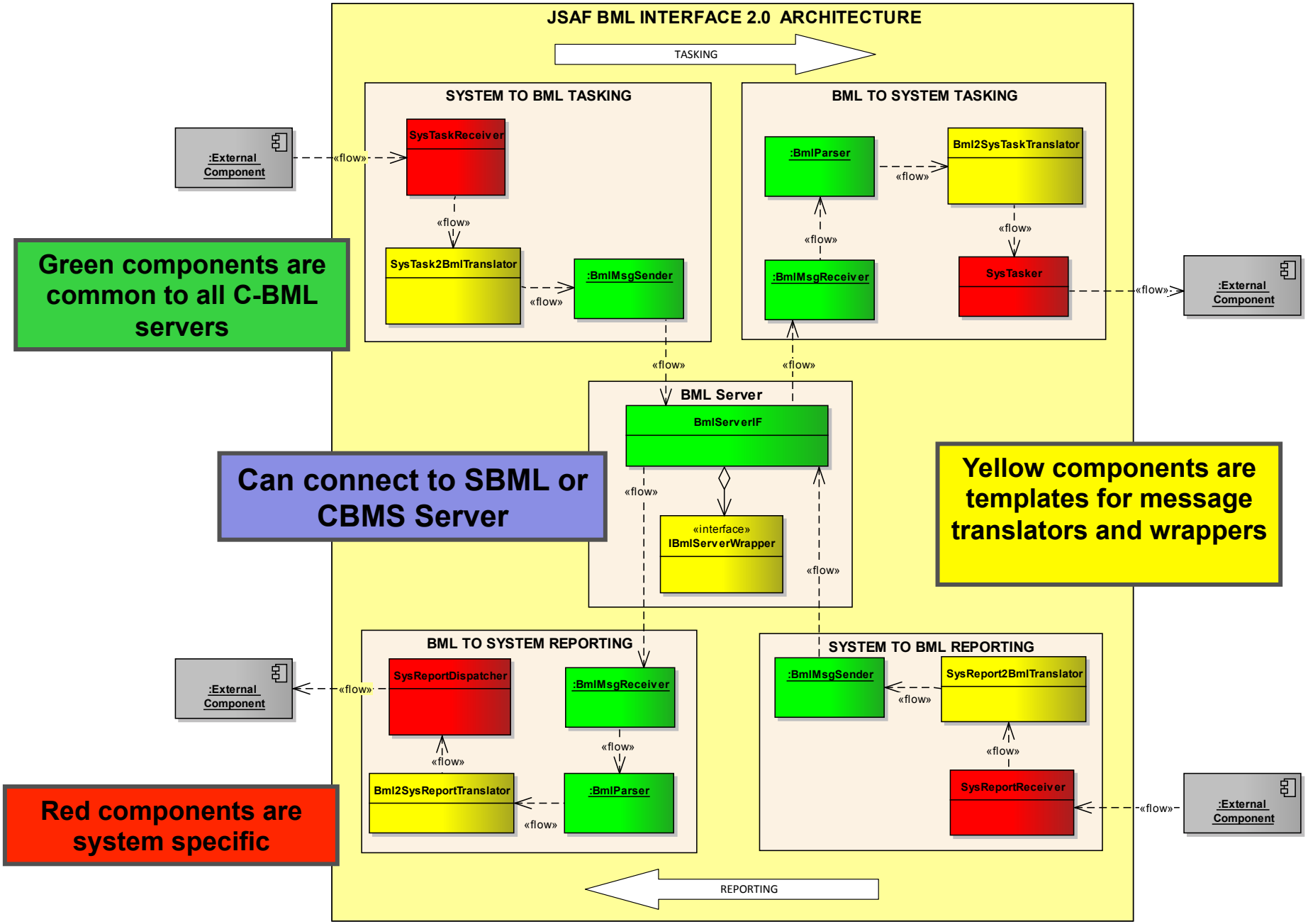


ICC & NIRIS

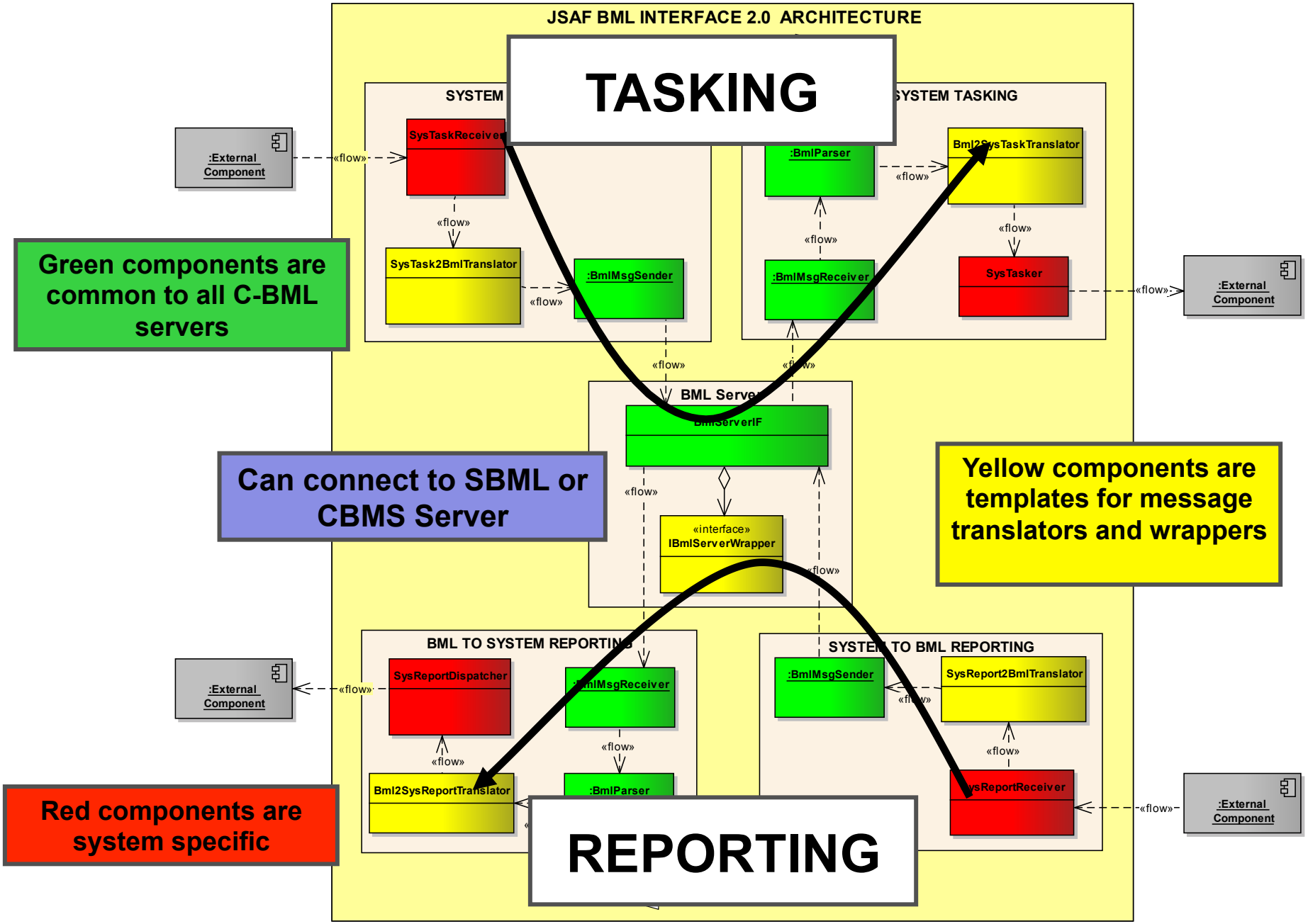
Message Processing and Middleware

JSAF Simulation

Air Operations Messaging Capability



Air Operations Messaging Capability

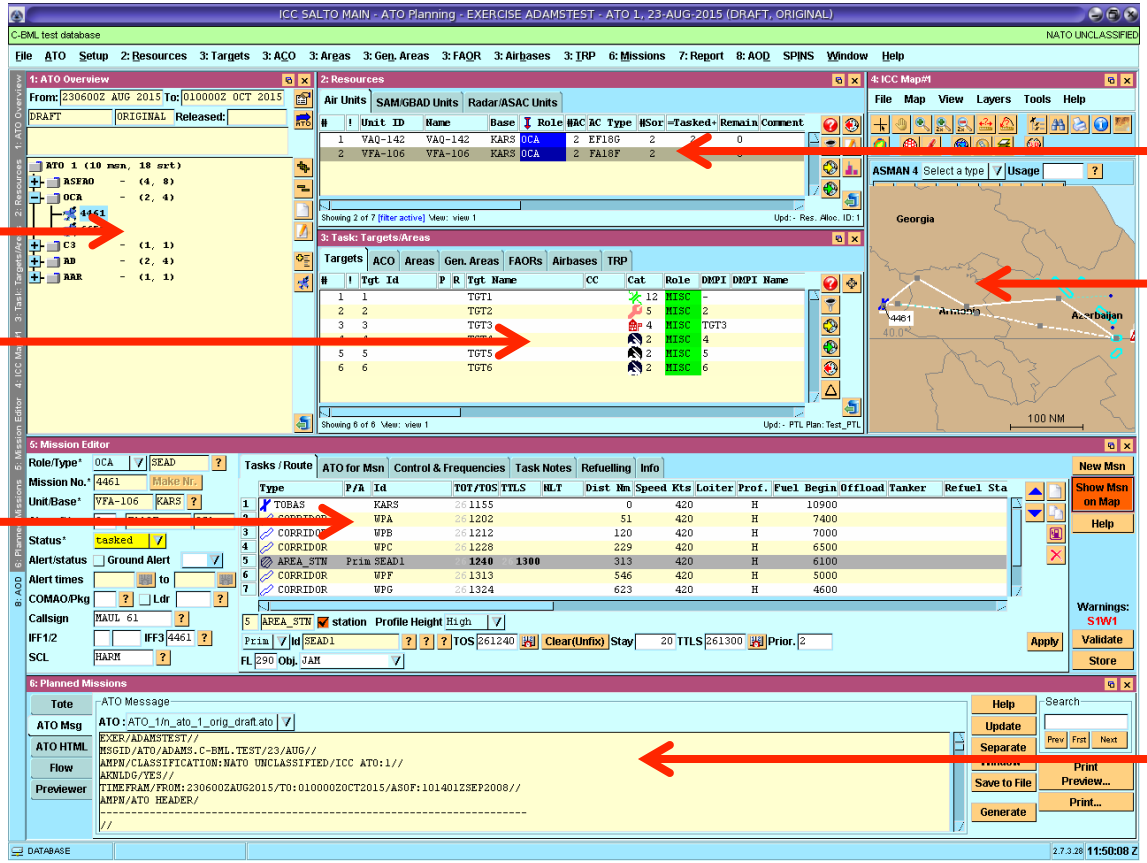


Specific Systems – ICC

- ICC – NATO Integrated Command and Control – software for air operations
  - This is an Air Campaign planning tool widely used in NATO
  - It can generate ACOs, ATOs and ACMREQs
  - It can be integrated with a targeting tool (JTS/FAST)
  - It can be used to display a Recognised Air Picture and Common Operational Picture from operational feeds
  - It can integrate with ISTAR assets, e.g. using the CSD

- ACO – Airspace Control Order
- ATO – Air Tasking Order
- ACMREQ – Airspace Control Measure Request
- JTS – Joint Targeting System
- FAST – Flexible Advanced C2 Services for Time-Sensitive Targeting
- CSD – Coalition Shared Database

ICC – The User Interface



TaskOrg

ACMs

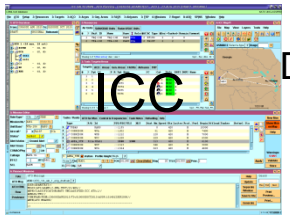
Mission Editor

Resources

2D Map

Mission Tote & ATO

ICC Tasking (C-BML Order) Translator



Develop ACO, ATO

ICC DB

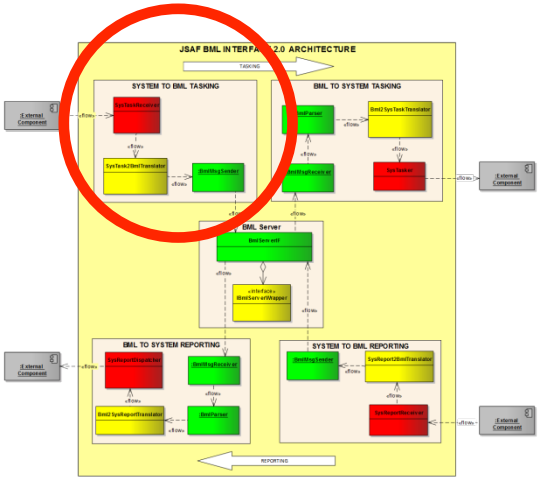
or

ACO & ATO

Load ACO, ATO

Parse ACO, ATO

Create & Publish C-BML Orders



C2Sim WS

Specific Systems – JSAF

- JSAF – Joint Semi-Automated Force simulation
  - ➢ This can be modified for C2-Sim because:
    - It can be initialised with structured data
    - It has behavioural models for Units, Entities and Equipment
    - There is an accessible dynamic tasking interface (***not*** scripted)
  - ➢ 'Front-end/Back-end' MVC distributed architecture (***not*** Server/Client)
  - ➢ HLA FOM already includes:
    - Tasking Interactions:
      - Tasking State
      - Tasking Parameters
      - Background Parameters
      - Behaviour Status

JSAF – The User Interface

User Tools

Environment

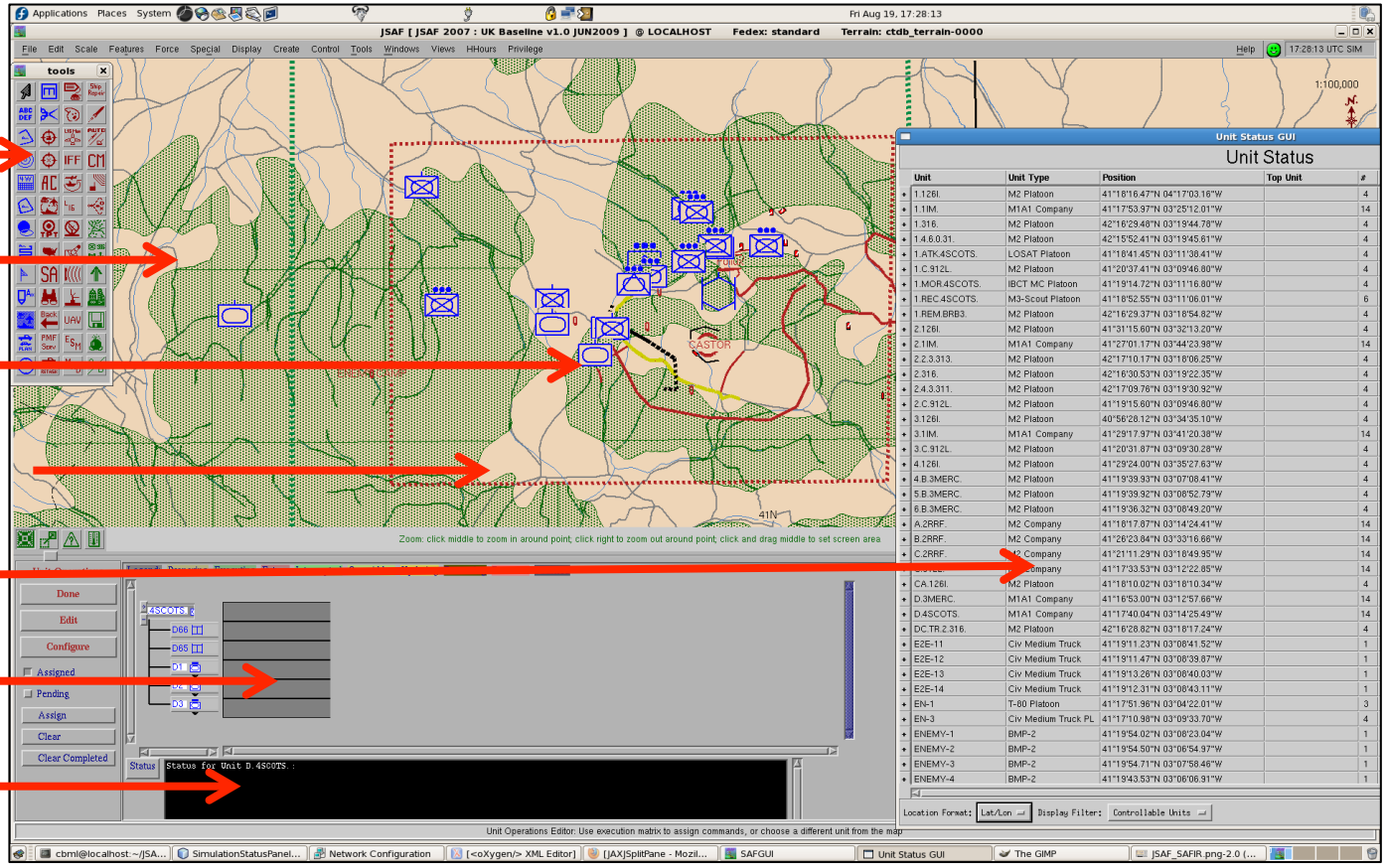
Units

Overlays, Graphics

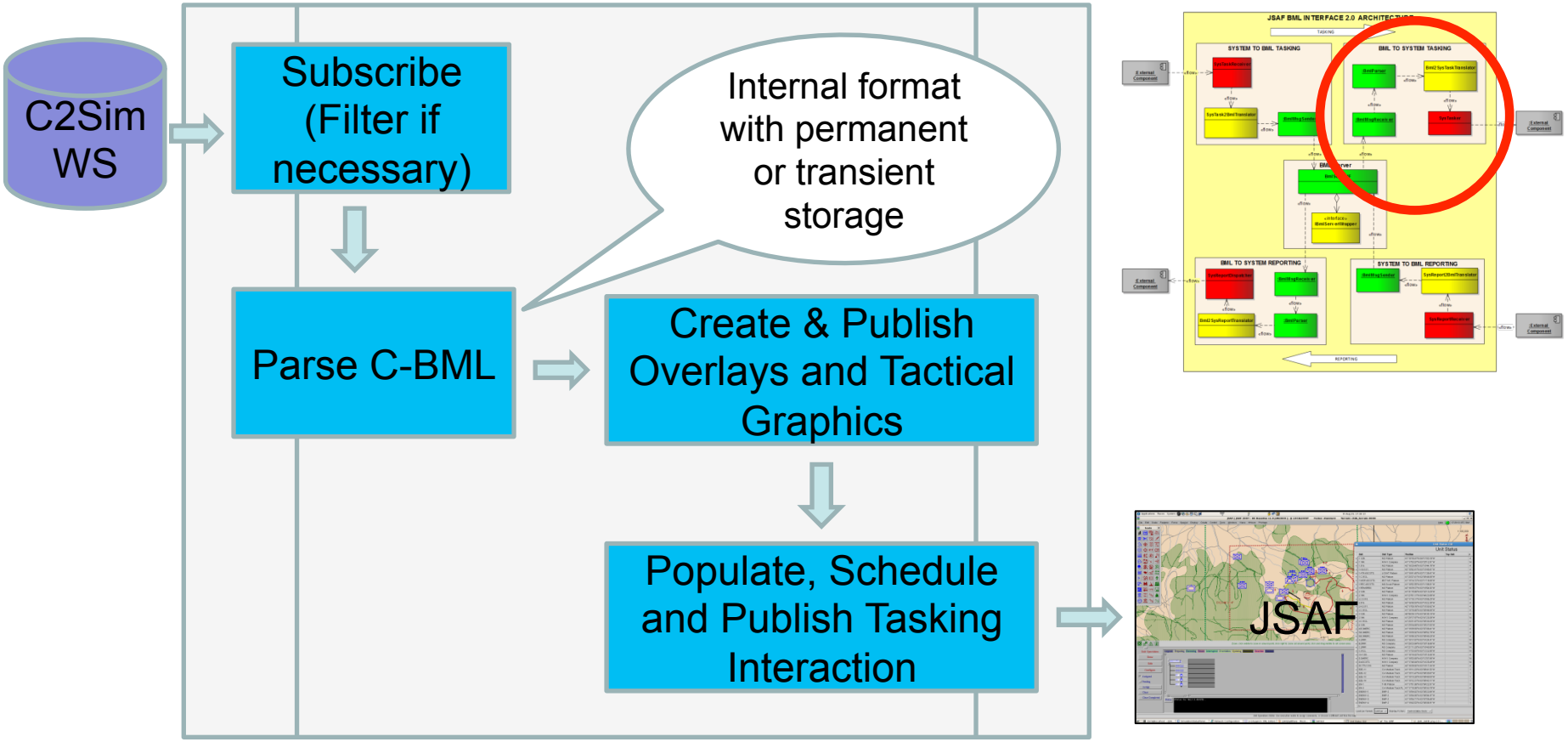
Unit Status

Tasking Matrix

Detailed O/P



JSAF Tasking (C-BML Order) Translator



Reporting

- Simulation provides *Ground Truth*
- Reports to C2 provide *Perceived Truth*
  - Latency, sampling frequency, sensor errors, identification errors, etc increase inaccuracy
- C-BML reports:
  - Positions, Tracks, Event locations – Should be displayed graphically on a map display
  - Other status, e.g. Logistics, Mission reports, Acknowledgements – Better displayed in a written list
- A C2 display, say of a COP, is merely an extension of the operator's memory

Reporting (cont)

- Need to get symbology correct, MSDL is helpful here as it can include 2525D symbol codes for units/equipment
- Mapping to operational message sets is important, not all use 2525D codes, e.g. OTH-Gold
- Overloading C2 systems and middleware with reports is a potential difficulty:
  - May need to throttle, filter or sieve reports
  - May need to be controlled on both or either side of server
- Timestamping of reports is a challenge

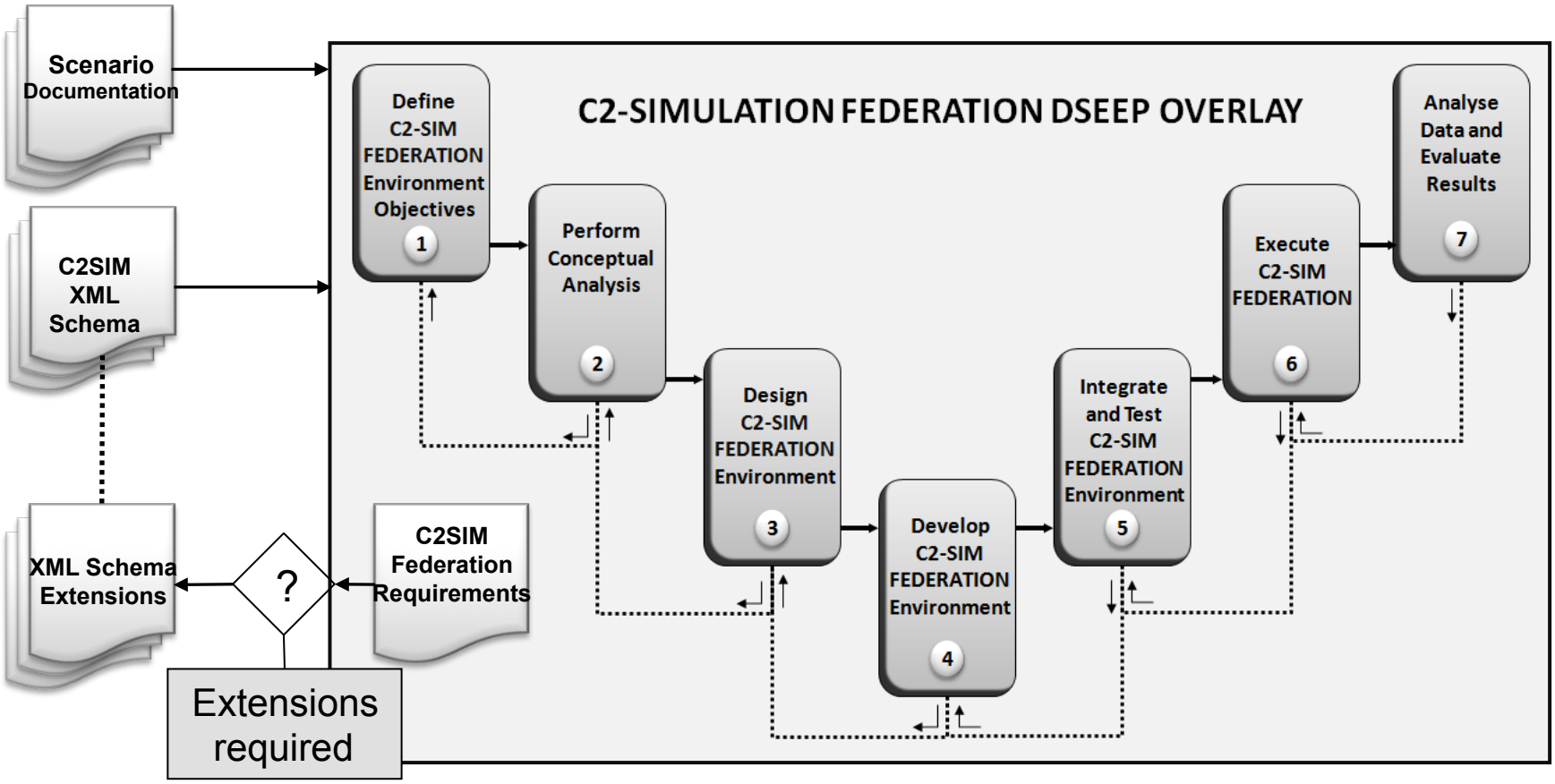
Supporting Approaches

- DSEEP Overlay for C2Sim
- SISO Guide to Scenario Development
- M&S and C2Sim as Services

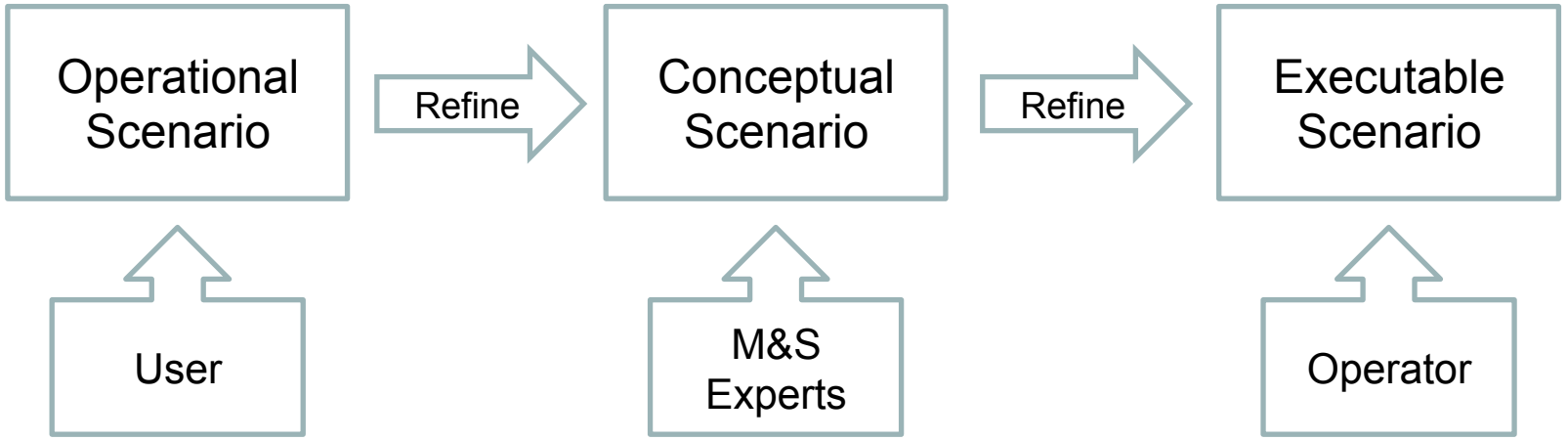
C2Sim DSEEP Overlay

- Distributed Simulation Engineering and Execution Process
- Developed by MSG-085 to help capture the systems engineering processes required to support a C2Sim federation, particularly the System Design Agreements
- Recommendation of MSG-085 is to use a C2Sim DSEEP Overlay when developing complex federations
- Lends itself very well to Agile development methods

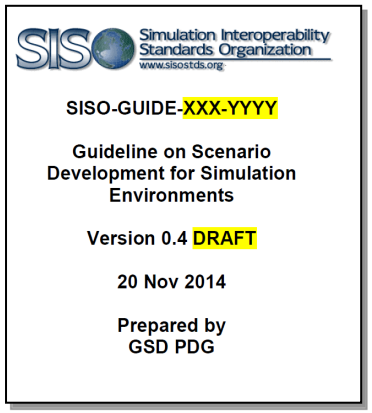
A C2Sim DSEEP Overlay



Guideline on Scenario Development

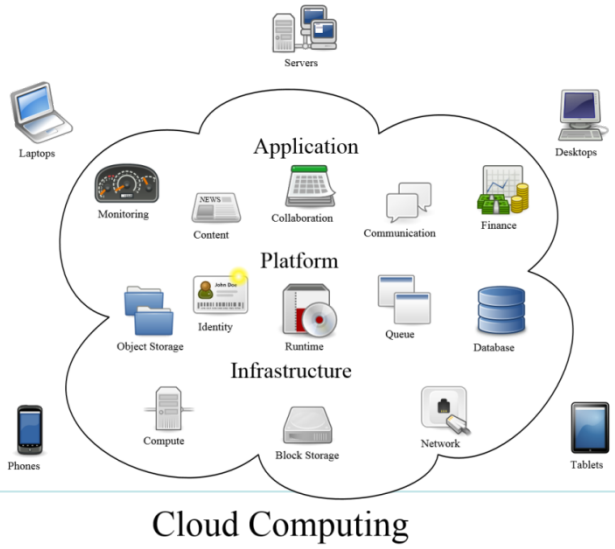


- SISO Guide (currently in draft, Aug 2015)
- C-BML identified as having a role in formal scenario specification for Operational and Executable scenarios
- Refinement processes may require extra data definitions over and above what C2Sim supplies

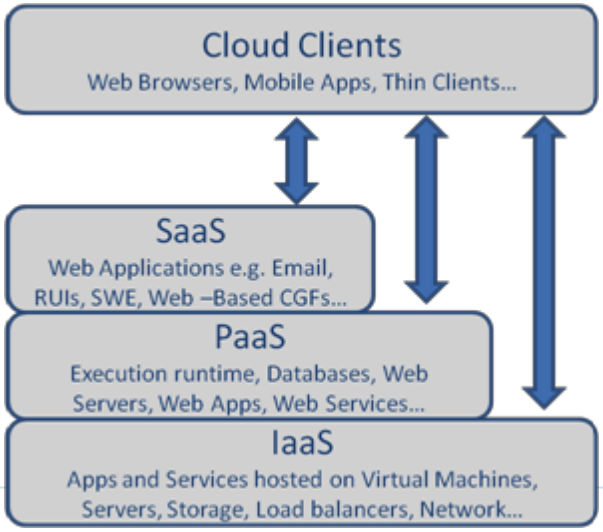


M&S as a Service

- NATO MSG-136 research programme is investigating cloud-based computing systems to support M&S as a Service
  - ➢ Clients access Services, Platforms and Infrastructure 'in a cloud environment'
- What is require to extend this to include C2Sim as a Service?



Cloud Computing



C2Sim as a Service

- C2Sim Interoperability Services are needed to support:
  - Initialisation, development, validation, storing, merging and distribution
  - Exchange of C2Sim messages – push/pull, pub/sub, unicast, multicast, broadcast
    - Addressing, Routing, Acknowledgement, Error-handling
  - Logging, replay and analysis of C2Sim messages
  - Augmentation of C2Sim messages, e.g. adding common metadata
  - Modification of C2Sim messages, e.g. timestamp shifting
  - Translation of C2Sim messages, e.g. between different 'dialects'
  - Exercise Management
    - Coordination/monitoring of participants – which sites/players are joined, their capabilities, status, etc
    - Coordination/monitoring of applications – which applications are joined, etc
    - Security – which data is it possible to exchange and with whom?
    - Time management
    - Federation agreements
- Need to provide service profile meta-data to permit registration, discovery and execution

Questions