NORTH ATLANTIC TREATY ORGANIZATION
SCIENCE & TECHNOLOGY ORGANIZATION
NATO MODELLING AND SIMULATION STC

Establishing an M&S Ecosystem to support Multi-Domain Operations (MDO)

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CA2X2Forum, Sept 2026

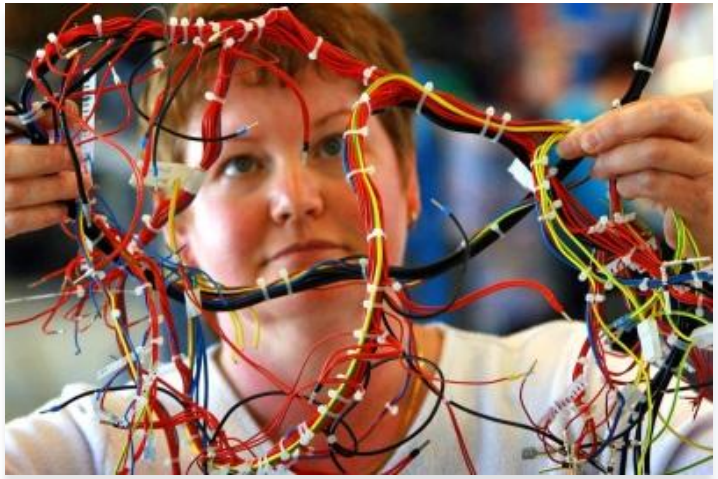
Modelling and Simulation as a Service (MSaaS)
NATO Modelling and Simulation Group

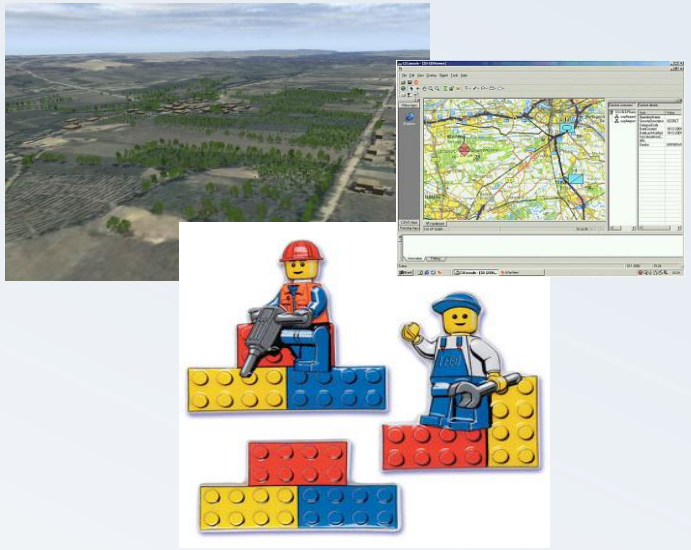
Simulation is a Critical Technology

Training, Mission Rehearsal, and Decision support

Simulation Systems Development Challenge

- Constructed from many components and tools (vendors)
- Interconnected with other simulation systems (standards)
- Data from many sources (suppliers)





Opportunity: Cloud computing

amazon web services™

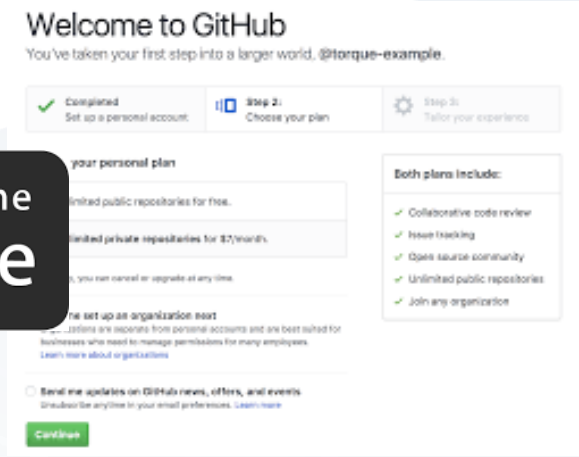
Google Cloud Platform

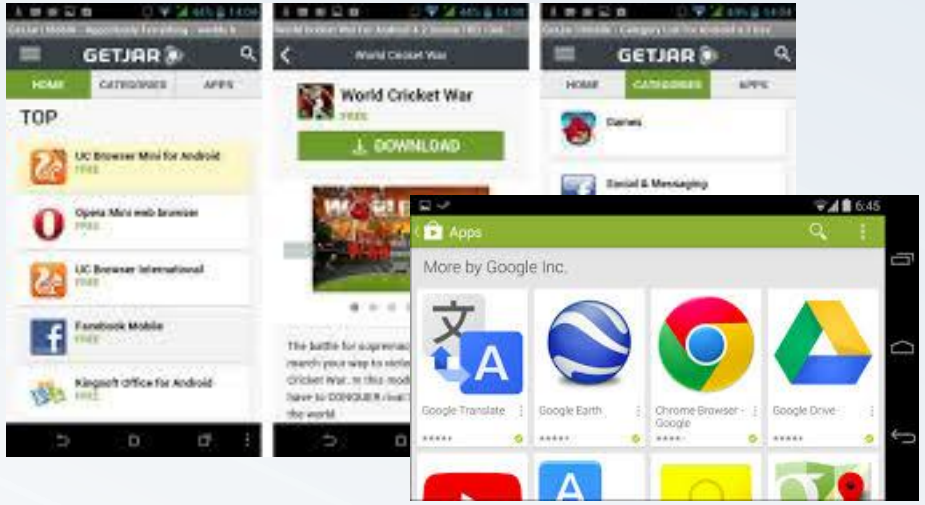
Microsoft Azure

Google docs

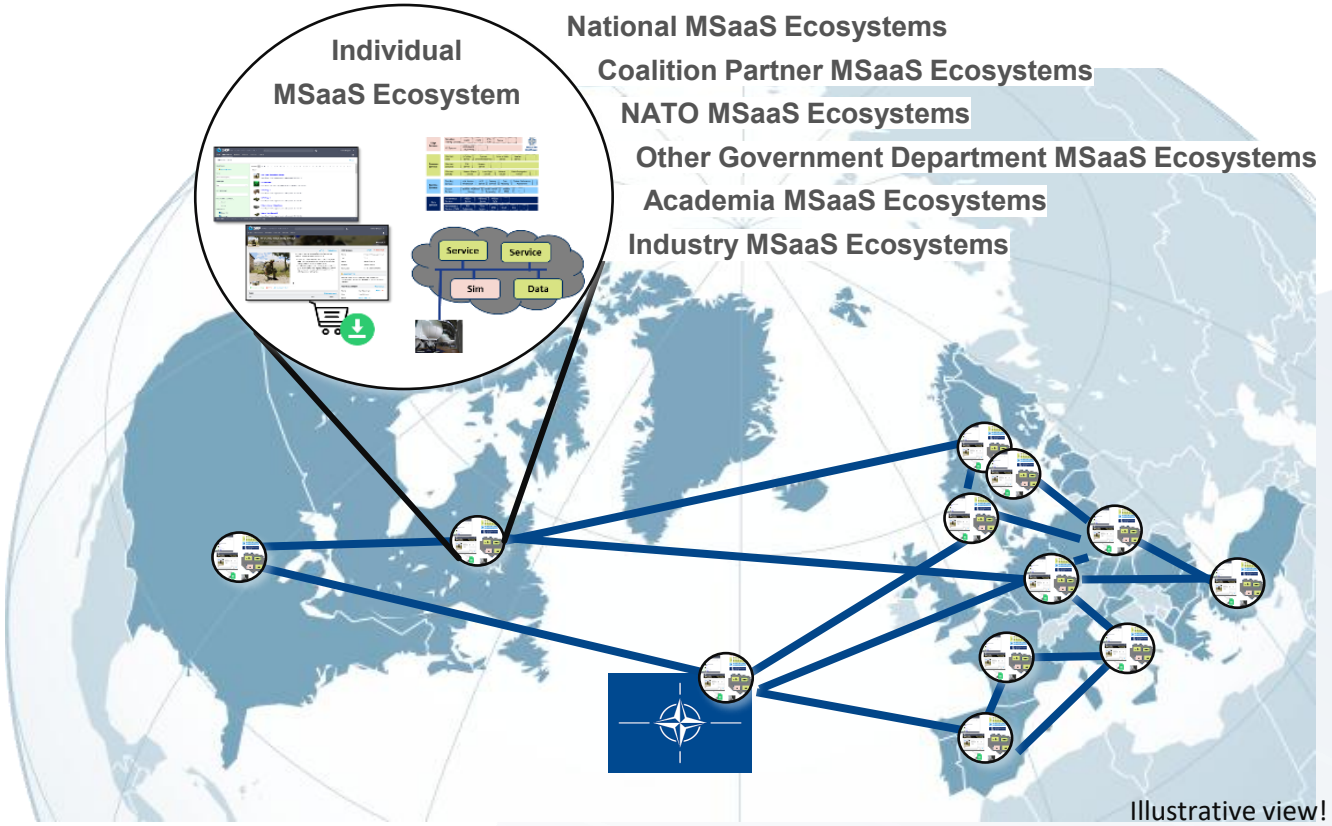
Available on the Android App Store

Download on the App Store





Vision: A federated M&S ecosystem



Joint effort of various players:

NATO OTAN
Modelling and Simulation as a Service (MSaaS)
NATO Modelling and Simulation Group

S&T, Standards, Policies, Governance

Nations/ MoDs

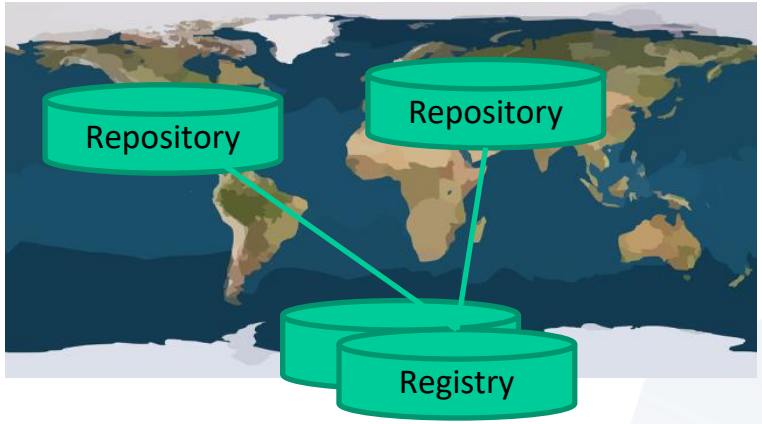
Initial Operational Use by Multiple COI

Industry

Service Offerings, aaS solutions

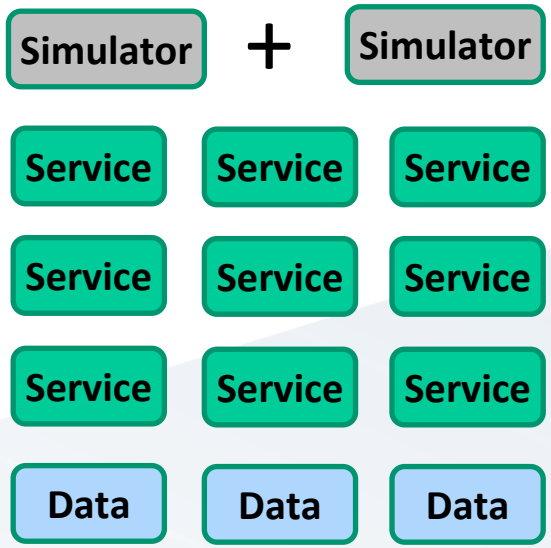
Composition through an MSaaS Portal

Discover



Simulation Resources
- Simulation assets
- Simulation data
- Simulation services

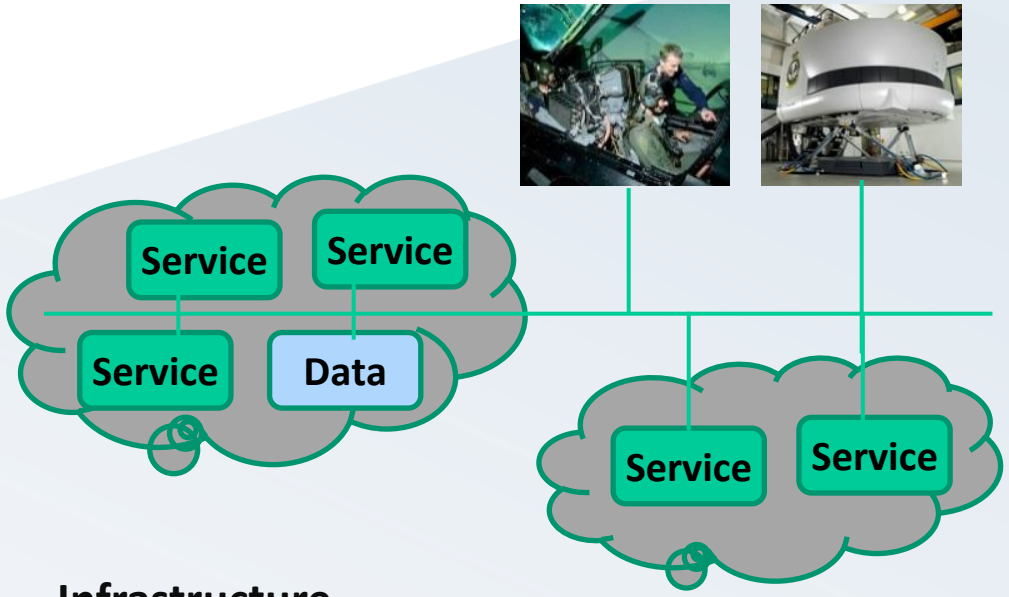
Compose



Simulation Services
- Simulation Service
- Visualisation Service
- Scenario Generation Service

+ many more

Execute



Infrastructure
- Local Area Network
- Private Clouds
- Public Clouds
- Hybrid Clouds

Service Delivery
- Virtual Machines
- Docker Containers
- Web Services

MSaaS Achievements

- MSaaS Concepts (AMSP-02 CONEMP)
- MSaaS Business Model
- MSaaS Reference Architecture (Discovery, Composition, Deployment)
- Tools (Portals, Service Management & Control, Security,..)
- Simulation Services (validated in Experiments)

NATO STANDARD

AMSP-02

ALLIED FRAMEWORK FOR MODELLING AND SIMULATION AS A SERVICE (MSAAS) CONCEPT OF EMPLOYMENT

Edition A, Version 1

AUGUST 2023

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ALLIED MODELLING AND SIMULATION PUBLICATION

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ALLIED FRAMEWORK FOR MODELLING AND SIMULATION AS A SERVICE (MSAAS) CONCEPT OF EMPLOYMENT | CADRE INTERALLIÉ POUR LE CONCEPT D'EMPLOI DE LA MODÉLISATION ET LA SIMULATION EN TANT QUE SERVICE

EDITION/ÉDITION 1

29 August/août 2023

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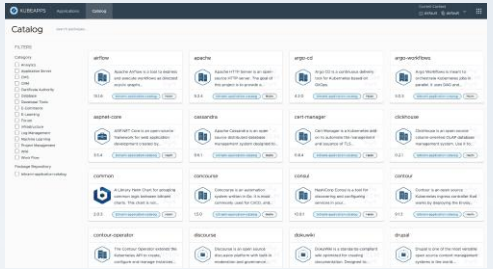


MSG-232 in a Nutshell

"Establishing an M&S Ecosystem to support Multi-Domain Operations (MDO)"
Duration: Feb 2025 – Feb 2028

O1: Validate "Allied Framework for MSaaS" and M&S services in NATO and national MDO-related exercises and applications

- Inject MSaaS into exercises, e.g.
  - BGR CPX (NMA)
  - DYMG (2025), 2026, 2027
  - GLADIATOR ALLIANCE, SPARTAN ALLIANCE, BOLD QUEST, VIKING / Nordic-CPX, CWIX …
- Explore options to use MSaaS for Operational Decision Support
  - Growing interest from SHAPE and Nations
- Start establishing (experimental) MSaaS (+DST) infrastructure
  - Build upon MSaaS sandbox from MSG-195
  - Go from OPEN/NU to NS (e.g., using JFTC BattleLab, DEU MSaaS Hub, …)

O2: Define an open, federated M&S Ecosystem to support MDO

- Define a coherent set of standards required to establish an M&S Ecosystem
  - Identify and describe critical services (see also MSG-201) and MSaaS interoperability standards (see also MSG-223)
  - MSaaS Portal
- Identify Lessons Learned from exercises and applications (see O1)
  - Maintain and revise MSaaS standards and documents as needed (AMSP-02, AMSP-03 (TRA), BM, OCD)
  - Collaborate with DST working group to create exercise preparation checklists/guides/etc.
- Educate stakeholders and grow community of interest

O3: Advance critical S&T

- Address critical S&T topics
  - Service composition and composition validation
  - Federated service management and control (fSMC)

O1: MSaaS for MDO

- Term “MDO” is somewhat fuzzy and means a lot of different thing to different people:
  - How do we understand “MDO”? (Joint? Air Ground integration?, New Domains …)
  - How can MSaaS help wrt MDO? Training/Exercises (at what level)? Decision Support and COA analysis on JFC level? …
- Include Services for Cyber (MSG-200), EW (MSG-2xx), Medical (MSG-HFM-239), Logistics, Space (Space FOM, Space Weather (MSG-235)), Information Ops..

O2: M&S Ecosystem

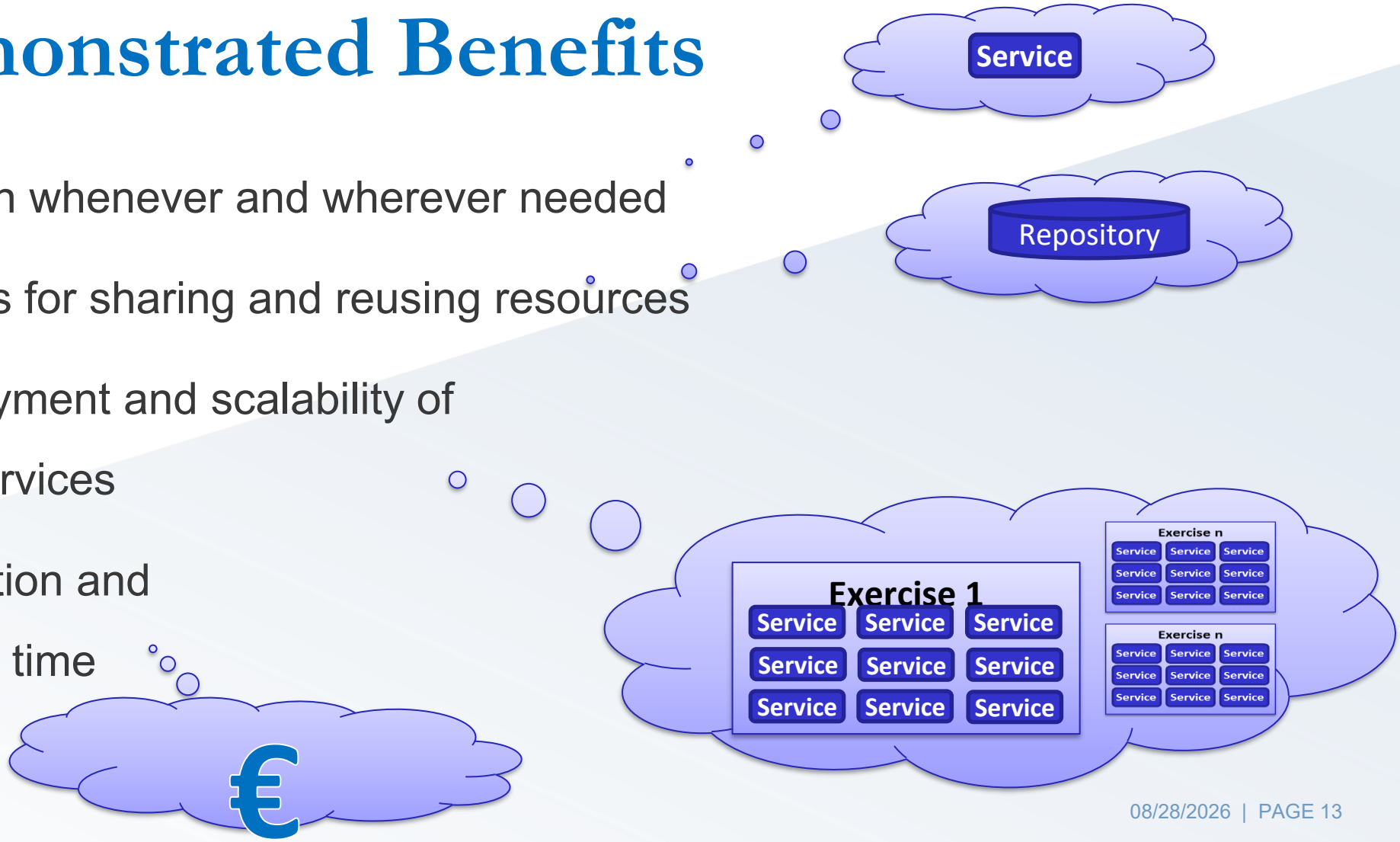
- Mature “MSaaS / M&S Ecosystem Technical Framework”
  - Integrate MSaaS TRA principles in AMSP-03 ‘’RA for Distributed Simulation’’
- Identify missing (interoperability) standards
  - Federated Service Management & Control (SMC), i.e. starting/stopping/monitoring services across multiple MSaaS implementations
  - Investigate internet technologies (eg Kafka, Keycloak, etc.) to complement “traditional” simulation standards (eg HLA)
- Contribute to M&S Ecosystem Roadmap and Implementation Guidance
  - Support continuous testing in MSG-232 sandbox, DST, CWIX etc
  - Discuss **non-technical issues** for establishing MSaaS (eco-system) e.g. IPR, costing,..

O3: Advance Critical S&T

- Mature Discovery, automate Composition and Verification
  - Mature Service MetaData for semantic validation of compositions
- Mature federated Service Management and Control (fSMC)
  - Develop fSMC concept
  - Validate fSMC concept throught tests in CWIX
- Mature security mechanisms (eg Zero Trust for HLA)

MSaaS Demonstrated Benefits

- Delivery of simulation whenever and wherever needed
- Improved capabilities for sharing and reusing resources
- Automation of deployment and scalability of compositions and services
- Reduction of integration and preparation cost and time



Summary

- **MSaaS is a proven innovation towards more accessible and cost effective M&S capabilities**

- **MSaaS is happening NOW and the NATO M&S Science & Technology Committee is actively involved!**

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