



GEMSTONE

Government Enterprise Modeling and Simulation
Trusted Operations Networked Ecosystem

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- M&S and Digital Engineering efforts are slow due to difficulty accessing data and tools
 - 40-80% of a study is gathering and wrangling data
- The Community is federated, diverse, and crosses many organizations
- Heterogeneous IT and Security Standards

Results in:

- Data NOT shared or reused
- Tools and work duplicated
- Difficulty discovering and accessing M&S and Engineering tools
- Disparate access to compute resources
- Quality and speed of work is reduced

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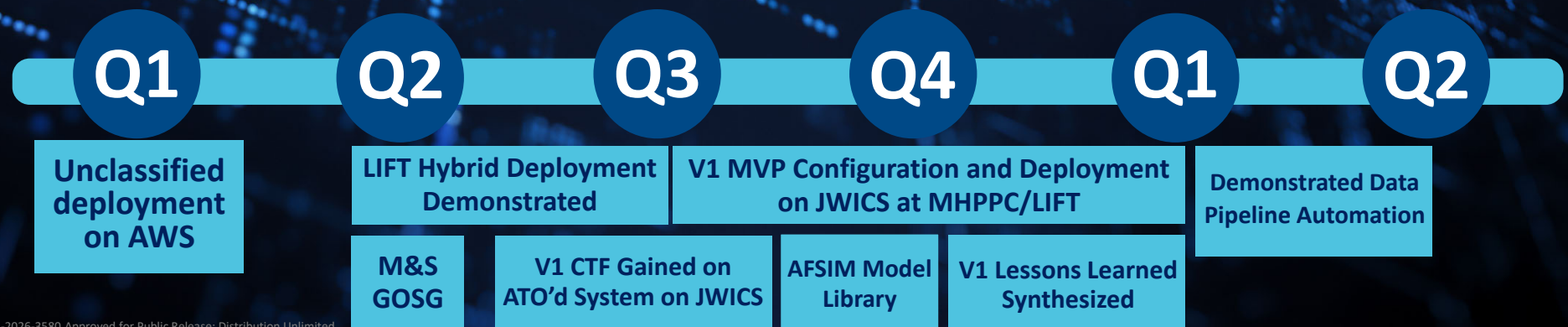
Inception

- 2023 DAF M&S Council Study
- DAF Chief Modeling and Simulation Officer directed prototype development

Fall 2024 – Unclass MVP instance demonstrated key capabilities

- Scalable compute for containerized tools with license sharing - AFSIM, Cameo, Python, Gitlab, plus many open-source and GOTS analysis tools
- Data discovery and sharing in zero-trust framework
- Multiple simulations run in parallel
- Single sign-on

- Jan 2025 – Hybrid deployment on LIFT with cloud extension
- Feb 2025 – General Officer Steering Group Demo on LIFT
- Jun 2025 – AFSIM Sensor Model Library
 - Demonstrated useful model repository sharing – immediately brought on users
- Dec 2025 – Jobs running on TS Hybrid Deployment on MHPCC/LIFT AFWICS
- Feb 2026 – Automated Data pipeline for AFSIM Model Library



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M&S
GATEWAY

- Tool access and scalable compute are useful, but data access is the paramount issue
- Manual upload, download, and updating across environments prevents true data integration across organizations
- Gateway V1 had some redundant capabilities and organizations want to keep their current environments
- Proprietary solutions have cost challenges at scale and limited control

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Heterogeneous IT and Security Standards

- Inconsistent IT and security standards hinder cross-network digital integration
- Legacy processes to access necessary compute and tools compound schedule delays
- Environment setup and maintenance is complex and labor extensive

Proprietary IP, Sensitive Data, and Tool Differences

- Proprietary data in Industry models prohibits true digital integration
- Data accessibility between Government and industry must cross network boundaries
- System data spans multiple classifications, preventing consistent workflows and end-to-end integration

Limited Open Approaches

- Proprietary tech stack solutions inadvertently create lock-in and barriers to entry
- Non-software engineering tools and workflows lack CI/CD support
- CI/CD implementation benefits are limited to software engineer expertise

W K H # V R O X W I R Q

GEMSTONE is an open technology stack that empowers users of new or existing environments to build, publish, discover, and integrate tools, data, and compute across organizations.

REUSE INSTEAD OF REBUILD

**BRING YOUR OWN
ENVIRONMENT**

**CONTROLLED COLLABORATION
ACROSS ORGANIZATIONS AND
NETWORK BOUNDARIES**

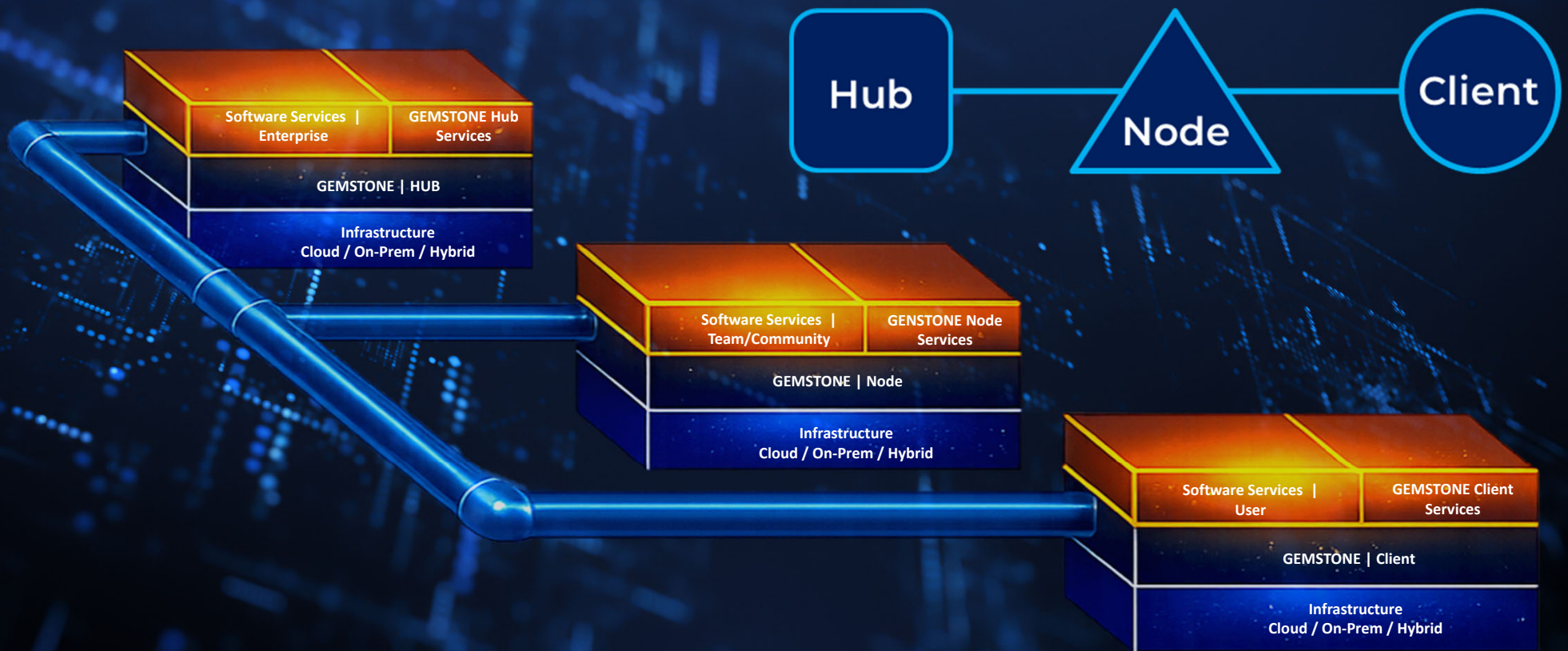


SECURITY-FIRST POSTURE

**LOWER ADMIN FRICTION
FOR TOOL AVAILABILITY**

**EXTENSIBLE ARCHITECTURE
THAT IS OPEN-SOURCED
OWNED BY THE GOVERNMENT**

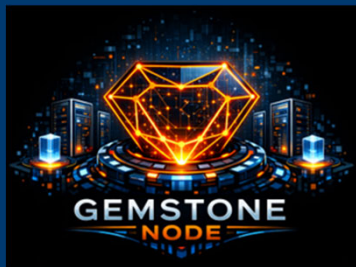
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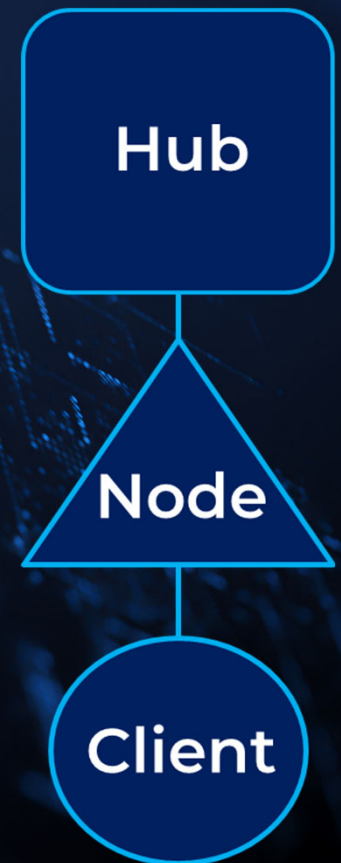
Centralized essential M&S services to streamline operations, lower costs, and connect organizations across the M&S ecosystem.



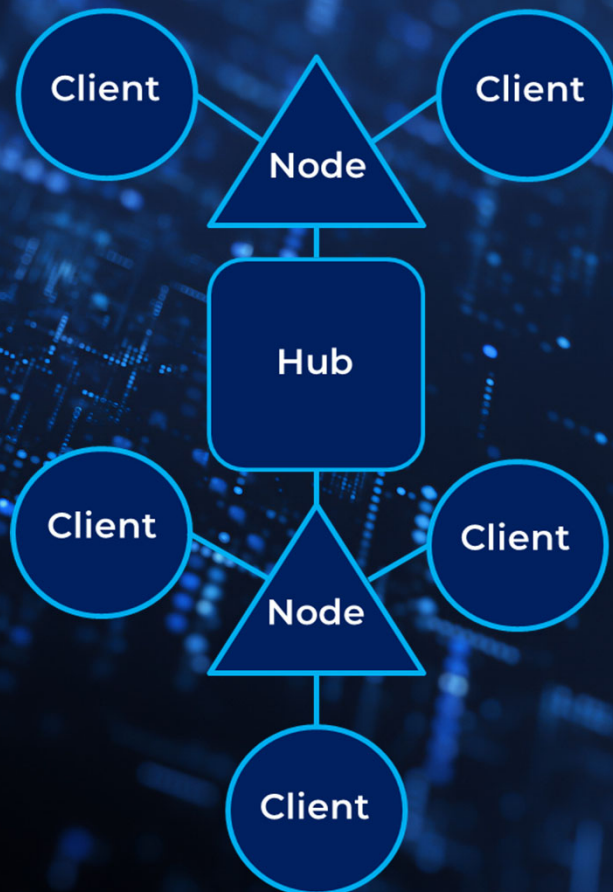
Tailorable M&S backbones that provide mission-specific services and connect directly to the GEMSTONE Hub, with each community shaping its required services and infrastructure.



Tools and compute needed to create or consume digital artifacts and connect directly to a GEMSTONE Node for required services.



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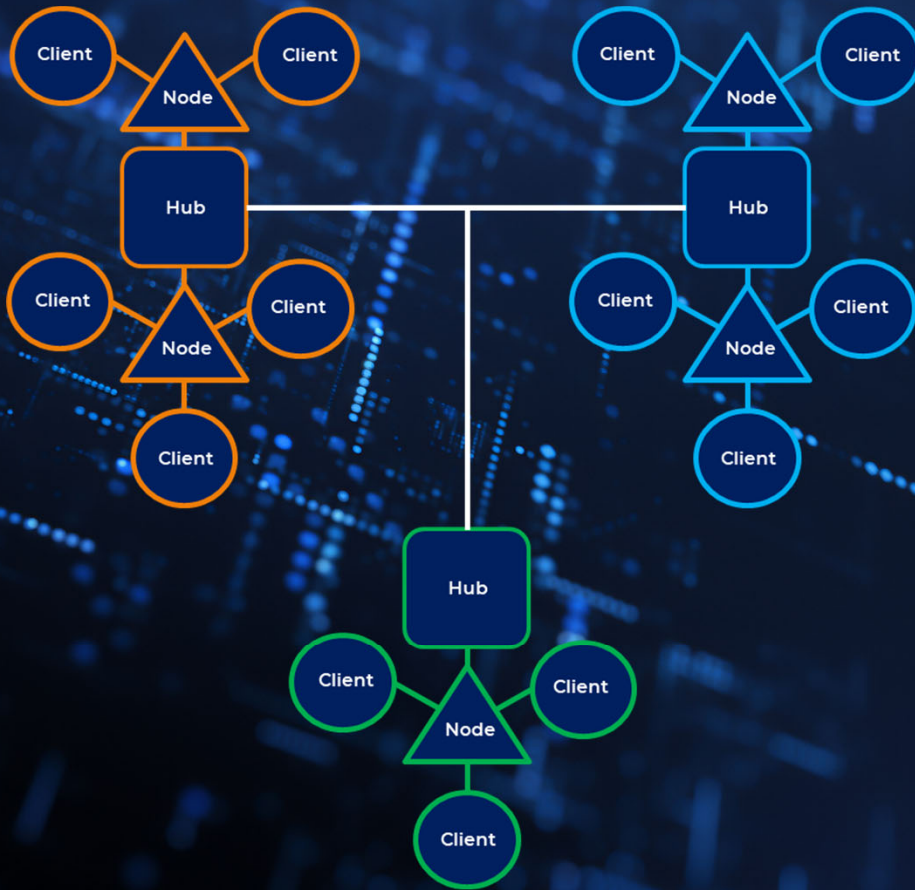
The Modeling and Simulation Matrix is a multi-environment system within an organization enabled by the GEMSTONE Platform

➤ **Nodes tailored to meet specific mission M&S/DE needs and objectives**

➤ **DAF examples of Nodes are AFRL's DLE or DTO's LaunchPad**

➤ **Users can subscribe their clients to one or more Node, depending on mission requirements**

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➤ GEMSTONE enables a networked ecosystem that meshes across the DoW and industry

➤ Every participating organization Matrix can securely subscribe, exchange data, and share information

➤ This enables cross-organizational workflows and supports true digital supply chains

➤ The ecosystem grows organically as more organizations leverage the digital backbone

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Unified Environments

Limits adoption by forcing
into one environment

Proprietary data hard to
share across boundaries

Slow to integrate new or
proprietary tools

Data transfer between
tools is difficult and often
depends on third party
software

GEMSTONE Hub-Node Architecture

Enables scalable adoption
by tailoring to existing
environments

Supports protection of
controlled data, keeping it
in an organization's
network boundary

Provides marketplace
for integrating new or
custom tools

Includes built-in CI/CD-
style data transformation
across tools

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GEMSTONE User-Facing Node Services

- GEMSTONE Tool Marketplace UI
- GEMSTONE Model/Data/Artifact Marketplace UI
- GEMSTONE API/Model/custom-tool Publisher UI
- GEMSTONE Digital Workflow Automation UI
- Server-Side Client Tools
 - Knowledge Manager
 - Learning Manager
 - PLM
 - Generative AI LLM Chat
 - Custom according to Needs



GEMSTONE Hub Services

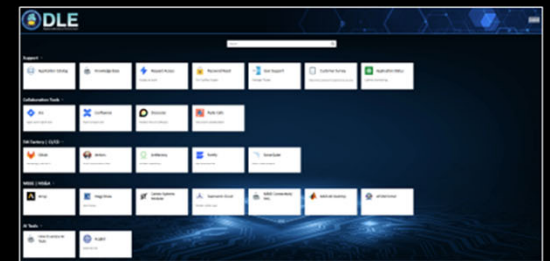
- Centralize Authentication
- Centralized License Server
- Tool Marketplace Server
- Model/Data/Artifact Marketplace Registry and Server
- CI/CD Internal Pipeline Service Manager
- API Manager

GEMSTONE Client Apps



+ Custom according to client needs

EXAMPLE: DLE Client Session



- + GEMSTONE Tool Marketplace UI
- + GEMSTONE Model/Data/Artifact Marketplace UI
- + GEMSTONE API/Model/custom-tool Publisher UI
- + GEMSTONE Digital Workflow Automation UI

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**Government Owned
Open Source**

Air Gap Deployment

**Multiple security
layers, including IL7**

**Secure libraries
for application
development**

**Distribution pipeline
for new capabilities**

**Custom applications
approved within
5 minutes**

**Development and
deployment of tailored
environments in 1 day**

Unified plugin system

**Approved & hardened
Python libraries at IL 5
and above**

**Deploy models and
simulations as API
consumable web services**

**Customization and
expansion via software
development kit**

**Platform enables
distributed simulations**

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2026

- Deploy a baseline GEMSTONE platform instance in unclassified environments
- Automate platform provisioning and configuration through CaC/IaC
- Deliver common user applications and instantiate initial CMSO Hub/Node capabilities
- Onboard partner organizations and operate live industry, government, and academic instances
- Release a GEMSTONE SDK for tool, application, and capability providers
- Expose black-box model runners and static data assets as reusable services within the GEMSTONE ecosystem
- Create custom GEMSTONE applications that use GEMSTONE Digital command-and-control (DC2) services to access capabilities and data exposed by other tools
- Orchestrate digital threads across multiple tools, environments, and data sources

2027

- Create DC2-enabled digital threads using internal APIs and Data APIs exposed by tools and services in other hubs
- Package and deploy digital threads so other organizations can execute them within their own GEMSTONE environments
- Support operational program use on the unclassified GEMSTONE instance, including bring-your-own-environment models
- Enable information exchange across unclassified GEMSTONE environments
- Federate existing and new environments as nodes of the DAF Hub
- Integrate GEMSTONE with HPC environments to support compute-intensive workflows
- Deploy AI MCP capabilities to GEMSTONE nodes
- Run initial non-containerized applications in a GEMSTONE node to support JSE, JPO DESL, and hardware-intensive M&S environments

2028

- Deploy GEMSTONE clients across hybrid and mixed infrastructure environments
- Validate secure operations across high-side and air-gapped deployment environments
- Deploy GEMSTONE edge infrastructure on constrained compute resources
- Integrate with a government-approved CDS to enable multi-level security capabilities



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