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GDMS US-IMS Cloud Migrations

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POSTER

GENERAL DYNAMICS
Mission Systems

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ABSTRACT

General Dynamics Mission Systems (GDMS) is seeking ways to improve the maintainability and scalability of its applications and IT infrastructure by leveraging emerging cloud technology and best practices. The cloud offers many advantages over traditional IT infrastructures, including greater flexibility, reduced cost, improved backup solutions, and faster deployment cycles.

GDMS cloud migration consists of

- Moving new and existing applications to a cloud-ready architecture;
- Creating new cloud infrastructure and services;
- Incorporating cloud solutions in backup plans.

Cloud applications are developed as a collection of smaller services, which are deployed as containerized services. Legacy monolith applications are refactored into a design that allows for containerization of individual services. Applications are then deployed and managed using container orchestration services. Kubernetes was chosen as the orchestration tool because of its maturity and flexibility. Finally, data and artifacts are stored in cloud databases and other cloud backup solutions for persistent, off-site, and unlimited data storage capability.

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INTRODUCTION

Why the need for cloud infrastructure?

- Cloud solutions improve stakeholder collaboration.
- Cloud tools modernize and make the software development cycle more efficient.
- Cloud adaptation can improve RASA system and internal data processing performance.

Cloud for Software Development

- Faster, more consistent deployments
  - Adoption of Continuous Integration / Continuous Deployment (CI/CD) methodology.
- Automated testing, deployment, and backups.

Current Cloud Applications

Vision	RASA/SAUNA SOH monitoring and analysis tool.
Beowulf	Spectral analysis tool.
Cerebro	Internal State of Health and analysis tool.
Pipeline 2.0	Next-gen IMS data processing.

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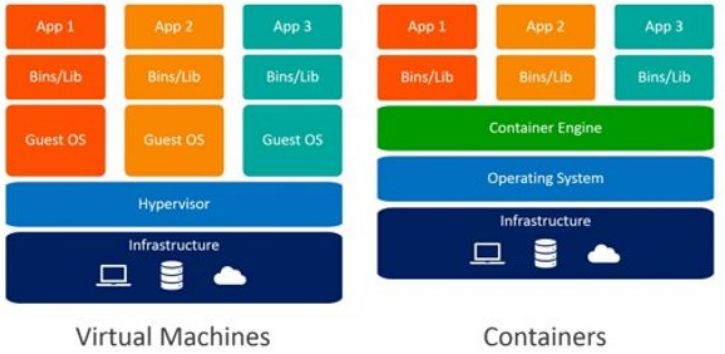
METHODS

Docker Platform

Docker/Container – lightweight, standalone, executable software packages running on the **Docker Engine**. Services for large applications can be broken down into multiple software containers that require much fewer resources than virtual machines



Benefits:

- Less computing resources required than virtual machines;
- Faster testing cycles;
- Compatible with any machine with **Docker Engine** installed.

Current Applications:

- Internal data processing;
- Data visualization tools.

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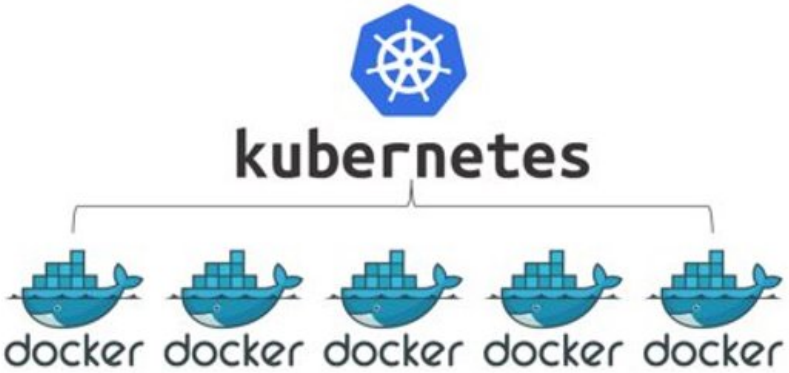
METHODS

Orchestration

GDMS utilized **Kubernetes**: a docker/container orchestration tool.

Uses:

Automates deployment, scaling, and management of various containerized applications in the program.



Benefits:

Centralizes and simplifies container development.

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METHODS

Continuous Integration / Continuous Deployment (CI/CD)

Methodology and development philosophy to implement smaller and more frequent updates, automated testing, and automated deployment.

- Gitlab runners created to automate deployment process from Gitlab repository.

Benefits:

- Gitlab repository works as centralized space to improve collaboration across teams.
  - Smaller, more frequent updates yields faster concept to production time.
  - Improved velocity, quality, and performance metrics.
  - More comprehensive automated testing.

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METHODS

Amazon Web Services

Amazon Web Service – Object Storage Service

Uses:

Cloud database management.

Benefits:

- Scalable, durable, reliable cloud services.
- Persistent, off-site, and unlimited resource capability.

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METHODS

Cloud architecture for future improved RASA performance:

Reliability

- Future development will containerize each RASA server.
- Updates will require only updating a specific server orchestrated from a central repository.
- Software updates will still follow CCR approval process.

Scalability

- Container-based RASA can more readily integrate new features.

Maintainability

- Method of updating RASA software via Docker/Container streamlines the process.

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METHODS

Improved stakeholder collaboration:

Collaboration

- Encourages collaboration across organizations through programs like:
  - Vision
  - Beowulf
  - Mothman (PNNL)

Experience

- Increases experience working with PNNL.
- Vision docker image.

Future Application

- Docker containers can be shared between organizations and deployed to any platform

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RESULTS

Application of cloud infrastructure to GDMS Nuclear Monitoring Program:

Reliability

- Enables consistent build environment.

Redundancy

- Allows for a redundant, decentralized, and clustered infrastructure.

Scalability

- Easier to add new nodes to applications.
- Backend data processing is more efficient.

Maintainability

- Containerizing RASA servers will make RASA system more modular, easier to update and maintain, and may improve uptime.

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CONCLUSIONS

Conclusions

- Cloud enables the GDMS Nuclear Monitoring program to develop, deploy, and maintain software more **efficiently** while becoming more **reliable, scalable, redundant, and maintainable.**
- Cloud facilitates **collaboration** across multiple organizations.
- Cloud-based architecture **modernizes, simplifies, and automates** the software development and deployment cycle.
- Cloud databases are **persistent, off-site,** and have **unlimited data storage capability.**
- Docker/Container applications enable **greater flexibility** for platforms, are **scalable**, and offer **easier maintenance** than virtual machines.