

Ground System Architectures Workshop

Leaping into New Space:
How to Leverage and Integrate
with Traditional Aerospace

February 26–29, 2024
Renaissance Los Angeles Airport Hotel
Classified Session—February 29, 2024

Working Group D Outbrief

***Cloud Computing and Big Data
Technologies for Ground Systems***

***Ramesh Rangachar,
The Aerospace Corporation***

February 29, 2024



Session Goals



- Discuss the current trends, best practices, and lessons learned in using Cloud Computing and Big Data technologies
- **Special Topic for GSAW 2024: Suitability of Cloud Computing for Satellite Mission Operations**
- Satellite mission operations is usually slow to integrate new technologies; cloud computing (public or private) is not an exception
- Discuss the suitability of cloud computing for Satellite mission operations
- Topics of discussion include:
 - *State of the art of mission operations in the cloud*
 - *Maturity and feasibility of cloud services for mission operations*
 - *Mission operations functions/services best suited for cloud adoption*
 - *Enabling mission operations in the cloud for various classes of satellites*
 - *Future trends/plans*

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Presenters/Panelists

Time	Presentation	Presenter
1:00 PM to 3:00 PM	Introduction	Ramesh Rangachar The Aerospace Corporation
	Command and Control in the Cloud: Leveraging Cloud Technology While Remaining Cloud Agnostic	Ryan Melton CEO, OpenC3, Inc.
	Satellite Operations in the Cloud – GMV Perspective	Amaya Atencia Division Head, Mission Data Systems and Products, GMV
	Hybrid approach to IT cloud infrastructure	Michel Horny, EUMETSAT
	Kratos' experience in enabling mission operations in the cloud	Scott Criley Vice President, Mission Solutions Development, Kratos
	Commercial Cloud for DoD Satellite C2 Operations	Jannell Villegas The Aerospace Corporation
	Evaluating Utilization of Commercial Cloud Services for Satellite Mission Operations	Justin Gronert JPSS Mission Operations Manager, NOAA/NESDIS/OSPO
3:00 PM to 3:15 PM	Break	
3:15 PM to 5:00 PM	Panel Discussion: Suitability of Cloud Computing for Satellite Mission Operations Panelists: Amaya Atencia, Scott Criley, Justin Gronert, Michel Horny, Ryan Melton, and Jannell Villegas Moderator: Sheryl Olguin, Systems Director, The Aerospace Corporation	

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Key Points



- Command and Control in the Cloud (Ryan Melton)
 - *OpenC3: Same application can work in any cloud (public or private) or on a standalone server*
 - *Use functionally equivalent services available inside and outside of the cloud*
 - *Maximize the benefits of the cloud; be aware of the downside*
- GMV Perspective (Amaya Atencia)
 - *Discussed challenges and strategies for cloud provider selection, storage management, data governance, impact on long term missions, “as a service” business model, and evolution to cloud GS*
 - *Integration with existing systems is an important consideration*
 - *Customers are using GMV systems in the cloud*
- Multi-mission IT Infrastructure: Evolution and challenges (Michel Horny)
 - *EUMETSAT is evolving towards a common infrastructure architecture*
 - *Simplified management of the infrastructure environment; simplified and quicker delivery; improved security management; improved obsolescence management*
 - *Enables EUMETSAT to move from mission specific computing facilities to multi-mission computing “private cloud for internal users”*
 - *Using private cloud mainly due to data privacy/governance concerns*



Key Points



- A More Orchestrated Ground (Scott Criley)
 - *New Approaches to modernize ground architectures: Virtualization, Software Defined Networking, Cloud Computing, 5G*
 - *Enabling more integrated satellite and ground operations to respond to changes in threat, supply and demand*
 - *Dynamic ground systems are digital, virtual, and orchestrated. This new approach to ground systems helps deliver a service in minutes (instead of weeks to months)*
- Prototype USSF Enterprise Satellite Operations (Jannell Villegas)
 - *Leverage the Public Cloud Infrastructure and Services (Unclassified and Classified AWS platform) to increase resilience and decrease ownership cost; Secure Authority to Operate in 3 months of project start*
 - *Inherited physical and infrastructure security controls, alleviating years of program work; leverage proven CI/CD Pipeline*
 - *Common Scheduler (single scheduler to communicate across multiple antenna networks), Common Telemetry & Commanding (modular design, standardized look and feel across multiple mission customers)*
- NESDIS Ground Enterprise Evolution (Justin Gronert)
 - *NESDIS has successfully conducted cloud-based command and control assessments.*
 - *Emerging technologies and business practices offer a potential path forward: Cloud-based solutions, new technologies, commercial services*
 - *NESDIS is planning on performing further demonstrations and analysis in viable Cloud-Based Architectures*



Conclusions

- Cloud solutions have become very mature. Customers have adopted cloud computing to meet their mission needs
- Cloud adoption is dependent on the use cases
 - *Innovation, scalability, faster time-to-market, frequent changes in configuration, higher risk tolerance*
 - *Preferred for larger workloads; may not be appropriate for smaller workloads*
 - *Performance: May not be appropriate for certain low latency applications*
 - *Cost: Can become expensive, especially with the use of managed services*
- Technical training is important for cloud adoption. At the same time, training to manage cloud costs is also needed
- Cloud agnostic vs cloud native: This is a tough decision