Working Group Outbrief

Ground System Architectures Workshop

Session 11A

Cloud Computing for Ground Systems VII

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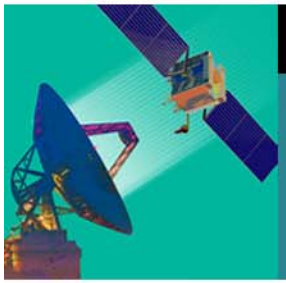
AEROSPACE



Session 11A

Session Goals

- Investigate the convergence of *Cloud Computing, Big Data*, and *Big Identity* in the context of ground systems
  - What are the key mission requirements for the adoption of cloud computing for ground systems?
  - What are the benefits and challenges to the adoption of cloud computing for ground systems?
  - What are the enablers required for cloud computing in ground systems to become a reality?
  - How does the convergence of cloud computing and big data impact ground systems?
  - How will the *convergence of "urbanized" ground systems* be affected and enabled by collaboration and federation technologies?

Big Picture Perspective: Transition of the Space Enterprise

The First 50 years… The Frontier Years

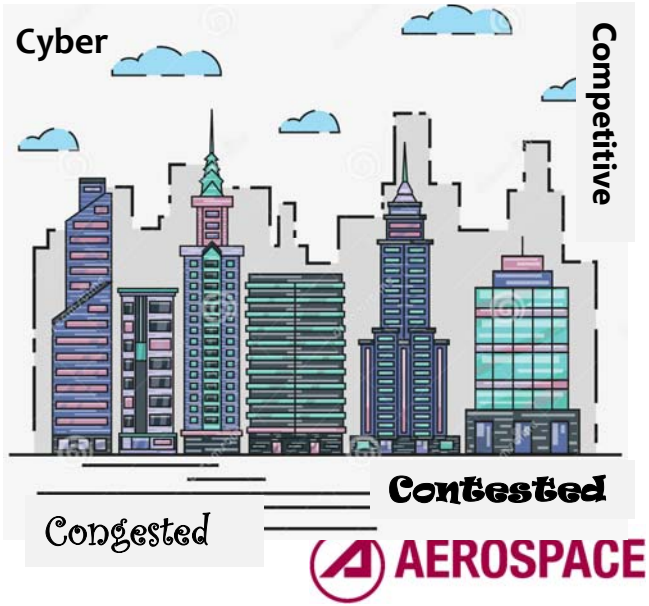
- *Going where no one had gone before…*
- *Each mission had to develop and bring everything to that frontier*
- *Like building a homestead in the wilderness, each stove-piped system had to carry the full industrial base, technologies, systems development, launch, ground operations, dissemination and sustainment to the site*

Enabling Technologies & Market Drivers

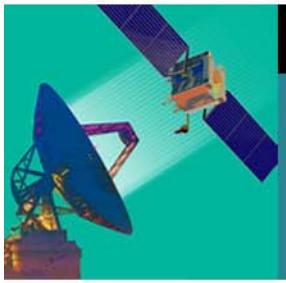
- **Commercial & International Space Industry**
- **Pervasive open source software**
- **High bandwidth networks**
  - **Commercial Services**
  - **Cloud Computing**
  - **Netcentricity**
  - **Nanotechnologies**
  - **Horizontal industries**

The Future of Space… The Urban Years

- *Imagine an **urban space future**… A layered, plug-in architecture/infrastructure where capabilities are families of payloads that plug in to a hosting layer*
- *The hosted payloads plug into a cyber-protected transport layer: akin to tying into a city's roads, power, water, sewer and network grids*
- *Transport layers connect to a mission management layer that manages and disseminates payload data to users*
- *Transformation is via customizable mission payloads, commercially available buses, launch services and provisioned operations*
- *Organizations will need to securely collaborate in this "urban environment", i.e., share data and resources*



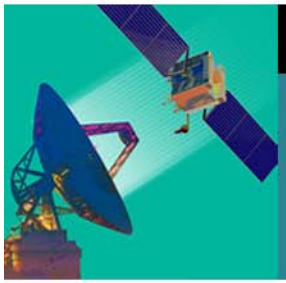
Adapted from "*Shape the Future of Space", by Dr. Jim Gee, Aerospace*



Session 11A

Presenters/Panelists

Title	Presenter	Organization
Introduction	Ramesh Rangachar	The Aerospace Corporation
Container Management Systems	Ann Chervenak	The Aerospace Corporation
SCAPE Framework - Leverage Advances in Big Data to Make Multi-Sensor Data Discoverable	Josh Perrius	Booz Allen Hamilton
Hybrid virtualization for the Earth Observation Payload Data Ground Segment (PDGS)	Gioacchino Buscemi	European Space Agency
Federation Management: What It Is and Why It Is Critical to Future Ground Systems	Craig Lee	The Aerospace Corporation
Town Hall Meeting: Cloud Computing Solution for Ground Systems		



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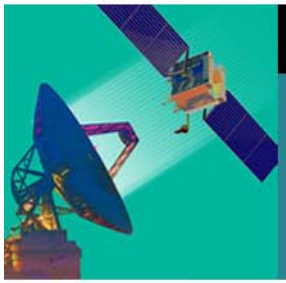
Key Points

- Robust discussion on containers
  - Pros and cons of containers vis-a-vis virtual machines wrt resource consumption efficiency, security, and enabling future architectures such as microservices
- SCAPE
  - The integration of multiple open-source tools to produce a cloud-hosted "big data" capability that includes a data registry, in-memory big data processing, and complex event processing
- EO Payload Data Ground Segment
  - A ten-year journey to produce a converged physical and virtual ground system for data ingest, processing and dissemination across multiple sites
- Federation Management
  - How to securely "bridge silos" among mission partners, i.e., how to create a security and collaboration context that enables joint security policies to be defined, agreed upon, and enforced among participants



Session 11A

Conclusions

- How to enable the "urbanization" of ground systems
  - Deploy missions in a complex eco-system of provided infrastructure services and mission partners
- How to migrate existing missions to the Cloud
  - How to identify common services
  - How to evaluate re-host (aka “forklift”), re-factor, versus re-build
  - *Probable focus of next year's Cloud WG*
- The NIST/IEEE Joint Cloud Federation WG
  - Define what federation means for the USGov
  - Identify areas of standardization
  - Produce running prototypes
  - *Engagement of stakeholders and vendors will be critical!*