Working Group Outbrief

Ground System Architectures Workshop

Session 11E

Cloud Computing for Satellite Operations II

Ramesh Rangachar, Intelsat

Mark Walker, Kratos Integral Systems International

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Session Goals

- The motivation: Cloud computing is bringing a fundamental shift in Information Technology Management

- The approach: The working group consisted of presentations and discussions on cloud computing

- The goal: Develop a roadmap and reference model for successful migration to a cloud environment; discuss key issues in migrating to a cloud environment.

# Ground System Architectures Workshop

Presenters/Panelists

| Title	Presenter	Organization
Introduction	Mark Walker	Integral Systems
Overview	Craig Lee	The Aerospace Corporation
Heterogeneous, High-Performance Cloud Computing	Steve Crago	University of Southern California / Information Sciences Institute
Cloud Computing Applications in Space System Acquisitions	Charles Tang	Aerospace Corporation
Discussion		
Break		
Application Development for the Cloud: A Paradigm Shift	Ramesh Rangachar	Intelsat
Space Flight Dynamics as a Service	Haisam Ido	Honeywell Technology Solutions Inc. (HTSI)
NCOIC Presentation	Craig Lee	Aerospace Corporation
Discussion, Wrap Up, and Next Steps		
Adjourn		

# Cloud Roadmap Elements

- **Private Cloud**
  - Start small
  - Add heterogeneous nodes, e.g., GPUs
  - Develop SaaS Portals
  - Support Programming Paradigms, e.g., Map-Reduce
  - Demonstrate fail-over
  - Scale-up -- add physical servers, data sources, apps
- **Distributed Cloud Infrastructures**
  - Cloud Workflow Management
  - Policy-based Data Management
  - Virtual Applications (vApps)
  - Service-Level Agreements
  - Autonomic Control Planes
- **Crossing Trust Boundaries – *Inter-Clouds***
  - Federated Identity Management
  - Federated Authentication & Authorization
 - Single Sign-on
  - Virtual Organizations
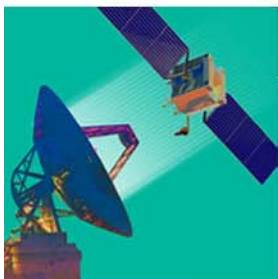
A Cloud-Based Reference Model
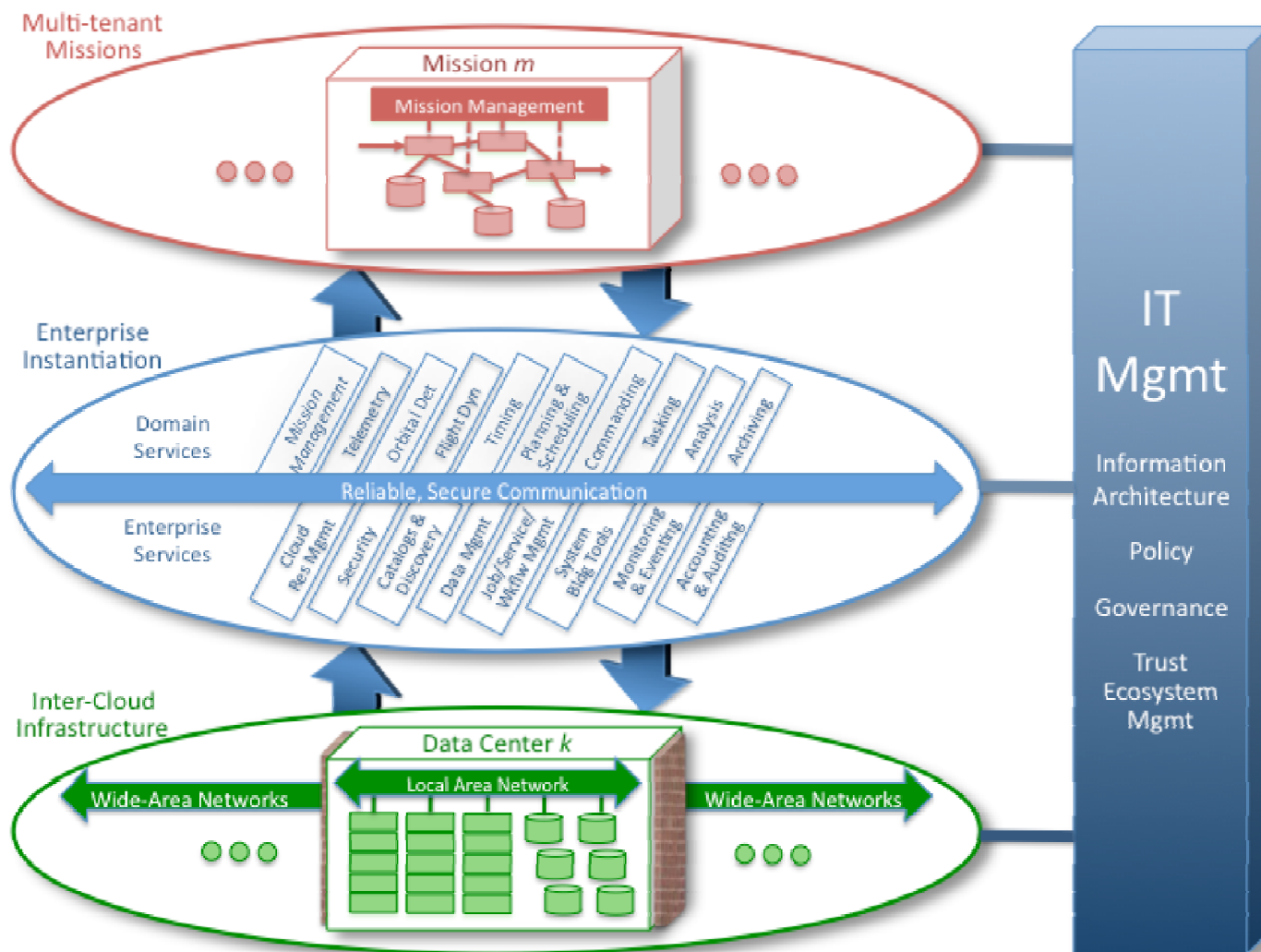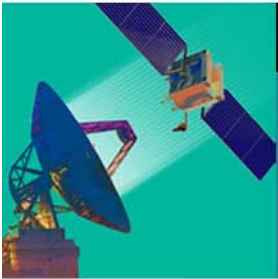
Key Points

- # Security and information assurance are still key concerns
  - – Certification and accreditation
  - – Key road block to migration
  - – Address security hardening
- # Legacy command and control system migration and RMA
  - – How to make the customer comfortable?
  - – How to approach validation after migration?
- # Requirements
  - – Opportunity for cloud computing to connect the capabilities to current and future requirements

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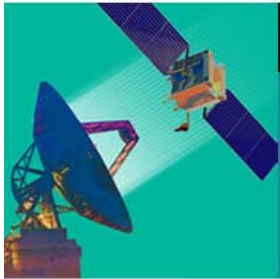
Key Points (2)

- Cloud computing for ground data processing
  - Best fit for cloud technology applications
- Cloud computing for spacecraft command and control?
  - Private clouds: maybe…
  - Public clouds: Comfort level is not there
- Knowledge and skillset
  - Need training to take advantage of cloud programming paradigms
- Success stories
  - Spacecraft operators are risk averse
  - The perception of risk can only be overcome with more success stories in the domain
  - Metrics are needed
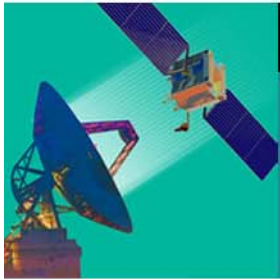
Conclusions and Next Steps

- Cloud computing is here to stay
- The technology *will* impact ground system architectures
- The GSAW community needs to continue to:
  - Demonstrate how cloud computing meets user requirements through success stories and metrics
  - Adjust development paradigms to capitalize on the benefits provided by the cloud environment
  - Address certification and accreditation concerns
  - Apply and refine the cloud computing for spacecraft operations reference model and roadmap