Standards and interoperability: space missions in the Internet era

Adrian J. Hooke
Jet Propulsion Laboratory
California Institute of Technology
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Standardization Themes

- Highly Efficient Interoperable Communications for Resource-Constrained Environments
- Interoperable Plug-'n-Play Onboard Interfaces
- Missions as Extensions of the Earth's Internet
- Standard Space Link Access Services

GSAW
Interoperable
NASA, DOD,
NOAA, Commercial
Space Infrastructure
GSAW2001
Breakout 2:
“Standards and interoperability: space missions in the Internet era”

INTRODUCTION TO SPACE STANDARDIZATION
Adrian J. Hooke/NASA-JPL

OVERVIEW OF STANDARD SPACECRAFT ARCHITECTURES
Joe Smith/NASA-JPL.

STANDARD SPACE LINK CAPABILITIES
Greg Kazz/NASA-JPL

OVERVIEW OF STANDARDS FOR SPACE LINK ACCESS
Fred Brosi,
John Pietras/NASA-GSFC-GST

CCSDS SPACE LINK EXTENSION SERVICES:
Hugh Kelliher,
CASE STUDY OF THE DERA GROUND IMPLEMENTATION
Paula Quintela/VEGA Group plc

OPTIONS FOR INTERNET PROTOCOLS IN SPACE
Eric Travis/NASA-GSFC-GST

SCPS CAPABILITIES AND SOFTWARE
Bob Durst, NASA-JPL-MITRE

SPACE FILE DELIVERY PROTOCOLS
Scott Burleigh, NASA-JPL

SPACE MISSION COMMUNICATIONS SECURITY:
Howard Weiss/NASA-Sparta
Overview of the Options
Nick Shave/BNSC-Logica

DOD RANGE STANDARDIZATION:
Darrell Ernst, MITRE
NEEDS AND OPTIONS - THE RTTN
Adrian Hooke, JPL
Emerging Trends

• Current point-to-point/stovepipe architectures are rapidly evolving towards highly networked configurations

• It is highly desirable to integrate ‘untethered’ vehicles with Internet-based ground operations

• “Postal Model” store and forward operations will become increasingly important

• It is imperative to achieve increased interoperability and standardization across the national space and range infrastructure
  – Military and Civilian Space
  – Military and Civilian Ranges

• All communities have a common need for a full stack of spectrum and power-efficient standardized communications protocols
**Scope of Real Time Telemetry Networks**

**Familiar Web-based interfaces**
- Wired Internet

**Untethered Highly Stressed Wireless Network**
- Significant Delay
- Constrained Processing/Storage
- Constrained Power/Bandwidth
- Weak Signals - High Errors
- Asymmetric Data Rates
- Often Unidirectional
- Disjoint Connectivity

**Wired Internet**
- No Delay
- Today's computers
- Plenty of Power/Bandwidth
- Clean Data
- Symmetric Data Rates
- Bidirectional Data Transfer
- Continuous Connectivity
Growing Consensus

• ISO/CCSDS has laid the groundwork for standardized space and range interoperability
  – But the standards are not static and must evolve
  – DOD needs to figure out how to participate in the open international standardization process

• CCSDS protocols are being adopted by ever-wider segment of the aerospace community
  – Costs will go down if we converge on “a few” common approaches and thus grow our own market to encourage commercial investment

• We should build on basic CCSDS capabilities to provide greater levels of standardization
  – Stressed wireless networking, in cooperation with the Internet Society
  – Distributed application interchange, in cooperation with groups like the OMG
Current Standardization Options

- Constrained Applications
- Constrained Networking
- Constrained Links

- Space Task Force
- IPNRG
- IRTF
- CCSDS
- ISO