A COTS-Based Reference Architecture for Satellite Ground Systems

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Outline

- Architectural Principles
- Why A COTS-Based Architecture?
- Layered Network Approach
- Ground/Space Trades
- Standards
- Conclusions

Architecture Principles

- Framework should maximize the reuse of complete off-the-shelf components
- Flexible framework that allows the mission developer the opportunity to tradeoff features and risk in the design of the overall mission

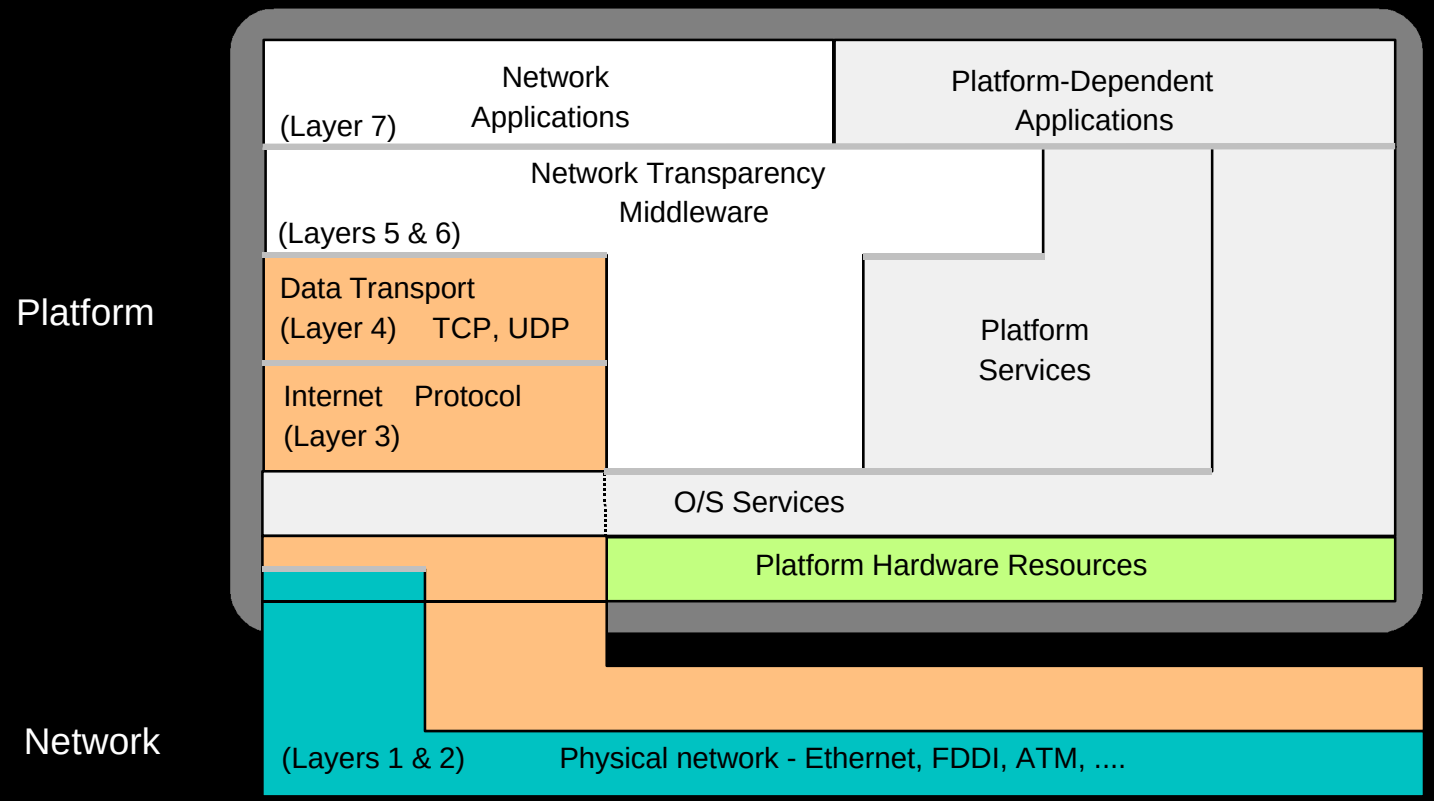
Why A COTS-Based Architecture?

- Maximize component choices and minimize dependence on any specific supplier
- Spread maintenance cost across multiple organizations

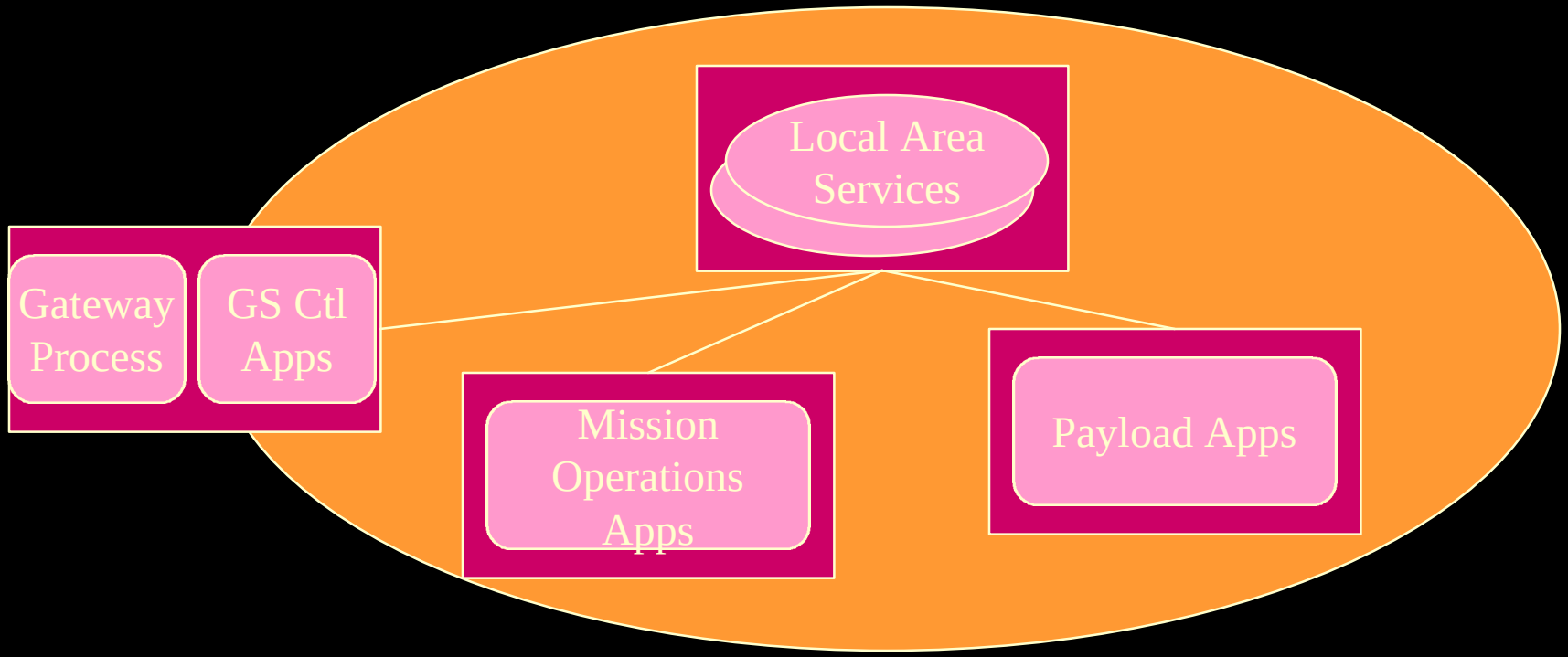
Layered Network Approach

Architecture Layers

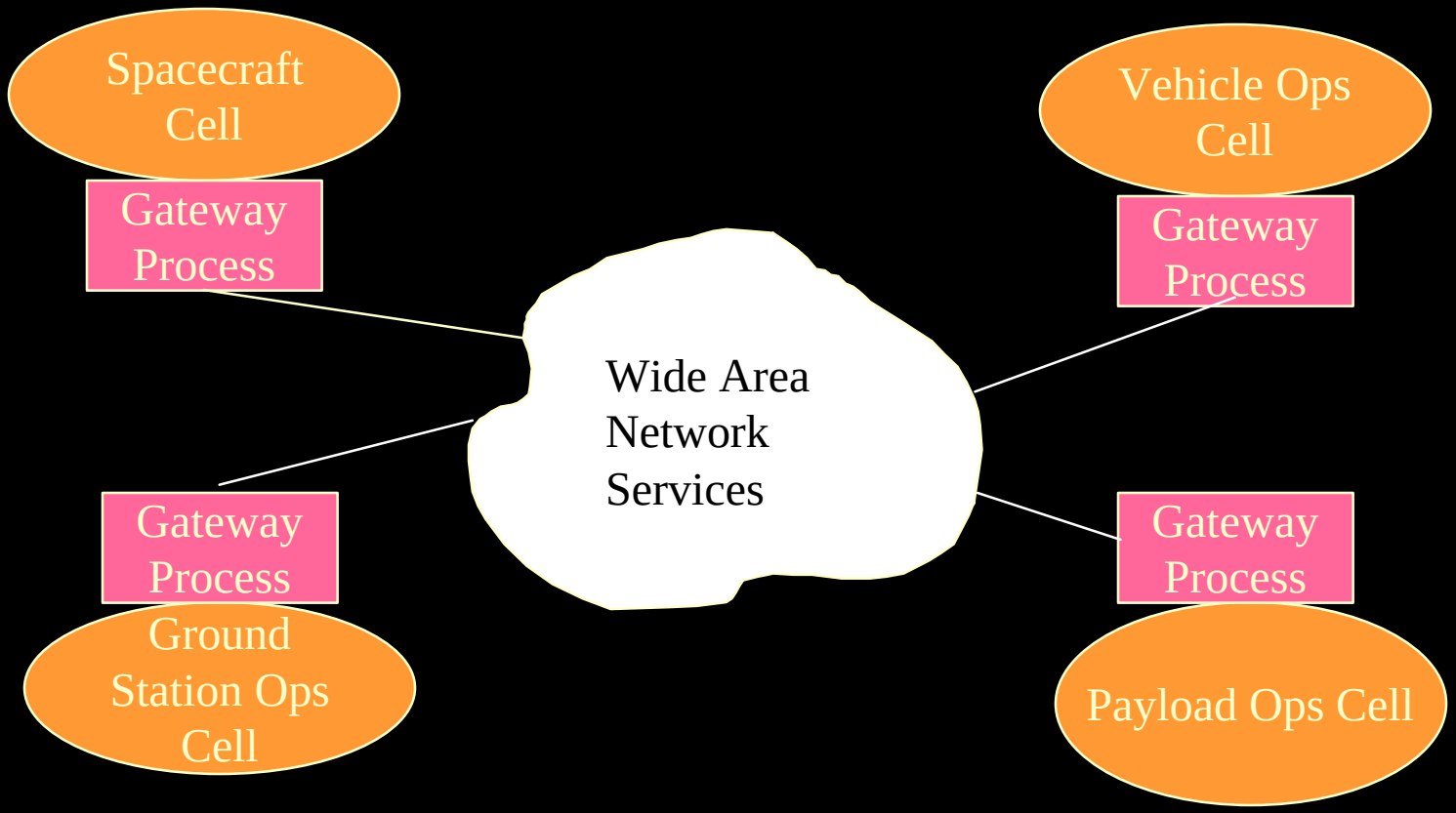
Platform Services



Local Area Cell Architecture

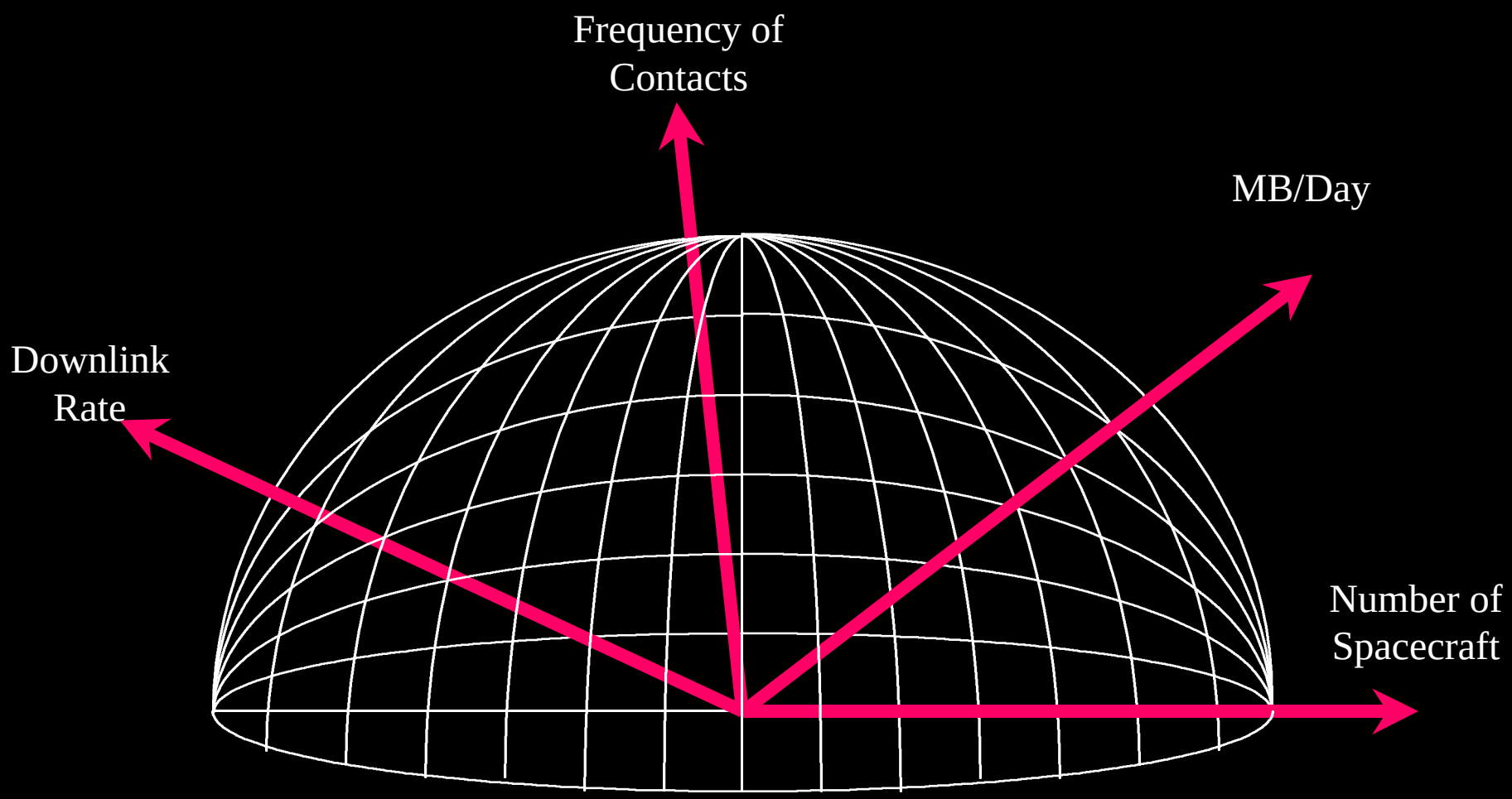


Global Services Architecture



Ground/Space Trades

Architecture Addresses Multiple Dimensions of Mission System



Ground/Space Trades

- Architecture allows functions to be moved between ground and space
  - Architecture addresses entire mission system as a whole network, not as two separate systems
  - Network transparency allows applications to be anywhere in the network and still interact
  - Trades based on multi-dimensional aspects of the problem

Ground Space/Trades

- System is built to meet mission needs
  - Network approach allows applications to be seen as individual pieces
  - Selection of pieces is based on mission needs
  - Designer can easily trade off cost of a component against risk of not having the functionality
  - Mission only pays for applications that it needs

Standards

Standards

- Establish a core of widely accepted and supported standards (Global standards)
- Supplement with a wider set of system implementation standards (Mission standards)
- Differentiate between integration and development standards

Standards Categories

	Global	Mission
Integration	Used when selecting building blocks	Additional standards needed to integrate a given mission
Development	Applied when developing software to be part of a product line	Applied when developing mission unique software

Prototypes

- IMACCS
  - Demonstrated feasibility of integrating a ground data system using COTS
- BIOS
  - Demonstrated use of network transparency layer (CORBA) to allow movement of components within an overall architecture

Conclusions

- Architecture is flexible enough to accommodate a wide range of mission requirements
- Network transparency provides for the capability to trade functions easily between ground and space
- Standards facilitate integration without unnecessary constraint

Acknowledgments

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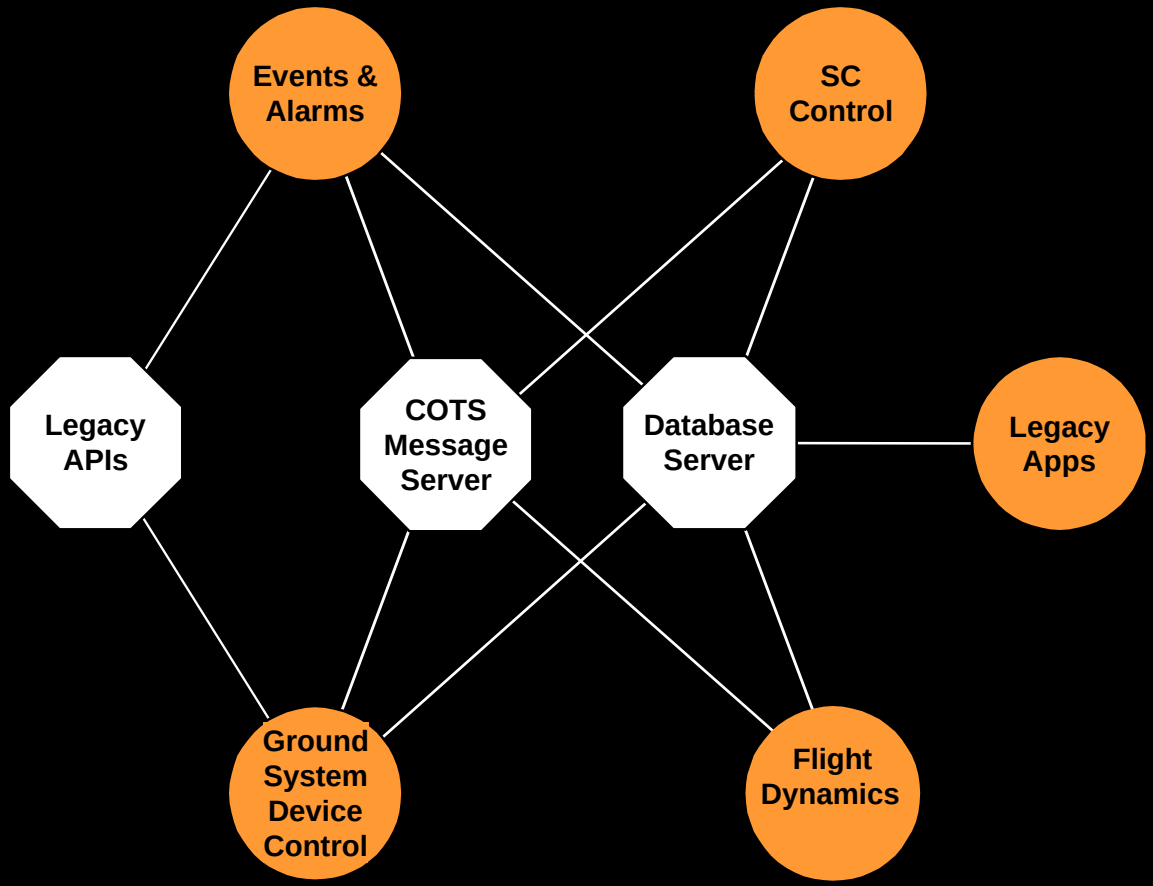
References

1. Renaissance Generic Architecture, 504-REN-96/003, Mission Operations and Data Systems Directorate, NASA/GSFC, May 1996.
2. Renaissance Standards, 504-REN-96/005, Mission Operations and Data Systems Directorate, NASA/GSFC, May 1996.
3. Stottlemyer, Alan, and Hassett, Kevin, "Open Systems Architecture in a COTS Environment," Proceedings of International Telemetering Conference, Vol. 32, San Diego, California, October, 1996.
4. Stottlemyer, Alan, and Hassett, Kevin, "The Role of Standards in COTS Integration Projects," Proceedings of International Telemetering Conference, Vol. 32, San Diego, California, October, 1996.
5. Stottlemyer, Alan, and Hassett, Kevin, "Open Systems Architecture for COTS Implementation," Wescon®/96 Conference Proceedings, Vol. 32, San Diego, California, October, 1996.

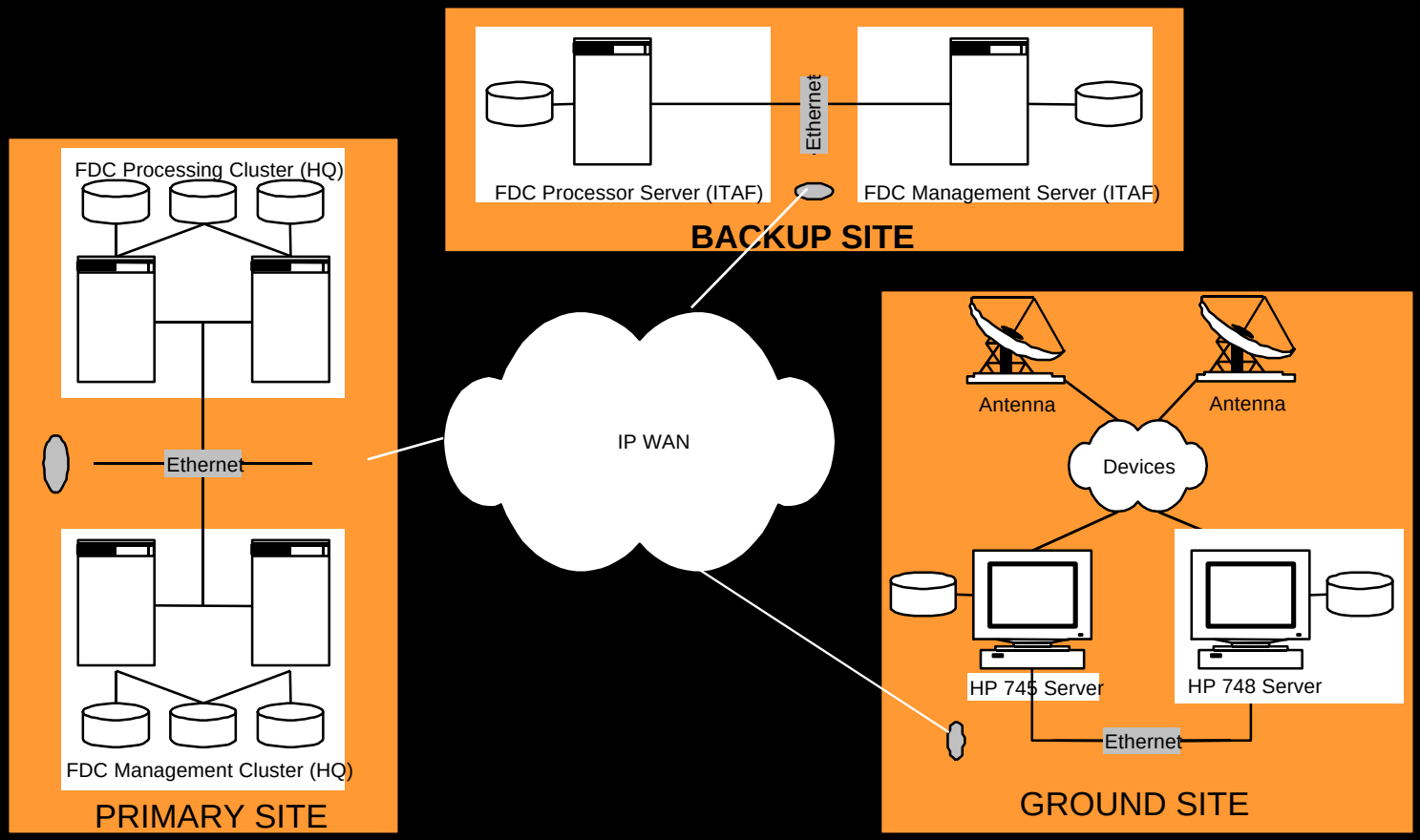
References 1 and 2 are available through Mr. Gary Meyers, NASA/GSFC, Greenbelt, MD 20771.

Appendix A- Sample Implementation Architecture

Sample Logical Architecture Implementation



Sample Global Services Implementation



Sample Implementation Features

- Device Control/Management provides gateway functions between primary control center cell and ground site cells
- Database server replication features provides gateway functions between primary control center cell and backup control center cell

Sample Implementation Features (Cont'd)

- Each component was specified with a set of COTS products
- COTS products selection was a mix of command & control applications and system/network management tools
- Spacecraft could be easily integrated as a cell using the Device Control/Management functionality