

# Ground Station Information Architecture Design Methodology

April Gillam  
Walter Green  
Mike O'Brien

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([walter.h.green@aero.org](mailto:walter.h.green@aero.org))

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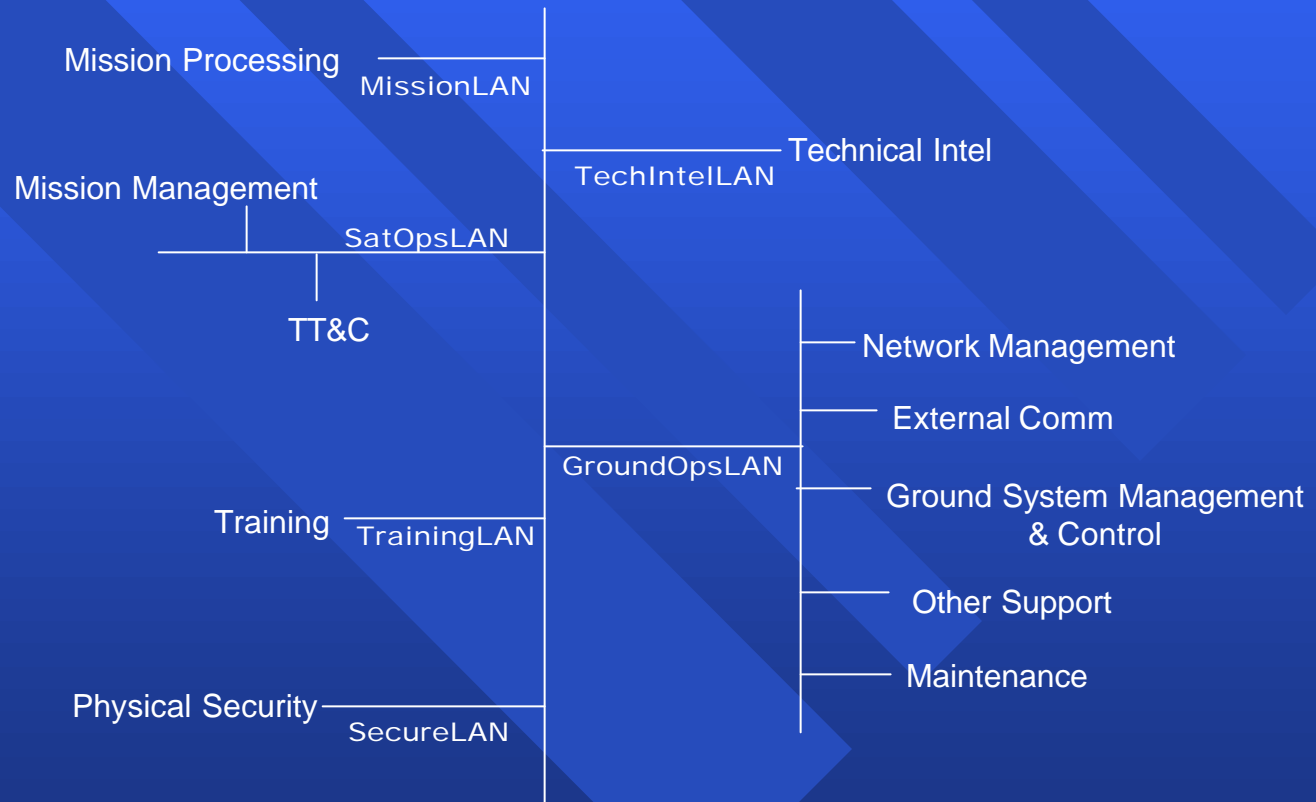
# Agenda

- What is an Information Architecture?
- Process/Development Model
- Primary Design Factors
- IA Methodology
- Design Evolution & Tradeoffs
- Lessons Learned
- Future Work

# Information Architecture

- IA is defined by
  - Networks
  - Bandwidth allocations
  - Information/traffic characterization
- Goals
  - Model flow of Ground Station information
    - Within a Ground Station or between a Ground Station & External Entities
      - Satellites, Other ground stations, Information consumers
  - Characterize types of information in Ground Station
    - Nature of data (e.g. binary, text, block, stream, image...)
    - Producers & Consumers
    - Data rate
  - Characterize network constraints

# Ground Station LAN Topology



# Process/Development Model

- Collaborative Environment
  - IA module interfaces with modules that affect it or are impacted by IA
  - All domain experts and the customer together in CDC during analysis runs
- Spiral Development
  - Iterative development
  - As each module develops and evolves, other modules also change to meet the changing needs
  - Preliminary network concept matures due to staffing, processing, & communications module results



# Primary Design Factors

- Customer Requirements
  - Mission requirements (e.g. alert warnings, weather reports, processed imagery)
  - Timeliness
  - Volume of data
  - Report frequency
  - Reliability
- System Constraints
  - Satellite downlinks/uplinks
  - Existing networks
  - Existing ground facilities
  - Technology/COTS products available

# IA Methodology

- Determine network requirements
- Characterize and size networks & servers
  - Functional Allocation  
(e.g. SatOpsLAN has both Mission Management and TT&C functions)
  - Top-down decomposition
    - System information flow diagram
    - Characterize individual flows
    - Assign “real” resources to flows
- Generate inputs for
  - Communications
  - Processing

# System Connectivity

Microsoft Excel - iamaster1.xls

File Edit View Insert Format Tools Data Window Help

Geneva 10 B I U

V81

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z			
1	<b>System Connectivity</b>																												
2				3.6 kbps	56 kbps	15 Mbps	15 Mbps																						
3																													
4				<b>External</b>										<b>PIGS Internal</b>															
5																													
6	Node	Function	Data Type	ORGS	TDDS	NCA/	Technica Intel	Other Sensor	LARC/	BIGS	Remote Terminals	WAN In	WAN Out	Input from ORGS	Output to ORGS	Router	Mission Processing	Technical Intel	Mission Mgt	Telemetry Processing	Com mands	Ground System Control	Syste m Stat	Storage	Training				
7	<b>External</b>																												
8	ORGS	2-d Tracks	Raw Sensor											1.5 Mbps			1.5 Mbps									1.5 Mbps	1.5 Mbps		
9		Health & Status												15 Mbps			15 Mbps									15 Mbps			
10				External to PIGS																									
11	Tasking Authori	External Tasking Requests for Data												56 kbps						56 kbps						56 kbps	56 kbps		
12	Ground System	Ground Monitoring											3.6 kbps	9.6 kbps					3.6 kbps	9.6 kbps					3.6 kbps	9.6 kbps			
13																													
14	<b>Internal</b>																												
15	PIGS	Input Ports	WAN In																										
16			WAN Out																										
17			Input from ORGS (was Output to ORGS (was																										
18																													
19	Router	Mission Processi	All Missile Launch																										
20																													
21	Technical Intelligence	Technical Intelligence																											
22	Mission Manage	Commands Processed																											
23	TT&C	Telemetry																											
24	TT&C	Commands																											
25	Ground Syst	Ground System																											
26	Gnd Sys Ctl&	System Status																											
27	Archival	Storage																											
28	Training	Training																											

Master Output / Master Analysis / ftns / connections / connect2 / arrows / Sheet5 / Module0

Ready Sum=0

# Lessons Learned

- Module continually evolves
- Diagrams are essential for complex systems
- The impact of dependencies between modules may be different from expectations
- Multiple IA experts are required since no single expert has experience or expertise across all satellite missions, ground architectures, and technologies

# Future Work

- Automatic flow of data between diagrams & models
- Incorporate expert knowledge about protocols
  - SONET, ATM
- Use of standards: JTA, DII COE, Open Systems
- Capture additional dependencies between IA and software, processing, and other modules
- Develop approach to security
- LAN types: ethernet, FDDI, ATM
- Architecture: client-server tiers