



Toolkits Required for ADS-B and Next Generation Surveillance

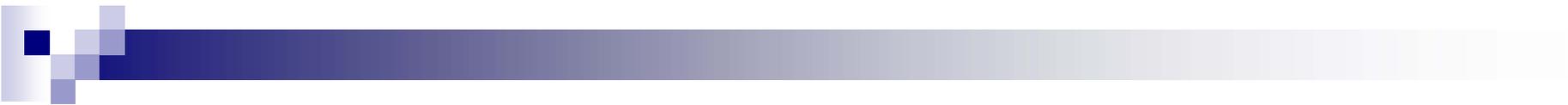
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Overview

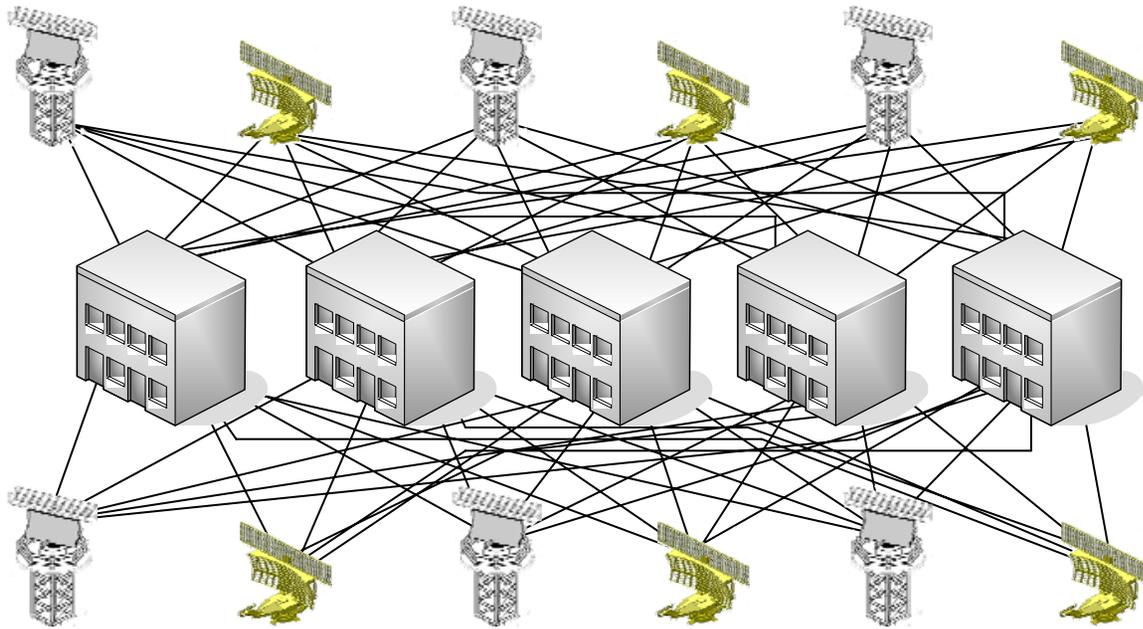
- New tools will be required to support, development, subsystem validation, and traffic generation during system testing.
- These tools will continue to be used to support regression testing, certification, and maintenance.



Infrastructure Transition

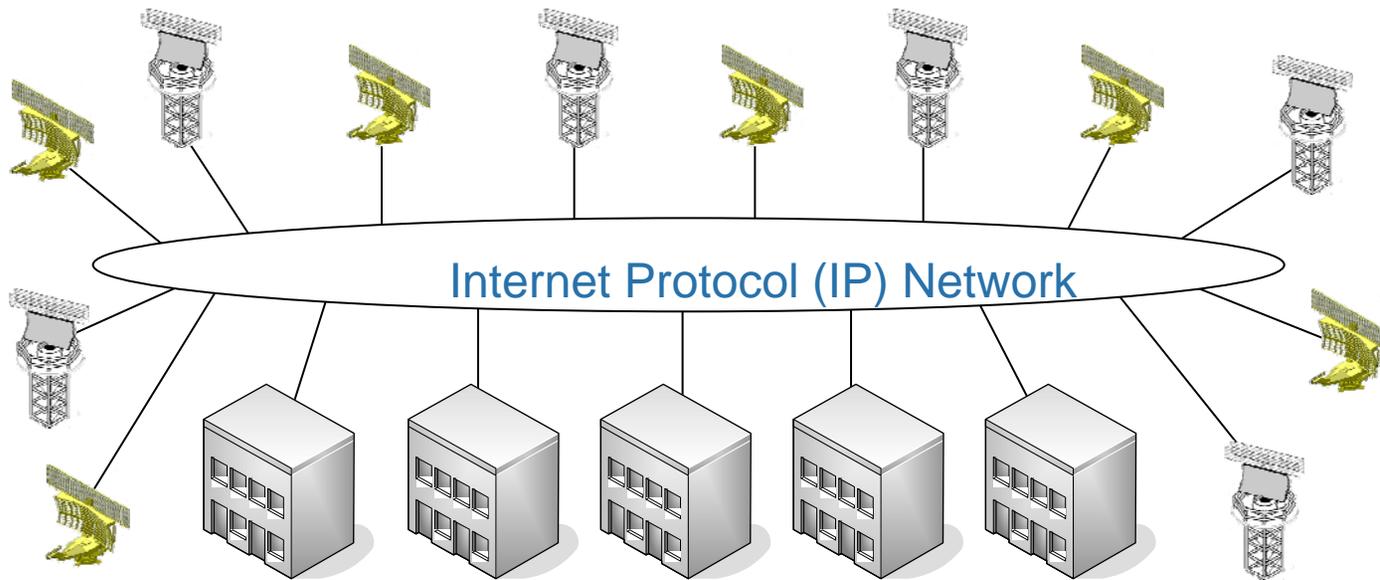
- The existing point to point fixed line low speed surveillance data path will transition to a Broadband multicasted Network

Current FAA Surveillance Architecture



- 2400 Baud Point to Point Synchronous RS232
- Simple

Networked Architecture

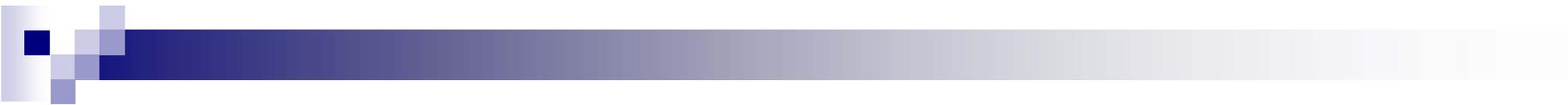


- Greater than 10 Mbit/sec lines
- IP backbone with Multicast routing
- Larger payload and frequency



70's Generation Gap

- Several Generations of technology will be bridged
- Existing support infrastructure will have to be updated with new tools and procedures
- Training



Tool Categories

- Data Load Generators
- Recording and Retrieval Capabilities
- Data Analysis and Reduction Tools
- Simulations
- Data Monitors (real time data analyzer)
- Automation



Data Load Generators

- Programmable message rate generation adaptable to thousands of messages per second.
- Programmable message size including fixed or varying lengths.
- Programmable generation of formatted targets, including range, and azimuth and velocity.
- ADS-B and legacy correlated data to test surveillance combiners.



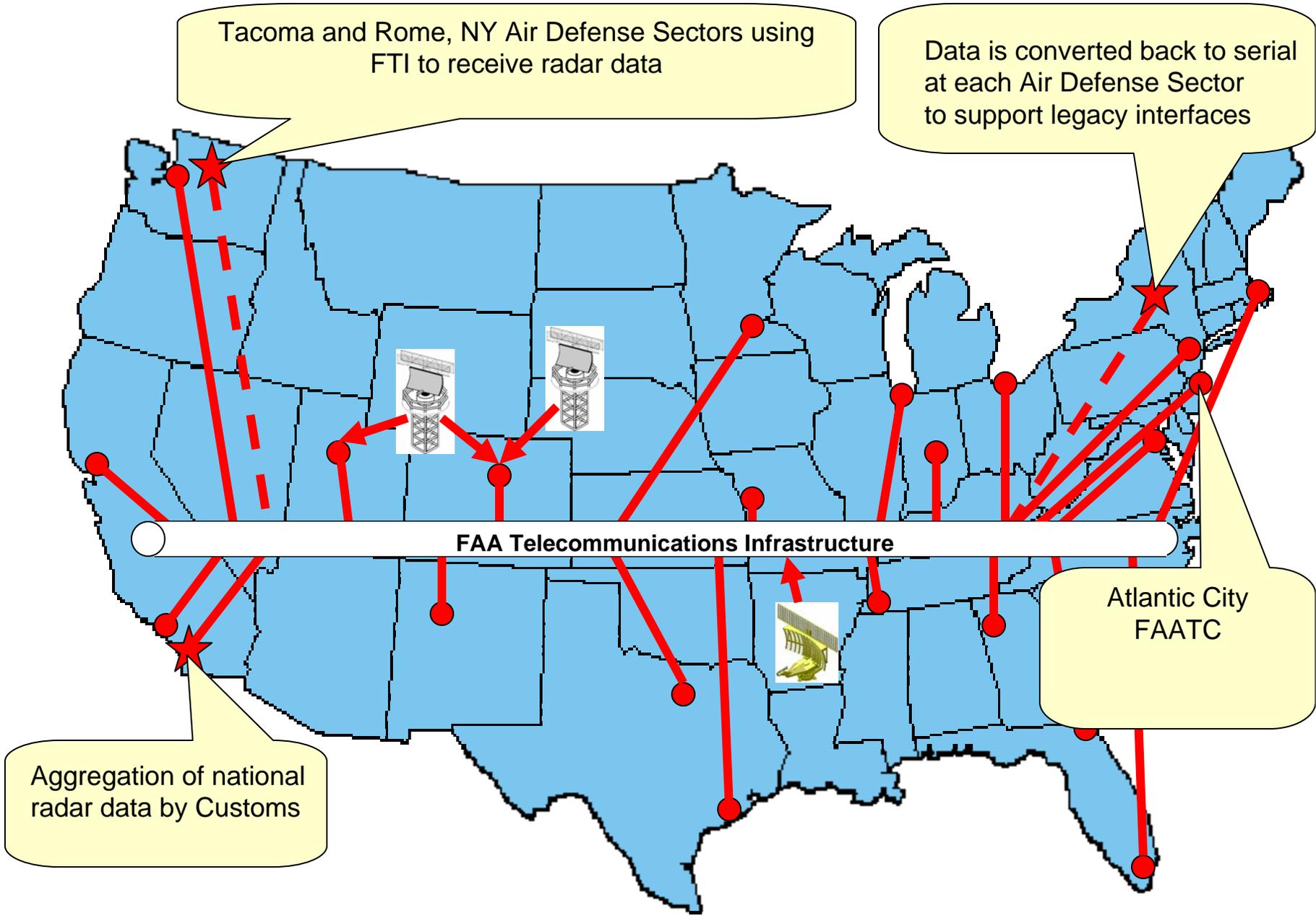
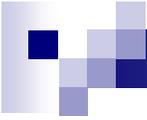
Data Load Generators (cont.)

- Configurable data format including the capability to create valid messages of different ASTERIX categories as well as existing legacy formatted messages.
- Accurate time stamping of all generated messages.
- Ability to generate and inject data errors.
- Capability to replay user defined scenarios or previously recorded data streams of live data.



Recording and Retrieval

- Accurate timestamp capability
- Filter capabilities to allow retrieval of selected information based upon user queries
- Export capabilities in various formats for use by data reduction functions.
- Storage and archival capabilities which will be required to save formal test data for posterity and also to allow dissemination of data to other users.
- Statistical routines and summary reports per time period and/or surveillance source.



Data Analysis and Reduction

Microsoft Excel - stats1

File Edit View Insert Format Tools Data Window Help PDF Create! Type a question for help

	A	B	C	D	E	F	G	H	I	J	K
1	File: secondary_lan.cap										
2			CD-2	ASR-9							
3	AIMS		0	n/a		Data Packets		201,492			
4	AIMS (Test)		0	n/a		File Length (Bytes)		44,256,126			
5	Beacon		191,661	12848		Data Length (Bytes)		32,549,337			
6	BRTQC		4,013	1054		Transmit Time (Seconds)		61.167			
7	Reinforced		471,370	58905		Max Data Bytes per Packet		1,468			
8	Search		185,646	40478		Min Data Bytes per Packet		34			
9	Search (Test)		1,572	0		Ave Data Bytes per Packet		161			
10	Sector Mark (Beacon)	n/a		0		Ave Data Bytes per Second		532,140			
11	Sector Mark (Search)	n/a		33511		Ave Data Bits per Second		4,257,120			
12	Site ID		10,367	0							
13	Site ID (Test)		0	0							
14	SRTQC		3,979	1638							
15	Status		4,732	1516							
16	Status (Test)		0	0							
17	Strobe (Beacon)		0	n/a							
18	Strobe (Search)		8	n/a							
19	Weather		0	0							
20	Weather (Test)		0	0							
21	Unknown		0	2980							
22			873,348	152,930							
23											
24											
25		Centers		Sites		Message Formats		Message Types			
26		ZAB	a	ABI		CD-2		ASR-9		Beacon (Reinforced)	
27		ZAU		ABT		CD-2 Fullscan		ASR-9		BRTQC	
28		ZBW	a	ACT		ASR-9		ASR-9		Search (Correlated)	
29		ZDC	a	ADW				ASR-9		Search Test (Correlated)	
30		ZDV		AEX				ASR-9		Search (Uncorrelated)	

Ready NUM

Exported captured results to spreadsheet



Data Monitors

- Ability to monitor the data in real time
- Must extract data from 5M bit/sec data line
- Plan view display of individual radars
- Eliminate finger pointing interface boundaries
- Must be domain aware

SGAT: Capture File Analysis and Replay

Summary

Run Time (All Packets)	File Size (Bytes)	Total Packets	Total ECGP Packets
0 Hour(s); 1 Minute(s); 1.166866 Second(s)	44,256,126	201,492	200,380

Message Type / Class	CD1, CD2, ARSR3, ARSR4	ASR-9	MAR
AIMS:	0	n/a	0
AIMS (Test):	0	n/a	0
Beacon:	191,661	12,848	0
BRTQC:	4,013	1,054	0
Reinforced:	471,370	58,905	0
Search:	185,646	40,478	0
Search (Test):	1,572	0	0
Sector Mark (Beacon):	n/a	0	n/a
Sector Mark (Search):	n/a	33,511	n/a
Site ID:	10,367	0	0
Site ID (Test):	0	0	0
SRTQC:	3,979	1,638	0
Status:	4,732	1,516	0
Status (Test):	0	0	0
Strobe (Beacon):	0	n/a	0
Strobe (Search):	8	n/a	0
Weather:	0	0	0
Weather (Test):	0	0	0
Unknown:	0	2,980	0
Total:	873,348	152,930	0

UDP Packet Information | ECGP Message Summary | ECGP Message Detail

Transmit All UDP Packets Transmit Only ECGP Formatted Packets

FILE: C:\Documents and Settings\Pivinski\Desktop\SGAT Capture Replay Data

Analysis Format: Any

Process Status: File Loaded

Open Capture File Local IP: 10.0.1.51 Remote Port: 1969 Multicast Address: 239.1.1.1 Transmit Loop

Data Monitor of Surveillance LAN



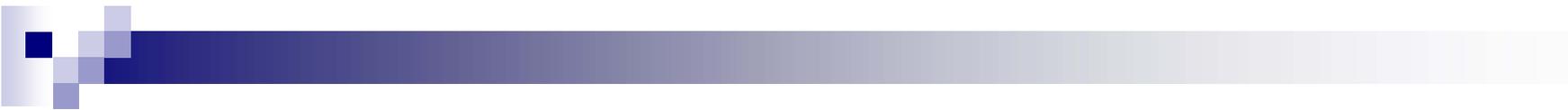
Automation

- Ability to automate tools and simulators in concert allows reproducibility
- Eliminates human error
- System test time is an expensive resource and automated test and configuration



Remote Test Capabilities

- Networked surveillance infrastructure will connect over 400 Service Delivery Points
- These will be geographically distributed across the US
- Requirements testing will require coordinated remote control of system resources for performance testing



Remote Test Capabilities (cont.)

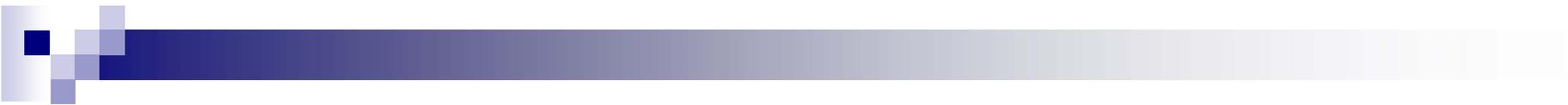
- System Monitor and Control capabilities will also require full system remote testing to validate operation over the network
- Remote Operation will be required to insure the reproducibility necessary to validate requirements



Latency

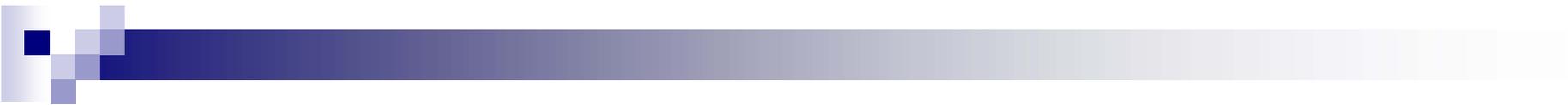
- “The Service Provider shall verify that the maximum delay between the reception of ADS-B Message, containing a State Vector or an emergency condition, and the reception of the corresponding ADS-B Report at the Service Delivery Point (SDP) are less than or equal to 700ms under the conditions of the operating environment.”

- ASD-B RFO



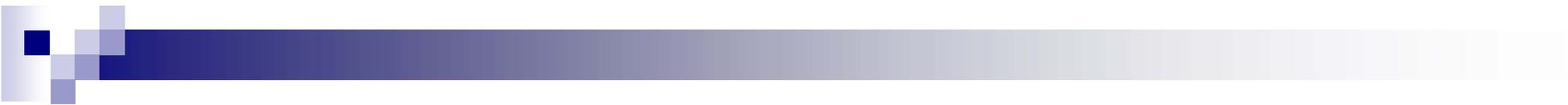
Latency Statistics

- “The verification shall document the minimum, maximum and average latencies for each aircraft/vehicle.”
- Similar requirements apply to:
 - ADS-R
 - TIS-B
 - FIS-B
 - ASD-B RFO



Tool Evolution

- The vast majority of the tools used today were not meant to be fielded.
- They were scripts and programs created by the testers or developers for their own use.
- History has shown that these tools will live on and be used to continually validate, certify and maintain the system after deployment.
- There are several handy dandy routines that have been used for the last 25 years.



Summary

- The Next Generation Surveillance system will require new tools and skill sets to maintain.
- Two types will be required
 - Standard Ethernet sniffers and IP trace tools
 - Domain specific tools
- Data reduction tools will be critical to analyzing the vast amount of data
- Tools will live on as a part of the system