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IPv6 Based Aircraft Data Networks and Voice Services

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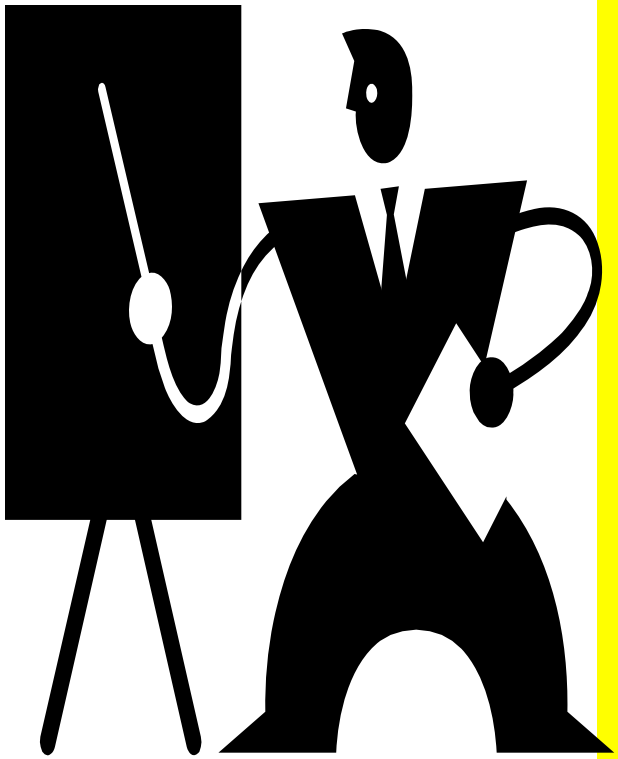
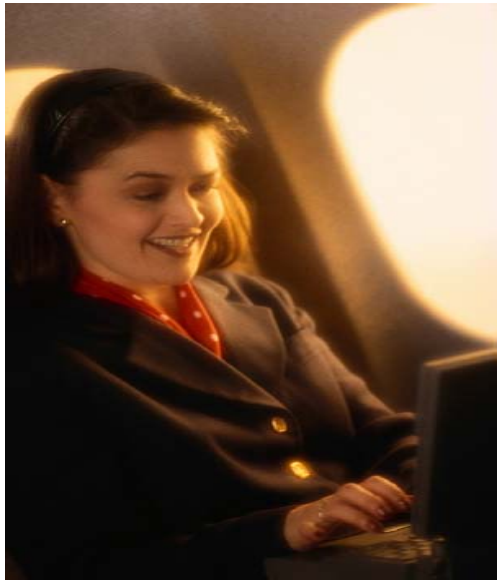
Outline

- Introduction
- ADN Architecture
  - Services
- IPv6 and ADN
- Voice over IPv6
- Test-Bed
- Results & Analysis
- Conclusions & Future Directions



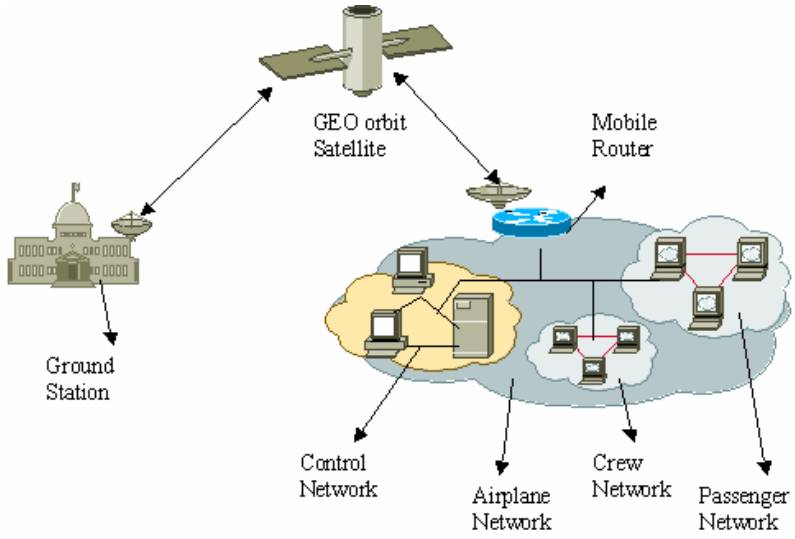
Introduction

- Aircraft Data Networks are fast becoming a reality
- Internet connectivity within the aircraft enables new services within the aircraft
- Open Issues
  - Addressing
    - IPv6
  - Quality of Service



ADN Architecture

- Three network subgroups
  - Control network
    - Avionics subsystem
    - Small amount of data
  - Crew network
    - Connected to corporate network
    - Voice/data traffic
  - Passenger network
    - Internet access
    - Voice/data traffic



ADN Architecture (Contd…)

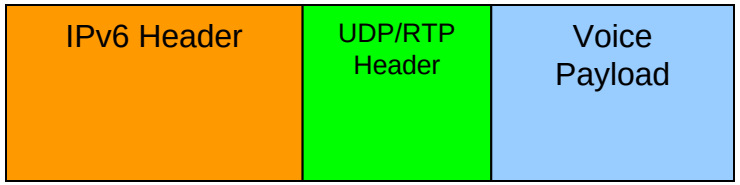
- Services within the aircraft
  - Real-time data backup
  - Data services to crew/passengers
  - Internet based entertainment
  - Internet telephony

IPv6 and ADN

- IPv6 supports larger address space
  - Every element within the aircraft can have it's own address
- IPv6 has built-in security features
  - Support for IPSec is a requirement in IPv6 implementation
- Simplified routing
- Mobility support

Voice over IPv6

- Standards are still evolving
- IPv6 overhead
  - Voice packets have small payload
- Equipment/Protocol support
- IPv4 over IPv6
  - Tunneling

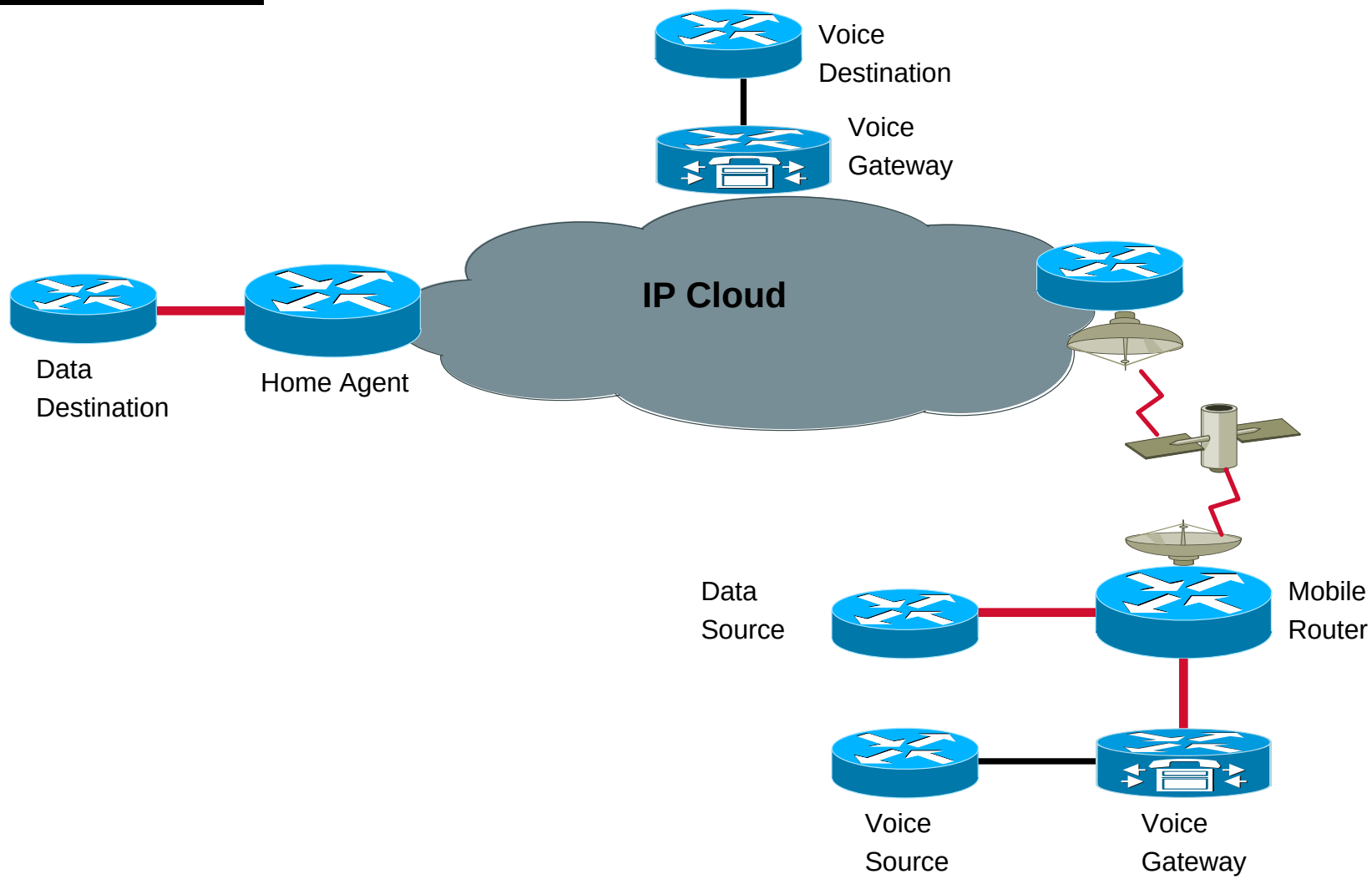


$$\%Overhead = \frac{Total\ Packet\ Size - Voice\ Payload\ Size}{Total\ Packet\ Size} * 100$$

VoIP within IPv6 enabled ADN

- Overhead due to IPv6
  - Headers
  - Security
- Overhead due to mobility
  - Mobility support tunnels
  - Delay due to longer paths
- Resource constraints
  - Processing power

Test-Bed


Voice
Destination
Voice
Gateway
IP Cloud
Data
Destination
Home Agent
Data
Source
Mobile
Router
Voice
Source
Voice
Gateway

Test-Bed (contd…)

- Tools
  - CallGen for voice traffic
  - PaGen for data traffic
  - PSQM Server for voice quality measurement
- Scenarios
  - IPv4 based mobility
    - With and without data
  - IPv6 based mobility
    - With and without data
- Parameters
  - End-to-end delay
  - Perceptual Speech Quality Measurement (PSQM) score

Results

Data traffic (pps)	Voice Traffic (calls)	IPv4 Based Mobility	IPv6 Based Mobility
		PSQM (Avg)	PSQM (Min)
0	3	1.601	2.042
	10	1.660	2.167
	15	1.701	2.207
100	3	1.833	4.338
	10	1.862	4.6
	15	1.845	4.751
200	3	1.869	5.008
	10	1.874	6.705
	15	1.876	7.075

PSQM Score

Data traffic (pps)	Voice Traffic (calls)	IPv4 Based Mobility		IPv6 Based Mobility	
		Max (ms)	Avg (ms)	Max (ms)	Avg (ms)
0	3	416	363	448	401
	10	414	398	497	403
	15	429	402	499	421
100	3	423	399	784	640
	10	431	404	785	642
	15	424	409	834	655
200	3	418	403	744	654
	10	422	410	774	676
	15	451	411	774	676

Voice End-to-end delay

Analysis

- It was observed that voice quality deteriorates in an IPv6 environment compared to IPv4 environment
  - Overhead due to additional headers
  - Overhead due to processing requirements
  - Overhead due to tunneling
- Introduction of security further deteriorates the overall quality

Conclusions

- Voice over IPv6 is a possibility in an IPv6 enabled ADN environment
- Voice over IPv6 requires IPv4 tunneling over IPv6 (in the present scenario)
- IPv6 adds overhead to every voice packet
- Future Directions
  - Reduce the effect of overhead on voice quality
    - Multiple voice frames per IPv6 packet
  - Eliminate the requirement of IPv4 over IPv6 tunnels
  - Dynamic CODEC selection

QUESTIONS ?

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