IPv6 Technology Gaps in Comparison to the Aeronautical Telecommunications Network

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Presentation Outline

- Assume familiarity with TCP/IP

- Introduce ATN

- Compare ATN to IPv6
  - Mobility, Policy Routing, Multihoming, Security

- Identify work to be done on IPv6!
  - Both research and standards development

Meet ATN

- Complete stack designed specifically for niche of aeronautical communications
  - Air Traffic Services (FAA/Eurocontrol/etc)
  - Airline Operations
  - Passenger Services
- Augment/Supplement/Subsume/Replace several systems
  - ACARS / FANS
  - ADS / CPDLC / VHF Voice

Based on ISO OSI (!)

- Complete 7-layer stack
- Key Modifications from OSI:
  - Security framework
  - Compression for air-ground links
  - Routing protocol additions for policy routing and mobility

ATN Subnetworks

- Ground-Ground: X.25, Ethernet, SONET, usual suspects

- Air-Ground: VHF Data Link (VDL), Mode S, HF, Gatelink

- Avionics: LANs, e.g. Ethernet, FDDI, AFDX (Deterministic Ethernet)

- Routing by domains and inter/intradomain routing protocols

- Just like TCP/IP …

ATN Naming/Addressing

- Hierarchical scheme used for:
  - Network Layer Entities
  - Network/Transport/Session Users/Apps
  - Routing/Administrative Domains
  - App/Presentation Context
  - Managed Objects
  - Everything Else
- All in X.500 … NOT AT ALL LIKE TCP/IP

TCP/IP Naming/Addressing

- **Mess** of:
  - DNS
  - IP addresses
  - IANA protocol numbers & port assignments
  - ASNs
  - SIP, email, URI, etc
  - /etc/{hosts,protocols,services}

QoS

- ATN defines 14 app categories with distinct transmission priorities

  – Used inside CLNP headers

  – Range from distress calls to passenger entertainment

- Very similar to Diffserv

  – Just more tightly defined

Security

- ATN has application and routing protocol security functions based on:
  - Elliptic Curve Diffie-Hellman (ECDH)
  - HMAC (keyed hash)
  - X.509
- IPsec and TLS provide these (and more)
  - Better algorithm agility
  - Eggs not all in one metaphorical basket
- Neither suite has jamming or identity protection countermeasures

Yet, IPv6 is Needed

- GAO / OMB advice

- DoD interoperability

- Cheaper total cost

  - Protocol maintenance

  - Personnel Training

  - Equipment manufacturing

IPv6 Policy Routing

- For Air-Ground links, desire to use cheap links first, never let passenger traffic onto ATC links, etc

- ATN integrates policy exchange along with the IDRP routing protocol messages between mobile router and access router

- There are no existing IPv6 protocol mechanisms for policy exchange

    – IETF monami6 efforts should help, although this will be mobile element to home agent

IPv6 vs ATN Mobility

- Mobile IPv6 (MIPv6) and NEMO are tunnel-based

- ATN mobility is routing protocol-based
  - Achieved through IDRP routing protocol
  - Scope is limited to speed convergence (doesn't influence IS-IS for example)
  - Very similar to using OSPF for MANET in IP world

Mobility Differences

- The two mobility approaches are fundamentally different
  - Route optimization is end-node job in MIPv6
    - Not supported at all (yet) in NEMO (!)
  - Tunnel overhead in MIPv6 / NEMO
    - Both bit-bloat and latency
  - QoS marks – hidden in tunnel or inconsistent meaning
- ATN's approach avoids all such issues

Multihoming

- IPv6:
  - None
  - Addressing is not Provider Independent
  - IETF shim6 efforts will produce site-based solution
- In ATN, the AS structure is entirely different, so this is no problem for the routing protocol

Promising R & D Topics

- IPv6 policy exchange

  - Can monami6's solution do all that ATN can?

- IPv6 Network Mobility

  - Can adequate NEMO route optimization techniques be found?

- IPv6 multihoming

  - Is the shim6 solution preferable to Provider Independent addressing?

- More ... talk with or email me