STANAG 5066 Edition 2 Review of Comments and Way Ahead

presented to

High Frequency Industry Association

18 July 2007

presented by

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STANAG 5066
Edition 2 – Scope and Contents

- **Main body provides overview of the structure of the Profile**
- **List of Annexes**
    - A: Subnetwork Interface Sub-layer
    - B: Channel Access Sub-layer
    - C: Data Transfer Sub-layer
    - D: Interface between Data Transfer Sub-layer and Communications Equipment
    - E: HF Modem Remote
    - F: Subnetwork
    - G:
    - (info only)
    - (info only)
    - (info only)
    - Overview (tbd)
    - Control Protocols (tbd)
    - High-Frequency Wireless-Token-Ring-Protocol (tbd)
    - M *unused / reserved* *()*
    - N Addressing Guidance (tbd)
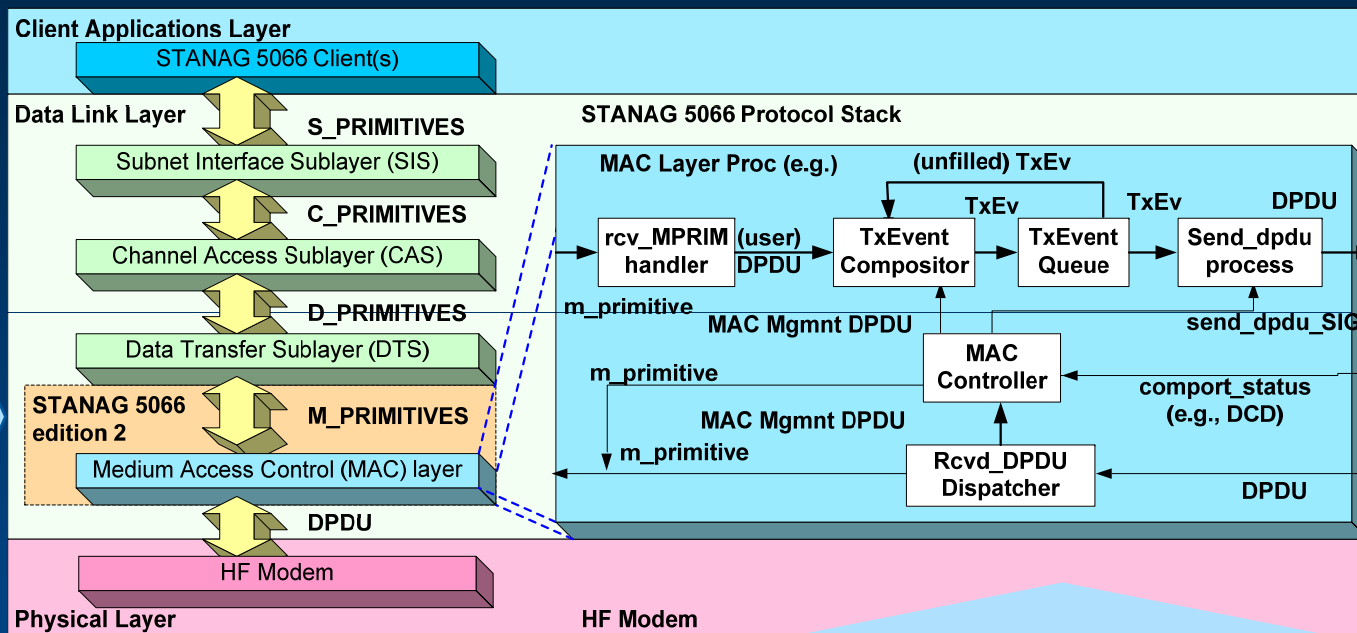   - O Integration with Internet Protocol (IP) Networks (tbd)

Roadmap Endorsed by BLOS-COMMS AHWG Oct 2005

Edition 2 Overview

Annex F, N, O: IP-over-HF Networking

Annex J: Overview of MAC-layer functionality Relationship to other layers / annexes

Client Applications Layer
STANAG 5066 Client(s)

Data Link Layer
S_PRIMITIVES
Subnet Interface Sublayer (SIS)

C_PRIMITIVES
Channel Access Sublayer (CAS)

D_PRIMITIVES
Data Transfer Sublayer (DTS)

STANAG 5066 edition 2
M_PRIMITIVES
Medium Access Control (MAC) layer

DPDU

HF Modem

Physical Layer   HF Modem

STANAG 5066 Protocol Stack

MAC Layer Proc (e.g.)   (unfilled) TxEv

| rcv_MPRIM handler | (user) DPDU | TxEvent Compositor | TxEv | TxEvent Queue | TxEv | Send_dpdu process | DPDU |

m_primitive
MAC Mgmnt DPDU   send_dpdu_SIG

MAC Controller

m_primitive
MAC Mgmnt DPDU   comport_status (e.g., DCD)

m_primitive   Rcvd_DPDU Dispatcher   DPDU

Annexes K, L, M: Tailored MAC-layer functionality for specific requirements:
Annex K: Random-Access Protocols
Annex L: HF Wireless Token Protocol (shown)
Annex M: *reserved (e.g., for adaptive TDMA)*

- ***Proposed annexes provide modularity / opacity for new functions and guidance***

Agenda

- **Comments received on S'5066 Ed. 2**
  - Annex J - none
  - Annex K - none
  - Annex L - extensive set of comments
    - from Thales-France, too numerous to review in prior format, as they are embedded in the document text in track-changes mode
      - many / most are editorial in nature and have been accepted by NC3A
      - detailed review of remainder is (still) required
    - from NC3A – a proposed re-drawing of the state-machine diagram for enhanced clarity
  - Annex N - some
    - requests for regional address-block decomposition
      - has been completed based on US source proposal
  - Annex O – none, as it had not been released;
    - contents outlined based on operational lessons learned

Annex J — Overview of MAC-layer functionality

- **Annex J —**
  - "GENERAL REQUIREMENTS FOR ENHANCED MEDIA-ACCESS-CONTROL (MAC) CAPABILITIES IN STANAG 5066 (INFORMATIVE)"
- **No comments received**
  - unknown reason for lack of comments
    - no one has read it ?
    - none submitted based on a perception that comments on 'Informative' annexes are not required ?
    - implied lack of support for eventual ratification?
- **Custodian will assume that current text is acceptable**

Annex K

- **Annex K —**
  - "HIGH-FREQUENCY CARRIER-SENSE MULIPLE-ACCESS PROTOCOLS (INFORMATIVE)"
- **No comments received formally**
  - same concerns as before
- **Custodian's remarks**
  - will assume that current text is acceptable, *BUT*
  - intent is to codify current vendor practice for collision avoidance in current Edition 1 implementations, *without* impinging on or unwittingly incurring IPR restrictions.

Annex L – Wireless Token-Ring Protocol

- **Extensive set of comments (*still under review*)**
  - from Thales-France, too numerous to review in prior format, as they are embedded in the document text in track-changes mode (in part)
    - many / most are editorial in nature and have been accepted by NC3A
    - review of remainder still in process, as some propose fundamental changes, and only some of those with a specific replacement for the text or figure on which the comment was made.
  - from NC3A – a proposed re-drawing of the state-machine diagram for enhanced clarity
- **US Navy and AUSCANNZUKUS testing**
  - TRIDENT Warrior 05/06
  - includes an IP-address auto-configuration mode and subnet-management interface that has not been published
    - auto-configuration a major tenet of the NNEC / NII initiative

- **Comment Categories (color-coded by Thales)**
  - requests for clarification
  - requests for editorial rigor and consistency w/ Ed.1
    - e.g., use of 'shall', 'shall not', 'may', 'may not' …
    - Figure / Table numbering
    - key-words in italics
  - adding/deleting/moving text from one area to another
    - suggested aim is to introduce concepts more logically
  - updates to the state-transition tables
    - corrections, where necessary
    - omissions now included
  - Acronym insertions (for document clarity and cohesion)
  - new sections (e.g., for concept definitions)
  - new propositions (with Thales-provided index number)
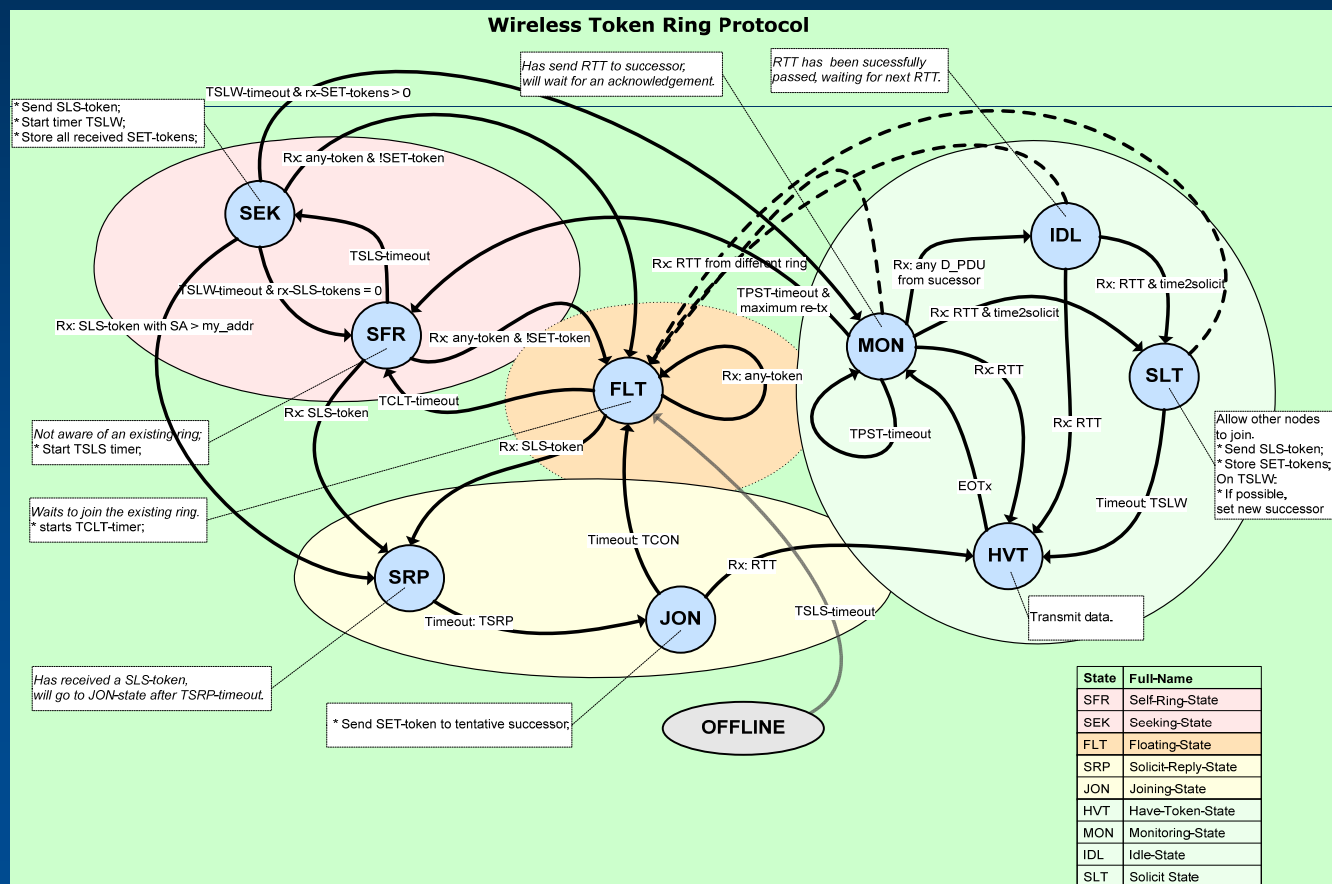
HFTRP State Diagram: *Underlined* Updated
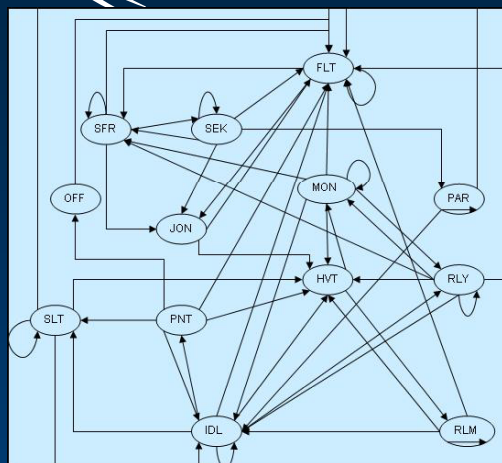
from this

- a new state diagram generated to improve clarity and presentation of the protocol processing requirements

to this

- introduces the SRP (*solicitation-reply)* state to simplify description of the joining process
- excludes relay-token processing,
  - to be included
  - likely as a separate diagram for additional clarity

Wireless Token Ring Protocol

State	Full-Name
SFR	Self-Ring-State
SEK	Seeking-State
FLT	Floating-State
SRP	Solicit-Reply-State
JON	Joining-State
HVT	Have-Token-State
MON	Monitoring-State
IDL	Idle-State
SLT	Solicit State

Annex L – Comments by Thales (2)

- **Principal Issues Raised**
  - "the most difficult point … the criterion to use the relay-token mode …"
    - optimistic versus pessimistic joining w.r.t. to connectivity to the solicitor'
  - subtleties in use of timers
- **Custodian's remarks**
  - comments raised demonstrate a good understanding of the protocol and raise valid points
  - comments should be resolved in conjunction with US, as proposer and implementer of the WTRP
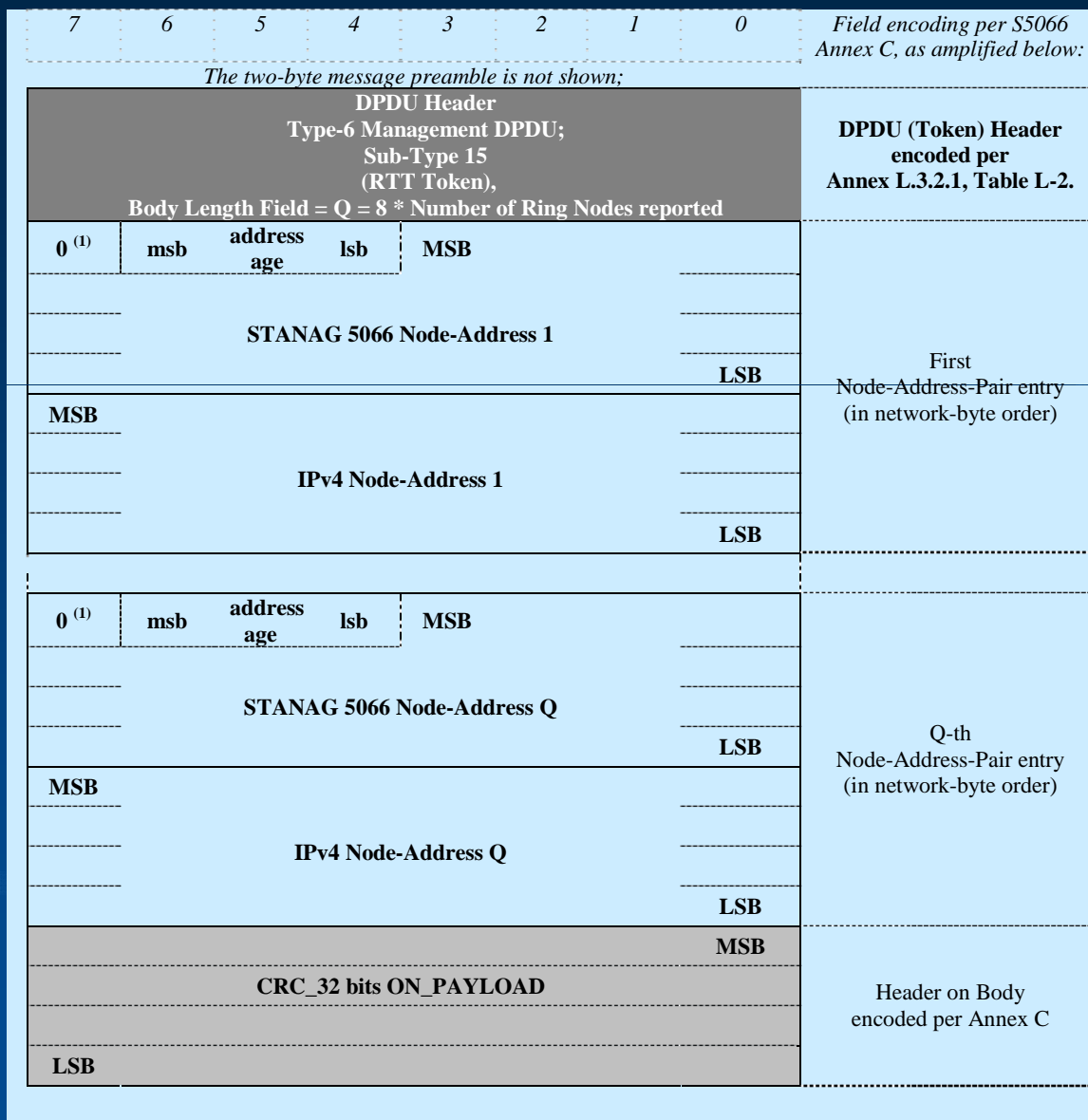
- **why and when token-relay (as opposed to relay of other DPDU traffic) is required:**
  - to relay the RTT when the successor is not reachable
  - in certain topologies (hub-and-spoke; linear)
    - these can occur as the ring grows in size and evolves even if the network does not require them in a later ring-configuration.
- **how to promote efficiency?**
  - restrict ring token-relay usage in the ring?
  - through optimistic joining?
  - ring-rethreading?
- **to what extent should token-relay be supported?**
  - the current USN implementation supports one token-relay topology only, i.e., only on token relayer in the network

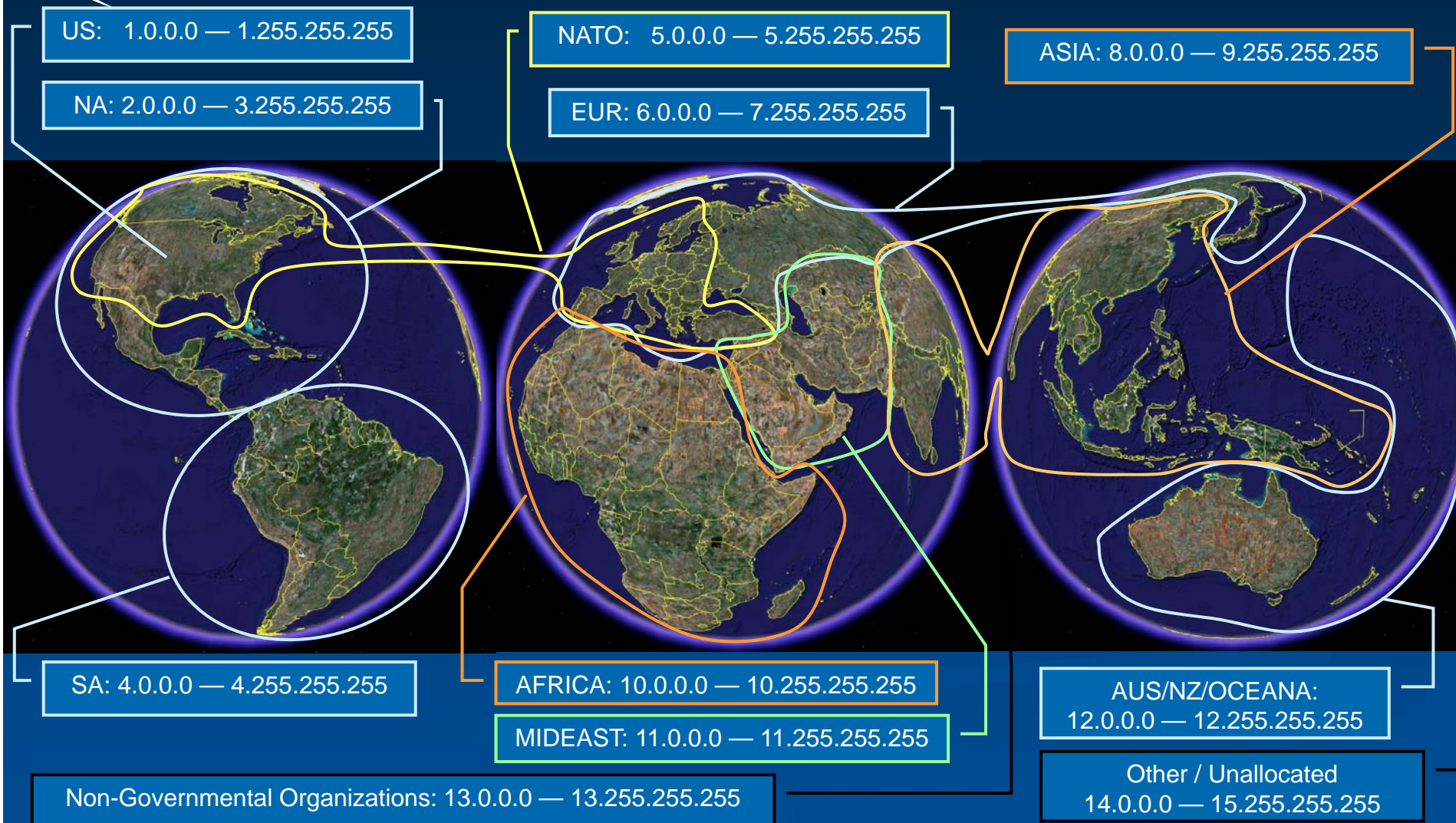# Proposed Support for Dynamic IP-Address Assignment

- **USN HF IP implementation**
  - uses token w/ payload (an extension of the Annex C definition that will require specification support)
  - passes a list of address pairs with the RTT to allow a node to:
    - identify the IP subnetwork and unused addresses
    - select a unused IP address
    - communicate its choice to other ring members

7	6	5	4	3	2	1	0	Field encoding per S5066 Annex C, as amplified below:

The two-byte message preamble is not shown;

DPDU Header Type-6 Management DPDU; Sub-Type 15 (RTT Token), Body Length Field = Q = 8 * Number of Ring Nodes reported	DPDU (Token) Header encoded per Annex L.3.2.1, Table L-2.

0 (1)	msb	address age	lsb	MSB		First Node-Address-Pair entry (in network-byte order)
STANAG 5066 Node-Address 1				LSB	
MSB					
IPv4 Node-Address 1				LSB	

0 (1)	msb	address age	lsb	MSB		Q-th Node-Address-Pair entry (in network-byte order)
STANAG 5066 Node-Address Q				LSB	
MSB					
IPv4 Node-Address Q				LSB	

	MSB	Header on Body encoded per Annex C
CRC_32 bits ON_PAYLOAD		
LSB		

Annex N – Guidance on S'5066 Addressing – Regional Allocations

US: 1.0.0.0 — 1.255.255.255

NATO: 5.0.0.0 — 5.255.255.255

ASIA: 8.0.0.0 — 9.255.255.255

NA: 2.0.0.0 — 3.255.255.255

EUR: 6.0.0.0 — 7.255.255.255

SA: 4.0.0.0 — 4.255.255.255

AFRICA: 10.0.0.0 — 10.255.255.255

AUS/NZ/OCEANA:
12.0.0.0 — 12.255.255.255

MIDEAST: 11.0.0.0 — 11.255.255.255

Other / Unallocated
14.0.0.0 — 15.255.255.255

Non-Governmental Organizations: 13.0.0.0 — 13.255.255.255

No apparent objections or comment on the top-level allocations

US

"1" . "x"	Organization	"1" . "x"	Organization
1.1	US Navy	1.8	US Joint Forces Commands
1.2	US Marine Corps	1.9 – 19	Other US Military
1.3	US Air Force	1.20	US Federal Emergency Management Agency
1.4	US Army	1.21	BATF
1.5	US Special Operations Forces	1.22	US Federal Bureau of Investigation
1.6	US Coast Guard	1.23 – 1.255	Other US Govt
1.7	US Military Sealift Command		

North America

"w" . "x"	Country	"w" . "x"	Country
2.1	Antigua & Barbuda	2.15	Guatemala
2.2	Bahamas	2.16	Haiti
2.3	Barbados	2.17	Honduras
2.4	Belize	2.18	Jamaica
2.5, 2.6, 2.7	Canada	2.19	Mexico
2.8	Costa Rica	2.20	Nicaragua
2.9	Cuba	2.21	Panama
2.10	Dominica	2.22	St. Kitts and Nevis
2.11	Dominican Republic	2.23	St. Lucia
2.12	Ecuador	2.24	Trinidad & Tobago
2.13	El Salvador	3.1	United States (non-US Government)
2.14	Grenada		

South America

"w" . "x"	Country	"w" . "x"	Country
4.1	Argentina	4.7	Guyana
4.2	Bolivia	4.8	Paraguay
4.3	Brazil	4.9	Peru
4.4	Chile	4.10	Suriname
4.5	Colombia	4.11	Uruguay
4.6	Ecuador	4.12	Venezuela

NATO

"w" . "x"	Country	"w" . "x"	Country
5.1	Belgium	5.12	Norway
5.2	Czech Republic	5.13	Poland
5.3	Denmark	5.14	Portugal
5.4	France	5.15	Spain
5.5	Germany	5.16	Turkey
5.6	Greece	5.17	United Kingdom
5.7	Hungary	5.18	United States
5.8	Iceland	5.19	Allied Command for Operations
5.9	Italy	5.20	Allied Command for Transformation
5.10	Luxembourg	5.21	NATO CIS Services Agency
5.11	Netherlands	5.22	NATO Consultation, Command and Control Agency

- **Comment requests for sub-region allocations**
  - these were available in the US source document
  - have been brought into the latest draft of Annex

Europe

"w" . "x"	Country	"w" . "x"	Country
6.1	Albania	6.27	Lithuania
6.2	Andorra	6.28	Luxembourg
6.3	Austria	6.29	Macedonia
6.4	Belarus	6.30	Malta
6.5	Belgium	6.31	Moldova
6.6	Bosnia & Herzegovina	6.32	Monaco
6.7	Bulgaria	6.33	Netherlands
6.8	Croatia	6.34	Norway
6.9	Cyprus	6.35	Poland
6.10	Czech Republic	6.36	Portugal
6.11	Denmark	6.37	Romania
6.12	Estonia	6.38, 39, 40	Russia
6.13	Finland	6.41	San Marino
6.14, 6.15	France	6.42	Slovakia
6.16, 6.17	Germany	6.43	Slovenia
6.18	Greece	6.44	Serbia & Montenegro
6.19	Holy See	6.45	Spain
6.20	Hungary	6.46	Sweden
6.21	Iceland	6.47	Switzerland
6.22	Ireland	6.48	Turkey
6.23, 6.24	Italy	6.49	Ukraine
6.25	Latvia	6.50, 51, 52	United Kingdom
6.26	Liechtenstein	6.53	Yugoslavia

Asia

"w" . "x"	Country	"w" . "x"	Country
8.1	Bangladesh	8.12	Malaysia
8.2	Bhutan	8.13	Maldives
8.3	Brunei	8.14	Mongolia
8.4	Cambodia	8.15	Myanmar
8.5	China	8.16	Nepal
8.6	India	8.17	Phillipines
8.7	Indonesia	8.18	Singapore
8.8	Japan	8.19	Sri Lanka
8.9	Korea, North	8.20	Taiwan
8.10	Korea, South	8.21	Thailand
8.11	Laos	8.22	Vietnam

Africa

"w" . "x"	Country	"w" . "x"	Country
10.1	Algeria	10.27	Lesotho
10.2	Angola	10.28	Liberia
10.3	Benin	10.29	Madagascar
10.4	Botswana	10.30	Malawi
10.5	Burkina Faso	10.31	Mali
10.6	Burundi	10.32	Mauritania
10.7	Camaroon	10.33	Mauritius
10.8	Cape Verde Islands	10.34	Morocco
10.9	Central African Republic	10.35	Mozambique
10.10	Chad	10.36	Namibia
10.11	Comoros	10.37	Niger
10.12	Congo (Brazzaville)	10.38	Nigeria
10.13	Congo (Kinshasha)	10.39	Rwanda
10.14	Côte d'Ivoire	10.40	Sao Tome
10.15	Djbouti	10.41	Senegal
10.16	Egypt	10.42	Sierra Leone
10.17	Equatorial Guinea	10.43	Somalia
10.18	Eritrea	10.44	South Africa
10.19	Ethiopia	10.45	Sudan
10.20	Gabon	10.46	Swaziland
10.21	Gambia	10.47	Tanzania
10.22	Gambia	10.48	Togo
10.23	Ghana	10.49	Tunisia
10.24	Guinea	10.50	Uganda
10.25	Guinea-Bissau	10.51	Zambia
10.26	Kenya	10.52	Zimbabwe

Mid-East

"w" . "x"	Country	"w" . "x"	Country
11.1	Afganistan	11.12	Lebanon
11.2	Armenia	11.13	Oman
11.3	Azerbiajan	11.14	Pakistan
11.4	Bahrain	11.15	Qatar
11.5	Georgia	11.16	Saudi Arabia
11.6	Iran	11.17	Syria
11.7	Iraq	11.18	Tajikistan
11.8	Jordan	11.19	Turkmenistan
11.9	Kazakhstan	11.20	United Arab Emirates
11.10	Kuwait	11.21	Uzbekistan
11.11	Kyrgyzstan	11.22	Yemen

Australia, New Zealand, Oceana

"w" . "x"	Country	"w" . "x"	Country
12.1	Australia	12.9	Papua New Guinea
12.2	Fiji	12.10	Samoa
12.3	Kiribati	12.11	Seychelles
12.4	Marshall Islands	12.12	Solomon Islands
12.5	Micronesia	12.13	Tonga
12.6	Nauru	12.14	Tuvalu
12.7	New Zealand	12.15	Vanuatu
12.8	Palau		

Non-Governmental Organizations and Other

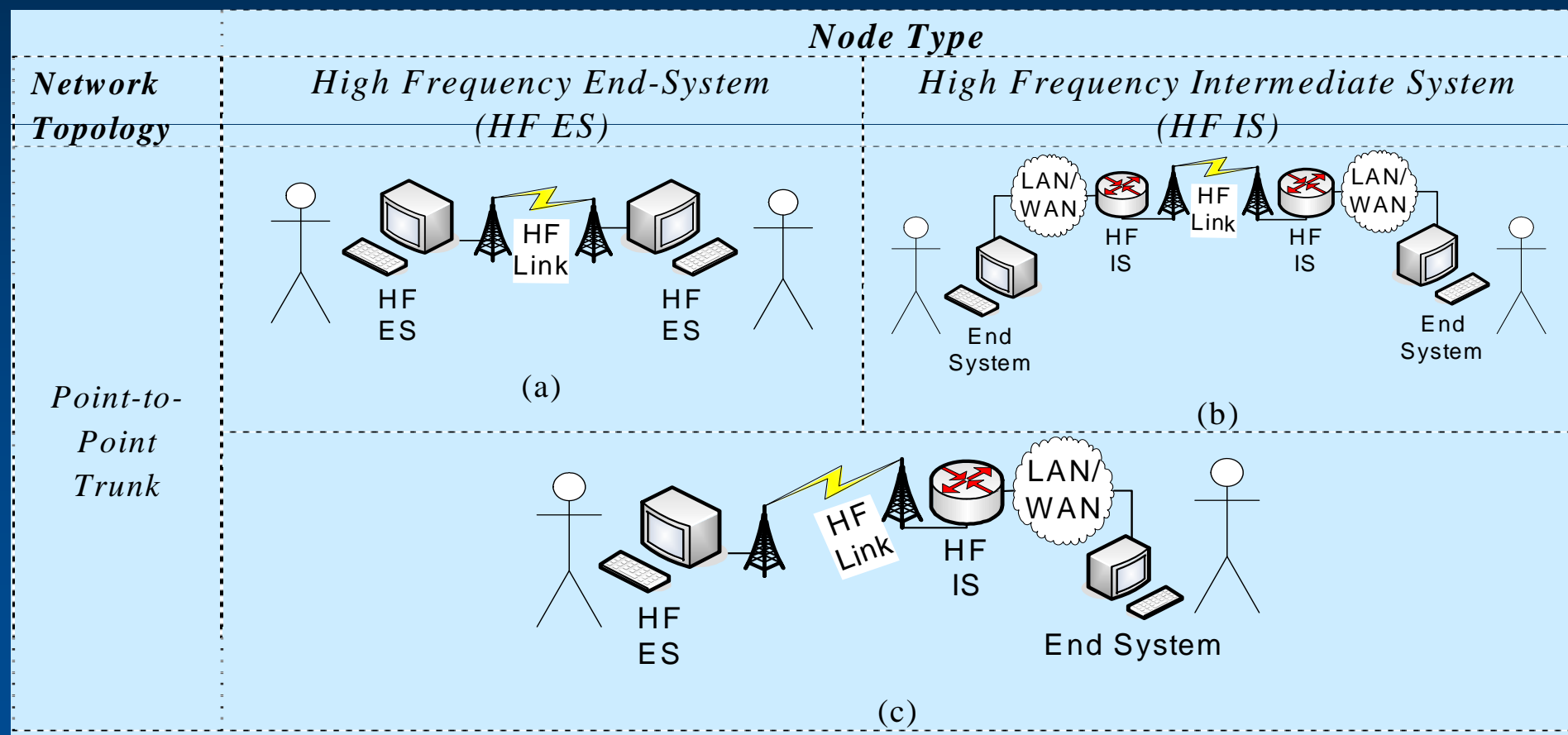| "w" . "x"	NGO	"w" . "x"	NGO
13.1	United Nations		
13.2	Red Cross		
14.0-255	Other		
15.0.255	Other		

- **most sub-region addressing authorities unidentified**
  - STANAG encourages nations to contact custodian
  - NATO- / PfP- national input desirable prior to final promulgation

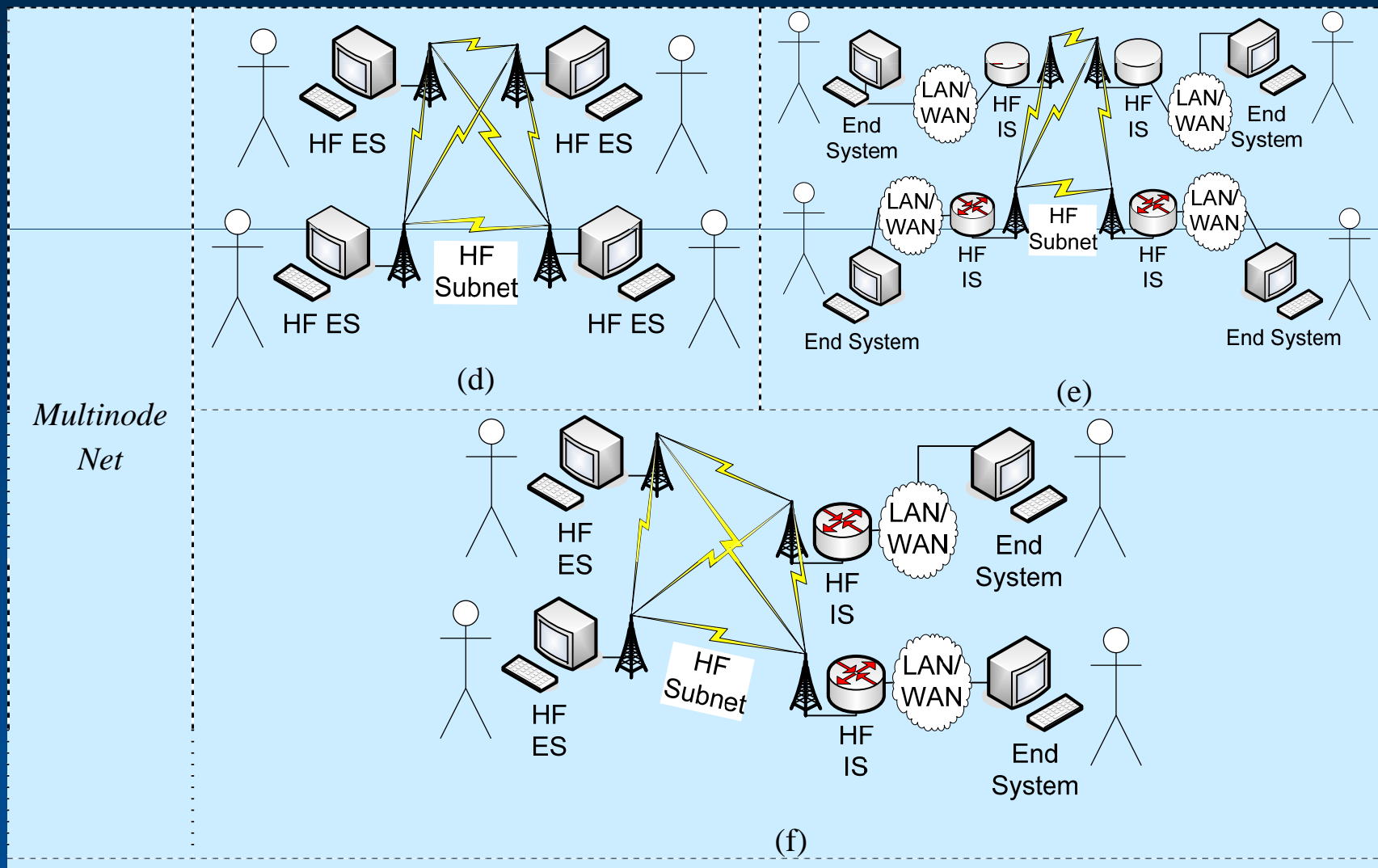# Annex O - Integration with Internet Protocol (IP) Networks

- **Topics**
  - definitions; use cases ; traffic shaping; multi topology routing
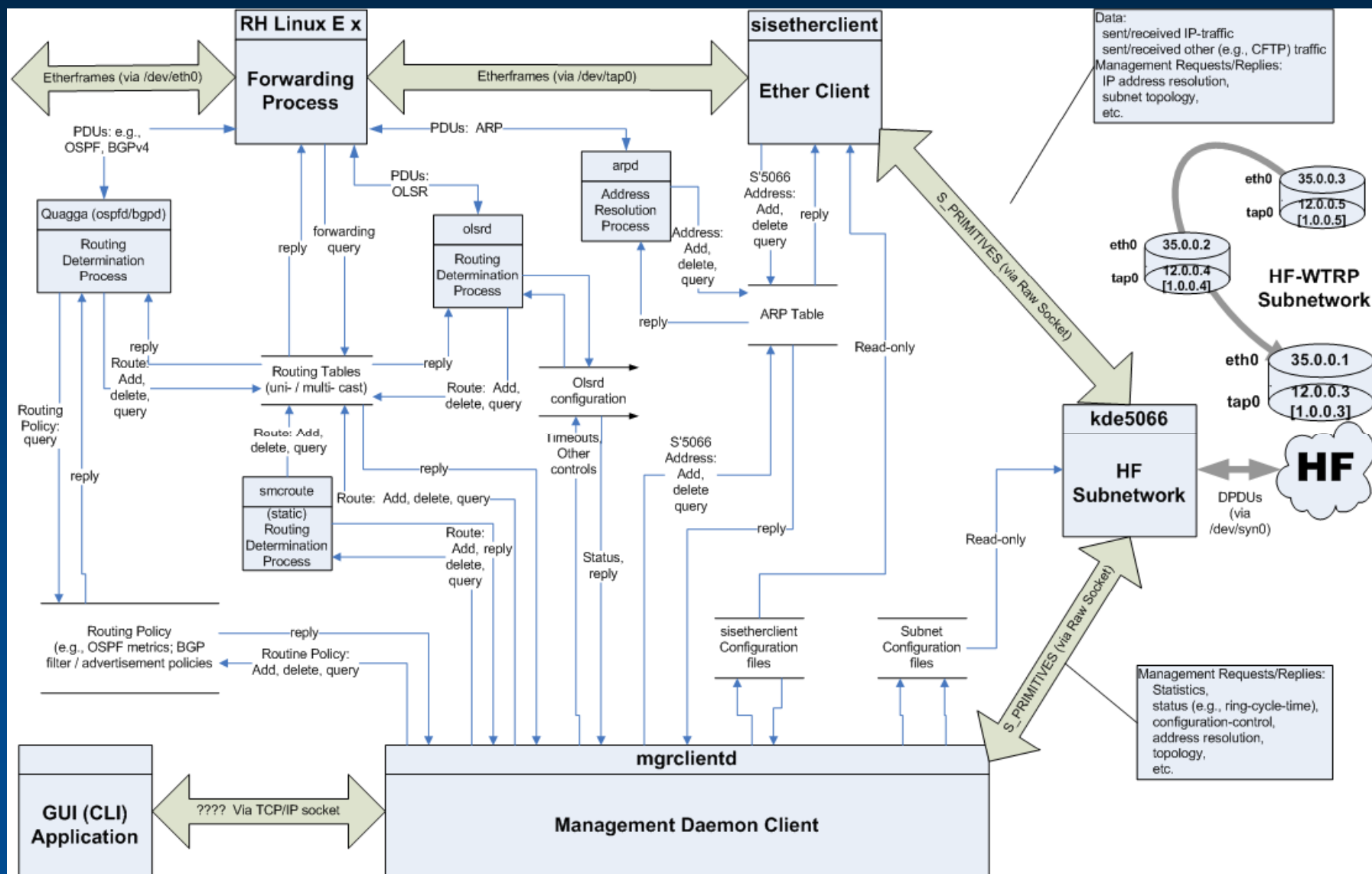 - IP node management

	Node Type	
Network Topology	*High Frequency End-System (HF ES)*	*High Frequency Intermediate System (HF IS)*
Point-to-Point Trunk	(a)	(b)
	(c)	

- **Use Cases – point-to-point trunking**

Use Cases – multi-node networks

HF IP Management Overview –
abstraction of current prototype

- **Nominal QoS Traffic-Shaping Model**
  - implementable outside of the S'5066 IP-/Ether- client
  - in current prototypes, implemented using standard IP-datagram filters (e.g., 'iptables') and queue-management tools (e.g., 'tc')
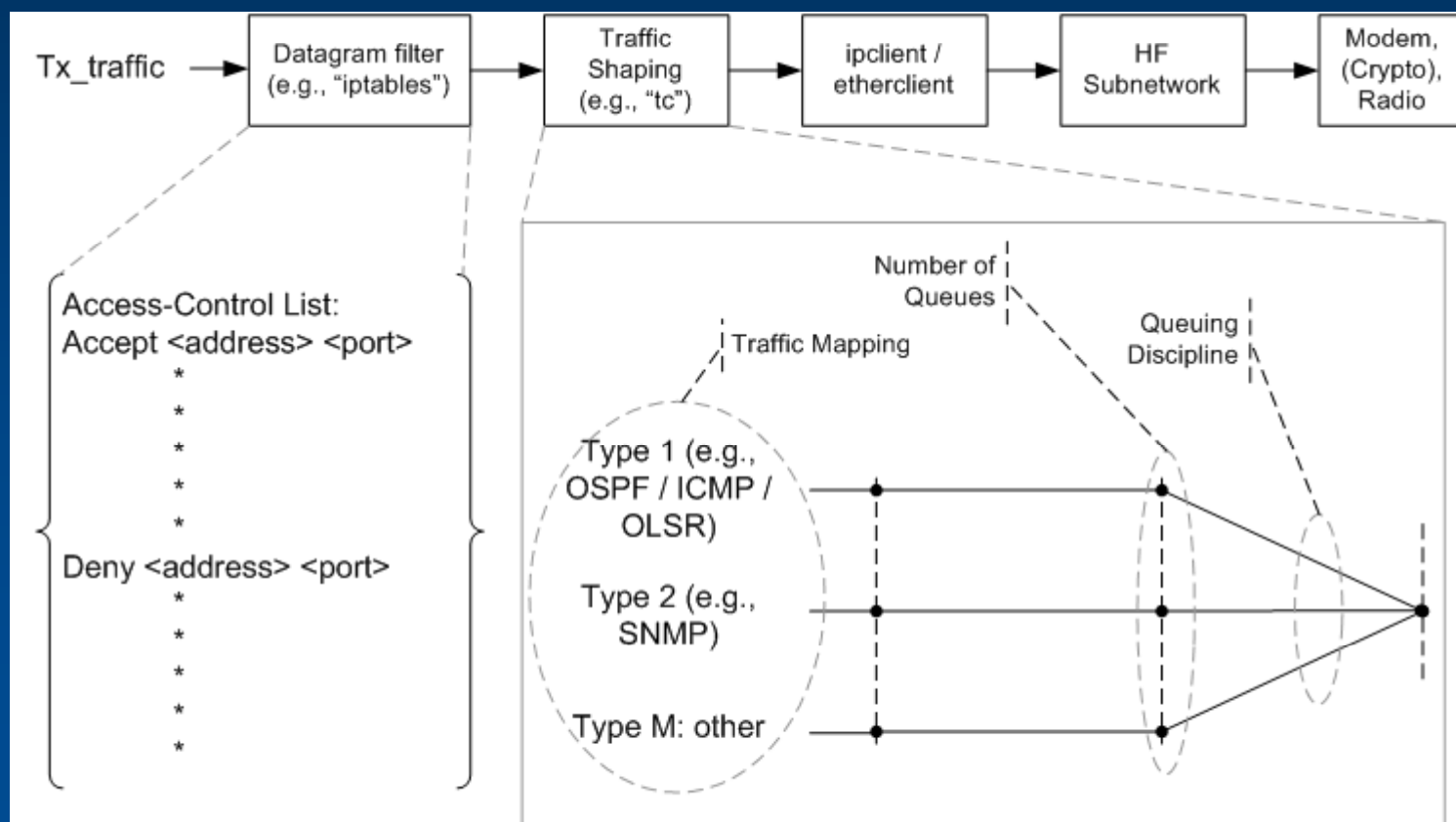
IP-Traffic Shaping: Router-Admission Controls, Policy-Based- and Multiple-Topology Routing

▪ **Nominal Model –**
  ▪ overlapping wireless IP networks w/ different coverage/capabilities
  ▪ policy-based routing or QoS-based multiple-topology routing

▪ **Goals -**
  ▪ traffic-load distribution
  ▪ redundancy / resilence to node or link loss
  ▪ generalized and applicable to other media, not just HF
    ▪ this may make these topics candidates for a different STANAG, e.g., 5067
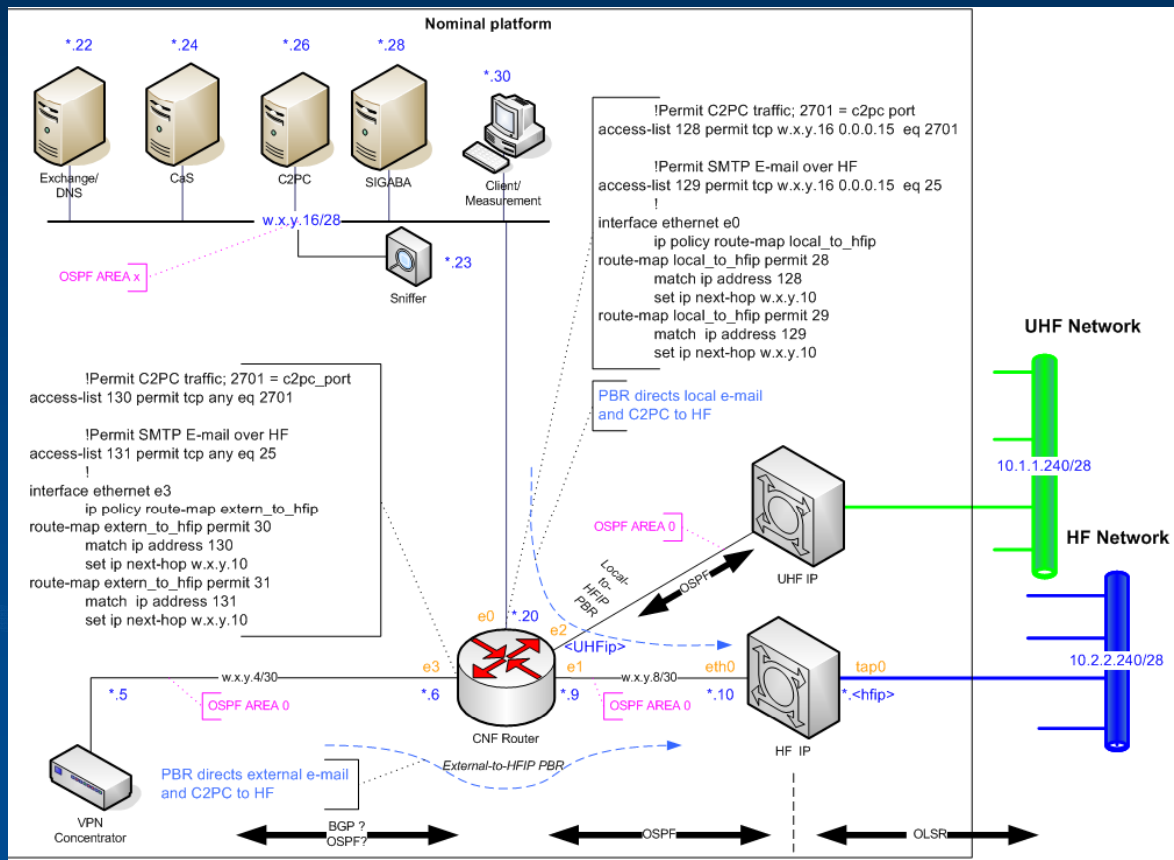
Summary and Way Ahead

- **resolve/cleanup Annex L issues and release**

  - resolve *national comments* in concurrence with NC3A / TCF / US

- **draft and release Annex O on IP networking**

  - question is how far to take it and what to push off onto STANAG 5067 on IP networking (or other generic IP STANAG)

- **finalize S5066 E2 ratification draft for Fall 2007**