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ATNP/WG 2 WP355

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AERONAUTICAL TELECOMMUNICATION NETWORK PANEL (ATNP)
WORKING GROUPS 1 AND 2

ADDRESSING GUIDANCE FOR DIVERSE GROUND-BASED SUBNETWORKS

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SUMMARY

THIS PAPER IS A CONTINUATION OF WP290, 24-28 JUNE 1996, PARAGRAPH 2.7 (NAMING AND ADDRESSING) AND PROVIDES GUIDANCE FOR INTEGRATING DIFFERENT SUBNETWORK ADDRESSING STRUCTURES INTO THE ATN.

1.0 BACKGROUND

THE INTERCONNECTION OF THE VARIOUS MULTINATIONAL DATA NETWORKS INTO AN AIR TRAFFIC MANAGEMENT INTERNET HAS BEEN DEFINED IN THE ICAO AERONAUTICAL TELECOMMUNICATIONS NETWORK (ATN) STANDARDS AND RECOMMENDED PRACTICES (SARPS)[1]. THE NETWORKS THAT WILL BE INTEGRATED INTO THE ATN USE A NEWER TECHNOLOGY OR WERE IN USE PRIOR TO THE DEVELOPMENT OF THE SARPS. THESE NETWORKS, ONCE INTEGRATED INTO THE ATN WILL BECOME SUBNETWORKS, WHICH ARE MADE UP OF A VARIETY OF PROTOCOLS AND ADDRESS STRUCTURES. IN ADDITION, EMERGING NETWORK TECHNOLOGIES THAT ARE JUST BEGINNING THEIR DEPLOYMENT CYCLE MUST BE ABLE TO INTERFACE TO THE ATN. THEREFORE, CONSIDERATION SHOULD BE GIVEN ON HOW TO INTEGRATE VARIOUS ADDRESS STRUCTURES INTO THE ATN. THIS PAPER MAKES RECOMMENDATIONS ON HOW TO DEAL WITH THE DIVERSE ADDRESS STRUCTURES AND SUCCESSFULLY INTEGRATE THEM INTO THE ATN.

2.0 DISCUSSION

IN ORDER TO EFFICIENTLY IMPLEMENT THE GLOBAL ATN, MEMBER STATES ARE GOING TO IMPLEMENT THE ICAO ATN PROTOCOLS WITH EXISTING SUBNETWORKS AND USE THE ATN ROUTING NETWORK TO TIE THESE SUBNETWORKS TOGETHER TO FORM THE ATN, FIGURE 1. THESE SUBNETWORKS USE A VARIETY OF POPULAR PROTOCOLS THAT HAVE DIFFERENT ADDRESSING MECHANISMS. THESE ADDRESSING MECHANISMS CONTAIN DIFFERENT LENGTHS AS WELL AS DIFFERENT SEMANTICS (E.G., HIERARCHICAL, FLAT ADDRESSES). PRESENTLY, THE DRAFT ATN SARPS LOOKS ONLY AT THE SUBNETWORK ELEMENTS USING THE PROTOCOLS DEFINED IN THE SARPS AND DOES NOT MAKE RECOMMENDATIONS TO INTEGRATE EXISTING SUBNETWORKS. THIS LACK OF INTEGRATION WILL CAUSE INTEROPERABILITY PROBLEMS IN THE ATN. IN ORDER TO AVOID THIS SITUATION, ADDRESSING STANDARDS FOR THE MOST COMMON SUBNETWORK PROTOCOLS AND THE MOST POPULAR EMERGING PROTOCOLS ARE REVIEWED IN RESPECT TO THE ATN.

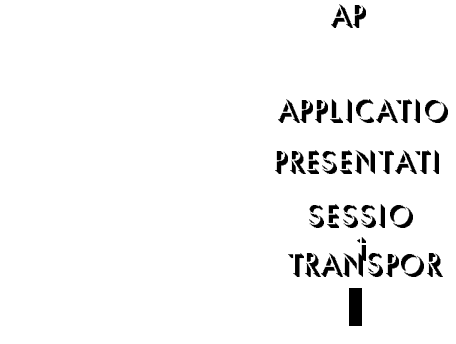

FIGURE 1 ATN SUBNETWORK ADDRESS INTEGRATION

THE MOST COMMONLY IMPLEMENTED NETWORK PROTOCOLS THAT SHOULD BE CONSIDERED ARE:

- INTERNET PROTOCOL SUITE
- ETHERNET LOCAL AREA NETWORKS
- X.25 PACKET SWITCHED NETWORKS

IN ADDITION TO THESE EXISTING PROTOCOLS, THE FOLLOWING DATA TRANSMISSION TECHNOLOGIES ARE GAINING IN POPULARITY AND WILL EVENTUALLY ACHIEVE WIDE SCALE DEPLOYMENT AND SHOULD ALSO BE CONSIDERED.

- ASYNCHRONOUS TRANSFER MODE
- FIBER DISTRIBUTED DATA INTERFACE
- INTEGRATED SERVICE DIGITAL NETWORK
- FRAME RELAY

THEREFORE, TO ENSURE A COHERENT DATA NETWORK ENVIRONMENT, CONSIDERATION SHOULD BE GIVEN TO IMPLEMENTATION/INTEGRATION OF THESE VARIOUS ADDRESSING SCHEMES INTO THE ATN. THE SARPS DEFINES THE NETWORK SERVICE ACCESS POINT (NSAP), WHICH IS ONE SIDE OF THE PROBLEM, BUT IT MUST FURTHER DEFINE THE STANDARD SUBNETWORK PROFILES IN ORDER TO ENSURE INTEROPERABILITY AT THE SUBNETWORK LEVEL, AND AN INTERFACE RICH ENVIRONMENT THAT PROMOTES ACCESS TO THE ATN DOMAIN.

2.1 INTERNET PROTOCOL SUITE (IPS)

IMPLEMENTATION OF ADDRESSING IN AN IPS ENVIRONMENT IS DONE IN ACCORDANCE WITH RFC-791, INTERNET PROTOCOL[2]. IMPLEMENTATION OF ADDRESSING IN THE ATN IS PERFORMED IN ACCORDANCE WITH ISO 6523-ICD-INFORMATION TECHNOLOGY-STRUCTURE FOR IDENTIFICATION OF ORGANIZATIONS[3], AND ISO 8348 AD2, INFORMATION PROCESSING SYSTEMS-DATA COMMUNICATIONS-NETWORK SERVICE DEFINITIONS: ADDENDUM 2 NETWORK LAYER ADDRESSING.[4]. THE TWO ADDRESSING STRUCTURES ARE INCOMPATIBLE AND MUST BE ACCOMMODATED USING AN ENCAPSULATION OR CONVERSION TECHNIQUE. THIS WILL ALLOW COMMUNICATION BETWEEN IPS BASED SUBNETWORKS AND THE ATN.

2.2 ETHERNET LOCAL AREA NETWORKS

INTEGRATION OF ETHERNET SUBNETWORKS ARE DESCRIBED IN VOLUME VI OF THE DRAFT SARPS, SECTION 5.7. REFER TO THIS DOCUMENT FOR INFORMATION ON INTEGRATING AN ETHERNET SUBNETWORK.

2.3 X.25 PACKET SWITCHED NETWORK

IMPLEMENTATION OF X.25 ARE DESCRIBED IN VOLUME VI OF THE DRAFT SARPS, SECTION 5.4. REFER TO THIS DOCUMENT FOR INFORMATION ON INTEGRATING AN X.25 SUBNETWORK.

2.4 ASYNCHRONOUS TRANSFER MODE (ATM)

ADDRESSING SUPPORT FOR ATM IS DEFINED IN USER NETWORK INTERFACES (UNI) 3.0/3.1[5]. THE ADDRESS FORMAT IS BASED ON THE OSI SYNTAX FOR NETWORK SERVICE ACCESS POINT (NSAP) ADDRESSES. HOWEVER, IT IS NOT AS DEFINED AND ALLOCATED BY ISO. DESPITE THE SIMILAR STRUCTURE, THEY ARE BETTER DESCRIBED AS PRIVATE ATM NETWORK ADDRESSES AND ARE USED TO IDENTIFY SUBNETWORK POINTS OF ATTACHMENT. THE 20-BYTE ATM ADDRESSES ARE DESIGNED FOR USE WITHIN PRIVATE ATM NETWORKS. THERE ARE THREE DIFFERENT FORMATS: NSAP ENCODED E.164[6], DATA COUNTRY CODE (DCC) FORMAT, AND INTERNATIONAL CODE DESIGNATOR (ICD) FORMAT. IMPLEMENTATION OF ATM SUBNETWORKS WILL REQUIRE AN ADDRESS CONVERSION PROCESS IN ORDER TO CONVERT FROM THE ATM DEFINED NSAP TO THE ATN DEFINED NSAP.

2.5 FIBER DISTRIBUTED DATA INTERFACE (FDDI)

THE PHYSICAL LAYER AND DATA LINK INTERFACE FOR FDDI IS COVERED IN ISO 9314-1, FIBER DISTRIBUTED DATA INTERFACE[7]. HOWEVER, FDDI IS NOT A NETWORK LEVEL PROTOCOL AND DOES NOT HAVE AN ADDRESS LIKE ISDN, X.25, B-ISDN, OR FRAME RELAY. INSTEAD FDDI SHOULD BE ABLE TO USE ANY OF THE HIGHER LEVEL PROTOCOL ADDRESS SCHEMES. USE ISO 9542 AND ADDENDUMS, END SYSTEM TO INTERMEDIATE SYSTEM ROUTING EXCHANGE PROTOCOL[8] IN CONJUNCTION WITH ISO 8473[9], THE PROTOCOL FOR PROVIDING THE CONNECTIONLESS-MODE NETWORK SERVICE FOR THE ADDRESS RESOLUTION FUNCTIONALITY.

2.6 INTEGRATED SERVICE DIGITAL NETWORK (ISDN)

THE NETWORK LAYER FOR ISDN IS COVERED IN ISO 9574, INFORMATION TECHNOLOGY-TELECOMMUNICATIONS AND INFORMATION EXCHANGE BETWEEN SYSTEMS-PROVISION OF THE OSI CONNECTION-MODE NETWORK SERVICE BY PACKET MODE TERMINAL EQUIPMENT CONNECTED TO AN INTEGRATED SERVICES DIGITAL NETWORK (ISDN)[10]. ISDN SPECIFIES AN INFORMATION ELEMENT (IE) TO CARRY ADDRESS INFORMATION. THIS IE IS THE CALLED/CALLING PARTY NUMBER. INSIDE OF THIS IE ARE TWO MORE SUBFIELDS. ONE IS THE TYPE OF NUMBER AND THE OTHER IS NUMBERING PLAN.

THE TYPE OF NUMBER LISTS EITHER:

UNKNOWN,
INTERNATIONAL,
NATIONAL,
NETWORK SPECIFIC,
SUBSCRIBER, OR
ABBREVIATED NUMBER.

THE NUMBERING PLAN LISTS ONE OF THE FOLLOWING:

UNKNOWN.
ISDN/TELEPHONY (E.163/E.164).
DATA (X.121).
TELEX (F.69).
NATIONAL STANDARD.
PRIVATE.

IMPLEMENTATION OF ADDRESSING IS PERFORMED IN ACCORDANCE WITH ISO 8348, ADDENDUM 2, INFORMATION PROCESSING SYSTEMS-DATA COMMUNICATIONS-NETWORK SERVICE DEFINITIONS. THE NUMBERING PLAN USED IS ISDN/TELEPHONY (E.163/164).

2.7 FRAME RELAY

FRAME RELAY USES THE SAME FORMAT AS ISDN (E.163/164). ADDRESS INTEGRATION IS DONE IN ACCORDANCE WITH ISO 8348, ADDENDUM 2, INFORMATION PROCESSING SYSTEMS-DATA COMMUNICATIONS-NETWORK SERVICE DEFINITIONS[4].

• 2.8 RECOMMENDATION

DEVELOP STANDARDS PROFILES AND PROCEDURES TO INTEGRATE THESE AND OTHER PROTOCOLS INTO THE ATN END SYSTEMS IN ORDER TO ALLOW COMMUNICATIONS OVER OTHER TYPES OF SUBNETWORKS.

LIST OF REFERENCES

1. ICAO CNS/ATM-1 PACKAGE SARPS AND GUIDANCE MATERIAL

2. RFC-791 INTERNET PROTOCOL, J. POSTEL SEPTEMBER 1991

3. ISO 6523 1984: DATA INTERCHANGE-STRUCTURE FOR THE
NTIFICATION OF ORGANIZATIONS

4. ISO/IEC 8348 AD2: 1988 INFORMATION PROCESSING SYSTEMS-DATA
AMUNICATIONS-NETWORK SERVICE DEFINITION: ADDENDUM 2 NETWORK LAYER
RESSING.

5. ATM PANEL RECOMMENDATION 1993: UNIVERSAL NETWORK INTERFACE
3.1

6. E.164 1991: NUMBERING PLAN FOR THE ISDN ERA

7. ISO 9314-1 1989: FIBRE DISTRIBUTED DATA INTERFACE (FDDI)-PART 1-
SICAL LAYER PROTOCOL (PHY)

8. ISO/IEC 9542 1988: INFORMATION PROCESSING SYSTEMS-
COMMUNICATIONS AND INFORMATION EXCHANGE BETWEEN SYSTEMS-ES TO IS ROUTING
HANGE PROTOCOL

9. ISO 8473 1988: INFORMATION PROCESSING SYSTEMS-DATA
AMUNICATIONS-PROTOCOL FOR PROVIDING THE CONNECTIONLESS-MODE NETWORK
/ICE

10. ISO 9574 1989: INFORMATION TECHNOLOGY-TELECOMMUNICATIONS
) INFORMATION EXCHANGE BETWEEN SYSTEMS-PROVISION OF THE OSI CONNECTION-
DE NETWORK SERVICE BY PACKET MODE TERMINAL EQUIPMENT CONNECTED TO AN
:GRATED SERVICES DIGITAL NETWORK (ISDN)