ATNP/WG2-WP230

.

AERONAUTICAL TELECOMMUNICATION NETWORK PANEL
WORKING GROUP 2 (WG2)

5 - 9 February 1996

Common ICAO [International Civil Aviation Organization] Interchange Network (CIDIN) Compatibility with the Aeronautical Telecommunication Network (ATN)

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SUMMARY

This paper discusses the CIDIN Standards and Recommended Practices, and incompatibles between the CIDIN architecture and the ATN architecture. It is suggested that these incompatibilities be taken into account before a WG1 recommendation for integration of CIDIN into the ATN architecture.

1.0 BACKGROUND

In March 1995, the Aeronautical Telecommunication Network Panel (ATNP) Working Group 1 (WG1) discussed a proposal to eliminate the Common ICAO [International Civil Aviation Organization] Interchange Network (CIDIN) Standards and Recommended Practices (SARPs) [1] from the Aeronautical Telecommunication Network (ATN) Manual. A WG1 deliverable “CIDIN as a subnetwork of ATN” was identified. This paper provides a high-level description of the CIDIN architecture, compares the CIDIN and ATN architecture, and suggested that the incompatibilities be discussed before WG1 recommends integration of CIDIN into the ATN architecture.

2.0 DISCUSSION

ICAO’s work on the CIDIN was initiated to provide a new, transparent data communications with greater performance and capacity than the existing Aeronautical Fixed Telecommunica-tions Network (AFTN). While CIDIN was designed to support the existing AFTN services, it was also designed to provide new and enhanced services. The ICAO Automated Data Interchange Systems Panel first met in February 1969, and completed the CIDIN SARPs in October 1980. The following subsections summarize the CIDIN protocols and operations as described in ICAO Annex 10, Volumes 1 and 2 [2].

2.1 COMMON ICAO DATA INTERCHANGE NETWORK ARCHITECTURE

Applications in centres may communicate to applications in other centres via CIDIN. The CIDIN architecture assumes that there are three types of centres: entry, transit, and exit. Entry centres refers to the centre that has a message to transmit to another center. Transit centres forward messages between the entry center and the destination centre. The exit centre is the destination centre for a message. Centre applications envisioned include Air Traffic Control processor exchanges, flight information services, flight briefing services, flight plan systems, search and rescue systems, and fault reporting.

The CIDIN architecture was based on the International Standards Organization (ISO) reference model and supports the physical through transport layers. CIDIN supports these layers with the following protocols:

1. Link Access Protocol-Balanced (LAP-B) as specified in International Telephone and Telephone Consultative Committee (CCITT) Recommendation X.25 -1980 [3]),

2. X.25 Packet Layer Protocol as specified in CCITT Recommendation X.25 1980,

3. CIDIN Frame Protocol, and

4. CIDIN Transport protocol level.

These protocols, in support of entry, relay, and exit centres, are shown in Figure 1.

Information concerning the CIDIN data link layer through transport layer are provided in Sections 2.1 through 2.4.

2.1.1 Data Link Protocol

Annex 10 supports the link level procedures as described in International Telecommunication Union (ITU) CCITT Recommendation X.25, Section 2, Yellow Book (1980).

2.1.2 CCITT X.25

CIDIN supports Permanent Virtual Circuits (PVCs). In terms of packet types, CIDIN supports Data, Receive Not Ready, Reset, and Restart packets. Operations concerning

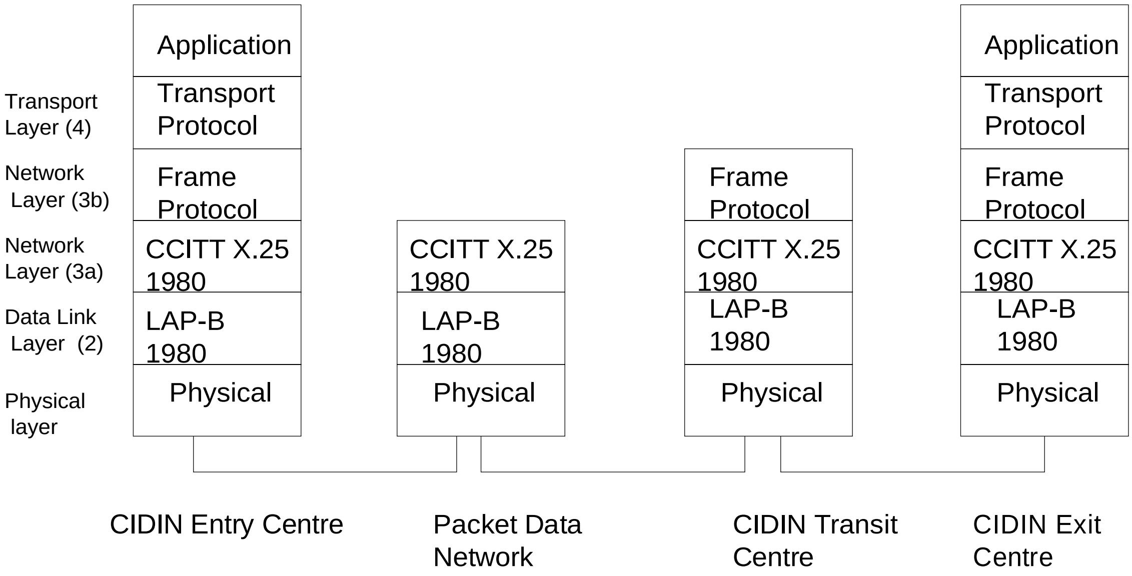

Figure 1. CIDIN Protocols

the receipt and transmittal of these packet types are described in Annex 10. It was recommended that the CIDIN centre select the following options, if available:

1. Maximum user data field of 256 octets,

2. Packet sequence modulo of 8,

3. Local significance of packet sequencing numbers, clearing procedures, and reset procedure,

4. Default window size of seven, and

5. LAP-B data link control procedures.

2.1.3 CIDIN Frame Protocol

The CIDIN Frame Protocol was designed to enhance the functionality of the ISO network layer with specific services to support the needs of the aeronautical community. In particular, it provides for:

1. Frames to be sent to multiple exit addresses, and

2. Frames to indicate priority CIDIN unique priority levels
(low, medium, high, and highest).

CIDIN Frame header formats, methodology for routing and relaying of CIDIN frames, selection of PVCs for transmission of frames, and error conditions are described in Annex 10. Fields in the frame header include the Message Priority Indicator and the Exit Address(es) (Ax).

2.1.4 Transport Protocol

CIDIN provides a unique transport layer protocol which supports:

1. Messages of unlimited length

2. Message acknowledgments

3. Recovery of lost messages

4. Error procedures for invalid messages

5. Conversational traffic (dialogues)

6. Network management messages

CIDIN transport headers are defined, as well as associated transport related procedures for both entry and exit centres in the CIDIN SARPs. Fields in the transport header include the Message Identification Number (MIN), CIDIN frame sequence number, Entry Address (AE), and network acknowledgment indicator (NA).

2.2 COMPARISON OF CIDIN TO ATN ARCHITECTURES

Figure 2 compares the ATN Architecture to the CIDIN architecture.

Note 1: The ATN Internetwork SARPs does not specify requirements for the SNAcP, but requires ISO/IEC 8473-3 if ISO 8208 is supported.

Note 2: When ISO 8208 is supported, then ISO 7776B should be supported for the link layer.

From this table, it can be readily observed that:

1. ATN and CIDIN transport protocols are incompatible

2. ATN and CIDIN network layer protocols are incompatible

	ATN Internet SARPs Architecture	CIDIN Architecture
Transport Layer (4)	ISO/IEC 8073	CIDIN Transport
Network Layer SNICP (3c)	ISO/IEC 8473-1, ISO/IEC 9542, ISO/IEC 10747	CIDIN Frame
SNDCF (3b)	ISO/IEC 8473-3*	CIDIN Unique
SNaCP (3a)	See Note 1	CCITT X.25 (1980)
Link layer (2)	See Note 2	LAP-B (1980)

Figure 2. CIDIN and ATN Architectures

The detailed areas of incompatibility between the ATN and CIDIN architectures are summarized in Table 1.

Table 1. Comparison of CIDIN and ATN Architectures

	ATN	**CIDIN**	**Compatible?**
Transport Layer	ISO/IEC 8072, ISO/IEC 8073	CIDIN unique Transport Protocol	No
Network Layer SNICP Subnetwork Dependent Convergence Network (SNDCF) SNaCP	 SNICF: ISO/IEC 8473-1 ISO/IEC 9542 (ES-IS) ISO/IEC 8648 ISO/IEC 10747 (IDRP is required for BISs only) ISO/IEC 8473-3 (SNDCF) Note 1	 CIDIN Frame Protocol Not supported Not Supported Not supported Not supported CCITT X.25 - 1980 (PVCs only) No security or priority features supported	 No 1984, 1988 are backward Compatible to 1980, but new option/facilities were provided
Link Layer	Not specified in ATN SARPs	LAP-B	N/A
Transport Layer Addressing	ATN-Unique	CIDIN unique (See Note 2)	No
Network Layer Addressing	ATN Unique	CIDIN Unique (See Note 3) recommended	No
Security	ATN Unique (Traffic Types)	None	No

Priority	14 values supported in ATN SARPs	4 values are supported: 00 Low CIDIN Priority 01 medium CIDIN priority 10 high CIDIN priority 11 highest CIDIN priority	Priority values must be mapped

Note 1: While the ATN SARPs does not require the support of X.25, if ISO 8208 is supported, then support for switched virtual circuits (SVCs) are required as part of the SNDCF.

Note 2: In the CIDIN transport protocol, the addressing field is variable in length. The number of octets used is indicated in bits 1–4 of the first octet in the address.

Note 3: It is recommended that the CIDIN frame protocol support a hierarchical addressing scheme based on the following:

First Octet:	CIDIN Centre Code
Second Octet:	National Subcentre Code
Third Octet	Organization code
Fourth Octet	Station Code

These incompatibilities must be taken into account to support the integration of CIDIN over ATN. To integrate CIDIN into the ATN architecture, SICAS panel has recommended that the CIDIN SARPs be modified to support an interface directly to the 3a (X.25) protocol. However, to support this recommendation as documented by the SICAS panel.

1. The CIDIN SARPs should support an interface to the subnetwork layer, and

2. CIDIN SARPs should support SVCs.

However, this proposal does not consider the forward compatibility concerns with the standard conforming to Recommendation X.25 (1980) versus the later versions (1984, 1988). Specific differences between these X.25 versions are discussed in Section 2.2.1.

2.2.1 Subnetwork Differences

The CCITT X.25 (1984 and 1988) standards are backwards compatible to the CCITT X.25 (1980) standard. However, the ATN Internet may require newer X.25 options and facilities that are not supported in CIDIN. Table 2 shows the differences between the 1980, 1984, and 1988 standards.

Table 2. Differences between CCITT X.25 Standards

Feature	**CCITT X.25 1980**	**CCITT X.25 1984**	**CCITT X.25 1988**
Datagram service	Yes	No	No
Fast Select option for SVCs	No	Yes	Yes
Calling and Called Address Extension	No	Yes	Yes (See Note 1)
Support for Modulo 128 frame sequence numbering	No	Yes	Yes
Support for 32768 bits in an I Frame (N1)	No	Yes	Yes
Maximum User Data Field lengths in Data packets of 2048 and 4096 octets	No	Yes	Yes
Facility Field lengths from 64 to 109 octets	No	Yes	Yes
On-line Facility Registration Facility	No	Yes	Yes
Local Charging Prevention Facility	No	Yes	Yes
Network User Identification Facility	No	Yes	Yes
Charging Information Facility	No	Yes	Yes
Hunt Group Facility	No	Yes	Yes
Call Redirection and Call Redirection Notification Facility	No	Yes	Yes
Called Line Address Modified Notification Facility	No	Yes	Yes
Transit Delay Selection and Indication Facility	No	Yes	Yes
CCITT-specified Data Terminal Equipment (DTE) facilities to support priority and protection	No	No	Yes
Addition of the call deflection capability consisting of two optional user facilities (call deflection subscription and call deflection selection)	No	No	Yes
Revision of the Network User Identification (NUI) capability to explicitly distinguish two optional user facilities (NUI subscription, NUI selection)	No	No	Yes
Revision of the NUI capability to add a new optional user facility for NUI override	No	N	Yes
Revision of the Recognized Private Operating Agency (RPOA) text to explicitly distinguish two optional user facilities for RPOA subscription and RPOA selection	No	No	Yes
Modification of the CUG and CUGOA selection facilities use of basic and extended formats	No	No	Yes
Completion of the specification of actions to be taken by the DTE on receipt of errored packets.	No	No	Yes
Addition of the throughput class value of 64 kbits/s	No	No	Yes
Addition of three new diagnostic codes	No	No	Yes
Modifications to diagnostic code table covering application of diagnostic codes to packet types	No	No	Yes

Table 2. (Concluded)

Feature	**CCITT X.25 1980**	**CCITT X.25 1984**	**CCITT X.25 1988**
Modification to the state table covering call collisions	No	No	Yes
Addition of text indicating DTEs may be tolerant to received unassigned or reserved code points in parameter fields to facilitate possible latter extensions	No	No	Yes

Note 1: Coding of the Calling and Called Address Extension facilities were modified in the 1988 version from the 1984 version.

Depending on the features supported in the ATN internet, an X.25 gateway may be required between the ATN internet and CIDIN. ISO 8878 provides the requirements for an SNDCF for X.25 (1980). Appendix B provides guidance on providing internetworking with a relay system between X.25/PLP-1984 and X.25/PLP-1980. The operation of the relay is shown in Figure 3. Note that to support interactions between an ATN application and a CIDIN application, since the layer 3c and 4 protocols are different. A gateway to allow interaction between these protocols would be required. Methods to support CIDIN to ATN application interactions are not discussed in this paper.

Given these factors, the SICAS panel recommendation may be require more investigation than originally envisioned.

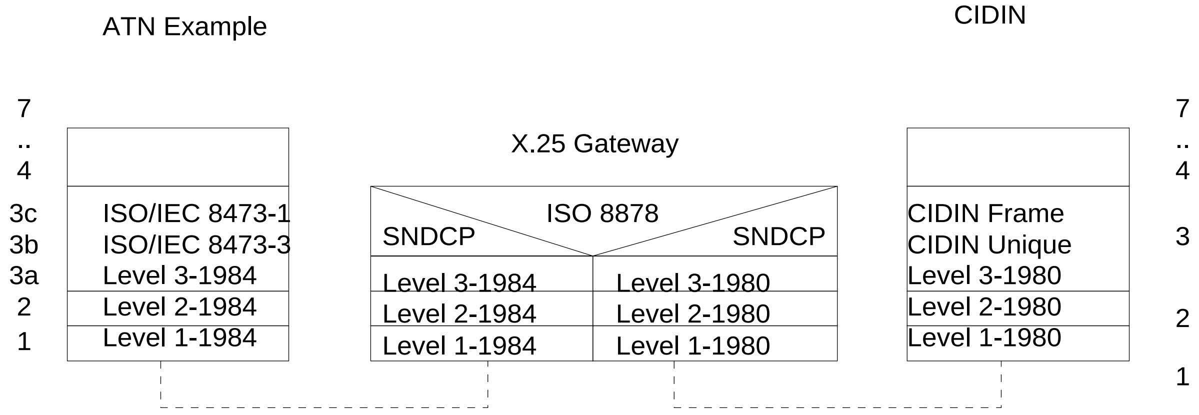

Figure 3. X.25 Gateway

3.0 CONCLUSION

There are incompatibilities between the CIDIN and ATN architecture in the transport layer, network layer, addressing, security, and priority areas. To support the CIDIN architecture, there are a number of outstanding technical issues addressed in this paper associated with these incompatibilities. It is suggested that these incompatibilities be taken into account before a WG1 recommendation for integration of CIDIN into the ATN architecture.

LIST OF REFERENCES

1. ICAO Standards and Recommended Practices (SARPs) for the Common ICAO Data Interchange Network (CIDIN), dated 1981.

2. ICAO Annex 10 Aeronautical Telecommunications, Fourth Edition, April 1985.

3. CCITT Recommendation X.25, Interface between Data Terminal Equipment (DTE) and Data Circuit-Terminating Equipment (DCE) for Terminals operating in the Packet Mode and Connected to Public Data Networks by Dedicated Circuit, dated 1980.

GLOSSARY

AFTN	Aeronautical Fixed Telecommunications Network
ATN	Aeronautical Telecommunication Network
ATNP	Aeronautical Telecommunication Network Panel
CCITT	International Telephone and Telephone Consultative Committee
CIDIN	Common ICAO [International Civil Aviation Organization] Data Interchange Network
DTE	Data Terminal Equipment
ICAO	International Civil Aviation Organization
IEC	International Electrotechnical Commission
ISO	International Standards Organization
LAP-B	Link Access Protocol -Balanced
NUI	Network User Identification
PVC	Permanent Virtual Circuit
RPOA	Recognized Private Operating Agency
SARPs	Standards and Recommended Practices
SICAS	Secondary Surveillance Radar Improvements and Collision Avoidance System
SNAcP	Subnetwork Access Protocol
SNDCF	Subnetwork Dependent Convergence Network
SNDCP	Subnetwork Dependent Convergence Protocol
SVC	Switched Virtual Circuit
WG1	Working Group 1