REDDIG/4-WP/11
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INTERNATIONAL CIVIL AVIATION ORGANIZATION
SOUTH AMERICAN REGIONAL OFFICE

FOURTH INFORMAL MEETING ON THE PLANNING AND IMPLEMENTATION OF THE SAM DIGITAL NETWORK

(REDDIG/4)

(Lima, Peru, 4 - 8 September 2000)

Agenda Item 4: Other matters

(Presented by the Secretariat)

Summary

This working paper addresses matters related to digital network interconnection at the CAR/SAM boundaries, as well as the internetworking feasibility between them, while meeting the aeronautical operational requirements as recommended in the CAR/SAM FASID.

References:

CAR/SAM/3 RAN Meeting report, Doc. 9749;
Summary of Discussions and Conclusions of the CAR/SAM 01/00-CNS Informal Meeting;
GREPECAS/9 Meeting report; and
ITU-T Recommendations Series X, Q and I.

1. Background

1.1 The interconnection of digital networks was subject of discussion during the CAR/SAM/3 RAN meeting due to the concern raised by some States in relation to the potential problem of interconnection between the current and emerging digital networks at the boundaries of the CAR and SAM Regions. In this regard, the CAR/SAM/3 RAN meeting formulated Rec. 9/1 and several Conclusions (9/8, 13/28 and 13/29) leading to conduct the study on this matter.

1.2 Based on the mentioned Conclusions 9/8 and 13/28, ICAO coordinated and organized the CAR/SAM 01/00-CNS informal meeting, held in Mexico from 26 to 29 June 2000. This informal meeting studied several options to establish the architecture for the interconnection of the CAR/SAM digital networks. The purpose of the mentioned interconnection was to implement, by means of the facilities contemplated in the digital networks, the communication operational requirements as recommended in the CAR/SAM FASID, Tables CNS 1A and CNS 1C. It should be noted that the mentioned informal meeting dit not reach a final recommendation on this matter and the work performed by the meeting was dedicated to select adequate options in relation with the interconnection of digital networks. Although a good advance of the work has been done during the meeting, it was recognized that further studies on the selected options are needed.

1.2.1 The meeting should note that the CAR/SAM 01/00-CNS informal meeting organized a way to coordinate by e-mail the development and the necessary studies of the selected options in preparation of future meetings dealing with the interconnection of digital networks. The corresponding studies should be prepared based on a standardized format with the purpose to find, by comparison, the economical and technical advantages of the same. In order to perform this task, each Administration affected by the CAR/SAM/3 Conclusions 9/8 and 13/28 should designate a counterpart to work together by e-mail, in coordination with the ICAO Secretariat, for the preparation of the mentioned studies.

1.3 The GREPECAS/9 Meeting reviewed the work carried out by the CAR/SAM 01/00-CNS informal meeting, and concluded (Conclusion 9/1) that the solutions for the interconnection of digital networks in the CAR/SAM regions should be carried out by the mechanism of informal meetings already organized by ICAO among the States/Organizations affected by the CAR/SAM/3 RAN Conclusions 9/8 and 13/28. Likewise, GREPECAS considered a new task for its CNS Committee to develop the corresponding guidance material for interconnection of digital networks.

2. **Analysis**

2.1 As indicated above, the CAR/SAM/3 RAN Meeting formulated **Rec. 9/1 - Implementation of digital networks to improve the current AFS and to facilitate the introduction of the ATN**, which is reproduced below.

Recommendation 9/1 Implementation of digital networks to improve the current AFS and to facilitate the introduction of the ATN

That:

a) in order to meet, in a reliable and cost-effective manner, current and future AFS requirements for voice/data communications and to facilitate the introduction of ATN, States in CAR/SAM Regions make an effort to proceed with the process of implementing modern digital communication networks in a coordinated manner;

b) in order to facilitate the above, GREPECAS develop, as a matter of urgency and before the forthcoming GREPECAS meeting, criteria and guidelines necessary for establishing, as fas as feasible, inter-networking between various available and emerging digital networks, while meeting aeronautical operational requirements; and

c) ICAO provide, as necessary, appropriate technical cooperation mechanism(s) for a) and b) above.

2.2 The above mentioned Rec. 9/1 requests the "establishing, as far as feasible, inter-networking between various available and emerging digital networks, while meeting aeronautical operational requirements". The meeting should note that this sentence would be the key element to face with the planning of the interconnection of digital networks developing "as far as feasible" the corresponding inter-networking, which concept is analyzed in this working paper considering the current and recognized definitions and concepts developed by the ITU and the communication industry.

2.2.1 It should be noted that internetworking is a function (ITU-T Rec. X.300) provided through the interface that interconnect networks. According to ITU recommendation X.200 related with **Open Systems Interconnection (OSI)**, the OSI network environment is concerned not only with the transfer of information between systems, i.e transmission, but also with their capability to *interwork* to achieve a common (distributed) task. In other words, OSI is concerned with the interconnection aspects of *cooperation* between systems which is implied by the expression "systems interconnection". The internetworking function, as defined , is applied to real open systems, which are systems that meet ITU-T Rec. X.200 or those developed by ISO in cooperation with the ITU and being applied by ICAO for the architecture of the ATN. Additionally, it should be noted the definition of internetworking considered in the ITU-T Rec. Q 602, which is applied also for voice communications:

"Q.602

Internetworking is defined as:

> the controlled transfer of signalling information across the interface between different signalling systems where the significance of transferred information is identical or where the significance is translated in a defined number, and
>
> the performance of appropriate switching procedures in association with the transfer."

In connection with the above, it should be noted that signalling systems capable of internetworking are those internationally standarized such as No7, PSS1, No 5, R2, etc., and at the level of data transmission protocols such as X.25, Frame Relay, etc. It should be also noted that internetworking include switching functions performed at the nodes of the network (ITU-T Rec I.112) , that means that networks having at their nodes only functions to establish point-to-point dedicated circuits by multiplexing data and voice channels, the concept of internetworking can be not apply to these kind of networks, since they only provides the physical media to connect switching nodes of open or close real systems outside of the concerned network and connected to it.

2.2.2 What happens in closed systems? In closed systems, such as those proprietary VSAT systems established for voice and data, internetworking as explained above, with other proprietary or open systems, would require special interfaces, which should be specially designed and developed.

2.2.3 If the network provides only the physical media, the "internetworking" will be reduced to extend the physical communication channels through a physical interface between networks to connect terminals/nodes related in both network environments by specific communication requirements, which in the case of ICAO, are designated as aeronautical operational communication requirements as recommended in the CAR/SAM FASID.

3. **Discussion on the internetworking possibilities in the CAR/SAM regions boundaries**

3.1 In the boundaries of the CAR/SAM regions the MEVA, E-CAR and REDDIG digital networks should be interconnected studying "as far as feasible" internetworking between them. The characteristics of these networks are as follows:

MEVA A SCPC/DAMA VSAT network using the PAS-5 satellite, establishing physical point-to-point connections among its users for voice and data. DAMA access is used for voice switching functions. DAMA as a proprietary physical level switching solution has no internetworking possibilities among DAMA access implemented in different VSAT networks.

E-CAR A terrestrial optic fibre open system network designed as an ATN compatible sub-network using ISDN. The E-CAR has nodes near the SAM region at San Juan and Piarco.

REDDIG A multiservice/multiprotocol open system design, ATN compatible, based on Frame Relay or ATM, using as main physical media VSAT technology with TDMA or MCPC access method. The satellite INTELSAT 903 is being proposed to be used. ISDN as terrestrial back-up is being considered.

Note: The networks MEVA and E-CAR are already interconnected at the corresponding nodes implemented at Miami.

3.2 Taking into account the comments provided in paragraph 2 above, the situations MEVA/REDDIG and E-CAR/REDDIG interconnections will be considered separately. In so doing, it should be noted that requirements not always are needed to be met by the mentioned digital networks, instead of that, leased services using digital circuits could be established, and a good example of that are the X.25 circuit United States-Lima and the telegraphic circuit Madrid-Caracas.

Interconnection MEVA/REDDIG

1) It should be noted that VSAT networks, from the physical media (satellite segment) point of view, are closed systems. The physical media of the MEVA and REDDIG use different satellites and different access methods. MEVA does not provide OSI network functions. Interconnection of the two systems should be made at the physical level by implementing this interconnection by means of a dedicated circuit linking one REDDIG node with a MEVA node or by co-locating one REDDIG node with a MEVA node. In this regard, the voice/data communications channels at the REDDIG FRAD connectors can be transferred to the MEVA physical connections for dedicated point-to point or DAMA switching as necessary and/or to establish a data circuit for AFTN/ATN purposes. In the proper sense of internetworking, voice communications internetworking is not possible, since REDDIG use voice over Frame Relay and MEVA is a proprietary DAMA system. From the point of view of the data internetworking, this would be possible for the AFTN outside of both networks at the level of the AFTN switching systems, and in the case of ATN, REDDIG is being designed as an ATN compatible sub-network, while the current MEVA only represents the physical layer of the OSI reference model. It is expected that the future MEVA (MEVA II) would be an ATN compatible network in which case internetworking would be possible through an ATN router.

Interconnection REDDIG/E-CAR

2) At Caracas, REDDIG and E-CAR nodes will implemented. In relation with the E-CAR, it is being considered that the Caracas node would be connected with the nodes at San Juan and Piarco. Currently, the E-CAR Caracas node is partially implemented and the voice and data communications with United States and Puerto Rico are implemented. There are potential possibilities of internetworking which should be studied in the light of the characteristics offered by the two open systems. A solution for the interconnection REDDIG/E-CAR was already proposed by the mentioned Informal Meeting CAR/SAM 01/00-CNS, which should be further elaborated for discussion. In this regard, the solution proposed contemplates the existence of E-CAR and REDDIG nodes at Caracas.

3.3 It should be noted that the RLA/98/019 technical cooperation project is closely following-up the discussions carried out on this matter and already provided advice, through the ICAO Secretariat, on the options selected by the CAR/SAM 01/00-CNS informal meeting.

4. Conclusions

4.1 From the above consideration, it can be concluded that:

a) The CAR/SAM States have implemented or are to implement several digital coordinated networks, and to take advantage of these modern communication structures, it should be at the CAR/SAM boundaries, interconnected as required, considering as far as feasible internetworking functions between them.

b) The concerns expressed by the CAR/SAM/3 RAN Meeting on interconnection of digital networks are being addressed by GREPECAS (CNS Committee) and ICAO through the coordination and organization of CAR/SAM Informal Meetings, which mechanism was supported and recognized by GREPECAS as the adequate approach to deal with the subject.

c) The CAR/SAM 01/00-CNS Informal Meeting identified several options of digital networks interconnections, which should be further studied by future CAR/SAM Informal Meetings tasked with this matter, until an adequate solution is recommended by the mechanism of informal meetings to the States/Organizations concerned.

d) Considering the bodies involved in resolving the interconnection of CAR/SAM digital networks, in coordination with the ICAO Secretariat, the RLA/98/019 regional technical cooperation project would provide, as necessary, advice on this matter.

5. Action suggested

5.1 The meeting is invited to consider the information provided in this working paper and to agree on the conclusions expressed in paragraph 4 above.

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