A CONNECTION-MODE NETWORK SERVICE RELAY FUNCTIONAL SPECIFICATION

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Abstract

Functional standardization activities in ISO and in regional workshops are currently addressing end-system profiles and network layer relay profiles for the interconnection of several types of subnetworks. In order to achieve end-system interconnectivity, connection-mode network layer relays appear as one of the key pieces of the Open Systems Interconnection puzzle. In this paper the authors present a connection-mode relay functional specification that is being input to the European Workshop for Open Systems, discuss the relevant profile options, and identify some issues that will require future attention and discussion.

KEY WORDS: Service relay, protocol relay, network-layer relays, internetworking, international standardized profiles.

1. Introduction

The generalized use of local area networks (LANs), and the need for information interchange between users connected to different types of LANs, possibly located in geographically distant places, has lead in the last few years to the development of LAN interconnection solutions based on wide area packet switching data networks (PSDN WANs) [1].

To prevent incompatibilities between different interconnection solutions, there is an ongoing functional standardization activity in ISO aiming at the development of International Standardized Profiles (ISP), that benefits from the harmonized input of regional workshops (EWOS[1], NIST OIW[2], and AOW[3]). This will, hopefully, lead to standardized and compatible implementations of relays for the interconnection of those types of networks.

This paper presents the main aspects of a proposal for a connection-mode network service (CONS) relay functional standard, or profile, for the interconnection of CSMA/CD LANs and Packet Switched Data Networks. The presented work is being input to the EWOS Expert Group on Lower Layers where it is a current work item, and from where it will be fed into the other regional workshops for harmonization and, eventually, to ISO Special Group on Functional Standardization (SGFS).

Section 2 presents the some aspects of functional standardization activities in the area. A detailed profile presentation is given in section 3, where all the relevant profile options are discussed. Section 4 presents some conclusions and future work directions.

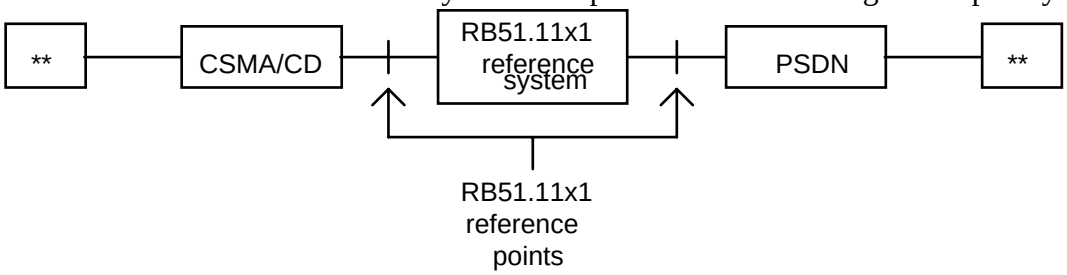
2. Network layer relays profiling

ISO/IEC Technical Report 10000-2 [2] defines a

[1] European Workshop for Open Systems
[2] National Institute for Standards and Technology - OSI Implementors Workshop
[3] Asian and Oceanic Workshop

taxonomy for relay system classification that will be used throughout this paper.

At the present moment, several functional standardization activities address network layer relaying, covering connectionless network service (CLNS) relaying (RAp.q profiles), CONS relaying (RBp.q profiles) and X.25 Packet Level Protocol relaying (RCp.q profiles). These functional specifications are being developed by regional



** other compatible network equipment:
- OSI relays;
- OSI end systems;
- other equipment.

Figure 1 - Scenario of applicability of the RB51.11x1 profiles.

TABLE 1 - General description of the profile parts

Part	Title	Standards constrained
1	Subnetwork-type independent requirements	ISO 10177 [5], ISO 8208 [6]
2	LAN Subnetwork-type dependent media independent requirements	ISO 8208 [6], ISO 8802-2 [7]
3	CSMA/CD LAN Subnetwork-type dependent media dependent requirements	ISO 8802-3 [8]
4	PSDN Subnetwork dependent media dependent requirements for virtual calls over a permanent access	ISO 8208 [6], ISO 7776 [9]
5	Profile RB51.1111	parts 1-4 and standards for the X.25 dedicated access by a PSTN
6	Profile RB51.1121	parts 1-4 and standards for the X.25 dedicated access by a digital data circuit /CSDN

workshops and are at different development stages (e.g., development in progress within organization, harmonization between regional workshops in progress, submitted to JTC1/SGFS for ISP processing). Current profile work addresses the interconnection of different types of subnetworks (e.g., CSMA/CD, Token Ring, PSDN and FDDI) in various combinations. In addition, several end-system profiles are approved, or near approval, in ISO, that use the connectionless-mode or the connection-mode approach at the network layer. ISO maintains a directory of ISPs that contains updated profile status information [3].

For now, the presented work only specifies two profiles: RB51.1111 and RB51.1121 (referred in the text as RB51.11x1). Figure 1 illustrates the scenario in which RB51.11x1 profiles are applicable. The figure shows two reference points, but an implementation of this profile may include more attachments to either of the subnetworks.

3. RB51.11x1 profile options description

3.1 General overview

The specification of these profiles is contained in a document written according to the multi-part ISP rules [4]. A general description of the profile parts is presented in Table 1.

The scope of this paper is only to present and discuss the main options taken in the specification of profiles RB51.11x1. In accordance to this, in the rest of the paper there are no further references to the structure of the work neither to where in the parts appear the constraints or the requirements made.

The rest of the chapter is a description of the requirements on the base standards and the justification for those requirements. A distinction is made between static and dynamic requirements. The former are requirements for implementation, and the later are requirements for use.

TABLE 2 - Static conformance requirements, with respect to ISO 10177

1) meet the static conformance requirements specified in clause 6.1 of ISO 10177.
2) implement the following capabilities identified in table 1 of ISO 10177: a. use of VC service; b. NC establishment, outgoing;c. NC establishment, incoming; d. expedited data transfer; e. receipt confirmation; f. NC release on mapping-protocol violation; g. NC reset on mapping-protocol violation.
3) conform to the following PICS items in clauses A.5, A.6 and A.7 of ISO 10177: a. NC establishment incoming on VC - m; b. NC establishment outgoing on VC - m; c. expedited data transfer - m; d. receipt confirmation - m; e. INTERRUPT when non-use of Expedited Data negotiated NC release - o.1; f. INTERRUPT when non-use of Expedited Data negotiated NC reset - o.1; g. D-bit when non-use of Receipt Confirmation negotiated NC release - o.2; h. D-bit when non-use of Receipt Confirmation negotiated NC reset - o.2; i. Q-bit set to 1 NC release - o.3; j. Q-bit set to 1 NC reset - o.3; k. Zero-length M-bit sequence NC release - o.4; l. Zero-length M-bit sequence NC reset - o.4; m. Zero-length M-bit sequence ignore - o.4.

m stands for mandatory item. o.n stands for support of at least one of the items identified with the same "n" [4] [10].

3.2 Requirements for ISO/IEC 10177

This standard defines the mappings between the X.25 packet level protocol PDUs and the network internal layer service (NILS) for the provision of the CONS.

Table 2 summarizes the proposed profiles static conformance requirements, with respect to ISO 10177 [5].

The use of the Virtual Call (VC) service is a characteristic of RB51.11x1 profiles and, of course, a profile implementation needs to establish outgoing connections when it decides to accept incoming connections. The expedited data transfer service is part of the CONS [11] as well as the receipt confirmation service.

The mapping protocol violations are events that although correct from the viewpoint of ISO 8208 are errors according to ISO 8878 [12] and ISO 10177. So, in item 2 the two methods of acting when one of these violations occurs are supported. The situation of ignoring the errors would lead to internetworking problems. In item 3 the restriction is to support at least one of the methods of action for each of the identified violations.

Additionally, a conforming implementation shall conform to the dynamic conformance requirements specified in clause 6.3 of ISO 10177.

3.3 Requirements for ISO/IEC 8208

3.3.1 Subnetwork-type independent requirements

Table 3 summarizes the proposed profiles static conformance requirements, with respect to ISO 8208.

The "transmit RR packets" requirement is due to the fact that this requirement is not clearly stated in ISO 10177. The same type of problem applies to the option "Call clearing to reject an incoming VC". Finally, for coherence with the ISO 10177 requirement to send data packets with the Q bit set to zero, sending data packets with the Q-bit set to 1 is excluded.

In addition, a conforming implementation shall conform to the dynamic conformance requirements specified in clause 21 of ISO 8208/Amd.3.

3.3.2 LAN dependent media independent requirements

Table 4 summarizes the proposed profiles LAN dependent media independent static conformance requirements, with respect to ISO 8208.

Support of LLC type 2 is mandatory. Support of the values in 3) contributes to a more efficient LAN operation, by using its large bandwidth and its large packet sizes. The support of the dynamic role selection method has the advantage of being automatic and based in the restart procedure which is mandatory ISO 8208, and so it adds no extra costs. According to ISO 8208 it is required to support at least one of the sequencing methods (modulo 8 or modulo 128). To avoid interworking incompatibilities the requirement for modulo 8 sequencing was made mandatory.

TABLE 3 - Static conformance requirements, with respect to ISO 8208

1) meet the requirements for the X.25 Packet Layer Protocol of ISO 8208, as modified by ISO 10177 in clause 6.2.1.
2) meet the static conformance requirements specified in clause 21 of ISO 8208/Amd.3 [13].
3) implement the following option from clause 21.1.2 of ISO 8208/Amd.3 [13]: a. transmit RR packets.
4) conform to the following PICS items in clauses C.6.4.1 and C.6.8.1 of ISO 8208/Amd.3 [13]: a. Call clearing to reject an incoming VC - m b. Sending Q=1 in data packets - x

Table 5 summarizes the proposed profiles LAN dependent media independent dynamic conformance requirements, with respect to ISO 8208.

Requirement 2) is also used in ISO 10614-2 [15] and ISO 10609-12 [16]. This is the kind of constraint which can lead to interworking problems with solutions based on the specifications in [17]. LLC type 1 support seems to be unnecessary because all the standardized solutions must support LLC type 2, as required by ISO 8881.

Method 3) presents a harmonized procedure for a subject that is poorly defined in ISO 8881 and ISO 8208. Basically, this method establishes the following procedure: the logical channel ranges to be used are determined by local knowledge; if local knowledge is not available then, by default, only a single two-way logical channel will be used; if more than one channel is available, a higher value may be negotiated using the On-line Facility Registration Facility.

TABLE 4

1) meet the requirements for the X.25 Packet Layer Protocol of ISO 8208, as modified for operation over LLC type 2 in a LAN environment by ISO 8881 [14].
2) support the following optional user facilities: a. Non-standard Default Packet Sizes; b. Non-standard Default Window Sizes.
3) support at least the following non-standard default parameter values: a. all Non-standard Default Packet Sizes from 32 octets to 1024 octets; b. all Non-standard Default Window Sizes from 1 to 7.
4) conform to the following PICS items in clause C.5 of ISO 8208/Amd.3: a. DTE/DCE (1988, 1984 and 1980) - x b. DTE/DTE with dynamic role selection - m c. Modulo 8 - m

TABLE 5

1) carry out the supported ISO 8208 functions in accordance with the procedures for the X.25 PLP of ISO 8208, as modified for operation over LLC type 2 in a LAN environment by ISO 8881 [14].
2) not make use of the procedures for the operation of ISO 8208 over LLC type 1, defined in section 3 of ISO 8881.
3) support the method of determining the range of logical channels approved in EWOS and already used in ISO 10614-2 [15].

3.3.3 PSDN dependent media dependent requirements

Table 6 summarizes the proposed profiles PSDN dependent media dependent static conformance requirements, with respect to ISO 8208.

TABLE 6

1) implement operation in a DTE/DCE environment according to ISO 8208.
2) conform to the following PICS items in clause C.5 of ISO 8208/Amd.3: a. DTE/DTE environments - x b. DTE/DCE (1980) - x c. Modulo 8 - m

ISO 10117 states that compatibility with the 1980 version of ISO 8208 is outside its scope, and so this environment is not supported by these profiles.

4. Conclusion

This paper presented the main points of a proposal for connection-mode network service relay profiles RB51.1111 and RB51.1121, that is being input to the European Workshop for Open Systems for further development. RB profiles are key profiles of the OSI architecture, as they are indispensable when end-systems conforming to TB, TC, TD or TE profiles are attached to the interconnected subnetworks.

The work behind the presented proposal also permitted to identify some issues requiring strategic discussion, namely the possibility to support the connection-mode as well as the connectionless-mode network service in the same relay, the possibility to use X.25 over LLC type 1 procedures, the use of universally administered 48-bit MAC addresses (in order to eliminate the need for duplicate address check procedures), and the hidden inefficiency of RA profiles that use the connectionless-mode network protocol over X.25 and interconnect TA end-systems. These issues were taken into account in the elaboration of the proposal, although they were not addressed by this paper.

In addition to discussing these issues, future work will try to harmonize the proposed profile among the regional workshops and, eventually, to develop the specification of profiles RB53.11x1, for which there is a recognized interest. Other possible work would be the inclusion of management capabilities, routeing and security, but this will largely depend on the general policy

to be taken in relation to other lower layer profiles.

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