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INTEGRATED SERVICES DIGITAL NETWORK (ISDN)

OVERALL NETWORK ASPECTS AND FUNCTIONS

SUPPORT OF BROADBAND CONNECTIONLESS DATA SERVICE ON B-ISDN

ITU-T Recommendation I.364

(Previously "CCITT Recommendation")

FOREWORD

The ITU Telecommunication Standardization Sector (ITU-T) is a permanent organ of the International Telecommunication Union. The ITU-T is responsible for studying technical, operating and tariff questions and issuing Recommendations on them with a view to standardizing telecommunications on a worldwide basis.

The World Telecommunication Standardization Conference (WTSC), which meets every four years, established the topics for study by the ITU-T Study Groups which, in their turn, produce Recommendations on these topics.

ITU-T Recommendation I.364 was prepared by the ITU-T Study Group XVIII (1988-1993) and was approved by the WTSC (Helsinki, March 1-12, 1993).

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NOTES

1 As a consequence of a reform process within the International Telecommunication Union (ITU), the CCITT ceased to exist as of 28 February 1993. In its place, the ITU Telecommunication Standardization Sector (ITU-T) was created as of 1 March 1993. Similarly, in this reform process, the CCIR and the IFRB have been replaced by the Radiocommunication Sector.

In order not to delay publication of this Recommendation, no change has been made in the text to references containing the acronyms "CCITT, CCIR or IFRB" or their associated entities such as Plenary Assembly, Secretariat, etc. Future editions of this Recommendation will contain the proper terminology related to the new ITU structure.

2 In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

CONTENTS

Recommendation I.364

SUPPORT OF BROADBAND CONNECTIONLESS DATA SERVICE ON B-ISDN

(Helsinki, 1993)

1 Scope

This Recommendation describes the support of connectionless data service on B-ISDN in accordance with

- Recommendation I.113; which defines "connectionless service" (vocabulary).
- Recommendation F.812; which provides a service description of a "Broadband Connectionless Data Bearer Service". F.812 generally describes the service to include:
  - source address validation;
  - addresses based on E.164 numbering;
  - multicasting;
  - group addressing;
  - network capabilities for charging;
  - interworking to other connectionless and connection oriented data services;
  - Quality of Service parameters.
- Recommendation I.211; which describes connectionless data service aspects. Recommendation I.211 identifies two configurations, Type i) and ii) to support connectionless data service. In Type i), a connectionless service function (CLSF) is installed outside the B-ISDN. In Type ii), a CLSF is installed within the B-ISDN, which handles routing of data to be transferred based on connectionless techniques.
- Recommendation I.327; which describes "high layer capabilities" for the support of services (e.g. connectionless service) and gives functional architectural models for the cases mentioned above.
- Recommendation I.362; which specifies the use of AAL Type 3/4 for connectionless data services (the use of other AAL Types is for further study), and identifies that routing and addressing is provided by the layer above AAL Type 3/4.
- Recommendation I.363; which specifies AAL Type 3/4.

This Recommendation relates to Type ii) (direct) provision of connectionless service, using B-ISDN connectionless service. However, aspects of this Recommendation may be applied to some Type i) provision of connectionless service. This Recommendation describes the framework for network support of connectionless data service and the protocols used to support connectionless service.

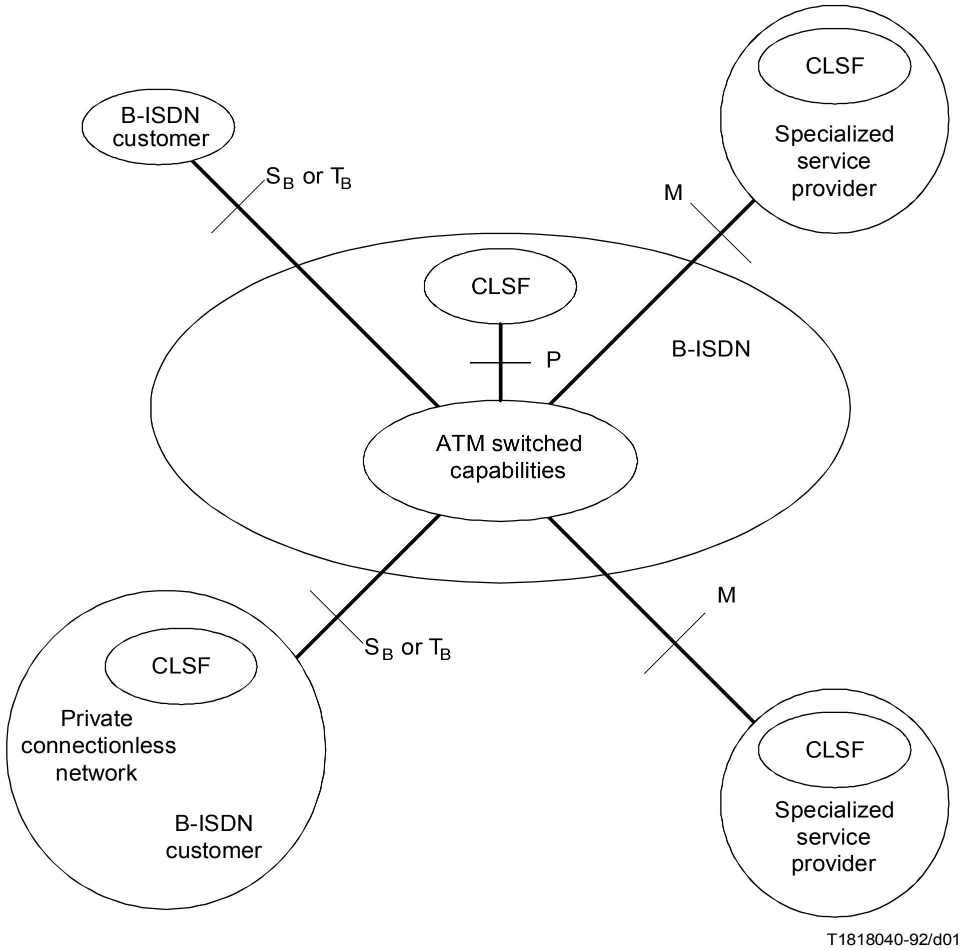
2 Framework for the provision of connectionless data service on B-ISDN

2.1 Definition of a broadband connectionless data service on B-ISDN

This definition is provided by Recommendation F.812 in conjunction with this Recommendation.

2.2 Functional architecture

The provision of the connectionless data service in B-ISDN is realized by means of ATM switched capabilities and connectionless service functions (CLSF). The ATM switched capabilities support the transport of connectionless data units in B-ISDN between specific functional groups CLSF able to handle the connectionless protocol and to realize the adaptation of the connectionless data units into ATM cells to be transferred in a connection-oriented environment. The CLSF functional groups may be located outside B-ISDN, in a private connectionless network or in a specialized service provider, or inside B-ISDN. The relevant reference configuration for the provision of the connectionless data service in B-ISDN is depicted in Figure 1.



CLSF Connectionless service functions
P, M, S, T Reference point

FIGURE 1/I.364

Reference configuration for the provision of the CL data service in B-ISDN

The ATM switched capabilities are performed by the ATM nodes (ATM switch/cross-connect) which realize the ATM transport network. The CLSF functional group terminates the B-ISDN connectionless protocol and includes functions for the adaptation of the connectionless protocol to the intrinsically connection-oriented ATM layer protocol. These latter functions are those performed by the ATM adaptation layer Type 3/4 (AAL 3/4), while the former ones are those related to the layer above AAL 3/4 denoted CLNAP (connectionless network access protocol).

The CL protocol includes functions such as routing, addressing, QOS selection. In order to perform the routing of CL data units, the CLSF has to interact with the control/management planes of the underlying ATM network. The interactions between the CSLF and control/management planes require further study.

The CLSF functional group can be considered implemented in the same equipment together with the ATM switched capabilities as depicted in Figure 2 (option A). In this case there is no need to define the interface at the P reference point. CLSF functional group and ATM switched capabilities can be implemented also in separate equipment (Figure 2, option B). In this case interfaces shall be defined at the M or P reference points (refer to Recommendations I.327/I.324) depending on whether the CLSF is located outside or inside the B-ISDN.

The general protocol structure for the provision of CL data service in B-ISDN is shown in Figure 3.

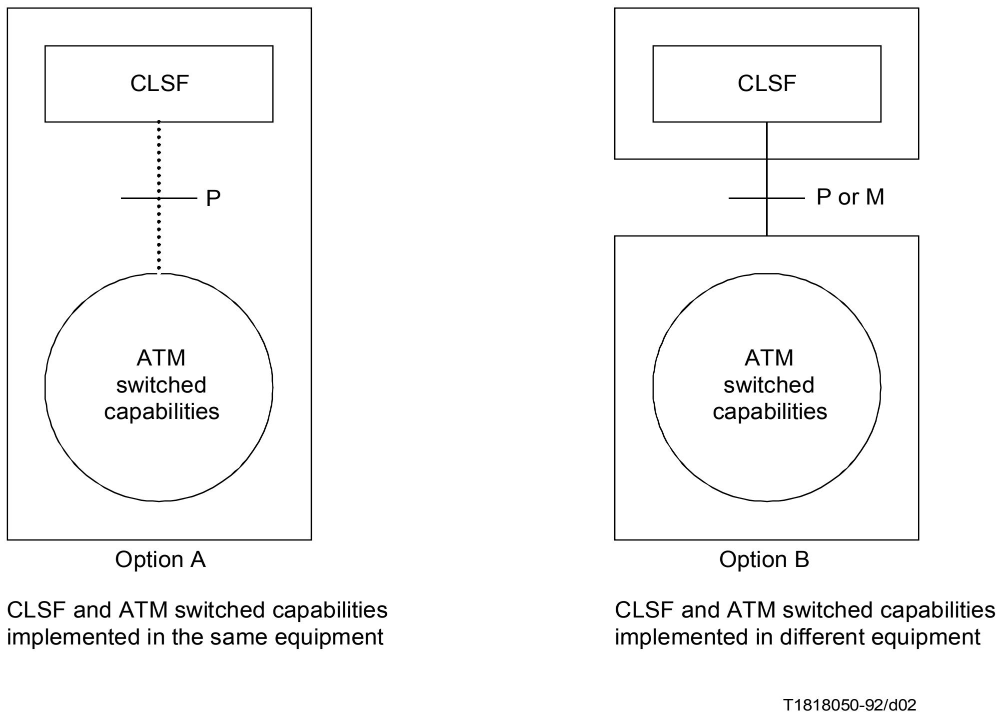


FIGURE 2/I.342

Implementation of CLSF and ATM switched capabilities

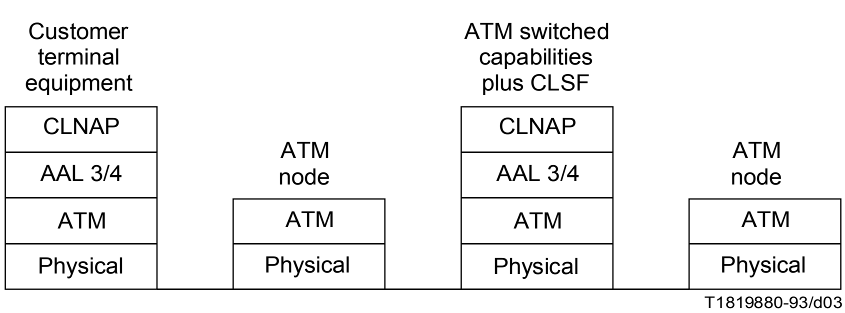


FIGURE 3/I.364

General protocol structure for provision of CL data service in B-ISDN

2.3 Interfaces

For further study.

2.4 Connections

For further study.

2.5 Protocols

The protocols for the support of connectionless data service on B-ISDN at the UNI and NNI are described in 3 and 4.

2.6 Numbering and addressing

The number structure of Recommendation E.164 shall be supported. The need for sub-addressing is for further study.

2.7 Traffic aspects

For further study.

2.8 Operations and maintenance

For further study.

2.9 Network charging capabilities

For further study.

2.10 Interworking with non-B-ISDN connectionless data protocols

For further study.

2.11 Interworking with connection oriented data services

For further study.

3 Protocol for the support of connectionless data service on B-ISDN at the UNI

The clause describes a protocol for supporting a connectionless data bearer service across the B-ISDN UNI. The protocol provides a layer service similar to the MAC sub-layer service described in the ISO/IEC 10039 standard, with enhanced capabilities.

This alignment is considered highly desirable in order to facilitate ease of interworking between the two protocols for supporting connectionless service.

3.1 Protocol architecture

The subclause provides a description of the protocol architecture for supporting connectionless layer service. Figure 4 illustrates the protocol architecture for supporting the connectionless layer service. The connectionless network access protocol (CLNAP) layer uses the Type 3/4 AAL unassured service and includes the necessary functionality to provide the connectionless layer service. The CLNAP layer provides its service to the CLNAP layer user as illustrated.

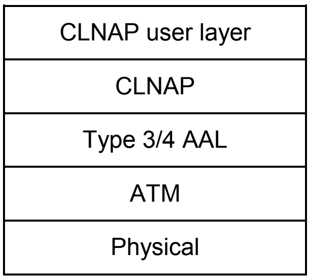


FIGURE 4/I.364

Protocol architecture for supporting connectionless service

3.2 Service provided by the connectionless service layer

The connectionless service layer provides for the transparent transfer of variable size data units from a source to one or more destinations in a manner such that lost or corrupted data units are not retransmitted. This transfer is performed using a connectionless technique, including embedding destination and source addresses into each data unit.

In general, the information exchanged between the CLNAP entity and the CLNAP user entity across the CLNAP SAP includes the following primitives:

1) CLNAP-UNITDATA.request (source-address, destination-address, data, QOS)

2) CLNAP-UNITDATA.indication (source-address, destination-address, data, QOS).

3.2.1 Description of primitives

3.2.1.1 CLNAP-UNITDATA.request

This primitive is issued by the CLNAP user to request the transfer of a CLNAP-SDU to its peer CLNAP-entity, if individual addresses are being used, or peer entities, if the CLNAP-SDU is group addressed. This CLNAP-SDU is always transmitted in a manner such that lost or corrupted data units are not retransmitted.

3.2.1.2 CLNAP-UNITDATA.indication

This primitive is issued to the CLNAP user entity to indicate the arrival of a CLNAP-SDU. In the absence of errors, the contents of the CLNAP-SDU are logically complete and unchanged relative to the data parameter in the associated CLNAP-UNITDATA.request.

3.2.2 Definition of parameters

For the purpose of this Recommendation, the following definition applies:

3.2.2.1 source-address: The source-address parameter specifies an individual CLNAP layer address.

3.2.2.2 destination-address: The destination-address parameter specifies either an individual or group CLNAP layer address.

3.2.2.3 Quality of Service (QOS): The QOS parameter specifies the quality of service desired for the CLNAP-SDU transfer.

3.2.2.4 data: The data parameter specifies the CLNAP-SDU to be transferred.

3.3 Service expected from the AAL

The B-ISDN CLNAP layer expects the AAL to provide for the transparent and sequential transfer of connectionless protocol data units (CLNAP-PDUs) between two CLNAP layer entities when accessing a point-to-point bi-directional AAL connection[1], or two or more CLNAP layer entities when accessing a de-centralized multipoint AAL connection[1] This transfer is provided in a manner such that lost or corrupted data units are not retransmitted (Unassured operation).

The information transfer between the CLNAP-entity and the AAL-entity can be performed in a message mode or streaming mode. The use of streaming mode service by CLNAP is for further study.

In general, the information exchanged between the AAL-entities and the CLNAP-entities across the AAL-SAP includes the following primitives:

1) AAL-UNITDATA.request (interface data, more, maximum length)
2) AAL-UNITDATA.indication (interface data, more, maximum length)
3) AAL-U-Abort.request
4) AAL-U-Abort.indication
5) AAL-P-Abort.indication.

A detailed description of the primitives and parameters is provided in Recommendation I.363. The CLNAP does not make use of the optional reception status parameter in the AAL-UNITDATA primitive.

3.4 Connectionless service layer functions

The functions provided by the CLNAP layer may include:

3.4.1 Preservation of CLNAP-SDUs

This function provides for the delineation and transfer of CLNAP-SDUs.

3.4.2 Addressing

This function provides the ability to a CLNAP user layer entity to select, on a per CLNAP-SDU basis, to which destination CLNAP user layer entity or entities the CLNAP-SDU is to be delivered and provides the ability to indicate to the CLNAP user the source of the CLNAP-SDU.

3.4.3 Carrier selection

This function provides the ability to a CLNAP user layer entity to explicitly select, either on a permanent or a per CLNAP-SDU basis, the end-user's preferred carrier. The mechanism for selection of the carrier on a CLNAP-SDU basis is for further study. The provision of this function by the network is for further study.

3.4.4 QOS selection

The QOS function provides selection of the quality of service desired for the CLNAP-SDU transfer. Actions taken by the B-ISDN or CLSF based on the QOS selected are for further study.

3.5 CLNAP protocol data unit (PDU) structure and encoding

The detailed structure of the CLNAP-PDU is illustrated in Figure 5.

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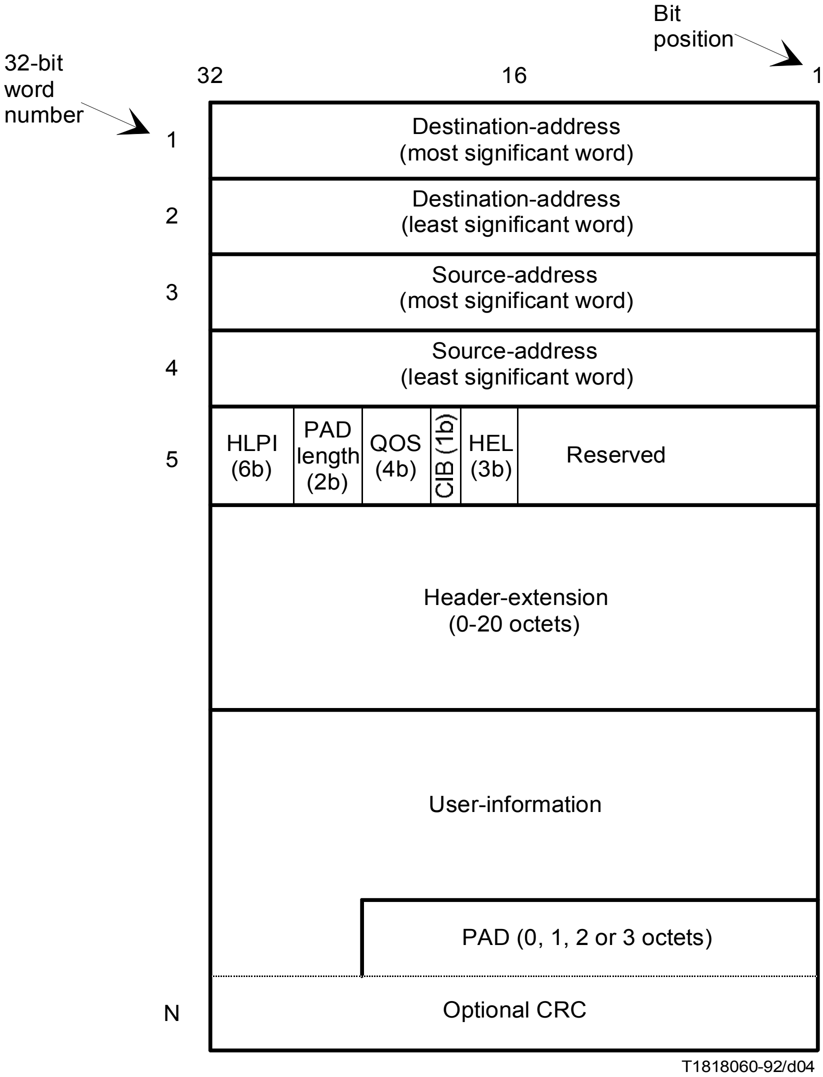
1) Refer to Recommendation I.363 for definition.



(nb) Length of field (n) in bits

FIGURE 5/I.364

Structure of the CLNAP-PDU

It contains the following fields:

3.5.1 Destination-address

This 8-octet field contains a 4 bit "address-type" subfield, followed by the 60-bit "address" subfield. The "address-type" subfield indicates whether the "address" subfield contains a publicly administered 60-bit individual address or a publicly administered 60-bit group address. The "address" subfield indicates to which CLNAP-entity(ies) the CLNAP-PDU is destined. The encoding of this "address-type" subfield is described in Annex A. The structure of this "address" subfield is structured according to Recommendation E.164. The encoding of the 60-bit address subfield is described in Annex A. The need for destination sub-addressing is for further study.

3.5.2 Source-address

This 8-octet field contains a 4 bit “address-type” subfield, followed by the 60-bit “address” subfield. The “address-type” subfield always indicates that the “address” subfield contains a publicly administered 60-bit individual address. The “address” subfield indicates the CLNAP-entity that sourced the CLNAP-PDU. The encoding of this “address-type” subfield is described in Annex A. The structure of this “address” subfield is structured according to Recommendation E.164. The encoding of the 60-bit address subfield is described in Annex A. The need for source sub-addressing is for further study.

3.5.3 Higher-layer-protocol-identifier (HLPI)

This 6-bit field is used to identify the CLNAP user layer entity which the CLNAP-SDU is to be passed to at the destination node. It is transparently carried end-to-end by the network.

3.5.4 PAD-length

This 2-bit field indicates the length of the PAD field (0-3 octets). The number of PAD octets is such that the total length of the user-information field and the PAD field together is an integral multiple of four octets.

3.5.5 Quality of service (QOS)

This 4-bit field is used to indicate the quality of service requested for the CLNAP-PDU. The semantics of this field are for further study.

3.5.6 CRC indication bit (CIB)

This 1-bit field indicates the presence (if CIB=1) or absence (if CIB=0) of a 32-bit CRC field.

3.5.7 Header extension length (HEL)

This 3-bit field can take on any value from 0-5 and indicates the number of 32-bit words in the header extension field.

3.5.8 Reserved

This 16-bit field is reserved for future use. Its default value is 0.

3.5.9 Header extension

This variable-length field can range from 0-20 octets; its length is indicated by the value of the header extension length field (see 3.5.7). Its use is for further study.

In cases where the header extension length (HEL) is unequal to zero, all unused octets in the header extension are set to zero. The information carried in the header extension is structured into information entities. An information entity (element) consists (in this order) of element length, element type, and element payload.

Element length: This is a 1-octet field and contains the combined lengths of the element length, element type, and element payload in octets.

Element type: This is also a 1-octet field and contains a binary encoded value which indicates the type of information found in the element payload field.

Element payload: This is a variable length field and contains the information indicated by the element type field.

3.5.10 User-information

This field is variable length up to 9188 octets and is used to carry the CLNAP-SDU. Further values of maximum length are for further study.

3.5.11 PAD

This field is 0, 1, 2 or 3 octets in length and coded as all zeroes. Within each CLNAP-PDU the length of this field is chosen such that the length of the resulting CLNAP-PDU is aligned on a 32-bit boundary.

3.5.12 CRC

This optional 32-bit field may be present or absent as indicated by the CIB field. The field contains the result of a standard CRC32 calculation performed over the CLNAP-PDU with the "Reserved" field always treated as if it were coded as all zeros. Appendix I provides the details on the encoding and checking of this field. The support of this CRC field by the network is for further study.

3.6 Procedures

For further study.

4 Protocol for the support of connectionless data service on B-ISDN at the NNI

For further study.

Annex A

(to Recommendation I.364)

Encodings

(This annex forms an integral part of this Recommendation)

TABLE A.1/I.364

Destination-address field

Address type	Meaning
1100	60-bit publicly administered individual address
1110	60-bit publicly administered group address

TABLE A.2/I.364

Source-address field

Address type	Meaning
1100	60-bit publicly administered individual address

The E.164 number carried in the 60-bit address subfield is the international ISDN number. The international ISDN number can be up to 15 decimal digits. When numbers are less than 15 decimal digits, the number is placed in the most significant bits of the address subfield. The remaining part of the address subfield is coded to all 1s.

The E.164 numbers are coded using binary coded decimal (BCD). The encoding of the encoded BCD digits into the address subfield follows the encoding principles described in I.361.

Appendix I

(to Recommendation I.364)

CRC32 generation and checking

(This appendix does not form an integral part of this Recommendation)

For the purpose of CRC calculation the CLNAP-PDU "Reserved" field is assumed to be zeros. The CRC32 is calculated using the following generator polynomial:

$$G(x) = x^{32} + x^{26} + x^{23} + x^{22} + x^{16} + x^{12} + x^{11} + x^{10} + x^{8} + x^{7} + x^{5} + x^{4} + x^{2} + x + 1$$

The CRC32 is the one's complement of the sum (modulo 2) of the following:

1) the remainder of $x^{k}*(x^{31} + x^{30} + x^{29} + ... + x^{2} + x + 1)$ divided (modulo 2) by $G(x)$, where k is the number of bits in the calculation fields, with

2) the remainder after multiplication of the contents (treated as a polynomial) of the calculation fields by x^{32} and then division (modulo 2) by $G(x)$.

The CRC field contains the coefficient of the highest term in the most significant bit position.

As an example implementation, at a transmitter, the initial remainder of the division is preset to all ones and is then modified by division of the calculation fields by the generator polynomial, $G(x)$. The one's complement of this remainder is inserted in the CRC field.

As an example implementation, at a receiver, the initial remainder is preset to all one's. The division of the received calculation field by the generator polynomial, $G(x)$, results in the absence of errors, in a unique remainder value which is represented by the polynomial:

$$C(x) = x^{31} + x^{30} + x^{26} + x^{25} + x^{24} + x^{18} + x^{15} + x^{14} + x^{12} + x^{11} + x^{10} + x^{8} + x^{6} + x^{5} + x^{4} + x^{3} + x + 1.$$

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