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Information technology – High-Performance Parallel Interface –

Part 2: Framing Protocol (HIPPI-FP)

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FOREWORD

1) ISO (International Organization for Standardization) and IEC (International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work.
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International Standard ISO/IEC 11518-2 was prepared by subcommittee 25: Interconnection of information technology equipment, of ISO/IEC joint technical committee 1: Information technology.

This edition cancels and replaces the first edition published in 1996. This second edition was updated as follows:

- the figure in the foreword was removed;
- a list of acronyms was added (see 3.3);
- the upper-layer protocol identifiers were updated (see 5.4.1).

This publication has been drafted in accordance with the ISO/IEC Directives, Part 3.

ISO/IEC 11518 consists of the following parts, under the general title *Information technology – High-Performance Parallel Interface:*

- *Part 1: Mechanical, electrical and signalling protocol specification (HIPPI-PH)*
- *Part 2: Framing Protocol (HIPPI-FP)*
- *Part 3: Encapsulation of ISO/IEC 8802-2 (IEEE Std 802.2) – Logical Link Control Protocol Data Units (HIPPI-LE)*
- *Part 4: Mapping of HIPPI to IPI device generic command sets (HIPPI-IPI)* (under consideration)
- *Part 5: Memory Interface (HIPPI-MI)* (under consideration)
- *Part 6: Physical Switch Control (HIPPI-SC)*
- *Part 8: Mapping to Asynchronous Transfer Mode (HIPPI-ATM)*
- *Part 9: Serial Specification (HIPPI-Serial)*

Annexes A, B and C are for information only.

INTRODUCTION

This standard defines the data framing for an efficient simplex high-performance point-to-point interface.

Characteristics of HIPPI-FP include:

- large block data transfers with framing to split the data into smaller bursts;
- separation of user control and data information, and early delivery of the control information;
- identifiers for multiple upper-layer protocols (ULPs);
- support for simplex topology;
- support for ULP non-word-aligned and an arbitrary number of byte transfers;
- error notifications, from the underlying physical layer, e.g. HIPPI-PH, are passed through this framing protocol to notify the upper layers of damaged data;
- provides a connection-less data service;
- best effort delivery of data, i.e. datagram;
- connection control information, which may be used for physical layer switching, is supported.

INFORMATION TECHNOLOGY – HIGH-PERFORMANCE PARALLEL INTERFACE –

Part 2: Framing protocol (HIPPI-FP)

1 Scope

This part of ISO/IEC 11518 provides data framing for a high-performance point-to-point interface between data-processing equipment. This part of ISO/IEC 11518 does not protect against certain errors that might be introduced by intermediate devices interconnecting multiple HIPPI-PHs.

The purpose of this part of ISO/IEC 11518 is to facilitate the development and use of the HIPPI in computer systems by providing common data framing. It provides an efficient framing protocol for interconnections between computers, high-performance display systems, and high-performance, intelligent block-transfer peripherals.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO/IEC 11518. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO/IEC 11518 are encouraged to investigate the possibility of applying the most recent edition of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO/IEC 11518-1:1995, *Information technology – High-Performance Parallel Interface – Part 1: Mechanical, electrical, and signalling protocol specification (HIPPI-PH)*

3 Definitions and conventions

3.1 Definitions

For the purposes of this part of ISO/IEC 11518, the following definitions apply.

3.1.1
burst
group of words sent by the Source to the Destination

Bursts contain 1 to 256 words. Bursts that contain less than 256 words are called short bursts. On a 32-bit HIPPI-PH, bursts contain an even number of 32-bit words.

3.1.2
byte
group of eight bits

Bytes are packed four per 32-bit word, or eight per 64-bit word.

3.1.3
connection
condition of the HIPPI-PH when data transfers from Source to Destination are possible

3.1.4
connection control information (CCI)
parameter sent as part of the sequence of operations establishing a connection from a Source to a Destination

NOTE ISO/IEC 11518-6 includes examples of CCIs and topologies.

3.1.5
destination
the equipment at the end of the interface that receives the data

3.1.6
optional
features that are not required by this part of ISO/IEC 11518

NOTE However, if any optional feature defined by this part of ISO/IEC 11518 is implemented, it must be implemented according to this part of ISO/IEC 11518.

3.1.7
packet
data set sent from Source to Destination

A packet is composed of one or more bursts. The HIPPI specification does not limit the maximum packet size, but a maximum size may be imposed by a given HIPPI implementation, or by a ULP. A packet consists of a header, one or two optional ULP data sets, and optional fill.

3.1.8
service interface (SI)
connection points to the ULP

3.1.9
source
the equipment at the end of the interface that transmits the data

3.1.10
state
current condition of the interface, excluding transitions, as indicated by the control primitives

3.1.11
station management (SMT)
the supervisory entity that monitors and controls the HIPPI

3.1.12
ULP data set
data transferred between the ULP and the HIPPI-FP

3.1.13
upper-layer protocol (ULP)
protocol immediately above the HIPPI-FP service interface

3.1.14
word
a unit of information, consisting of (32 or 64) bits, matching the HIPPI-PH word size

Words contain an ordered set of four bytes or eight bytes

3.2 Editorial conventions

In this standard certain terms that are proper names of signals or similar terms are printed in uppercase to avoid possible confusion with other uses of the same words (e.g., CLOCK). Any lowercase uses of these words have the normal technical English meaning.

A number of conditions, sequence parameters, events, states, or similar terms are printed with the first letter of each word in uppercase and the rest lowercase (e.g., In, Out, Enabled). Any lowercase uses of these words have the normal technical English meaning.

3.3 Acronyms

CCI connection control information

FP Framing Protocol

FPSM Framing Protocol, Station Management

IPI Intelligent Peripheral Interface

LLRC Length-longitudinal redundancy check

SMT station management

ULP upper-layer protocol

4 HIPPI structure

4.1 Structure

The HIPPI-FP has been designed in a modular fashion to support simplex or dual simplex configuration requirements.

A compliant HIPPI network shall maintain packet and burst structures from the original Source to the final Destination.

Figure 1 shows the basic organization of the information on the HIPPI.

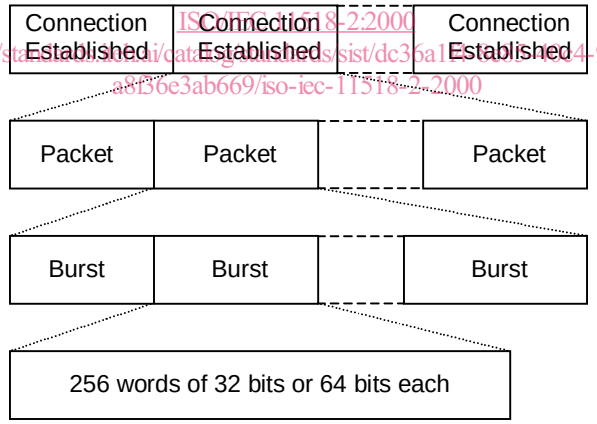

Figure 1 – Logical framing hierarchy

As specified in HIPPI-PH, once a connection is established, a packet (or multiple packets) can be sent from the Source to the Destination. Each packet contains one or more bursts. Bursts contain (1 to 256) words. Words contain four or eight bytes. Bursts that contain less than 256 words are called short bursts. A packet contains no more than one short burst. A short burst may be either the first or last burst of a multiburst packet. For error detection HIPPI-PH uses byte parity and a parity-based checksum on each burst.

On a 32-bit HIPPI-PH, bursts shall contain an even number of 32-bit words. Words shall contain an ordered set of bytes as specified in 7.1.

4.2 Error detection mechanisms

4.2.1 Byte parity

The HIPPI physical layer (HIPPI-PH) uses bit-parallel word transfers, using 32-bit words for an 800 Mbit/s data rate and 64-bit words for a 1 600 Mbit/s data rate. An odd-parity bit is also transmitted with each 8-bit byte of a word, i.e., four parity bits are transmitted with each 32-bit word. Hence an undetected error in a word would require a 2-bit error, with both bits being in the same byte.

4.2.2 LLRC

The Length-Longitudinal Redundancy Check (LLRC) implements even parity across the individual bits of multiple words in a burst. For example, bit 23 of the LLRC is the even parity of bit 23 of each word in the burst. A burst is nominally 256 words in length (1 Kbyte or 2 Kbytes), but short bursts may contain fewer words. Hence the LLRC would not detect errors where the same bit in an even number of words was incorrect.

In addition, the LLRC calculation includes the length of the burst. Hence, the LLRC would detect cases where a word was dropped or added, i.e., the length received was not the same as what was transmitted.

4.2.3 Packet length

A packet is composed of one or more bursts. In HIPPI-FP a length field specifying the number of bytes in the packet is specified. This length field provides a check for dropped or extra bursts. A special case where the packet length is not used is provided for such things as video data to a frame buffer, data collection from experimental equipment, etc.

4.3 Error detection limitations

The parity and LLRC will only fail on 4-bit errors in a rectangular pattern. That is, two bits in a byte must fail (undetected by the byte parity check) and the same two bits must fail in another word of the burst (undetected by the LLRC).

Use of the HIPPI-FP packet header length field permits the detection of lost bursts within a packet; however, no mechanism of either HIPPI-FP or HIPPI-PH allows the detection of data corruption caused by the substitution of one burst, with good parity and LLRC, for another burst of the same length.

5 HIPPI-FP service interface to upper layers

This clause describes the services provided by HIPPI-FP. The intent is to provide the formalism necessary to relate this interface to other HIPPI interfaces. How many of the services described herein are chosen for a given implementation, and whether others may be required, is up to the implementor; however, a set of HIPPI-FP services must be supplied sufficient to satisfy the ULP(s) being used. The services as defined herein do not imply any particular implementation, or any interface.

In this part of ISO/IEC 11518 the ULP and station management protocol (SMT) are service users, and the HIPPI-FP is the service provider to the ULP and SMT. The interfaces consist of the ULP primitives, prefixed with FP_, and the SMT primitives, prefixed with FPSM_.

The HIPPI-FP is also the service user of the HIPPI-PH services, prefixed with PH_.

Figure 2 shows the relationship of the HIPPI-FP interfaces.

5.1 Service primitives

All of the primitives and parameters are considered as required except where explicitly stated otherwise.

HIPPI service primitives are of four types.

– *Request primitives* are issued by a service user to initiate a service from the service provider. In this part of ISO/IEC 11518, a second Request primitive of the same name shall not be issued until the Confirm for the first request is received.

– *Confirm primitives* are issued by the service provider to acknowledge a Request.

– *Indicate primitives* are issued by the service provider to notify the service user of a local event. This primitive is similar in nature to an unsolicited interrupt. Note that the local event may have been caused by a service Request. In this part of ISO/IEC 11518, a second Indicate primitive of the same name shall not be issued until the Response for the first Indicate is received.

– *Response primitives* are issued by a service user to acknowledge an Indicate.

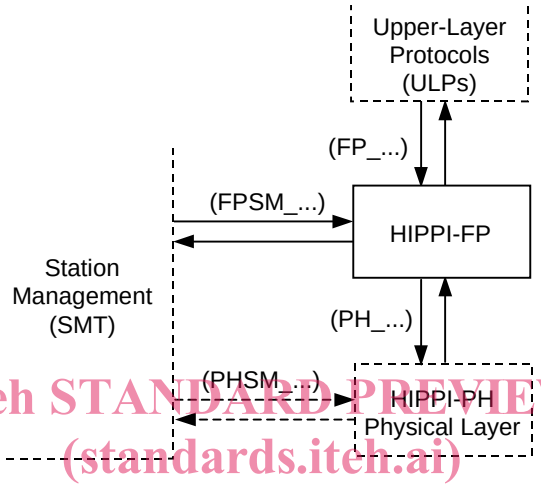

Figure 2 – HIPPI-FP service interface

5.2 Sequences of primitives

The order of execution of service primitives is not arbitrary. Logical and time sequence relationships exist for all described service primitives. Time sequence diagrams, as in figure 3, are used to illustrate a valid sequence. Other valid sequences may exist. The sequence of events between peer users across the user/provider interface is illustrated. In the time sequence diagrams the HIPPI-FP users are depicted on either side of the vertical bars while the service provider is in the centre. A ULP or SMT implementation may present multiple requests for services, but the requests shall be serviced one at a time and in the order presented.

5.3 HIPPI-FP service primitive summary

ULP Data Transfer
    FP_TRANSFER.Request (CCI, ULP-id,
        D1_Size, D1_Data_Set, D2_Size,
        D2_Data_Set, Keep_Connection,
        Start_D2_on_Burst_Boundary)
    FP_TRANSFER.Confirm
    FP_TRANSFER_D1.Indicate (ULP-id, CCI,
        Status, D2_Size, D2_Offset,
        D1_Area_Size, D1_Data_Set)
    FP_TRANSFER_D2.Indicate (ULP-id, CCI,
        Status, D2_Size, D2_Offset, D2_Data_Set)
    FP_TRANSFER.Response

Control Link
    FPSM_CONTROL.Request (Command,
        Command_Parameter)
    FPSM_CONTROL.Confirm (Status)