

## Requirements for Internet Hosts -- Communication Layers

### Status of This Memo

This RFC is an official specification for the Internet community. It incorporates by reference, amends, corrects, and supplements the primary protocol standards documents relating to hosts. Distribution of this document is unlimited.

### Summary

This is one RFC of a pair that defines and discusses the requirements for Internet host software. This RFC covers the communications protocol layers: link layer, IP layer, and transport layer; its companion [RFC-1123](#) covers the application and support protocols.

### Table of Contents

1.	INTRODUCTION .....	5
1.1	The Internet Architecture .....	6
1.1.1	Internet Hosts .....	6
1.1.2	Architectural Assumptions .....	7
1.1.3	Internet Protocol Suite .....	8
1.1.4	Embedded Gateway Code .....	10
1.2	General Considerations .....	12
1.2.1	Continuing Internet Evolution .....	12
1.2.2	Robustness Principle .....	12
1.2.3	Error Logging .....	13
1.2.4	Configuration .....	14
1.3	Reading this Document .....	15
1.3.1	Organization .....	15
1.3.2	Requirements .....	16
1.3.3	Terminology .....	17
1.4	Acknowledgments .....	20
2.	LINK LAYER .....	21
2.1	INTRODUCTION .....	21

end through the Internet, a message must be encapsulated inside a datagram.

#### IP Datagram

An IP datagram is the unit of end-to-end transmission in the IP protocol. An IP datagram consists of an IP header followed by transport layer data, i.e., of an IP header followed by a message.

In the description of the internet layer ([Section 3](#)), the unqualified term "datagram" should be understood to refer to an IP datagram.

#### Packet

A packet is the unit of data passed across the interface between the internet layer and the link layer. It includes an IP header and data. A packet may be a complete IP datagram or a fragment of an IP datagram.

#### Frame

A frame is the unit of transmission in a link layer protocol, and consists of a link-layer header followed by a packet.

#### Connected Network

A network to which a host is interfaced is often known as the "local network" or the "subnetwork" relative to that host. However, these terms can cause confusion, and therefore we use the term "connected network" in this document.

#### Multihomed

A host is said to be multihomed if it has multiple IP addresses. For a discussion of multihoming, see [Section 3.3.4](#) below.

#### Physical network interface

This is a physical interface to a connected network and has a (possibly unique) link-layer address. Multiple physical network interfaces on a single host may share the same link-layer address, but the address must be unique for different hosts on the same physical network.

#### Logical [network] interface

We define a logical [network] interface to be a logical path, distinguished by a unique IP address, to a connected network. See [Section 3.3.4](#).

**Specific-destination address**

This is the effective destination address of a datagram, even if it is broadcast or multicast; see [Section 3.2.1.3](#).

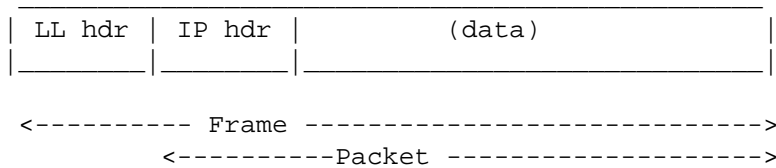
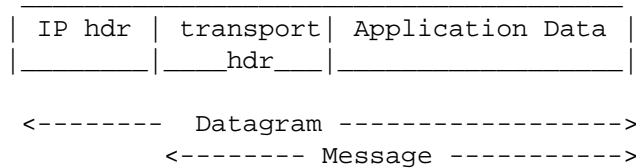
**Path**

At a given moment, all the IP datagrams from a particular source host to a particular destination host will typically traverse the same sequence of gateways. We use the term "path" for this sequence. Note that a path is uni-directional; it is not unusual to have different paths in the two directions between a given host pair.

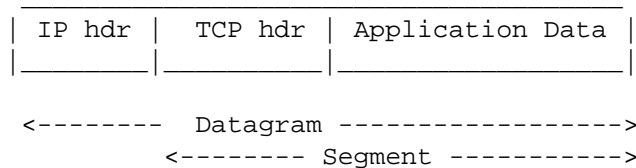
**MTU**

The maximum transmission unit, i.e., the size of the largest packet that can be transmitted.

The terms frame, packet, datagram, message, and segment are illustrated by the following schematic diagrams:

**A. Transmission on connected network:****B. Before IP fragmentation or after IP reassembly:**

or, for TCP:



#### 1.4 Acknowledgments

This document incorporates contributions and comments from a large group of Internet protocol experts, including representatives of university and research labs, vendors, and government agencies. It was assembled primarily by the Host Requirements Working Group of the Internet Engineering Task Force (IETF).

The Editor would especially like to acknowledge the tireless dedication of the following people, who attended many long meetings and generated 3 million bytes of electronic mail over the past 18 months in pursuit of this document: Philip Almquist, Dave Borman (Cray Research), Noel Chiappa, Dave Crocker (DEC), Steve Deering (Stanford), Mike Karels (Berkeley), Phil Karn (Bellcore), John Lekashman (NASA), Charles Lynn (BBN), Keith McCloghrie (TWG), Paul Mockapetris (ISI), Thomas Narten (Purdue), Craig Partridge (BBN), Drew Perkins (CMU), and James Van Bokkelen (FTP Software).

In addition, the following people made major contributions to the effort: Bill Barns (Mitre), Steve Bellovin (AT&T), Mike Brescia (BBN), Ed Cain (DCA), Annette DeSchon (ISI), Martin Gross (DCA), Phill Gross (NRI), Charles Hedrick (Rutgers), Van Jacobson (LBL), John Klensin (MIT), Mark Lottor (SRI), Milo Medin (NASA), Bill Melohn (Sun Microsystems), Greg Minshall (Kinetics), Jeff Mogul (DEC), John Mullen (CMC), Jon Postel (ISI), John Romkey (Epilogue Technology), and Mike StJohns (DCA). The following also made significant contributions to particular areas: Eric Allman (Berkeley), Rob Austein (MIT), Art Berggreen (ACC), Keith Bostic (Berkeley), Vint Cerf (NRI), Wayne Hathaway (NASA), Matt Korn (IBM), Erik Naggum (Naggum Software, Norway), Robert Ullmann (Prime Computer), David Waitzman (BBN), Frank Wancho (USA), Arun Welch (Ohio State), Bill Westfield (Cisco), and Rayan Zachariassen (Toronto).

We are grateful to all, including any contributors who may have been inadvertently omitted from this list.

## 2. LINK LAYER

### 2.1 INTRODUCTION

All Internet systems, both hosts and gateways, have the same requirements for link layer protocols. These requirements are given in Chapter 3 of "Requirements for Internet Gateways" [INTRO:2], augmented with the material in this section.

### 2.2 PROTOCOL WALK-THROUGH

None.

### 2.3 SPECIFIC ISSUES

#### 2.3.1 Trailer Protocol Negotiation

The trailer protocol [LINK:1] for link-layer encapsulation MAY be used, but only when it has been verified that both systems (host or gateway) involved in the link-layer communication implement trailers. If the system does not dynamically negotiate use of the trailer protocol on a per-destination basis, the default configuration MUST disable the protocol.

#### DISCUSSION:

The trailer protocol is a link-layer encapsulation technique that rearranges the data contents of packets sent on the physical network. In some cases, trailers improve the throughput of higher layer protocols by reducing the amount of data copying within the operating system. Higher layer protocols are unaware of trailer use, but both the sending and receiving host MUST understand the protocol if it is used.

Improper use of trailers can result in very confusing symptoms. Only packets with specific size attributes are encapsulated using trailers, and typically only a small fraction of the packets being exchanged have these attributes. Thus, if a system using trailers exchanges packets with a system that does not, some packets disappear into a black hole while others are delivered successfully.

#### IMPLEMENTATION:

On an Ethernet, packets encapsulated with trailers use a distinct Ethernet type [LINK:1], and trailer negotiation is performed at the time that ARP is used to discover the link-layer address of a destination system.

# Explore Litigation Insights

Docket Alarm provides insights to develop a more informed litigation strategy and the peace of mind of knowing you're on top of things.

## Real-Time Litigation Alerts



Keep your litigation team up-to-date with **real-time alerts** and advanced team management tools built for the enterprise, all while greatly reducing PACER spend.

Our comprehensive service means we can handle Federal, State, and Administrative courts across the country.

## Advanced Docket Research



With over 230 million records, Docket Alarm's cloud-native docket research platform finds what other services can't. Coverage includes Federal, State, plus PTAB, TTAB, ITC and NLRB decisions, all in one place.

Identify arguments that have been successful in the past with full text, pinpoint searching. Link to case law cited within any court document via Fastcase.

## Analytics At Your Fingertips



Learn what happened the last time a particular judge, opposing counsel or company faced cases similar to yours.

Advanced out-of-the-box PTAB and TTAB analytics are always at your fingertips.

## API

Docket Alarm offers a powerful API (application programming interface) to developers that want to integrate case filings into their apps.

## LAW FIRMS

Build custom dashboards for your attorneys and clients with live data direct from the court.

Automate many repetitive legal tasks like conflict checks, document management, and marketing.

## FINANCIAL INSTITUTIONS

Litigation and bankruptcy checks for companies and debtors.

## E-DISCOVERY AND LEGAL VENDORS

Sync your system to PACER to automate legal marketing.