Preliminary Design

Requested by: Mr. Ken Swarner
Systems Administrator
Computer Science Department of Siena College

TCP/IP Packet Descriptor

EdgeTech Development
"We're always on the cutting edge"
edgetechdevelopment@hotmail.com

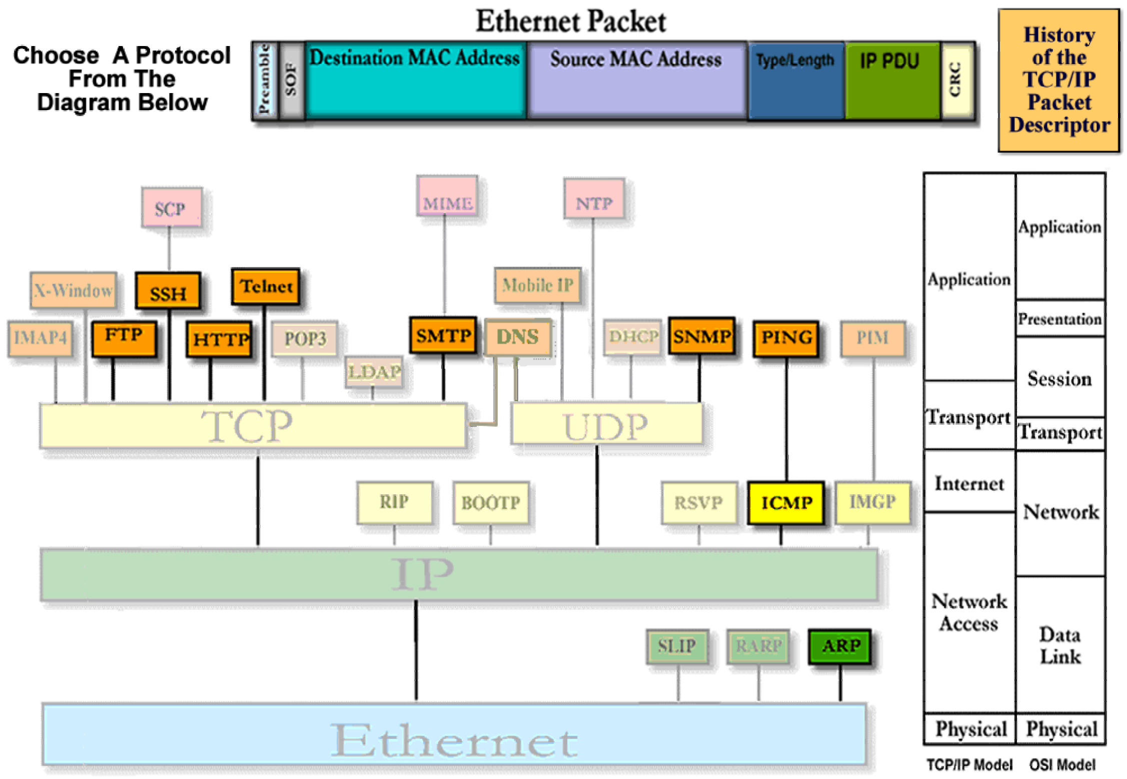
Prepared by: Matt DeCrescente, Team Leader
Eric Fish
Jill Foster
John Mooney
Das Nobel

December 5, 2003

Preliminary Design
Table of Contents

1.0 External Design Specifications

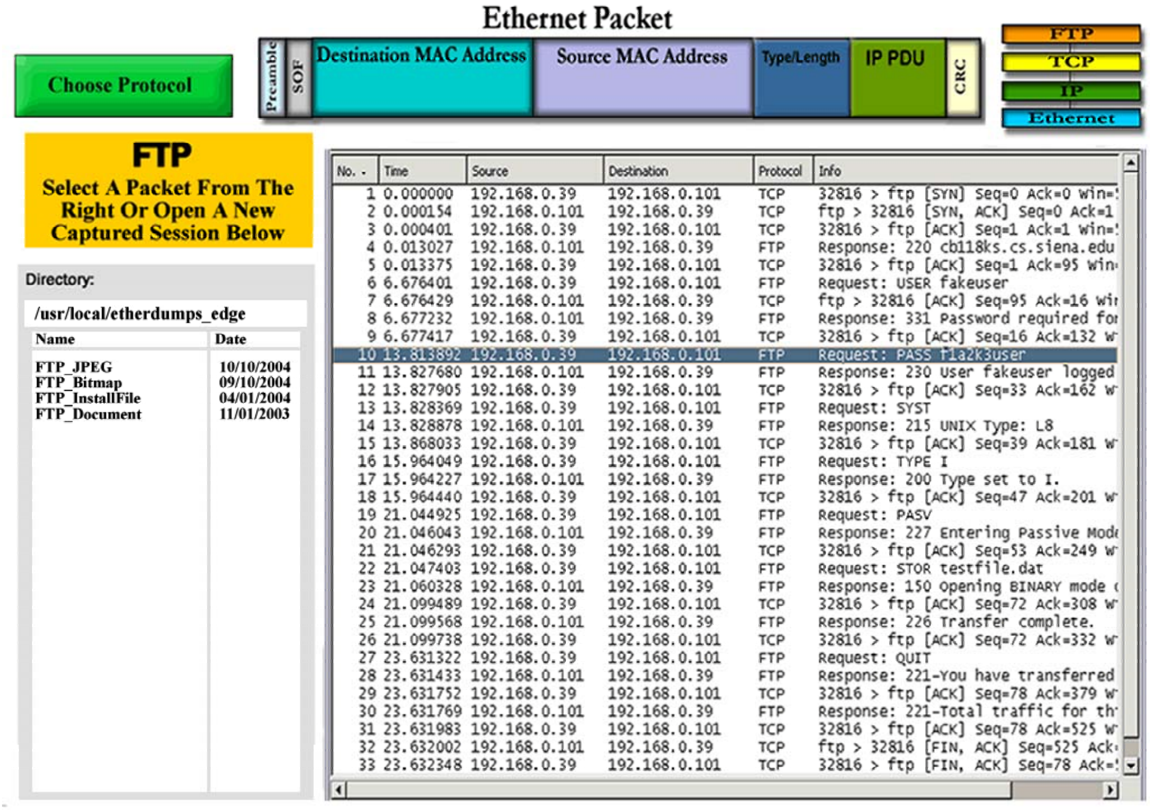
1.1 User displays



This is the first screen the user will see. It allows the user to choose a protocol that they would like to explore further. This will lead them to two other screens that will allow the user to select a packet for viewing purposes and to see what an Ethernet Packet looks like. Additionally, each frame within that packet will have the option to display information about that chosen frame.

The "*Protocol Selector Screen*" gives the user a graphical representation of how protocols are interrelated, and allows the desired protocol to be selected.

Our team has enhanced this screen to include a Type/Length segment in the Ethernet Packet area and a button to view the history of the project to give acknowledgements to the two teams prior to our involvement on the project. We have also included more protocols to illustrate that there are many other protocols within TCP/IP, even if we are not implementing them.



FTP

Select A Packet From The Right Or Open A New Captured Session Below

Directory:

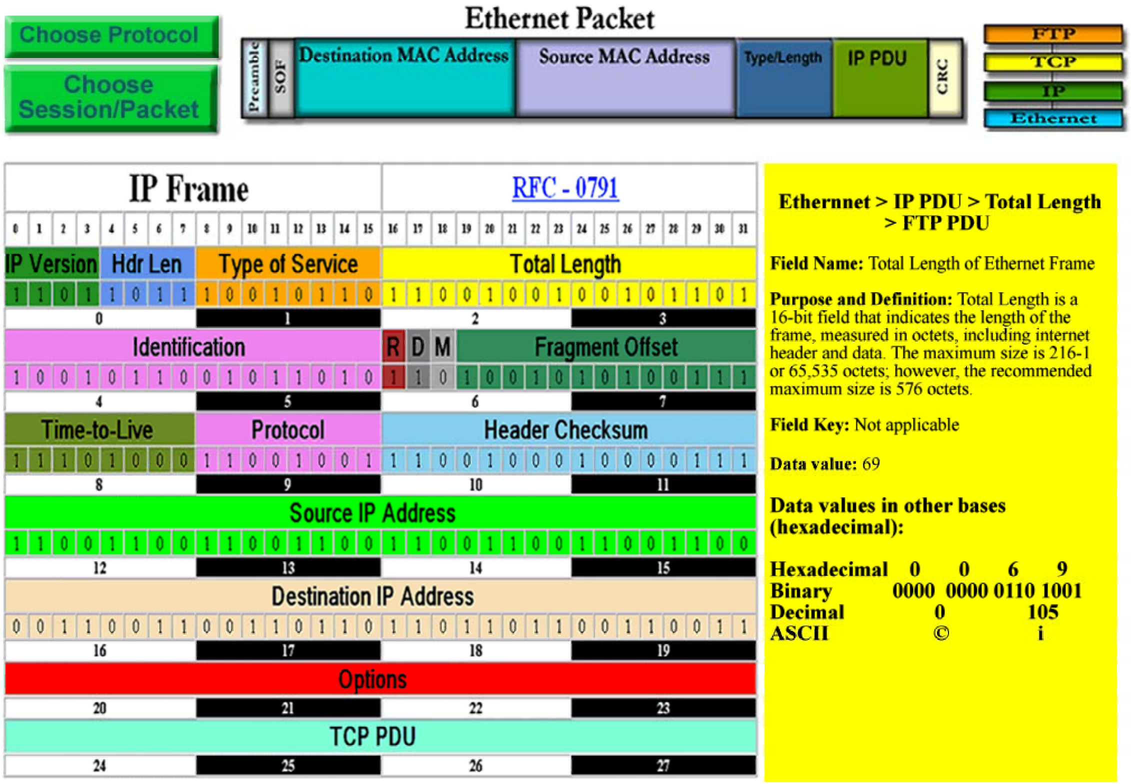
/usr/local/etherdumps_edge

Name	Date
FTP_JPEG	10/10/2004
FTP_Bitmap	09/10/2004
FTP_InstallFile	04/01/2004
FTP_Document	11/01/2003

No.	Time	Source	Destination	Protocol	Info
1	0.000000	192.168.0.39	192.168.0.101	TCP	32816 > ftp [SYN] Seq=0 Ack=0 Win=
2	0.000154	192.168.0.101	192.168.0.39	TCP	ftp > 32816 [SYN, ACK] Seq=0 Ack=1
3	0.000401	192.168.0.39	192.168.0.101	TCP	32816 > ftp [ACK] Seq=1 Ack=1 Win=
4	0.013027	192.168.0.101	192.168.0.39	FTP	Response: 220 cb118ks.cs.siena.edu
5	0.013375	192.168.0.39	192.168.0.101	TCP	32816 > ftp [ACK] Seq=1 Ack=95 Win
6	6.676401	192.168.0.39	192.168.0.101	FTP	Request: USER fakeuser
7	6.676429	192.168.0.101	192.168.0.39	TCP	ftp > 32816 [ACK] Seq=95 Ack=16 Wi
8	6.677232	192.168.0.101	192.168.0.39	FTP	Response: 331 Password required fo
9	6.677417	192.168.0.39	192.168.0.101	TCP	32816 > ftp [ACK] Seq=16 Ack=132 W
10	13.813892	192.168.0.39	192.168.0.101	FTP	Request: PASS f1a2k3user
11	13.827680	192.168.0.101	192.168.0.39	FTP	Response: 230 User fakeuser logged
12	13.827905	192.168.0.39	192.168.0.101	TCP	32816 > ftp [ACK] Seq=33 Ack=162 W
13	13.828369	192.168.0.39	192.168.0.101	FTP	Request: SYST
14	13.828878	192.168.0.101	192.168.0.39	FTP	Response: 215 UNIX Type: L8
15	13.868033	192.168.0.39	192.168.0.101	TCP	32816 > ftp [ACK] Seq=39 Ack=181 W
16	15.964049	192.168.0.39	192.168.0.101	FTP	Request: TYPE I
17	15.964227	192.168.0.101	192.168.0.39	FTP	Response: 200 Type set to I.
18	15.964440	192.168.0.39	192.168.0.101	TCP	32816 > ftp [ACK] Seq=47 Ack=201 W
19	21.044925	192.168.0.39	192.168.0.101	FTP	Request: PASV
20	21.046043	192.168.0.101	192.168.0.39	FTP	Response: 227 Entering Passive Mod
21	21.046293	192.168.0.39	192.168.0.101	TCP	32816 > ftp [ACK] Seq=53 Ack=249 W
22	21.047403	192.168.0.39	192.168.0.101	FTP	Request: STOR testfile.dat
23	21.060328	192.168.0.101	192.168.0.39	FTP	Response: 150 Opening BINARY mode
24	21.099489	192.168.0.39	192.168.0.101	TCP	32816 > ftp [ACK] Seq=72 Ack=308 W
25	21.099568	192.168.0.101	192.168.0.39	FTP	Response: 226 Transfer complete.
26	21.099738	192.168.0.39	192.168.0.101	TCP	32816 > ftp [ACK] Seq=72 Ack=332 W
27	23.631322	192.168.0.39	192.168.0.101	FTP	Request: QUIT
28	23.631433	192.168.0.101	192.168.0.39	FTP	Response: 221-You have transferred
29	23.631752	192.168.0.39	192.168.0.101	TCP	32816 > ftp [ACK] Seq=78 Ack=379 W
30	23.631769	192.168.0.101	192.168.0.39	FTP	Response: 221-Total traffic for th
31	23.631983	192.168.0.39	192.168.0.101	TCP	32816 > ftp [ACK] Seq=78 Ack=525 W
32	23.632002	192.168.0.101	192.168.0.39	TCP	ftp > 32816 [FIN, ACK] Seq=525 Ack
33	23.632348	192.168.0.39	192.168.0.101	TCP	32816 > ftp [FIN, ACK] Seq=78 Ack=

This is the second screen; this is where a user will be brought when the user selects the protocol they wanted to view. This screen is new to this program. Our team has included this new functional screen to allow a user to select a specific packet for viewing. The user can view the packet by double-clicking on the preferred packet.

The user can also choose a captured session from the directory. The directory has sorting capabilities based on name and date of the files. We have included a button for the user to get back to the *Protocol Selector Screen* by clicking on *"Choose a Protocol*". This screen also includes buttons to view the history of the project.



IP Frame

RFC - 0791

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
IP Version				Hdr Len				Type of Service								Total Length															
1	1	0	1	1	0	1	1	1	0	0	1	0	1	1	0	1	1	0	0	1	0	0	1	0	0	1	0	1	1	0	1
0								1								2								3							
Identification																R	D	M	Fragment Offset												
1	0	0	1	0	1	1	0	0	1	0	1	1	0	1	0	1	1	0	1	0	0	1	0	1	0	1	0	0	1	1	1
4								5								6								7							
Time-to-Live								Protocol								Header Checksum															
1	1	1	0	1	0	0	0	1	1	0	0	1	0	0	1	1	1	0	0	1	0	0	0	1	0	0	0	0	1	1	1
8								9								10								11							
Source IP Address																															
1	1	0	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1	0	0
12								13								14								15							
Destination IP Address																															
0	0	1	1	0	0	1	1	0	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1	0	0	1	1	0	0	1	1
16								17								18								19							
Options																															
20								21								22								23							
TCP PDU																															
24								25								26								27							

Ethernnet > IP PDU > Total Length > FTP PDU

Field Name: Total Length of Ethernet Frame

Purpose and Definition: Total Length is a 16-bit field that indicates the length of the frame, measured in octets, including internet header and data. The maximum size is 216-1 or 65,535 octets; however, the recommended maximum size is 576 octets.

Field Key: Not applicable

Data value: 69

Data values in other bases (hexadecimal):

Hexadecimal	**0**	**0**	**6**	**9**
Binary	**0000**	**0000**	**0110**	**1001**
Decimal		**0**		**105**
ASCII		**©**		**i**

Once a packet has been selected by the user, this screen will display. The basis for our protocol suite, the FTP PDU is displayed on the left, filled in with the given data for the selected protocol. The user is able to click on any field in the FTP PDU, and an information box will display on the right, describing that field. In the FTP PDU Data field, “TCP PDU” is written – this indicates that the entire TCP PDU is contained within the TCP Data field. If the user clicks on this field, the TCP PDU will be displayed.

The PDUs are shown in a hierarchical design on the top right corner of this screen: this allows the user to navigate between them. The user may also click on any PDU in this map to navigate. If at any point, the user wants to choose a different protocol or packet to view, he or she may click on the “*Choose a Protocol*” or the “*Choose a Packet/*Session” button in the top left corner.

1.2 User Command Summary

Choose Protocol

This is the *Protocol Selector Screen* that gives the user the option to choose preferred protocol. This function will display a hierarchical tree of available protocols. Those nodes which are active will be a link to redirect the user to then select a captured session/packet.

Choose Packet

This is the *Packet Selector Screen* that gives the user the option to choose preferred captured session or packet. This function will display a directory of files captured and a packet listing within a captured session.

Protocols

Active:
TCP/IP Terminal Emulation Protocol (TELNET), Simple Network Management Protocol (SNMP), File Transfer Protocol (FTP), Simple Mail Transfer Protocol (SMTP), Hyper Text Transfer Protocol (HTTP), Address Resolution Protocol (ARP), Internet Control Message Protocol (ICMP), Packet Internet Groper (PING), Secure Shell (SSH).

Inactive:
Serial Line Internet Protocol (SLIP), Reverse Address Resolution Protocol (RARP), Routing Information Protocol (RIP), Bootstrap Protocol (BootP), Resource Reservation Protocol (RSVP), Internet Group Management Protocol (IGMP), Personal Information Manager (PIM), Dynamic Host Configuration Protocol (DHCP), Network Time Protocol (NTP), MobileIP, Multi-Purpose Internet Mail Extension (MIME), Lightweight Directory Access Protocol (LDAP), Post Office Protocol – Version 3 (POP3), Domain Name System (DNS), Internet Message Access Protocol – Version 4 (IMAP4), X-window, Secure Copy (SCP).

PDU Hierarchy Tree

Allows the user to see their progression through the many packets, and also able to choose their desired packet.

Information Box

Allows the user to see the given information for a selected field.

Protocol Fields

Each field will be a link. When selected, it will be highlighted and the Information of that field will be shown to the right of the field display.

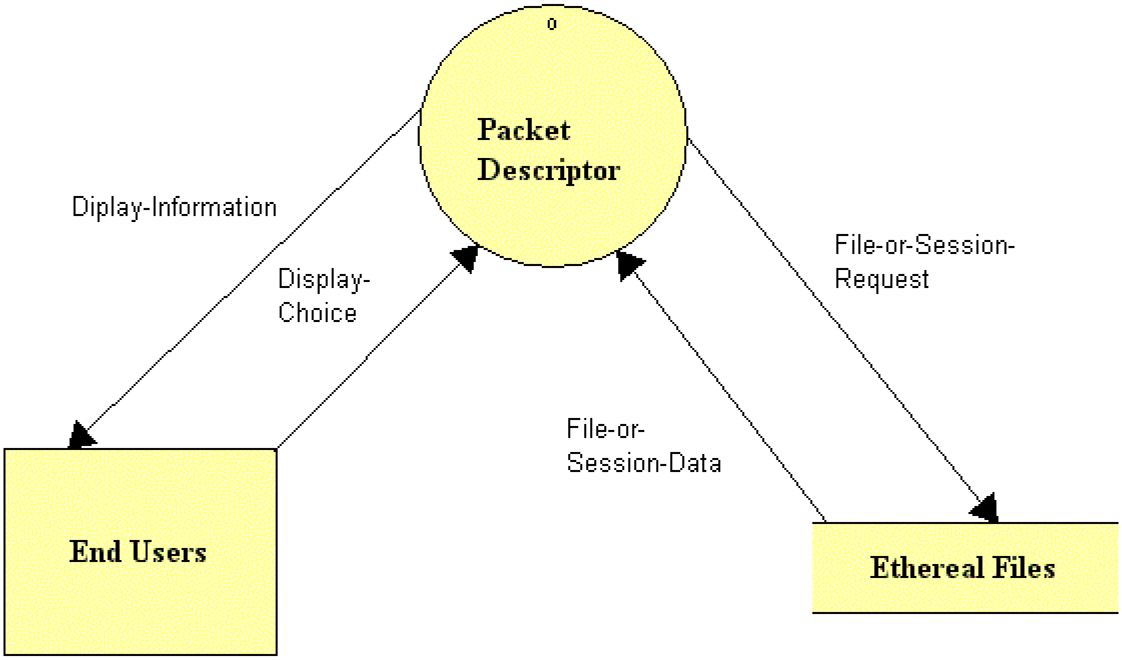
Request for Comments Link

Each PDU will have a link to a web site with extensive information about the selected protocol.

1.3 Detailed Data Flow Diagrams

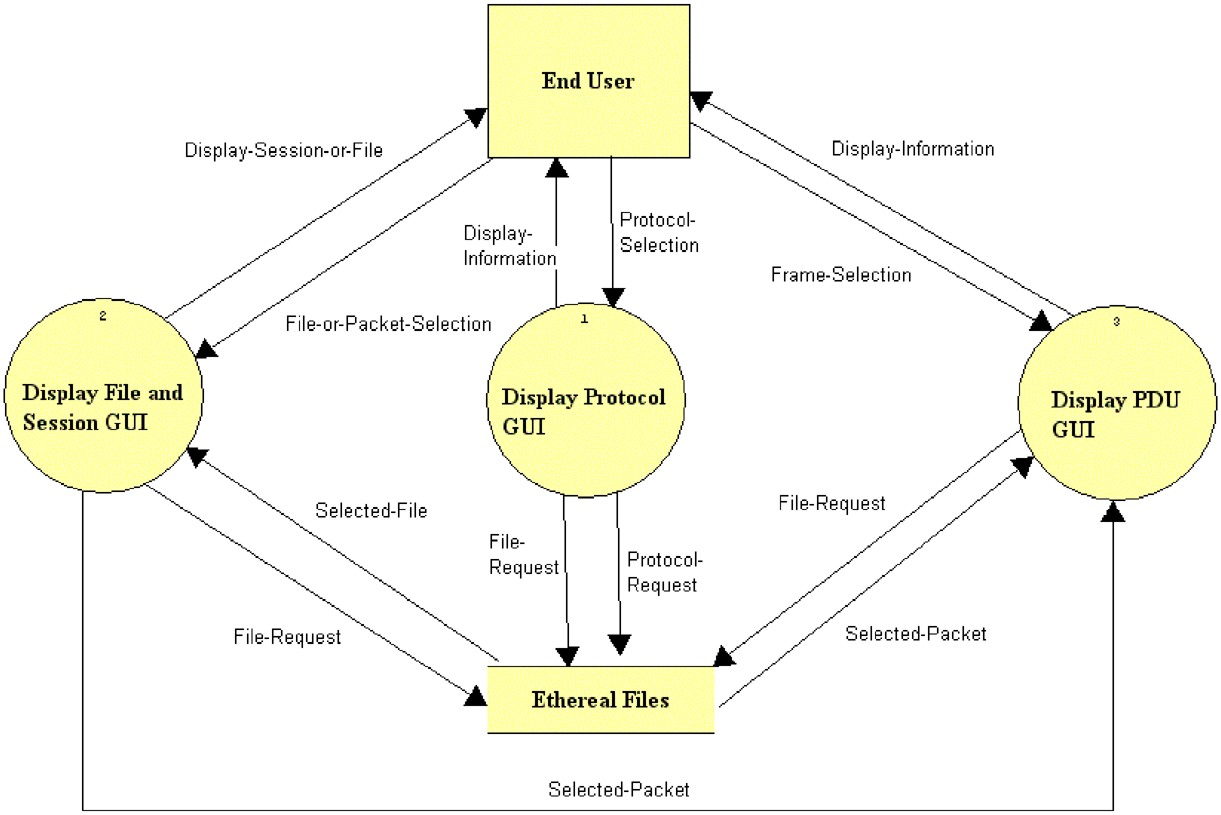
Level 0 Diagram:

Context Diagram:



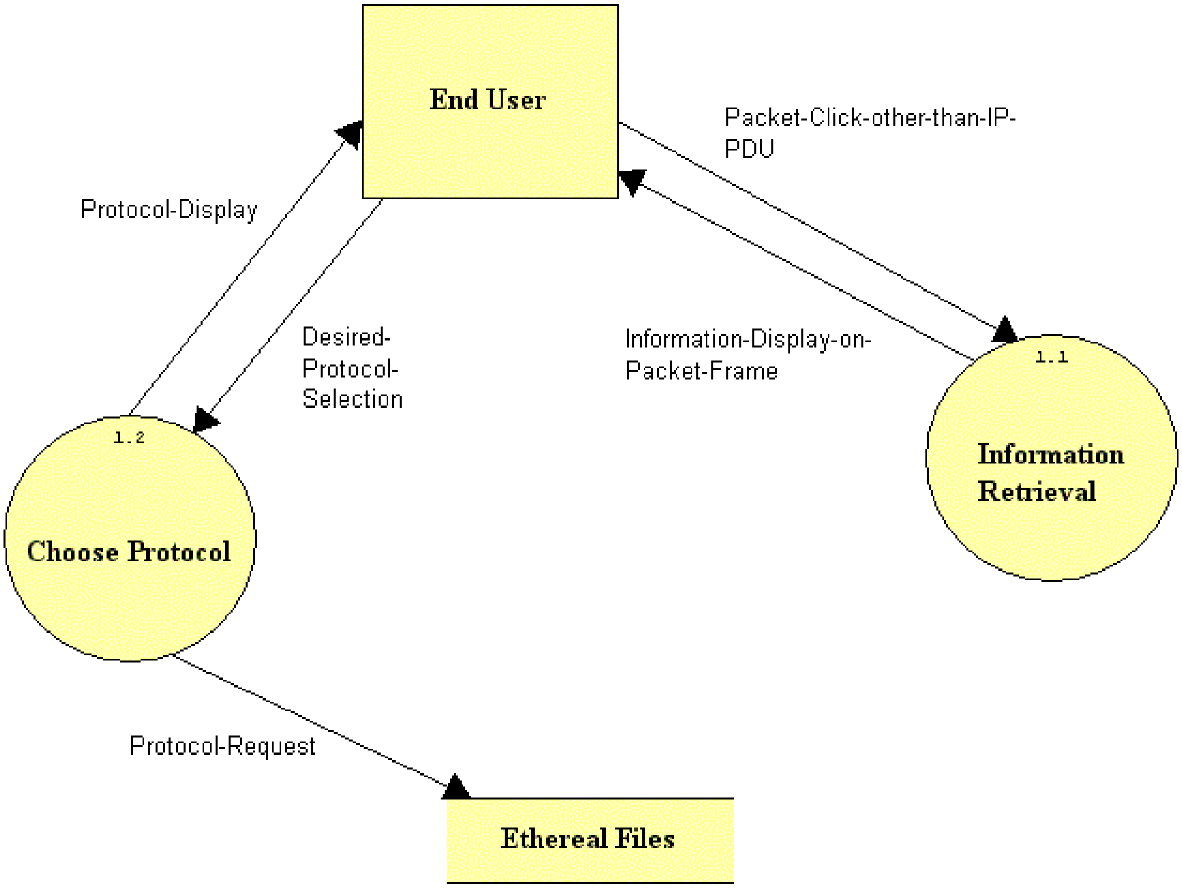
Context Diagram:

Level 0:



Detailed Diagram:

Level 1:



1.4 Hardware, Software and Human Interfaces

The prototype was developed and designed on Macromedia Fireworks, a graphic design program.

The program will be written in HTML using Macromedia MX and PHP (PHP Hypertext Processor) Version 4.1.2.

The TCP/IP Packet Descriptor program will be hosted as a web site on the Siena College Computer Science Department’s Oraserv Linux server (Red Hat version 7.1), running the Apache web server (version 1.3.19).

Any Netscape Navigator 7.x or greater and Internet Explorer 5.x or greater web browser may access the program.

2.0 Architectural Design Specification

2.1 User Commands – FTP (AKA "Clickable Buttons")

IP PDU
IP Version
Internet Header Length
Type of Service
Total Length of Ethernet Frame
Identification
Flags
Fragment Offset
Time to Live
Protocol
Header Checksum
Source IP Address
Destination IP Address
Options
Data

TCP PDU
Source Port Number
Destination Port Number
Sequence Number
Acknowledgement Number
Header Lengths
Reserved
Window Size
TCP Checksum
Urgent Pointer
Options
Data

FTP PDU
Source Port Number
Destination Port Number
Sequence Number
Acknowledgement Number
Header Length
Reserved
Window Size
FTP Checksum
Urgent Pointer
Options
Data

2.1.1 IP PDU for the selected FTP PDU

IP PDU > *IP Version* for the selected FTP PDU

Field Name: *IP Version*

Purpose and Definition: Version is a 4-bit field that indicates the format of the internet header.

Field Key: 4 = IPv4
6 = IPv6

Data value (decimal): 4

Data values in other bases:

Hexadecimal	4
Binary	0100
Decimal	4

IP PDU > *Internet Header Length* for the selected FTP PDU

Field Name: *Internet Header Length*

Purpose and Definition: The IHL field is a 4-bit field indicating the length of the internet header in 32 bit words, and thus points to the beginning of the data. The minimum value of a correct header is 5.

Field Key: *Not applicable*

Data value: The value contained in our field is 20 bytes. This is the hexadecimal and decimal value of 5 multiplied by 4 bits.

Data values in other bases:

Hexadecimal	0	5
Binary	0000	0101
Decimal	5	

IP PDU > *Type of Service* for the selected FTP PDU

Field Name: *Type of Service*

Purpose and Definition: Type of Service is an 8-bit field that provides and indication of the abstract parameters of the quality of service desired. These parameters guide the selection of the actual service parameters when transmitting a datagram through a particular network.

Field Key: The major choice is a three-way tradeoff between low-delay, high-reliability, and high-throughput.

0 1 2	3	4	5	6	7
Precedence	D	T	R	0	0

Bits 0-2: Precedence
Bit 3: (D) 0 = Normal Delay 1 = Low Delay
Bit 4: (T) 0 = Normal Throughput 1 = High Throughput
Bit 5: (R) 0 = Normal Reliability 1 = High Reliability

Precedence:

111 = Network Control
110 = Inter-network Control
101 = CRITIC/ECP
100 = Flash Overrided
011 = Flash
010 = Immediate
001 = Priority
000 = Routine

Data value (hexadecimal): 10

Data values in other bases:

Hexadecimal	1	0
Binary	0001	0000
Decimal	16	

IP PDU > *Total Length of Ethernet Frame* for the selected FTP PDU

Field Name: *Total Length of Ethernet Frame*

Purpose and Definition: Total Length is a 16-bit field that indicates the length of the frame, measured in octets, including internet header and data. The maximum size is 2^{16}-1 or 65,535 octets; however, the recommended maximum size is 576 octets.

Field Key: *Not applicable*

Data values (hexadecimal): 69

Data values in other bases:

Hexadecimal	0	0	6	9
Binary	0000	0000	0110	1001
Decimal	0		105	
ASCII	©		i	

IP PDU > *Identification* for the selected FTP PDU

Field Name: *Identification*

Purpose and Definition: Identification is a 16-bit field. An identifying value is assigned by the sender to aid in assembling the fragments of a datagram. The identifier is chosen based on the need to provide a way to uniquely identify the fragments and protocol for the time the datagram or any fragment could be alive in the internet.

Field Key: *Not applicable*

Data value (hexadecimal): AA 41

Data values in other bases:

Hexadecimal	A	A	4	1
Binary	1010	1010	0100	0001

IP PDU > *Flags* for the selected FTP PDU

Field Name: *Flags*

Purpose and Definition: Flags is a 3-bit field that indicates directions for fragmentation.

Field Key:
Bit 0: reserved, must be 0
Bit 1: (DF) 0 = May Fragment 1 = Don't Fragment
Bit 2: (MF) 0 = Last Fragment 1 = More Fragment

Data value (binary): 010

Data values in other bases: *Not applicable*

IP PDU > *Fragment Offset* for the selected FTP PDU

Field Name: *Fragment Offset*

Purpose and Definition: The Fragment Offset is a 13- bit field indicating where in the Ethernet frame this fragment begins. The Fragment Offset is measured in units of 8 octets, and the first fragment has offset 0.

Field Key: *Not applicable*

Data value (decimal): 0

Data values in other bases:
Binary: 0 0000 0000 0000

IP PDU > *Time to Live* for the selected FTP PDU

Field Name: *Time to Live*

Purpose and Definition: Time to Live is an 8-bit field that indicates the maximum time the datagram is allowed to remain in the internet. If this field contains the value 0, then the datagram must be destroyed. This field is modified in internet header processing. The time is measure in units of seconds, and is set by the sender to the maximum time the datagram is allowed to be in the internet. This field is decreased at each point that the internet header is processed. The intention is to cause undeliverable packets to be discarded, and to bind the maximum datagram lifetime.

Field Key: *Not applicable*

Data value (decimal): 64

Data values in other bases:

Hexadecimal	4	0
Binary	0100	0000
Decimal	64	

IP PDU > *Protocol* for the selected FTP PDU

Field Name: *Protocol*

Purpose and Definition: Protocol is an 8-bit field that indicates the next level protocol that is used in the data portion of the internet diagram.

Field Key:

Dec	Hex	Protocol	Dec	Hex	Protocol
0	00	Reserved	22	16	Multiplexing
1	01	ICMP	23	17	DCN
2	02	Unassigned	24	18	TAC Monitoring
3	03	Gateway-to-Gateway	25-76	19-4C	Unassigned
4	04	CMCC Gateway Monitoring Message	77	4D	Any local network
5	05	ST	100	64	SATNET and Backroom EXPAK
6	06	TCP	101	65	MIT Subnet Support
7	07	UCL	102-104	66-68	Unassigned
10	0A	Unassigned	105	69	SATNET Monitoring
11	0B	Secure	106	6A	Unassigned
12	0C	BBN RCC Monitoring	107	6B	Internet Packet Core Utility
13	0D	NVP	110-113	6E-71	Unassigned
14	0E	PUP	114	72	Backroom SATNET Monitoring
15	0F	Pluribus	115	73	Unassigned
16	10	Telnet	116	74	WIDEBAND Monitoring
17	11	XNET	117	75	WIDEBAND EXPAK
20	14	Chaos	120-376	78-0178	Unassigned
21	15	User Datagram	377	0179	Reserved

Data value (hexadecimal): 06

Data values in other bases:

Hexadecimal	0	6
Binary	0000	0110
Decimal	6	

RFC Link: http://www.faqs.org/rfcs/rfc790.html

IP PDU > ***Header Checksum*** for the selected FTP PDU

Field Name: *Header Checksum*

Purpose and Definition: The Header Checksum is a 16-bit field. The Checksum is the 16-bit one's complement sum of all 16-bit words in the header. For purposes of computing the checksum, the initial value of its field is zero. When both header checksums are equal, then the header bits are correct. If either checksums vary, then a new, correct packet will need to be sent.

This is a simple way to compute the checksum and experimental evidence indicates that it is adequate, but it is provisional and may be replaced by a CRC procedure, depending on further experience.

Field Key: *Not applicable*

Data value (hexadecimal): 0E 85

Data values in other bases:

Hexadecimal	0	E	8	5
Binary	0000	1110	1000	0101

IP PDU > *Source Address* for the selected FTP PDU

Field Name: *Source Address*

Purpose and Definition: The Source Address is a 32-bit field that contains the IP address of the host that sent the IP Packet.

Field Key: *Not applicable*

Data value (decimal): 192.168.0.39

Data values in other bases:

Hexadecimal	C	0	A	8	0	0	2	7
Binary	1100	0000	1010	1000	0000	0000	0010	0111
Decimal	192		168		0		39	

IP PDU > *Destination Address* for the selected FTP PDU

Field Name: *Destination Address*

Purpose and Definition: The Destination Address is a 32-bit field that contains the address of the host that is to receive the data contained within the IP packet.

Field Key: *Not applicable*

Data value (decimal): 192.168.0.101

Data values in other bases:

Hexadecimal	C	0	A	8	0	0	6	5
Binary	1100	0000	1010	1000	0000	0000	0110	0101
Decimal	192		168		0		101	

IP PDU > *Options and Padding* for the selected FTP PDU

Field Name: *Options and Padding*

Purpose and Definition: The options may or may not appear in Ethernet packets. They must be implemented by all IP modules (host and gateways). What is optional is their transmission in any particular packet, not their implementation.

The option field is variable in length. There may be zero or more options. There are two cases for the format of an option.

Case 1: A single octet of option type
Case 2: An option-type octet, an option-length octet, and the actual option-data octets.

Field Key: *Not applicable*

Data values: *Not applicable*

Data values in other bases: *Not applicable*

IP PDU > *Data* for the selected FTP PDU

Field Name: *Data*

Purpose and Definition: The Data is a variable length field which contains the actual data that is being sent from one host to another. The data field may start with a Layer 4 header, which will give additional instructions to the application that will be receiving the data; alternately, it may be an ICMP header and not contain any user data at all.

Field Key: *Not applicable*

**Data values (hexadecimal) **: (TCP) 80 30 00 15 81 A5 16 6C 87 A3 53 5D 80 18 16 D0 11 F4 00 00 01 01 08 0A 1B 25 F3 A1 0b DD 73 58
(FTP) 50 41 53 53 20 66 31 61 32 6B 33 75 73 65 72 0D 0A

Data values in other bases:
Hexadecimal: (TCP) 0 x 80 30 00 15 81 A5 16 6C 87 A3 53 5D 80 18 16 D0 11 F4 00 00 01 01 08 0A 1B 25 F3 A1 0B DD 73 58
(FTP) 50 41 53 53 20 66 31 61 32 6B 33 75 73 65 72 0D 0A

ASCII: (TCP) ↑ 0 © © ↑ ↑ © ↑ ↑ S] ↑ © © ↑ © ↑ © © © © © © © % ↑ ↑ © ↑ s X
(FTP) P A S S S © f 1 a 2 k 3 u s e r © ©

2.1.2 TCP PDU for the selected FTP PDU

IP > TCP PDU > *Source Port* for the selected FTP PDU

Field Name: *Source Port*

Purpose and Definition:
This 16-bit number represents the name of the application that sent the data in the IP packet.

Field Key: *Not applicable*

Data value (decimal): 32816

Data values in other bases:

Hexadecimal	8	0	3	0
Binary	1000	0000	0011	0000
Decimal	128		48	
ASCII	↑		0	

IP > TCP PDU > *Destination Port* for the selected FTP PDU

Field Name: *Destination Port*

Purpose and Definition:
This 16-bit number represents the name of the application that is to receive the data contained within the IP packet. This is one of the major differences between a Layer 3 and a Layer 4 header: the Layer 3 header contains the IP address of the computer that is to receive the IP packet; once that packet has been received, the port address in the Layer 4 header ensures that the data contained within that IP packet is passed to the correct application on that computer.

Field Key:
This key indicates assigned port number values:

Dec	**Port Numbers**
0	Reserved
1-32767	Internet registered ("well-known") protocols
32768-98303	Reserved, to allow TCPv7-TCPv4 conversion
98304 & up	Dynamic assignment

Data value (decimal): 21 (indicates FTP)

Data values in other bases:

Hexadecimal	0	0	1	5
Binary	0000	0000	0001	0101
Decimal	0		21	
ASCII	©		©	

Source: http://www.zvon.org/tmRFC/RFC1475/Output/chapter4.html

IP > TCP PDU > *Sequence Number* for the selected FTP PDU

Field Name: *Sequence Number*

Purpose and Definition:
TCP is responsible for ensuring that all IP packets sent are actually received. When an application's data is packaged into IP packets, TCP will give each IP packet a sequence number. Once all the packets have arrived at the receiving computer, TCP uses the number in this 32-bit field to ensure that all of the packets actually arrived and are in the correct sequence.

Field Key: *Not applicable*

Data value (decimal): 2175080044

Data values in other bases:

Hexadecimal	8	1	A	5	1	6	6	C
Binary	1000	0001	1010	0101	0001	0110	0110	1100
Decimal	0		60		176		60	
ASCII	©		‘		↑		‘	

IP > TCP PDU > *Acknowledgement Number* for the selected FTP PDU

Field Name: *Acknowledgement Number*

Purpose and Definition:
This number is used by the receiving computer to acknowledge which packets have successfully arrived. This number will be the sequence number of the next packet the receiver is ready to receive.

Field Key: *Not applicable*

Data value: 2275627869

Data values in other bases:

Hexadecimal	8	7	A	3	5	3	5	D
Binary	1000	0111	1010	0011	0101	0011	0101	1101
Decimal	135		163		83		93	
ASCII	↑		↑		S		]	

IP > TCP PDU > ***Header Length or Offset*** for the selected FTP PDU

Field Name: *Header Length or Offset*

Purpose and Definition:
This is identical in concept to the header length in an IP packet, except this time it indicates the length of the TCP header.

Field Key: *Not applicable*

Data value (bytes): 32

Data values in other bases:

Hexadecimal	8	0
Binary	1000	0000
Decimal	128	
ASCII	↑	

.

IP > TCP PDU > *Reserved* for the selected FTP PDU

Field Name: *Reserved*

Purpose and Definition:
These 6 bits are unused and are always set to 0.

Field Key: *Not applicable*

Data value (binary): 0000 00

Data values in other bases:

Hexadecimal	0	0	0	0	0	0
Binary	0000	0000	0000	0000	0000	0000
Decimal	0		0		0	
ASCII	©		©		©	

IP > TCP PDU > *Control Flags* for the selected FTP PDU

Field Name: *Control Flags*

Purpose and Definition:
Every TCP packet contains this 6-bit value that indicates how many octets it can receive at once. When IP packets are received, they are placed in a temporary area of RAM known as a buffer until the receiving computer has a chance to process them; this value represents how big a buffer the receiving host has made available for this temporary storage of IP packets.

Field Key:

- Urgent (URG)
- Acknowledgement (ACK)
- Push (PSH)
- Reset (RST)
- Synchronize (SYN)
- Finish (FIN)

Data value (binary): 01 1000

Data values in other bases: *Not applicable*

IP > TCP PDU > *Window Size* for the selected FTP PDU

Field Name: *Window Size*

Purpose and Definition:
Every TCP packet contains this 16-bit value that indicates how many octets it can receive at once. When IP packets are received, they are placed in a temporary area of RAM known as a buffer until the receiving computer has a chance to process them; this value represents how big a buffer the receiving host has made available for this temporary storage of IP packets.

Field Key: *Not applicable*

Data value (decimal): 5840

Data values in other bases:

Hexadecimal	1	6	D	0
Binary	0001	0110	1110	0000
Decimal	22		224	
ASCII	©		↑	

IP > TCP PDU > *Checksum* for the selected FTP PDU

Field Name: *Checksum*

Purpose and Definition:
Unlike IP, TCP is responsible for ensuring that the entire IP packet arrived intact. TCP will run a CRC on the entire IP packet (not just the header) and place the resulting checksum in this field. When the IP packet is received, TCP re-runs the CRC on the entire packet to ensure the checksum is the same.

Field Key: *Not applicable*

Data value (hexadecimal): 11 F4

Data values in other bases:

Hexadecimal	1	1	F	4
Binary	0001	0001	1111	0100
Decimal	17		244	
ASCII	©		©	

IP > TCP PDU > *Urgent Pointer* for the selected FTP PDU

Field Name: *Urgent Pointer*

Purpose and Definition:
If the Urgent flag is set to on, this value indicates where the urgent data is located.

Information Key: *Not applicable*

Data value: *Not applicable*

Data values in other bases: *Not applicable*

IP > TCP PDU > *Options and Padding* for the selected FTP PDU

Field Name: *Options and Padding*

Purpose and Definition:
Like IP options, this field is optional and represents additional instructions not covered in the other TCP fields. Again, if an option does not fill up a 32-bit word, it will be filled in with padding bits.

Field Key: *Not applicable*

Data value (hexadecimal): 01 01 08 0A 1B 25 F3 A1 0B DD 73 58

Data values in other bases:

Hexadecimal	0	1	0	1	0	8	0	A	1	B
Binary	0000	0001	0000	0001	0000	1000	0000	1010	0001	1011
Decimal	1		1		8		10		27	
ASCII	©		©		©		©		©	

Hexadecimal	2	5	F	3	A	1	0	B	D	D
Binary	0010	0101	1111	0011	1010	0001	0000	1011	1101	1101
Decimal	37		243		161		11		221	
ASCII	%		↑		↑		©		↑	

Hexadecimal	7	3	5	8
Binary	0101	0011	0101	1000
Decimal	115		96	
ASCII	↑		↑	

2.1.3 FTP PDU for the selected FTP PDU

IP >TCP > FTP Header for the FTP Packet

RFC Link: http://www.ietf.org/rfc/rfc0959.txt?number=959

The first four bytes of the FTP PDU specify access control identifiers, data transfer parameters or file transfer protocol (command codes are shown in parenthesis).

USER NAME (USER)

> The argument field is a Telnet string identifying the user. The user identification is that which is required by the server for access to its file system. This command will normally be the first command transmitted by the user after the control connections are made (some servers may require this). Some servers may also require additional identification information in the form of a password and/or an account command. Servers may allow a new USER command to be entered at any point in order to change the access control and/or accounting information. This has the effect of flushing any user, password, and account information already supplied and beginning the login sequence again. All transfer parameters are unchanged and any file transfer in progress is completed under the old access control parameters.

PASSWORD (PASS)

> The argument field is a Telnet string specifying the user's password. This command must be immediately preceded by the user name command, and, for some sites, completes the user's identification for access control. Since password information is quite sensitive, it is desirable in general to "mask" it or suppress typeout. It appears that the server has no foolproof way to achieve this. It is therefore the responsibility of the user-FTP process to hide the sensitive password information.

ACCOUNT (ACCT)

> The argument field is a Telnet string identifying the user's account. The command is not necessarily related to the USER command, as some sites may require an account for login and others only for specific access, such as storing files. In the latter case the command may arrive at any time. There are reply codes to differentiate these cases for the automation: when account information is required for login, the response to a successful PASSword command is reply code 332. On the other hand, if account information is NOT required for login, the reply to a successful PASSword command is 230; and if the account information is needed for a command issued later in the dialogue, the server should return a 332 or 532 reply depending on whether it stores (pending receipt of the ACCounT command) or discards the command, respectively.

CHANGE WORKING DIRECTORY (CWD)

This command allows the user to work with a different directory or dataset for file storage or retrieval without altering his login or accounting information. Transfer parameters are similarly unchanged. The argument is a pathname specifying a directory or other system dependent file group designator.

CHANGE TO PARENT DIRECTORY (CDUP)

This command is a special case of CWD, and is included to simplify the implementation of programs for transferring directory trees between operating systems having different syntaxes for naming the parent directory. The reply codes shall be identical to the reply codes of CWD.

STRUCTURE MOUNT (SMNT)

This command allows the user to mount a different file system data structure without altering his login or accounting information. Transfer parameters are similarly unchanged. The argument is a pathname specifying a directory or other system dependent file group designator.

REINITIALIZE (REIN)

This command terminates a USER, flushing all I/O and account information, except to allow any transfer in progress to be completed. All parameters are reset to the default settings and the control connection is left open. This is identical to the state in which a user finds himself immediately after the control connection is opened. A USER command may be expected to follow.

LOGOUT (QUIT)

This command terminates a USER and if file transfer is not in progress, the server closes the control connection. If file transfer is in progress, the connection will remain open for result response and the server will then close it. If the user-process is transferring files for several USERs but does not wish to close and then reopen connections for each, then the REIN command should be used instead of QUIT. An unexpected close on the control connection will cause the server to take the effective action of an abort (ABOR) and a logout (QUIT).

DATA PORT (PORT)

The argument is a HOST-PORT specification for the data port to be used in data connection. There are defaults for both the user and server data ports, and under normal circumstances this command and its reply are not needed. If this command is used, the argument is the concatenation of a 32-bit internet host address and a 16-bit TCP port address. This address information is broken into 8-bit fields and the value of each field is transmitted as a decimal number (in character string representation). The fields are separatedby commas. A port command would be:

```
PORT h1,h2,h3,h4,p1,p2
```

where h1 is the high order 8 bits of the internet host address.

PASSIVE (PASV)

This command requests the server-DTP to "listen" on a data port (which is not its default data port) and to wait for a connection rather than initiate one upon receipt of a transfer command. The response to this command includes the host and port address this server is listening on.

REPRESENTATION TYPE (TYPE)

The argument specifies the representation type as described in the Section on Data Representation and Storage. Several types take a second parameter. A single Telnet character denotes the first parameter, as is the second Format parameter for ASCII and EBCDIC; the second parameter for local byte is a decimal integer to indicate Byte size. The parameters are separated by a <SP> (Space, ASCII code 32).

The following codes are assigned for type:

```
         \    /
A - ASCII |    | N - Non-print
         |-><-| T - Telnet format effectors
E - EBCDIC|    | C - Carriage Control (ASA)
         /    \
I - Image

L <byte size> - Local byte Byte size
```

FILE STRUCTURE (STRU)

The argument is a single Telnet character code specifying file structure described in the Section on Data Representation and Storage.

The following codes are assigned for structure:

F - File (no record structure)
R - Record structure

P - Page structure
The default structure is File.

TRANSFER MODE (MODE)

The argument is a single Telnet character code specifying the data transfer modes described in the Section on Transmission Modes. The following codes are assigned for transfer modes:

S - Stream
B - Block
C - Compressed

The default transfer mode is Stream.

RETRIEVE (RETR)

This command causes the server-DTP to transfer a copy of the file, specified in the pathname, to the server- or user-DTP at the other end of the data connection. The status and contents of the file at the server site shall be unaffected.

STORE (STOR)

This command causes the server-DTP to accept the data transferred via the data connection and to store the data as a file at the server site. If the file specified in the pathname exists at the server site, then its contents shall be replaced by the data being transferred. A new file is created at the server site if the file specified in the pathname does not already exist.

STORE UNIQUE (STOU)

This command behaves like STOR except that the resultant file is to be created in the current directory under a name unique to that directory. The 250 Transfer Started response must include the name generated.

APPEND (with create) (APPE)

This command causes the server-DTP to accept the data transferred via the data connection and to store the data in a file at the server site. If the file specified in the pathname exists at the server site, then the data shall be appended to that file; otherwise the file specified in the pathname shall be created at the server site.

ALLOCATE (ALLO)

This command may be required by some servers to reserve sufficient storage to accommodate the new file to be transferred. The argument shall be a decimal integer representing the number of bytes (using the logical byte size) of storage to be reserved for the file. For files sent with record or page structure a maximum record or page size (in logical bytes) might also be necessary; this is indicated by a decimal integer in a second argument field of the command. This second argument is optional, but when present should be separated from the first by the three Telnet characters <SP> R <SP>. This command shall be followed by a STORe or APPEnd command. The ALLO command should be treated as a NOOP (no operation) by those servers, which do not require that the maximum size of the file be declared beforehand, and those servers interested in only the maximum record or page size should accept a dummy value in the first argument and ignore it.

RESTART (REST)

The argument field represents the server marker at which file transfer is to be restarted. This command does not cause file transfer but skips over the file to the specified data checkpoint. This command shall be immediately followed by the appropriate FTP service command, which shall cause file transfer to resume.

RENAME FROM (RNFR)

This command specifies the old pathname of the file, which is to be renamed. This command must be immediately followed by a "rename to" command specifying the new file pathname.

RENAME TO (RNTO)

This command specifies the new pathname of the file specified in the immediately preceding "rename from" command. Together the two commands cause a file to be renamed.

ABORT (ABOR)

This command tells the server to abort the previous FTP service command and any associated transfer of data. The abort command may require "special action", as discussed in the Section on FTP Commands, to force recognition by the server. No action is to be taken if the previous command has been completed (including data transfer). The control connection is not to be closed by the server, but the data connection must be closed.

There are two cases for the server upon receipt of this command: (1) the FTP service command was already completed, or (2) the FTP service command is still in progress.
In the first case, the server closes the data connection (if it is open) and responds with a 226 reply, indicating that the abort command was successfully processed.
In the second case, the server aborts the FTP service in progress and closes the data connection, returning a 426 reply to indicate that the service request terminated abnormally. The server then sends a 226 reply, indicating that the abort command was successfully processed.

DELETE (DELE)

This command causes the file specified in the pathname to be deleted at the server site. If an extra level of protection is desired (such as the query, "Do you really wish to delete?"), it should be provided by the user-FTP process.

REMOVE DIRECTORY (RMD)

This command causes the directory specified in the pathname to be removed as a directory (if the pathname is absolute) or as a subdirectory of the current working directory (if the pathname is relative).

MAKE DIRECTORY (MKD)

This command causes the directory specified in the pathname to be created as a directory (if the pathname is absolute) or as a subdirectory of the current working directory (if the pathname is relative).

PRINT WORKING DIRECTORY (PWD)

This command causes the name of the current working directory to be returned in the reply.

LIST (LIST)

This command causes a list to be sent from the server to the passive DTP. If the pathname specifies a directory or other group of files, the server should transfer a list of files in the specified directory. If the pathname specifies a file then the server should send current information on the file. A null argument implies the user's current working or default directory. The data transfer is over the data connection in type ASCII or type EBCDIC. (The user must ensure that the TYPE is appropriately ASCII or EBCDIC). Since the information on a file may vary widely from system to system, this information may be hard to use automatically in a program, but may be quite useful to a human user.

NAME LIST (NLST)

This command causes a directory listing to be sent from server to user site. The pathname should specify a directory or other system-specific file group descriptor; a null argument implies the current directory. The server will return a stream of names of files and no other information. The data will be transferred in ASCII or
EBCDIC type over the data connection as valid pathname strings separated by <CRLF> or <NL>. (Again the user must ensure that the TYPE is correct.) This command is intended to return information that can be used by a program to further process the files automatically. For example, in the implementation of a "multiple get" function.

SITE PARAMETERS (SITE)

This command is used by the server to provide services specific to his system that are essential to file transfer but not sufficiently universal to be included as commands in the protocol. The nature of these services and the specification of their syntax can be stated in a reply to the HELP SITE command.

SYSTEM (SYST)

This command is used to find out the type of operating system at the server. The reply shall have as its first word one of the system names listed in the current version of the Assigned Numbers document [4].

STATUS (STAT)

This command shall cause a status response to be sent over the control connection in the form of a reply. The command may be sent during a file transfer (along with the Telnet IP and Synch signals--see the Section on FTP Commands) in which case the server will respond with the status of the operation in progress, or it may be sent between file transfers. In the latter case, the command may have an argument field. If the argument is a pathname, the command is analogous to the "list" command except that data shall be transferred over the control connection. If a partial pathname is given, the server may respond with a list of file names or attributes associated with that specification. If no argument is given, the server should return general status information about the server FTP process. This should include current values of all transfer parameters and the status of connections.

HELP (HELP)

This command shall cause the server to send helpful information regarding its implementation status over the control connection to the user. The command may take an argument (e.g., any command name) and return more specific information as a response. The reply is type 211 or 214. It is suggested that HELP be allowed before entering a USER command. The server may use this reply to specify site-dependent parameters, e.g., in response to HELP SITE.

NOOP (NOOP)

This command does not affect any parameters or previously entered commands. It specifies no action other than that the server sends an OK reply.

The following is an example of the TCP PDU that would be containing in a PASSWORD (PASS) packet.

What is Contained in the Packet

Request: PASS
Request Arg: f1a2k3user

Data Values (hexadecimal): 50 41 53 53 20 66 31 61 32 6B 33 75 73 65 72 0D 0A

Data Values in Other Bases:

ASCII	P	A	S	S	SPC	f	1	a	2
Hexadecimal	5 0	4 1	5 3	5 3	2 0	6 6	3 1	6 1	3 2
Binary	0101 0000	0100 0001	0101 0011	0101 0011	0010 0000	0110 0110	0011 0001	0110 0001	0011 0010
Decimal	80	65	83	83	32	102	49	97	59

ASCII	K	3	u	s	e	r	\r	\n
Hexadecimal	6 B	3 3	7 5	7 3	6 5	7 2	0 D	0 A
Binary	0110 1011	0011 0011	0111 0101	0111 0011	0110 0101	0111 0010	0000 1101	0000 1010
Decimal	107	51	117	115	101	114	13	10

2.2 User Commands - ICMP (AKA "Clickable Buttons")

IP PDU
IP Version
Internet Header Length
Type of Service
Total Length of Ethernet Frame
Identification
Flags
Fragment Offset
Time to Live
Protocol
Header Checksum
Source IP Address
Destination IP Address
Options
Data

ICMP PDU
Type
Code
ICMP Checksum
Identifier
Data

2.2.1 IP PDU for the selected ICMP PDU

IP PDU > *Version* for the selected ICMP PDU

Field Name: *Version*

Purpose and Definition: Version is a 4-bit field that indicates the format of the internet header.

Field Key: 4 = IPv4
6 = IPv6

Data value (decimal): 4

Data values in other bases:

Hexadecimal	4
Binary	0100
Decimal	4

IP PDU > *Internet Header Length* for the selected ICMP PDU

Field Name: *Internet Header Length*

Purpose and Definition: The IHL field is a 4 bit field indicating the length of the internet header in 32 bit words, and thus points to the beginning of the data. The minimum value of a correct header is 5.

Field Key: *Not applicable*

Data value: The value contained in our field is 20 bytes. This is the hexadecimal and decimal value of 5 multiplied by 4 bits.

Data values in other bases:

Hexadecimal	0	5
Binary	0000	0101
Decimal	5	

IP PDU > *Type of Service* for the selected ICMP PDU

Field Name: *Type of Service*

Purpose and Definition: Type of Service is an 8-bit field that provides and indication of the abstract parameters of the quality of service desired. These parameters guide the selection of the actual service parameters when transmitting a datagram through a particular network.

Field Key: The major choice is a three-way tradeoff between low-delay, high-reliability, and high-throughput.

0 1 2	3	4	5	6	7
Precedence	D	T	R	0	0

Bits 0-2: Precedence		
Bit 3: (D)	0 = Normal Delay	1 = Low Delay
Bit 4: (T)	0 = Normal Throughput	1 = High Throughput
Bit 5: (R)	0 = Normal Reliability	1 = High Reliability

Precedence:

111 = Network Control	011 = Flash
110 = Internetwork Control	010 = Immediate
101 = CRITIC/ECP	001 = Priority
100 = Flash Overrided	000 = Routine

Data value (hexadecimal): 00

Data values in other bases:

Hexadecimal	0	0
Binary	0000	0000
Decimal	0	

IP PDU > *Total Length of Ethernet Frame* for the selected ICMP PDU

Field Name: *Total Length of Ethernet Frame*

Purpose and Definition: Total Length is a 16-bit field that indicates the length of the frame, measured in octets, including internet header and data. The maximum size is 2^{16}-1 or 65,535 octets; however, the recommended maximum size is 576 octets.

Field Key: *Not applicable*

Data values (decimal): 84

Data values in other bases:

Hexadecimal	0	0	5	4
Binary	0000	0000	0101	0100
Decimal	0		84	
ASCII	©		T	

IP PDU > *Identification* for the selected ICMP PDU

Field Name: *Identification*

Purpose and Definition: Identification is a 16-bit field. An identifying value is assigned by the sender to aid in assembling the fragments of a datagram. The identifier is chosen based on the need to provide a way to uniquely identify the fragments and protocol for the time the datagram or any fragment could be alive in the internet

Field Key: *Not applicable*

Data value (hexadecimal): 00 00

Data values in other bases:

Hexadecimal	0	0	0	0
Binary	0000	0000	0000	0000

IP PDU > *Flags* for the selected ICMP PDU

Field Name: *Flags*

Purpose and Definition: Flags is a 3-bit field that indicates directions for fragmentation.

Field Key:

Bit 0: reserved, must be 0		
Bit 1: (DF)	0 = May Fragment	1 = Don’t Fragment
Bit 2: (MF)	0 = Last Fragment	1 = More Fragment

Data value (binary): 010

Data values in other bases: *Not applicable*

IP PDU > *Fragment Offset* for the selected ICMP PDU

Field Name: *Fragment Offset*

Purpose and Definition: The Fragment Offset is a 13- bit field indicating where in the Ethernet frame this fragment begins. The Fragment Offset is measured in units of 8 octets, and the first fragment has offset 0.

Field Key: *Not applicable*

Data value (decimal): 0

Data values in other bases:
Binary: 0000 0000 0000

IP PDU > *Time to Live* for the selected ICMP PDU

Field Name: *Time to Live*

Purpose and Definition: Time to Live is an 8-bit field that indicates the maximum time the datagram is allowed to remain in the internet. If this field contains the value 0, then the datagram must be destroyed. This field is modified in internet header processing. The time is measure in units of seconds, and is set by the sender to the maximum time the datagram is allowed to be in the internet. This field is decreased at each point that the internet header is processed. The intention is to cause undeliverable packets to be discarded, and to bind the maximum datagram lifetime.

Field Key: *Not applicable*

Data value (decimal): 64

Data values in other bases:

Hexadecimal	4	0
Binary	0100	0000
Decimal	64	

IP PDU > *Protocol* for the selected ICMP PDU

Field Name: *Protocol*

Purpose and Definition: Protocol is an 8-bit field that indicates the next level protocol that is used in the data portion of the internet diagram.

Field Key:

Dec	Hex	Protocol	Dec	Hex	Protocol
0	00	Reserved	22	16	Multiplexing
1	01	ICMP	23	17	DCN
2	02	Unassigned	24	18	TAC Monitoring
3	03	Gateway-to-Gateway	25-76	19-4C	Unassigned
4	04	CMCC Gateway Monitoring Message	77	4D	Any local network
5	05	ST	100	64	SATNET and Backroom EXPAK
6	06	TCP	101	65	MIT Subnet Support
7	07	UCL	102-104	66-68	Unassigned
10	0A	Unassigned	105	69	SATNET Monitoring
11	0B	Secure	106	6A	Unassigned
12	0C	BBN RCC Monitoring	107	6B	Internet Packet Core Utility
13	0D	NVP	110-113	6E-71	Unassigned
14	0E	PUP	114	72	Backroom SATNET Monitoring
15	0F	Pluribus	115	73	Unassigned
16	10	Telnet	116	74	WIDEBAND Monitoring
17	11	XNET	117	75	WIDEBAND EXPAK
20	14	Chaos	120-376	78-0178	Unassigned
21	15	User Datagram	377	0179	Reserved

Data value (hexadecimal): 01

Data values in other bases:

Hexadecimal	0	6
Binary	0000	0001
Decimal	1	

RFC Link: http://www.faqs.org/rfcs/rfc790.html

IP PDU > *Header Checksum* for the Selected ICMP PDU

Field Name: *Header Checksum*

Purpose and Definition: The Header Checksum is a 16-bit field. This CRC algorithm is the 16-bit one's complement sum of all the 16-bit words in the header. For purposes of computing the checksum, the value of the checksum field is initially zero. When both header checksums are the same, then the header bits are correct. If either checksums vary, then a packet will need to be resent.

This is a simple way to compute the checksum and experimental evidence indicates that it is adequate, but it is provisional and may be replaced by a CRC procedure, depending on further experience.

Field Key: *Not applicable*

Data value (hexadecimal): B8 CC

Data values in other bases:

Hexadecimal	B	8	C	C
Binary	1011	1000	1100	1100

IP PDU > *Source Address* for the Selected ICMP PDU

Field Name: *Source Address*

Purpose and Definition: The Source Address is a 32-bit field that contains the IP address of the host that sent the IP Packet.

Field Key: *Not applicable*

Data value: 192.168.0.39

Data values in other bases:

Hexadecimal	C	0	A	8	0	0	2	7
Binary	1100	0000	1010	1000	0000	0000	0010	0111
Decimal	192		168		0		39	

IP PDU > *Destination Address* for the selected ICMP PDU

Field Name: *Destination Address*

Purpose and Definition: The Destination Address is a 32-bit field that contains the address of the host that is to receive the data contained within the IP packet.

Field Key: *Not applicable*

Data value: 192.168.0.101

Data values in other bases:

Hexadecimal	C	0	A	8	0	0	6	5
Binary	1100	0000	1010	1000	0000	0000	0110	0101
Decimal	192.		168.		0.		101	

IP PDU > *Options and Padding* for the selected ICMP PDU

Field Name: *Options and Padding*

Purpose and Definition: The options may or may not appear in Ethernet packets. They must be implemented by all IP modules (host and gateways). What is optional is their transmission in any particular packet, not their implementation.

The option field is variable in length. There may be zero or more options. There are two cases for the format of an option.

Case 1: A single octet of option type
Case 2: An option-type octet, an option-length octet, and the actual option-data octets.

Field Key: *Not applicable*

Data values: *Not applicable*

Data values in other bases: *Not applicable*

2.2.2 ICMP PDU for the selected ICMP PDU

IP > ICMP Header > *Type* for the selected ICMP PDU

Field Name: *Type*

Purpose and Definition: The type is an 8-bit field that identifies what sort of message the ICMP protocol is sending.

Field Key:

Dec	Hex	Message Type	Dec	Hex	Message Type
0	00	Echo Reply	16	10	Information Reply
1	01	Unassigned	17	11	Address Mask Request
2	02	Unassigned	18	12	Address Mask Reply
3	03	Destination Unreachable	19	13	Reserved (for Security)
4	04	Source Quench	20-29	14-1D	Reserved (for Robustness Experiment)
5	05	Redirect	30	1E	Traceroute
6	06	Alternate Host Address	31	1F	Datagram Conversion Error
7	07	Unassigned	32	20	Mobile Host Redirect
8	08	Echo	33	21	IPv6 Where-Are-You
9	09	Router Advertisement	34	22	IPv6 I-Am-Here
10	0A	Router Solicitation	35	23	Mobile Registration Request
11	0B	Time Exceeded	36	24	Mobile Registration Reply
12	0C	Parameter Problem	37	25	Domain Name Request
13	0D	Timestamp	38	26	Domain Name Reply
14	0E	Timestamp Reply	39	27	SKIP
15	0F	Information Request	40	28	Photuris
			41-255	29-FF	Reserved

Data value: 8 (Echo (ping) Request)

Data values in other bases:

Hexadecimal	0	8
Binary	0000	1000
Decimal	8	

RFC Link: http://www.iana.org/assignments/icmp-parameters

IP > ICMP Header > *Code* for the selected ICMP PDU

Field Name: *Code*

Purpose and Definition: Code is an 8-bit field that provides further information about the associated type field.

Field Key:

Type	Name
0	Echo Reply (used by "PING")
	0 No Code
1	Unassigned
2	Unassigned
3	Destination Unreachable
	0 Net Unreachable
	1 Host Unreachable
	2 Protocol Unreachable
	3 Port Unreachable
	4 Fragmentation needed and Don't Fragment was Set
	5 Source Route Failed
	6 Destination Network Unknown
	7 Destination Host Unknown
	8 Source Host Isolated
	9 Communication with Destination Network is Administratively Prohibited
	10 Communication with Destination Host is Administratively Prohibited
	11 Destination Network Unreachable for Type of Service
	12 Destination Host Unreachable for Type of Service
4	Source Quench
	0 No Code
5	Redirect
	0 Redirect Datagram for the Network
	1 Redirect Datagram for the Host
	2 Redirect Datagram for the Type of Service and Network
	3 Redirect Datagram for the Type of Service and Host
6	Alternate Host Address
	0 Alternate Address for Host
7	Unassigned
8	Echo (used by "PING")
	0 No Code
9	Router Advertisement
	0 No Code
10	Router Selection
	0 No Code
11	Time Exceeded
	0 Time to Live exceeded in Transit
	1 Fragment Reassembly Time Exceeded
12	Parameter Problem
	0 Pointer indicates the error
	1 Missing a Required Option
	2 Bad Length
13	Timestamp
	0 No Code
14	Timestamp Reply
	0 No Code
15	Information Request
	0 No Code
16	Information Reply
	0 No Code
17	Address Mask Request
	0 No Code
18	Address Mask Reply
	0 No Code
19	Reserved (for Security)
20-29	Reserved (for Robustness Experiment)
30	Traceroute
31	Datagram Conversion Error
32	Mobile Host Redirect
33	IPv6 Where-Are-You
34	IPv6 I-Am-Here
35	Mobile Registration Request
36	Mobile Registration Reply

Data value (decimal): 0

Data values in other bases:

Hexadecimal	0	0
Binary	0000	0000
Decimal	0	
ASCII	©	

IP > ICMP Header > *Checksum* for the selected ICMP PDU

Field Name: *Checksum*

Purpose and Definition: The checksum is the 16-bit one's complement of the one's complement sum of the ICMP message, starting with the ICMP type. For computing the checksum, the checksum field should initially be zero.

Field Key: *Not applicable*

Data value (hexadecimal): C9 15

Data values in other bases:

Hexadecimal	C	9	1	5
Binary	1100	1001	0001	0101
Decimal	201		21	
ASCII	↑		©	

IP > ICMP Header > *Identifier* for the selected ICMP PDU

Field Name: Identifier

Purpose and Definition: The identifier is a 16-bit field that is used in matching echoes and replies for when the code field is zero.

Field Key: *Not applicable*

Data value (hexadecimal): 70 60

Data values in other bases:

Hexadecimal	7	0	6	0
Binary	0111	0000	0110	0000
Decimal	112		96	
ASCII	P		‘	

IP > ICMP Header > *Sequence* for the selected ICMP PDU

Field Name: *Sequence*

Purpose and Definition: The sequence is a 16-bit field that is used in matching echoes and replies for when the code field is zero.

Field Key: *Not applicable*

Data value (hexadecimal): 00 00

Data values in other bases:

Hexadecimal	0	0	0	0
Binary	0000	0000	0000	0000
Decimal	0		0	
ASCII	©		©	

IP > ICMP Header > *Data* for the selected ICMP PDU

Field Name: *Data*

Purpose and Definition: The data is a variable-length field that contains the actual information that is sent in the ping packet.

Field Key: *Not applicable*

Data value (hexadecimal): 42 B1 89 3F 00 00 00 00 2C C6 07 00 00 00 00 00 10 11 12 13 14 15 16 17 18 19 1A 1B 1C 1D 1E 1F 20 21 22 23 24 25 26 27 28 29 2A 2B 2C 2D 2E 2F 30 31 32 33 34 35 36 37

Data values in other bases:

Hexadecimal	4	2	B	1	8	9	3	F	0	0
Binary	0100	0010	1011	0001	1000	1001	0011	1111	0000	0000
Decimal	66		177		137		63		0	
ASCII	B		↑		↑		?		©	

Hexadecimal	0	0	0	0	0	0	2	C	C	6
Binary	0000	0000	0000	0000	0000	0000	0010	1100	1100	0110
Decimal	0		0		0		44		198	
ASCII	©		©		©		,		↑	

Hexadecimal	0	7	0	0	0	0	0	0	0	0
Binary	0000	0111	0000	0000	0000	0000	0000	0000	0000	0000
Decimal	7		0		0		0		0	
ASCII	©		©		©		©		©	

Hexadecimal	0	0	1	0	1	1	1	2	1	3
Binary	0000	0000	0001	0000	0001	0001	0001	0010	0001	0011
Decimal	0		16		17		18		19	
ASCII	©		©		©		©		©	

Hexadecimal	1	4	1	5	1	6	1	7	1	8
Binary	0001	0100	0001	0101	0001	0110	0001	0111	0001	1000
Decimal	20		21		22		23		24	
ASCII	©		©		©		©		©	

Hexadecimal	1	9	1	A	1	B	1	C	1	D
Binary	0001	1001	0001	1010	0001	1011	0001	1100	0001	1101
Decimal	25		26		27		28		29	
ASCII	©		©		©		©		©	

Hexadecimal	1	E	1	F	2	0	2	1	2	2
Binary	0001	1110	0001	1111	0010	0000	0010	0001	0010	0010
Decimal	30		31		32		33		34	
ASCII	©		©		SPACE		!		“	

Hexadecimal	2	3	2	4	2	5	2	6	2	7
Binary	0010	0011	0010	0100	0010	0101	0010	0110	0010	0111
Decimal	35		36		37		38		39	
ASCII	#		$		%		&		‘	

Hexadecimal	2	8	2	9	2	A	2	B	2	C
Binary	0010	1000	0010	1001	0010	1010	0010	1011	0010	1100
Decimal	40		41		42		43		44	
ASCII	(		)		*		+		,	

Hexadecimal	2	D	2	E	2	F	3	0	3	1
Binary	0010	1101	0010	1110	00010	1111	0011	0000	0011	0001
Decimal	45		46		47		48		49	
ASCII	-		.		/		0		1	

Hexadecimal	3	2	3	3	3	4	3	5	3	6
Binary	0011	0010	0011	0011	0011	0100	0011	0101	0011	0110
Decimal	50		51		52		53		54	
ASCII	2		3		4		5		6	

Hexadecimal	3	7
Binary	0011	0111
Decimal	55	
ASCII	7	

2.3 User Commands - TELNET (AKA “Clickable Buttons”)

IP PDU
IP Version
Internet Header Length
Type of Service
Total Length of Ethernet Frame
Identification
Flags
Fragment Offset
Time to Live
Protocol
Header Checksum
Source IP Address
Destination IP Address
Options
Data

TCP PDU
Source Port Number
Destination Port Number
Sequence Number
Acknowledgement Number
Header Lengths
Reserved
Window Size
TCP Checksum
Urgent Pointer
Options
Data

TELNET PDU
Source Port Number
Destination Port Number
Sequence Number
Acknowledgement Number
Header Length
Reserved
Window Size
FTP Checksum
Urgent Pointer
Options
Data

2.3.1 IP PDU for the selected TELNET PDU

IP PDU > *Internet Header Length* for the selected TELNET PDU

Field Name: *IP Version*

Purpose and Definition: Version is a 4-bit field that indicates the format of the internet header.

Field Key:

4 = IPv4

6 = IPv6

Data value (decimal): 4

Data values in other bases:

Hexadecimal	4
Binary	0110

IP PDU > *Internet Header Length* for the selected TELNET PDU

Field Name: *Internet Header Length*

Purpose and Definition: The IHL field is a 4-bit field indicating the length of the internet header in 32 bit words, and thus points to the beginning of the data. The minimum value of a correct header is 5.

Field Key: *Not applicable.*

Data value: The value contained in our field is 20 bytes. This is the hexadecimal and decimal value of 5 multiplied by 4 bits.

Data values in other bases:

Hexadecimal	0	5
Binary	0000	0101
Decimal	5	

IP PDU > *Type of Service* for the selected TELNET PDU

Field Name: *Type of Service*

Purpose and Definition: Type of Service is an 8-bit field that provides and indication of the abstract parameters of the quality of service desired. These parameters guide the selection of the actual service parameters when transmitting a datagram through a particular network.

Field Key: The major choice is a three-way tradeoff between low-delay, high-reliability, and high-throughput.

0	1	2	3	4	5	6	7
Precedence			D	T	R	0	0

Bits 0-2: Precedence	
Bit 3: (D) 0 = Normal Delay	1 = Low Delay
Bit 4: (T) 0 = Normal Throughput	1 = High Throughput
Bit 5: (R) 0 = Normal Reliability	1 = High Reliability

Precedence:

111 = Network Control	011 = Flash
110 = Internet work Control	010 = Immediate
101 = CRITIC/ECP	001 = Priority
100 = Flash Overridden	000 = Routine

Data value (hexadecimal): 00

Data values in other bases:

Hexadecimal	1	0
Binary	0001	0000

IP PDU > *Total Length of Ethernet Frame* for the selected TELNET PDU

Field Name: *Total Length of Ethernet Frame*

Purpose and Definition: Total Length is a 16-bit field that indicates the length of the frame, measured in octets, including internet header and data. The maximum size is 216-1 or 65,535 octets; however, the recommended maximum size is 576 octets.

Field Key: *Not applicable*

Data value: 00 3E

Data values in other bases (hexadecimal):

Hexadecimal	8	0
Binary	1111	0000

IP PDU > *Identification* for the selected TELNET PDU

Field Name: *Identification*

Purpose and Definition: Identification is a 16-bit field. An identifying value is assigned by the sender to aid in assembling the fragments of a datagram. The identifier is chosen based on the need to provide a way to uniquely identify the fragments and protocol for the time the datagram or any fragment could be alive in the internet.

Field Key: *Not applicable*

Data value (hexadecimal): C7 57

Data values in other bases:

Hexadecimal	C	7	5	7
Binary	1100	0111	0101	0111

IP PDU > *Flags* for the selected TELNET PDU

Field Name: *Flags*

Purpose and Definition: Flags is a 3-bit field that indicates directions for fragmentation.

Field Key:

Bit 0: reserved, must be 0
Bit 1: (DF) 0 = May Fragment 1 = Don't Fragment
Bit 2: (MF) 0 = Last Fragment 1 = More Fragment

Data value (binary): 001

Data values in other bases:

Not Applicable

IP PDU > ***Fragment Offset*** for the selected TELNET PDU

Field Name: *Fragment Offset*

Purpose and Definition: The Fragment Offset is a 13- bit field indicating where in the Ethernet frame this fragment begins. The Fragment Offset is measured in units of 8 octets, and the first fragment has offset 0.

Field Key: *Not applicable*

Data value (decimal): 0

Data values in other bases:

Binary: 0 0000 0000 0000

IP PDU > ***Time to Live*** for the selected FTP PDU

Field Name: *Time to Live*

Purpose and Definition: Time to Live is an 8-bit field that indicates the maximum time the datagram is allowed to remain in the internet. If this field contains the value 0, then the datagram must be destroyed. This field is modified in internet header processing. The time is measure in units of seconds, and is set by the sender to the maximum time the datagram is allowed to be in the internet. This field is decreased at each point that the internet header is processed. The intention is to cause undeliverable packets to be discarded, and to bind the maximum datagram lifetime.

Field Key: *Not applicable*

Data value (decimal): 64

Data values in other bases:

Hexadecimal	4	0
Binary	0010	0000
Decimal	64	

IP PDU > *Protocol* for the selected TELNET PDU

Field Name: *Protocol*

Purpose and Definition: Protocol is an 8-bit field that indicates the next level protocol that is used in the data portion of the internet diagram.

Field Key:

Dec	**Hex**	**Protocol**
0	0	Reserved
1	1	ICMP
2	2	Unassigned
3	3	Gateway-to-Gateway
4	4	CMCC Gateway Monitoring Message
5	5	ST
6	6	TCP
7	7	UCL
10	A	Unassigned
11	B	Secure
12	C	BBN RCC Monitoring
13	D	NVP
14	E	PUP
15	F	Pluribus
16	10	Telnet
17	11	XNET
20	14	Chaos
21	15	User Datagram
22	16	Multiplexing
23	17	DCN
24	18	TAC Monitoring
25-76	19-4C	Unassigned
77	4D	Any local network
100	64	SATNET and Backroom EXPAK

101	65	MIT Subnet Support
102-104	66-68	Unassigned
105	69	SATNET Monitoring
106	6A	Unassigned
107	6B	Internet Packet Core Utility
110-113	6E-71	Unassigned
114	72	Backroom SATNET Monitoring
115	73	Unassigned
116	74	WIDEBAND Monitoring
117	75	WIDEBAND EXPAK
120-376	78-178	Unassigned
377	179	Reserved

Data value (hexadecimal): 06

Data values in other bases:

Hexadecimal	0	6
Binary	0000	0110
Decimal	6	

IP PDU > *Header Checksum* for the selected TELNET PDU

Field Name: *Header Checksum*

Purpose and Definition: The Header Checksum is a 16-bit field. The Checksum is the 16-bit one's complement sum of all 16-bit words in the header. For purposes of computing the checksum, the initial value of its field is zero. When both header checksums are equal, then the header bits are correct. If either checksums vary, then a new, correct packet will need to be sent.

Field Key: *Not applicable*

Data value (hexadecimal): F1 85

Data values in other bases:

Hexadecimal	F	1	8	5
Binary	1111	0001	1000	0101

IP PDU > *Source Address* for the selected TELNET PDU

Field Name: *Source Address*

Purpose and Definition: The Source Address is a 32-bit field that contains the IP address of the host that sent the IP Packet.

Field Key: *Not applicable*

Data value (decimal): 192.168.0.101

Data values in other bases:

Hexadecimal	C	0	A	8
Binary	1100	0000	1010	1000
Decimal	192		168	

Hexadecimal	0	0	6	5
Binary	0000	0000	0110	0101
Decimal	0		101	

IP PDU > *Destination Address* for the selected TELNET PDU

Field Name: *Destination Address*

Purpose and Definition: The Destination Address is a 32-bit field that contains the address of the host that is to receive the data contained within the IP packet.

Field Key: *Not applicable*

Data value (decimal): 192.168.0.39

Data values in other bases:

Hexadecimal	C	0	A	8
Binary	1100	0000	1010	1000
Decimal	192		168	

Hexadecimal	0	0	2	7
Binary	0000	0000	0010	0111
Decimal	0		39	

IP PDU > *Options and Padding* for the selected TELNET PDU

Field Name: *Options and Padding*

Purpose and Definition: The options may or may not appear in Ethernet packets. They must be implemented by all IP modules (host and gateways). What is optional is their transmission in any particular packet, not their implementation.

The option field is variable in length. There may be zero or more options. There are two cases for the format of an option.

Case 1: A single octet of option type
Case 2: An option-type octet, an option-length octet, and the actual option-data octets.

Field Key: *Not applicable*

Data value: *Not applicable*

Data values in other bases:

Not applicable

2.3.2 TELNET PDU for the selected TELNET PDU

IP > TCP PDU > *Source Port* for the selected TELNET PDU

Field Name: *Source Port*

Purpose and Definition: This 16-bit number represents the name of the application that sent the data in the IP packet.

Field Key: *Not applicable*

Data value: TELNET (23)

Data values in other bases:

Hexadecimal	1	7
Binary	0001	0111
Decimal	23	

IP > TCP PDU > *Destination Port* for the selected TELNET PDU

Field Name: *Destination Port*

Purpose and Definition: This 16-bit number represents the name of the application that is to receive the data contained within the IP packet. This is one of the major differences between a Layer 3 and a Layer 4 header: the Layer 3 header contains the IP address of the computer that is to receive the IP packet; once that packet has been received, the port address in the Layer 4 header ensures that the data contained within that IP packet is passed to the correct application on that computer.

Field Key: This key indicates assigned port number values:

Dec	**Port Numbers**
0	Reserved
1-32767	Internet registered ("well-known") protocols
32768-98303	Reserved, to allow TCPv7-TCPv4 conversion
98304 & up	Dynamic assignment

Data value (decimal): 80 25

Data values in other bases:

Hexadecimal	8	0	2	5
Binary	1000	0000	0010	0101
Decimal	128		37	

IP > TCP PDU > *Sequence Number* for the selected TELNET PDU

Field Name: *Sequence Number*

Purpose and Definition: TCP is responsible for ensuring that all IP packets sent are actually received. When an application's data is packaged into IP packets, TCP will give each IP packet a sequence number. Once all the packets have arrived at the receiving computer, TCP uses the number in this 32-bit field to ensure that all of the packets actually arrived and are in the correct sequence.

Field Key: *Not applicable*

Data value (decimal): 2635302920

Data values in other bases:

Hexadecimal	9	D	1	3
Binary	1001	1101	0001	0011
Decimal	157		19	

Hexadecimal	8	8	0	8
Binary	1000	1000	0000	1000
Decimal	136		8	

IP > TCP PDU > *Acknowledgement Number* for the selected TELNET PDU

Field Name: *Acknowledgement Number*

Purpose and Definition: This number is used by the receiving computer to acknowledge which packets have successfully arrived. This number will be the sequence number of the next packet the receiver is ready to receive.

Field Key: *Not applicable*

Data value (decimal): 2526101253

Data values in other bases:

Hexadecimal	9	6	9	1
Binary	1001	0110	1001	0001
Decimal	150		145	

Hexadecimal	3	F	0	5
Binary	0011	1111	0000	0101
Decimal	63		5	

IP > TCP PDU > *Header Length* for the selected TELNET PDU

Field Name: *Header Length or Offset*

Purpose and Definition: This is identical to the header length in an IP packet, except this time it indicates the length of the TCP header

Field Key: Not Applicable

Data value (bytes): 32

Data values in other bases:

Hexadecimal	8	0
Binary	1000	0000
Decimal	128	

IP > TCP PDU > *Reserved* for the selected TELNET PDU

Field Name: *Reserved*

Purpose and Definition: This number is used by the receiving computer to acknowledge which packets have successfully arrived. This number will be the sequence number of the next packet the receiver is ready to receive.

Field Key: Not Applicable

Data value: 0000 00

Data values in other bases:

Hexadecimal	0	0
Binary	0000	00

IP > TCP PDU > *Control Flags* for the selected TELNET PDU

Field Name: *Control Flags*

Purpose and Definition: Every TCP packet contains this 6-bit value that indicates how many octets it can receive at once. When IP packets are received, they are placed in a temporary area of RAM known as a buffer until the receiving computer has a chance to process them; this value represents how big a buffer the receiving host has made available for this temporary storage of IP packets.

Field Key:

- Urgent (URG)
- Acknowledgement (ACK)
- Push (PSH)
- Reset (RST)
- Synchronize (SYN)
- Finish (FIN)

Data value (binary): 01 1000

Data values in other bases:

Not applicable

IP > TCP PDU > *Window Size* for the selected TELNET PDU

Field Name: *Window Size*

Purpose and Definition: Every TCP packet contains this 16-bit value that indicates how many octets it can receive at once. When IP packets are received, they are placed in a temporary area of RAM known as a buffer until the receiving computer has a chance to process them; this value represents how big a buffer the receiving host has made available for this temporary storage of IP packets.

Field Key: *Not applicable*

Data value (decimal): 321120

Data values in other bases:

Hexadecimal	7	D	7	8
Binary	0111	1101	0111	1000
Decimal	321		120	

IP > TCP PDU > *Checksum* for the selected TELNET PDU

Field Name: *Checksum*

Purpose and Definition: Unlike IP, TCP is responsible for ensuring that the entire IP packet arrived intact. TCP will run a CRC on the entire IP packet (not just the header) and place the resulting checksum in this field. When the IP packet is received, TCP re-runs the CRC on the entire packet to ensure the checksum is the same.

Field Key: *Not applicable*

Data value (hexadecimal): 59 89

Data values in other bases:

Hexadecimal	5	9	8	9
Binary	0101	1001	1000	1001
Decimal	89		137	

IP > TCP PDU > *Options and Padding* for the selected TELNET PDU

Field Name: *Options and Padding*

Purpose and Definition: Like IP options, this field is optional and represents additional instructions not covered in the other TCP fields. Again, if an option does not fill up a 32-bit word, it will be filled in with padding bits.

Field Key: *Not applicable*

Data value (hexadecimal): 01 01 08 0A 0B D1 8D EC 1A AC 06 AB

Data values in other bases:

Hexadecimal	0	1	0	1
Binary	0000	0001	0000	0001

Hexadecimal	0	8	0	A
Binary	0000	1000	0000	1010

Hexadecimal	0	B	D	1
Binary	0000	1011	1101	0001

Hexadecimal	8	D	E	C
Binary	1000	1101	1110	1100

Hexadecimal	1	A	A	C
Binary	0001	1010	1010	1100

Hexadecimal	0	6	A	B
Binary	0000	0110	1010	1011

IP > TCP > *TELNET PDU* for the selected TELNET PDU

Field Name: *TELNET PDU*

RFC Link

Purpose and Definition: PASS (Password)
The argument field is a SSH string specifying the user's password. This command must be immediately preceded by the user name command, and, for some sites, completes the user's identification for access control. All information below is encrypted

Field Key: *Not applicable*

Data value: 03 B6 51 11 6A 46 12 36 4F 46 C9 63 B1 A4 B5 48 A2 BA 68 1C 42 17 AB D2 CE 8E 6D 3F 49 7E EB 36 A0 1B 16 62 E4 0F D7 55 DD 5F EB 52 64 B9 A7 62

Data values in other bases:

Hexadecimal	5	0	6	1
Binary	0101	0000	0110	0001
Decimal	80		97	
ASCII	P		a	

Hexadecimal	7	3	7	3
Binary	0111	0011	0111	0011
Decimal	115		115	
ASCII	s		s	

Hexadecimal	7	7	6	F
Binary	0111	0111	0110	1111
Decimal	119		111	
ASCII	w		o	

Hexadecimal	7	2	6	4

Binary	0111	0010	0110	0100
Decimal	114		100	
ASCII	r		d	

Hexadecimal	3	A	2	0
Binary	0011	1010	0010	0000
Decimal	58		32	
ASCII	:		©	

2.4 User Commands – ARP (AKA “Clickable Buttons”)

ARP PDU
Hardware Address Type
Protocol Address Type
Hardware Address Length
Port Address Length
Operation
Source Hardware Address
Source Protocol Address
Target Hardware Address
Target Protocol Address

2.4.1 ARP PDU for the selected ARP PDU

ARP PDU > *Hardware Address Type* for the selected ARP PDU

Field Name: *Hardware Address Type*

Purpose and Definition: The Hardware Address Type is the physical media that communicates on the network.

Field Key:

1 for Ethernet

2 for IEEE 802 LAN

Data value (hexadecimal): 00 01

Data values in other bases:

Hexadecimal	0	0	0	1
Binary	0000	0000	0000	0001

ARP PDU > *Protocol Address Type* for the selected ARP PDU

Field Name: *Protocol Address Type*

Purpose and Definition: Protocol Address Type defines the protocol that the terminals are using to connect with one another.

Field Key:

2048 IPv4 (0x0800)

Data value (hexadecimal): 08 00

Data values in other bases:

Hexadecimal	0	8	0	0
Binary	0000	1000	0000	0000

ARP PDU > *Hardware Address Length* for the selected ARP PDU

Field Name: *Hardware Address Length*

Purpose and Definition: Hardware Address Length is the length of the hardware address in bytes.

Field Key:

6 Ethernet / IEE 802

Data value (hexadecimal): 06

Data values in other bases:

Hexadecimal	0	6
Binary	0000	0110

ARP PDU > *Protocol Address Length* for the selected ARP PDU

Field Name: *Protocol Address Length*

Purpose and Definition: Protocol Address Length determines the length of the protocol address in bytes.

Field Key:

4 = IPv4

Data value (hexadecimal): 04

Data values in other bases:

Hexadecimal	0	4
Binary	0000	0100

ARP PDU > *Operation* for the selected ARP PDU

Field Name: *Operation*

Purpose and Definition: Operation determines whether a request or a response is being performed.

Field Key:

1 = Request

2 = Reply

Data value (hexadecimal): 00 01

Data values in other bases:

Hexadecimal	0	0	0	1
Binary	0000	0000	0000	0001

ARP PDU > *Sender Hardware Address* for the selected ARP PDU

Field Name: *Sender Hardware Address*

Purpose and Definition: Sender Hardware Address is the Physical address or MAC address of the network adapter of the sender's terminal.

Field Key:

00000C	**Cisco**
00000E	**Fujitsu**
00000F	**NeXT**
00001D	**Cabletron**
000020	**DIAB (Data Intdustrier AB)**
000022	**Visual Technology**
00002A	**TRW**
000032	**GPT Limited (reassigned from GEC Computers Ltd)**
00005A	**S & Koch**
00005E	**IANA**
000065	**Network General**
00006B	**MIPS**
000077	**MIPS**
00007A	**Ardent**
000089	**Cayman Systems Gatorbox**
000093	**Proteon**
00009F	**Ameristar Technology**
0000A2	**Wellfleet**
0000A3	**Network Application Technology**
0000A6	**Network General (internal assignment, not for products)**
0000A7	**NCD:X-terminals**
0000A9	**Network Systems**
0000AA	**Xerox:Xerox machines**
0000B3	**CIMLinc**
0000B7	**Dove:Fastnet**

0000BC	**Allen-Bradley**
0000C0	**Western Digital**
0000C5	**Farallon phone net card**
0000C6	**HP Intelligent Networks Operation (formerly Eon Systems)**
0000C8	**Altos**
0000C9	**Emulex:Terminal Servers**
0000D7	**Dartmouth College (NED Router)**
0000D8	**3Com? Novell? PS/2**
0000DD	**Gould**
0000DE	**Unigraph**
0000E2	**Acer Counterpoint**
0000EF	**Alantec**
0000FD	**High Level Hardvare (Orion, UK)**
000102	**BBN:BBN internal usage (not registered)**
0020AF	**3COM???**
001700	**Kabel**
008064	**Wyse Technology / Link Technologies**
00802B	**IMAC???**
00802D	**Xylogics, Inc. Annex terminal servers**
00808C	**Frontier Software Development**
0080C2	**IEEE 802.1 Committee**
0080D3	**Shiva**
00AA00	**Intel**
00DD00	**Ungermann-Bass**
00DD01	**Ungermann-Bass**
020701	**Racal InterLan**
020406	**BBN:BBN internal usage (not registered)**
026086	**Satelcom MegaPac (UK)**
02608C	**3Com:IBM PC; Imagen; Valid; Cisco**
02CF1F	**CMC:Masscomp; Silicon Graphics; Prime EXL**
080002	**3Com (Formerly Bridge)**
080003	**ACC (Advanced Computer Communications)**
080005	**Symbolics:Symbolics LISP machines**
080008	**BBN**
080009	**Hewlett-Packard**

08000A	Nestar Systems
080009	Hewlett-Packard
08000A	Nestar Systems
08000B	Unisys
080011	Tektronix, Inc
080014	Excelan:BBN Butterfly, Masscomp, Silicon Graphics
080017	NSC
08001A	Data General
08001B	Data General
08001E	Apollo
080020	Sun:Sun Machines
080022	NBI
080025	CDC
080026	Norsk Data (Nord)
080027	PCS Computer Systems GmbH
080028	TI
08002B	DEC
08002E	Metaphor
08002F	Prime Computer Prime 50-Series LHC300
080036	Intergraph:CAE stations
080037	Fujitsu-Xerox
080038	Bull
080039	Spider Systems
080041	DCA Digital Comm. Assoc.
080045	???? (May be Xylogics, but they claim not to know this number)
080046	Sony
080047	Sequent
080049	Univation
08004C	Encore
08004E	BICC
080056	Stanford University
080058	??? DECsystem-20
08005A	IBM
080067	Comdesign
080068	Ridge

080069	**Silicon Graphics**
08006E	**Concurrent Masscomp**
080075	**DDE (Danish Data Elektronik A/S)**
08007C	**Vitalink TransLAN III**
080080	**XIOS**
080086	**Imagen/QMS**
080087	**Xyplex terminal servers**
080089	**Kinetics AppleTalk-Ethernet interface**
08008B	**Pyramid**
08008D	**XyVision:XyVision machines**
080090	**Retix Inc:Bridges**
484453	**HDS???**
800010	**AT&T**
AA0000	**DEC:Obsolete**
AA0001	**DEC:Obsolete**
AA0002	**DEC:Obsolete**
AA0003	**Global physical address for some DEC machines**
AA0004	**DEC:Local logical address for systems running DECNET**

Data value (hexadecimal): 00 00 E6 34 ED A3

Data values in other bases:

Hexadecimal	0	0	0	0
Binary	0000	0000	0000	0000

Hexadecimal	E	6	3	4
Binary	1110	0110	0011	0100

Hexadecimal	E	D	A	3
Binary	1110	1101	1010	0011

ARP PDU > *Target Hardware Address* for the selected ARP PDU

Field Name: *Target Hardware Address*

Purpose and Definition: Target Hardware Address is the physical address or MAC address of the network adapter of the target terminal.

Field Key:

4 = IPv4

6 = IPv6

Data value (hexadecimal): 00 00 00 00 00 00

Data values in other bases:

Not Applicable

ARP PDU > *Target Protocol Address* for the selected ARP PDU

Field Name: *Target Protocol Address*

Purpose and Definition: Target Protocol Address is the protocol of the sender's computer that is used to identify the targets protocol.

Field Key:

4 = IPv4

6 = IPv6

Data value (decimal): 192.168.0.145

Data values in other bases:

Hexadecimal	C	0	A	8
Binary	1100	0000	1010	1000
Decimal	192		168	

Hexadecimal	0	0	9	1
Binary	0000	0000	1001	0001
Decimal	0		145	

2.5 User Commands – SSH (AKA "Clickable Buttons")

IP PDU
IP Version
Internet Header Length
Type of Service
Total Length of Ethernet Frame
Identification
Flags
Fragment Offset
Time to Live
Protocol
Header Checksum
Source IP Address
Destination IP Address
Options
Data

TCP PDU
Source Port Number
Destination Port Number
Sequence Number
Acknowledgement Number
Header Lengths
Reserved
Window Size
TCP Checksum
Urgent Pointer
Options
Data

SSH PDU
Source Port Number
Destination Port Number
Sequence Number
Acknowledgement Number
Header Length
Reserved
Window Size
SSH Checksum
Urgent Pointer
Options
Data

2.5.1 IP PDU for the selected SSH PDU

IP PDU > *IP Version* for the selected SSH PDU

Field Name: *IP Version*

Purpose and Definition: Version is a 4-bit field that indicates the format of the Internet header.

Field Key: 4 = IPv4
6 = IPv6

Data value (decimal): 4

Data values in other bases:

Hexadecimal	4
Binary	0100
Decimal	4

IP PDU > *Internet Header Length* for the selected SSH PDU

Field Name: *Internet Header Length*

Purpose and Definition: The IHL field is a 4-bit field indicating the length of the internet header in 32 bit words, and thus points to the beginning of the data. The minimum value of a correct header is 5.

Field Key: *Not applicable*

Data value: The value contained in our field is 20 bytes. This is the hexadecimal and decimal value of 5 multiplied by 4 bits.

Data values in other bases:

Hexadecimal	5
Binary	0101
Decimal	5

IP PDU > *Type of Service* for the selected SSH PDU

Field Name: *Type of Service*

Purpose and Definition: Type of Service is an 8-bit field that provides and indication of the abstract parameters of the quality of service desired. These parameters guide the selection of the actual service parameters when transmitting a datagram through a particular network.

Field Key: The major choice is a three-way tradeoff between low-delay, high-reliability, and high-throughput.

0	1	2	3	4	5	6	7
Precedence			D	T	R	0	0

Bits 0-2: Precedence

Bit 3: (D)	0 = Normal Delay	1 = Low Delay
Bit 4: (T)	0 = Normal Throughput	1 = High Throughput
Bit 5: (R)	0 = Normal Reliability	1 = High Reliability

Precedence:

111 = Network Control
110 = Internetwork Control
101 = CRITIC/ECP
100 = Flash Overrided
011 = Flash
010 = Immediate
001 = Priority
000 = Routine

Data value (hexadecimal): 00

Data values in other bases:

Hexadecimal	0	0
Binary	0000	0000
Decimal	0	

IP PDU > *Total Length of Ethernet Frame* for the selected SSH PDU

Field Name: *Total Length of Ethernet Frame*

Purpose and Definition: Total Length is a 16-bit field that indicates the length of the frame, measured in octets, including internet header and data. The maximum size is 2^{16}-1 or 65,535 octets; however, the recommended maximum size is 576 octets.

Field Key: *Not applicable*

Data values (hexadecimal): 00 64

Data values in other bases:

Hexadecimal	0	0	6	4
Binary	0000	0000	0110	0100
Decimal	0		100	

IP PDU > *Identification* for the selected SSH PDU

Field Name: *Identification*

Purpose and Definition: Identification is a 16-bit field. An identifying value is assigned by the sender to aid in assembling the fragments of a datagram. The identifier is chosen based on the need to provide a way to uniquely identify the fragments and protocol for the time the datagram or any fragment could be alive in the internet.

Field Key: *Not applicable*

Data value (hexadecimal): 30 CA

Data values in other bases:

Hexadecimal	3	0	C	A
Binary	0011	0000	1100	1010

IP PDU > *Flags* for the selected SSH PDU

Field Name: *Flags*

Purpose and Definition: Flags is a 3-bit field that indicates directions for fragmentation.

Field Key:

Bit 0: reserved, must be 0		
Bit 1: (DF)	0 = May Fragment	1 = Don't Fragment
Bit 2: (MF)	0 = Last Fragment	1 = More Fragment

Data value (binary): 001

Data values in other bases: *Not applicable*

IP PDU > *Fragment Offset* for the selected SSH PDU

Field Name: *Fragment Offset*

Purpose and Definition: The Fragment Offset is a 13- bit field indicating where in the Ethernet frame this fragment begins. The Fragment Offset is measured in units of 8 octets, and the first fragment has offset 0.

Field Key: *Not applicable*

Data value (decimal): 0

Data values in other bases:
Binary: 0 0000 0000 0000

IP PDU > *Time to Live* for the selected SSH PDU

Field Name: *Time to Live*

Purpose and Definition: Time to Live is an 8-bit field that indicates the maximum time the datagram is allowed to remain in the internet. If this field contains the value 0, then the datagram must be destroyed. This field is modified in internet header processing. The time is measure in units of seconds, and is set by the sender to the maximum time the datagram is allowed to be in the internet. This field is decreased at each point that the internet header is processed. The intention is to cause undeliverable packets to be discarded, and to bind the maximum datagram lifetime.

Field Key: *Not applicable*

Data value (decimal): 64

Data values in other bases:

Hexadecimal	4	0
Binary	0100	0000
Decimal	64	

IP PDU > *Protocol* for the selected SSH PDU

Field Name: *Protocol*

Purpose and Definition: Protocol is an 8-bit field that indicates the next level protocol that is used in the data portion of the internet diagram.

Field Key:

Dec	Hex	Protocol	Dec	Hex	Protocol
0	00	Reserved	22	16	Multiplexing
1	01	ICMP	23	17	DCN
2	02	Unassigned	24	18	TAC Monitoring
3	03	Gateway-to-Gateway	25-76	19-4C	Unassigned
4	04	CMCC Gateway Monitoring Message	77	4D	Any local network
5	05	ST	100	64	SATNET and Backroom EXPAK
6	06	TCP	101	65	MIT Subnet Support
7	07	UCL	102-104	66-68	Unassigned
10	0A	Unassigned	105	69	SATNET Monitoring
11	0B	Secure	106	6A	Unassigned
12	0C	BBN RCC Monitoring	107	6B	Internet Packet Core Utility
13	0D	NVP	110-113	6E-71	Unassigned
14	0E	PUP	114	72	Backroom SATNET Monitoring
15	0F	Pluribus	115	73	Unassigned
16	10	SSH	116	74	WIDEBAND Monitoring
17	11	XNET	117	75	WIDEBAND EXPAK
20	14	Chaos	120-376	78-0178	Unassigned
21	15	User Datagram	377	0179	Reserved

Data value (hexadecimal): 06

Data values in other bases:

Hexadecimal	0	6
Binary	0000	0110
Decimal	6	

RFC Link: http://www.faqs.org/rfcs/rfc790.html

IP PDU > *Header Checksum* for the selected SSH PDU

Field Name: *Header Checksum*

Purpose and Definition: The Header Checksum is a 16-bit field. The Checksum is the 16-bit one's complement sum of all 16-bit words in the header. For purposes of computing the checksum, the initial value of its field is zero. When both header checksums are equal, then the header bits are correct. If either checksums vary, then a new, correct packet will need to be sent.

This is a simple way to compute the checksum and experimental evidence indicates that it is adequate, but it is provisional and may be replaced by a CRC procedure, depending on further experience.

Field Key: *Not applicable*

Data value (hexadecimal): 87 AE

Data values in other bases:

Hexadecimal	8	7	A	E
Binary	1000	0111	1010	1110

IP PDU > *Source Address* for the selected SSH PDU

Field Name: *Source Address*

Purpose and Definition: The Source Address is a 32-bit field that contains the IP address of the host that sent the IP Packet.

Field Key: *Not applicable*

Data value (decimal): 192.168.0.101

Data values in other bases:

Hexadecimal	C	0	A	8	0	0	6	5
Binary	1100	0000	1010	1000	0000	0000	0110	0101
Decimal	192		168		0		101	

IP PDU > *Destination Address* for the selected SSH PDU

Field Name: *Destination Address*

Purpose and Definition: The Destination Address is a 32-bit field that contains the address of the host that is to receive the data contained within the IP packet.

Field Key: *Not applicable*

Data value (decimal): 192.168.0.39

Data values in other bases:

Hexadecimal	C	0	A	8	0	0	2	7
Binary	1100	0000	1010	1000	0000	0000	0010	0111
Decimal	192		168		0		39	

2.5.2 TCP PDU for the selected SSH PDU

IP > TCP PDU > *Source Port* for the selected SSH PDU

Field Name: *Source Port*

Purpose and Definition:
This 16-bit number represents the name of the application that sent the data in the IP packet.

Field Key: *Not applicable*

Data value: 1243

Data values in other bases:

Hexadecimal	0	4	D	B
Binary	0000	0100	1101	1011
Decimal	1243			

IP > TCP PDU > *Destination Port* for the selected SSH PDU

Field Name: *Destination Port*

Purpose and Definition:
This 16-bit number represents the name of the application that is to receive the data contained within the IP packet. This is one of the major differences between a Layer 3 and a Layer 4 header: the Layer 3 header contains the IP address of the computer that is to receive the IP packet; once that packet has been received, the port address in the Layer 4 header ensures that the data contained within that IP packet is passed to the correct application on that computer.

Field Key:
This key indicates assigned port number values:

Dec	**Port Numbers**
0	Reserved
1-32767	Internet registered ("well-known") protocols
32768-98303	Reserved, to allow TCPv7-TCPv4 conversion
98304 & up	Dynamic assignment

Data value (decimal): 1243

Data values in other bases:

Hexadecimal	0	4	D	B
Binary	0000	0100	1101	1011
Decimal	1243			

Source: http://www.zvon.org/tmRFC/RFC1475/Output/chapter4.html

IP > TCP PDU > *Sequence Number* for the selected SSH PDU

Field Name: *Sequence Number*

Purpose and Definition:
TCP is responsible for ensuring that all IP packets sent are actually received. When an application's data is packaged into IP packets, TCP will give each IP packet a sequence number. Once all the packets have arrived at the receiving computer, TCP uses the number in this 32-bit field to ensure that all of the packets actually arrived and are in the correct sequence.

Field Key: *Not applicable*

Data value (decimal): 4008673261

Data values in other bases:

Hexadecimal	E	E	E	F	7	F	E	D
Binary	1110	1110	1110	1111	0111	1111	1110	1101
Decimal	238		239		127		237	

IP > TCP PDU > *Acknowledgement Number* for the selected SSH PDU

Field Name: *Acknowledgement Number*

Purpose and Definition:
This number is used by the receiving computer to acknowledge which packets have successfully arrived. This number will be the sequence number of the next packet the receiver is ready to receive.

Field Key: *Not applicable*

Data value: 3798775616

Data values in other bases:

Hexadecimal	E	2	6	C	B	7	4	0
Binary	1110	0010	0110	1100	1011	0111	0100	0000
Decimal	226		108		183		64	

IP > TCP PDU > *Header Length or Offset* for the selected SSH PDU

Field Name: *Header Length or Offset*

Purpose and Definition:
This is identical in concept to the header length in an IP packet, except this time it indicates the length of the TCP header.

Field Key: *Not applicable*

Data value (bytes): 32

Data values in other bases:

Hexadecimal	8	0
Binary	1000	0000
Decimal	128	

IP > TCP PDU > *Control Flags* for the selected SSH PDU

Field Name: *Control Flags*

Purpose and Definition:
Every TCP packet contains this 6-bit value that indicates how many octets it can receive at once. When IP packets are received, they are placed in a temporary area of RAM known as a buffer until the receiving computer has a chance to process them; this value represents how big a buffer the receiving host has made available for this temporary storage of IP packets.

Field Key:

- Urgent (URG)
- Acknowledgement (ACK)
- Push (PSH)
- Reset (RST)
- Synchronize (SYN)
- Finish (FIN)

Data value (binary): 0001 1000

Data values in other bases:

Hexadecimal	1	8
Binary	0001	1000
Decimal	24	

IP > TCP PDU > *Window Size* for the selected SSH PDU

Field Name: *Window Size*

Purpose and Definition:
Every TCP packet contains this 16-bit value that indicates how many octets it can receive at once. When IP packets are received, they are placed in a temporary area of RAM known as a buffer until the receiving computer has a chance to process them; this value represents how big a buffer the receiving host has made available for this temporary storage of IP packets.

Field Key: *Not applicable*

Data value (decimal): 32120

Data values in other bases:

Hexadecimal	7	D	7	8
Binary	0111	1101	0111	1000
Decimal	125		120	

IP > TCP PDU > *Checksum* for the selected SSH PDU

Field Name: *Checksum*

Purpose and Definition:
Unlike IP, TCP is responsible for ensuring that the entire IP packet arrived intact. TCP will run a CRC on the entire IP packet (not just the header) and place the resulting checksum in this field. When the IP packet is received, TCP re-runs the CRC on the entire packet to ensure the checksum is the same.

Field Key: *Not applicable*

Data value (hexadecimal): 8B CA

Data values in other bases:

Hexadecimal	8	B	C	A
Binary	1000	1011	1100	1010
Decimal	139		202	

IP > TCP PDU > *Options and Padding* for the selected SSH PDU

Field Name: *Options and Padding*

Purpose and Definition:
Like IP options, this field is optional and represents additional instructions not covered in the other TCP fields. Again, if an option does not fill up a 32-bit word, it will be filled in with padding bits.

Field Key: *Not applicable*

Data value (hexadecimal): 01 01 08 0A 0B D1 8D EC 1A AC 06 AB

Data values in other bases:

Hexadecimal	0	1	0	1
Binary	0000	0001	0000	0001

IP > TCP PDU > *Timestamp* for the selected SSH PDU

Field Name: *Timestamp*

Purpose and Definition:
Unlike IP, TCP is responsible for ensuring that the entire IP packet arrived intact. TCP will run a CRC on the entire IP packet (not just the header) and place the resulting checksum in this field. When the IP packet is received, TCP re-runs the CRC on the entire packet to ensure the checksum is the same.

Field Key:
This key indicates assigned flag options:

Dec	**Port Numbers**
0	time stamps only, stored in consecutive 32-bit words,
1	each timestamp is preceded with internet address of the registering entity,
3	the internet address fields are pre-specified. An IP module only registers its timestamp if it matches its own address with the next specified internet address.

Data value (hexadecimal): 08 0A 14 42 6F 30 27 47 32 1F

Data values in other bases:

Hexadecimal	0	8	0	A	1	4	4	2	6	F
Binary	0000	1000	0000	1010	0001	0100	0100	0010	0110	1111
Decimal	8		10		20		66		111	
ASCII	©		©		©		B		o	

Hexadecimal	3	0	2	7	4	7	3	2	1	F
Binary	0011	0000	0010	0111	0100	0111	0011	0010	0001	1111
Decimal	48		39		71		50		31	
ASCII	0		‘		G		2		©	

2.5.3 SSH PDU for the selected SSH PDU

IP >TCP > SSH PDU for the SSH Packet

RFC Link: http://www.ietf.org/rfc/rfc0959.txt?number=959

PASS (Password)

The argument field is a SSH string specifying the user's password. This command must be immediately preceded by the user name command, and, for some sites, completes the user's identification for access control. All information below is encrypted.

What is Contained in the Packet
Request: PASS

Data Values (hexadecimal): 03 B6 51 11 6A 46 12 36 4F 46 C9 63 B1 A4 B5 48 A2 BA 68 1C 42 17 AB D2 CE 8E 6D 3F 49 7E EB 36 A0 1B 16 62 E4 0F D7 55 DD 5F EB 52 64 B9 A7 62

Data Values in Other Bases

Hexadecimal	0	3	B	6	5	1	1	1	6	A
Binary	0000	0011	1011	0110	0101	0001	0001	0001	0110	1010
Decimal	3		182		81		17		106	
ASCII	©		↑		Q		©		j	

Hexadecimal	4	6	1	2	3	6	4	F	4	6
Binary	0100	0110	0001	0010	0011	0110	0100	1111	0100	0110
Decimal	70		18		54		79		70	
ASCII	F		©		6		O		F	

Hexadecimal	C	9	6	3	B	1	A	4	B	5
Binary	1100	1001	0110	0011	1011	0001	1010	0100	1011	0101
Decimal	201		99		177		164		181	
ASCII	↑		c		↑		↑		↑	

Hexadecimal	4	8	A	2	B	A	6	8	1	C
Binary	0100	1000	1010	0010	1011	1010	0110	1000	0001	1000
Decimal	72		162		178		104		28	
ASCII	H		↑		↑		H		©	

Hexadecimal	4	2	1	7	A	B	D	2	C	E
Binary	0100	0010	0001	0111	1010	1011	1101	0010	1100	1110
Decimal	66		23		171		210		206	
ASCII	B		©		↑		↑		↑	

Hexadecimal	8	E	6	D	3	F	4	9	7	E
Binary	1000	1110	0110	1101	0011	1111	0100	1001	0111	1110
Decimal	142		109		63		73		126	
ASCII	↑		m		?		I		~	

Hexadecimal	E	B	3	6	A	0	1	B	1	6
Binary	1110	1011	0011	0110	1010	0000	0001	1011	0001	0110
Decimal	235		54		160		27		22	
ASCII	↑		6		↑		©		©	

Hexadecimal	6	2	E	4	0	F	D	7	5	5
Binary	0110	0010	1110	0100	0000	1111	1101	0111	0101	0101
Decimal	98		228		15		215		85	
ASCII	b		↑		©		↑		U	

Hexadecimal	D	D	5	F	E	B	5	2	6	4
Binary	1101	1101	0101	1111	1110	1011	0101	0010	0110	0100
Decimal	221		95		235		82		100	
ASCII	↑		_		↑		R		d	

Hexadecimal	B	9	A	7	6	2
Binary	1011	1001	1010	0111	0110	0010
Decimal	185		167		98	
ASCII	↑		↑		b	

2.6 User Commands (AKA “Clickable Buttons”)

IP PDU
IP Version
Internet Header Length
Type of Service
Total Length of Ethernet Frame
Identification
Flags
Fragment Offset
Time to Live
Protocol
Header Checksum
Source IP Address
Destination IP Address
Options
Data

UDP PDU
Source Port
Destination Port
Length
UDP Checksum
Data

2.6.1 IP PDU for the selected UDP PDU

IP PDU > *IP Version* for the selected UDP PDU

Field Name: *IP Version*

Purpose and Definition: Version is a 4-bit field that indicates the format of the Internet header.

Field Key: 4 = IPv4
6 = IPv6

Data value (decimal): 4

Data values in other bases:

Hexadecimal	4
Binary	0100
Decimal	4

IP PDU > *Internet Header Length* for the selected UDP PDU

Field Name: *Internet Header Length*

Purpose and Definition: The IHL field is a 4-bit field indicating the length of the Internet header in 32 bit words, and thus points to the beginning of the data. The minimum value of a correct header is 5.

Field Key: *Not applicable*

Data value: The value contained in our field is 20 bytes. This is the hexadecimal and decimal value of 5 multiplied by 4 bits.

Data values in other bases:

Hexadecimal	0	5
Binary	0000	0101
Decimal	5	

IP PDU > *Type of Service* for the selected UDP PDU

Field Name: *Type of Service*

Purpose and Definition: Type of Service is an 8-bit field that provides and indication of the abstract parameters of the quality of service desired. These parameters guide the selection of the actual service parameters when transmitting a datagram through a particular network.

Field Key: The major choice is a three-way tradeoff between low-delay, high-reliability, and high-throughput.

0 1 2	3	4	5	6	7
Precedence	D	T	R	0	0

Bits 0-2: Precedence
Bit 3: (D) 0 = Normal Delay 1 = Low Delay
Bit 4: (T) 0 = Normal Throughput 1 = High Throughput
Bit 5: (R) 0 = Normal Reliability 1 = High Reliability

Precedence:

111 = Network Control
110 = Internetwork Control
101 = CRITIC/ECP
100 = Flash Override
011 = Flash
010 = Immediate
001 = Priority
000 = Routine

Data value (hexadecimal): 10

Data values in other bases:

Hexadecimal	1	0
Binary	0001	0000
Decimal	16	

IP PDU > *Total Length of Ethernet Frame* for the selected UDP PDU

Field Name: *Total Length of Ethernet Frame*

Purpose and Definition: Total Length is a 16-bit field that indicates the length of the frame, measured in octets, including Internet header and data. The maximum size is 2^{16}-1 or 65,535 octets; however, the recommended maximum size is 576 octets.

Field Key: *Not applicable*

Data values (hexadecimal): 128

Data values in other bases:

Hexadecimal	0	1	2	8
Binary	0000	0001	0010	1000
Decimal	1		40	

IP PDU > *Identification* for the selected UDP PDU

Field Name: *Identification*

Purpose and Definition: Identification is a 16-bit field. An identifying value is assigned by the sender to aid in assembling the fragments of a datagram. The identifier is chosen based on the need to provide a way to uniquely identify the fragments and protocol for the time the datagram or any fragment could be alive in the Internet.

Field Key: *Not applicable*

Data value (hexadecimal): BBD7

Data values in other bases:

Hexadecimal	B	B	D	7
Binary	1011	1011	1101	0111

IP PDU > *Flags* for the selected UDP PDU

<u>Field Name:</u> *Flags*

<u>Purpose and Definition:</u> Flags is a 3-bit field that indicates directions for fragmentation.

<u>Field Key:</u>
Bit 0: reserved, must be 0
Bit 1: (DF) 0 = May Fragment 1 = Don't Fragment
Bit 2: (MF) 0 = Last Fragment 1 = More Fragment

<u>Data value (binary):</u> 0000

<u>Data values in other bases:</u> *Not applicable*

IP PDU > *Fragment Offset* for the selected UDP PDU

Field Name: *Fragment Offset*

Purpose and Definition: The Fragment Offset is a 13- bit field indicating where in the Ethernet frame this fragment begins. The Fragment Offset is measured in units of 8 octets, and the first fragment has offset 0.

Field Key: *Not applicable*

Data value (decimal): 0

Data values in other bases:
Binary: 0000 0000

IP PDU > *Time to Live* for the selected UDP PDU

Field Name: *Time to Live*

Purpose and Definition: Time to Live is an 8-bit field that indicates the maximum time the datagram is allowed to remain in the Internet. If this field contains the value 0, then the datagram must be destroyed. This field is modified in Internet header processing. The time is measure in units of seconds, and is set by the sender to the maximum time the datagram is allowed to be in the Internet. This field is decreased at each point that the Internet header is processed. The intention is to cause undeliverable packets to be discarded, and to bind the maximum datagram lifetime.

Field Key: *Not applicable*

Data value (decimal): 64

Data values in other bases:

Hexadecimal	4	0
Binary	0100	0000
Decimal	64	

IP PDU > *Time to Live* for the selected UDP PDU

Field Name: *Time to Live*

Purpose and Definition: Time to Live is an 8-bit field that indicates the maximum time the datagram is allowed to remain in the Internet. If this field contains the value 0, then the datagram must be destroyed. This field is modified in Internet header processing. The time is measure in units of seconds, and is set by the sender to the maximum time the datagram is allowed to be in the Internet. This field is decreased at each point that the Internet header is processed. The intention is to cause undeliverable packets to be discarded, and to bind the maximum datagram lifetime.

Field Key: *Not applicable*

Data value (decimal): 64

Data values in other bases:

Hexadecimal	4	0
Binary	0100	0000
Decimal	64	

IP PDU > *Protocol* for the selected UDP PDU

Field Name: *Protocol*

Purpose and Definition: Protocol is an 8-bit field that indicates the next level protocol that is used in the data portion of the Internet diagram.

Field Key:

Dec	Hex	Protocol	Dec	Hex	Protocol
0	00	Reserved	22	16	Multiplexing
1	01	ICMP	23	17	DCN
2	02	Unassigned	24	18	TAC Monitoring
3	03	Gateway-to-Gateway	25-76	19-4C	Unassigned
4	04	CMCC Gateway Monitoring Message	77	4D	Any local network
5	05	ST	100	64	SATNET and Backroom EXPAK
6	06	TCP	101	65	MIT Subnet Support
7	07	UCL	102-104	66-68	Unassigned
10	0A	Unassigned	105	69	SATNET Monitoring
11	0B	Secure	106	6A	Unassigned
12	0C	BBN RCC Monitoring	107	6B	Internet Packet Core Utility
13	0D	NVP	110-113	6E-71	Unassigned
14	0E	PUP	114	72	Backroom SATNET Monitoring
15	0F	Pluribus	115	73	Unassigned
16	10	Telnet	116	74	WIDEBAND Monitoring
17	11	XNET	117	75	WIDEBAND EXPAK
20	14	Chaos	120-376	78-0178	Unassigned
21	15	User Datagram	377	0179	Reserved

Data value (hexadecimal): 11

Data values in other bases:

Hexadecimal	1	1
Binary	0001	0001
Decimal	17	

RFC Link: http://www.faqs.org/rfcs/rfc790.html

IP PDU > *Header Checksum* for the selected UDP PDU

Field Name: *Header Checksum*

Purpose and Definition: The Header Checksum is a 16-bit field. The Checksum is the 16-bit one's complement sum of all 16-bit words in the header. For purposes of computing the checksum, the initial value of its field is zero. When both header checksums are equal, then the header bits are correct. If either checksums vary, then a new, correct packet will need to be sent.

This is a simple way to compute the checksum and experimental evidence indicates that it is adequate, but it is provisional and may be replaced by a CRC procedure, depending on further experience.

Field Key: *Not applicable*

Data value (hexadecimal): 3F 47

Data values in other bases:

Hexadecimal	3	F	4	7
Binary	0011	1111	0100	0111

IP PDU > *Source Address* for the selected UDP PDU

Field Name: *Source Address*

Purpose and Definition: The Source Address is a 32-bit field that contains the IP address of the host that sent the IP Packet.

Field Key: *Not applicable*

Data value (decimal): 192.168.0.71

Data values in other bases:

Hexadecimal	C	0	A	8	0	0	4	7
Binary	1100	0000	1010	1000	0000	0000	0100	0111
Decimal	192		168		0		71	

IP PDU > *Destination Address* for the selected UDP PDU

Field Name: *Destination Address*

Purpose and Definition: The Destination Address is a 32-bit field that contains the address of the host that is to receive the data contained within the IP packet.

Field Key: *Not applicable*

Data value (decimal): 192.168.0.255

Data values in other bases:

Hexadecimal	C	0	A	8	0	0	F	F
Binary	1100	0000	1010	1000	0000	0000	1111	1111
Decimal	192		168		0		255	

IP PDU > *Options and Padding* for the selected UDP PDU

Field Name: *Options and Padding*

Purpose and Definition: The options may or may not appear in Ethernet packets. They must be implemented by all IP modules (host and gateways). What is optional is their transmission in any particular packet, not their implementation.

The option field is variable in length. There may be zero or more options. There are two cases for the format of an option.

Case 1: A single octet of option type
Case 2: An option-type octet, an option-length octet, and the actual option-data octets.

Field Key: *Not applicable*

Data values: *Not applicable*

Data values in other bases: *Not applicable*

IP PDU > *Data* for the selected UDP PDU

Field Name: *Data*

Purpose and Definition: The Data is a variable length field, which contains the actual data that is being sent from one host to another. The data field may start with a Layer 4 header, which will give additional instructions to the application that will be receiving the data; alternately, it may be an ICMP header and not contain any user data at all.

Field Key: *Not applicable*

Data values (hexadecimal) : (UDP) FF FF FF FF FF FF 08 00 69 07 9A C5 08 00 45 10
01 28 BB D7 00 00 3C 11 3F 47 C0 A8 00 47 C0 A8 00 FF 02 0D 01 14 E9 DB 18 01
C2 5A 0A FF 13 D0 00 00 00 00 69 6E 64 79 00 00 00 00 7F FF 11 DB 00 00 00 00 00
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 7F FF 13 F0 00
00 00 00 7F FF 11 F6 00 00 00 00 00 00 00 00 00 00 00 00 7F FF FF FF 00 00 00 00 00
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
00 00 00 00 00 09 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 7F FF
17 E3 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
00 00 00 00 00 00 00 00 00 00 00 00 00 09 00 00 00 10 05 9D D8 00 00 00 00 10 00 DB
A8 00 00 00 00 0F B5 B1 74 00 00 00 00 0F AB 01 C8 00 00 00 00 10 05 9D F8 00 00
00 00 0F B5 9D D8 00 00 00 00 10 05 9D FC 00 00 00 00 0F B5 B1 74 00 00 00 00 10
05 9B 18 00 00 00 00 0F AB 02 80 00 00 00 00 00 00 00 00 00 00 00 00 00 00

Data values in other bases:
ASCII: (UDP) ↑ Extended ASCII

IP PDU > *Source Port* for the selected UDP PDU

RFC Link: http://www.ietf.org/rfc/rfc0768.txt?number=768

Field Name: *Source Port*

Purpose and Definition: Source Port is an optional field, when meaningful, it indicates the port of the sending process, and may be assumed to be the port to which a reply should be addressed in the absence of any other information. If not used, a value of zero is inserted.

Field Key: *Not applicable*

Data value (decimal): 45

Data values in other bases:

Hexadecimal	02	0D
Binary	0010	1101
Decimal	45	

IP PDU > *Destination Port* for the selected UDP PDU

Field Name: *Destination Port*

Purpose and Definition: Destination Port has a meaning within the context of a particular Internet destination address.

Field Key: *Not applicable*

Data value (decimal): 45

Data values in other bases:

Hexadecimal	02	0D
Binary	0010	1101
Decimal	45	

IP PDU > *Length* for the selected UDP PDU

Field Name: *Length*

Purpose and Definition: Length is the length in octets of this user datagram including this header and the data (This means the minimum value of the length is eight).

Field Key: *Not applicable*

Data value (decimal): 280

Data values in other bases:

Hexadecimal	01	01	08
Binary	0001	0001	1000
Decimal	280		

IP PDU > *Checksum* for the selected UDP PDU

Field Name: *Checksum*

Purpose and Definition: Checksum is the 16-bit one's complement of the one's complement sum of a pseudo header of information from the IP header, the UDP header, and the data, padded with zero octets at the end (if necessary) to make a multiple of two octets.

Field Key: *Not applicable*

Data value (decimal): E9 DB

Data values in other bases:

Hexadecimal	E	9	D	B
Binary	1110	1001	1101	1011

IP PDU > *Data* for the selected UDP PDU

Field Name: *Data*

Purpose and Definition:

Field Key: *Not applicable*

Data value (hexadecimal): 18 01 C2 5A 0A FF 13 D0 00 00 00 00 69 6E 64 79 00 00 00 00 7F FF 11 DB 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 7F FF 13 F0 00 00 00 00 7F FF 11 F6 00 00 00 00 00 00 00 00 00 00 00 00 7F FF FF FF 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 09 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 7F FF 17 E3 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 09 00 00 00 10 05 9D D8 00 00 00 00 10 00 DB A8 00 00 00 00 0F B5 B1 74 00 00 00 00 0F AB 01 C8 00 00 00 00 10 05 9D F8 00 00 00 00 0F B5 9D D8 00 00 00 00 10 05 9D FC 00 00 00 00 0F B5 B1 74 00 00 00 00 10 05 9B 18 00 00 00 00 0F AB 02 80 00 00 00 00 00 00 00 00 00 00 00 00 00 00

Data values in other bases:
(ASCII): ↑ Extended ASCII

2.6.2 UDP PDU for the selected UDP PDU

IP > UDP Header> *Source Port* for the selected UDP PDU

RFC Link: http://www.ietf.org/rfc/rfc0768.txt?number=768

Field Name: *Source Port*

Purpose and Definition: Source Port is an optional field, when meaningful, it indicates the port of the sending process, and may be assumed to be the port to which a reply should be addressed in the absence of any other information. If not used, a value of zero is inserted.

Field Key: *Not applicable*

Data value (decimal): 45

Data values in other bases:

Hexadecimal	02	0D
Binary	0010	1101
Decimal	45	

IP > UDP Header > *Destination Port* for the selected UDP PDU

Field Name: *Destination Port*

Purpose and Definition: Destination Port has a meaning within the context of a particular internet destination address.

Field Key: *Not applicable*

Data value (decimal): 45

Data values in other bases:

Hexadecimal	02	0D
Binary	0010	1101
Decimal	45	

IP > UDP Header> *Length* for the selected UDP PDU

Field Name: *Length*

Purpose and Definition: Length is the length in octets of this user datagram including this header and the data (This means the minimum value of the length is eight).

Field Key: *Not applicable*

Data value (decimal): 280

Data values in other bases:

Hexadecimal	01	01	08
Binary	0001	0001	1000
Decimal	280		

IP > UDP Header > *Checksum* for the selected UDP PDU

Field Name: *Checksum*

Purpose and Definition: Checksum is the 16-bit one's complement of the one's complement sum of a pseudo header of information from the IP header, the UDP header, and the data, padded with zero octets at the end (if necessary) to make a multiple of two octets.

Field Key: *Not applicable*

Data value (decimal): E9 DB

Data values in other bases:

Hexadecimal	E	9	D	B
Binary	1110	1001	1101	1011

IP > UDP Header > *Data* for the selected UDP PDU

Field Name: *Data*

Purpose and Definition:

Field Key: *Not applicable*

Data value (hexadecimal): 18 01 C2 5A 0A FF 13 D0 00 00 00 00 69 6E 64 79 00 00 00
00 7F FF 11 DB 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
00 00 00 00 00 7F FF 13 F0 00 00 00 00 7F FF 11 F6 00 00 00 00 00 00 00 00 00 00 00
00 7F FF FF FF 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 09 00 00 00 00 00 00 00 00 00 00 00 00
00 00 00 00 00 00 00 00 7F FF 17 E3 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 09 00 00 00 10 05
9D D8 00 00 00 00 10 00 DB A8 00 00 00 00 0F B5 B1 74 00 00 00 00 0F AB 01 C8 00
00 00 00 10 05 9D F8 00 00 00 00 0F B5 9D D8 00 00 00 00 10 05 9D FC 00 00 00 00
0F B5 B1 74 00 00 00 00 10 05 9B 18 00 00 00 00 0F AB 02 80 00 00 00 00 00 00 00 00
00 00 00 00 00 00

Data values in other bases:
(ASCII): ↑ Extended ASCII

2.7 User Commands – PING (AKA "Clickable Buttons")

IP PDU
IP Version
Internet Header Length
Type of Service
Total Length of Ethernet Frame
Identification
Flags
Fragment Offset
Time to Live
Protocol
Header Checksum
Source IP Address
Destination IP Address
Options
Data

ICMP PDU
Type
Code
ICMP Checksum
Identifier
Data

PING PDU
Type
Code
PING Checksum
Identifier
Sequence Number
Data

2.7.1 IP PDU for the selected PING PDU

IP PDU > *Differentiated Services Field* for the selected PING

RFC Link: http://www.ietf.org/rfc/rfc0768.txt?number=768

Field Name: *Differentiated Services Field*

Purpose and Definition: Type of Service is an 8-bit field that provides and indication of the abstract parameters of the quality of service desired. These parameters guide the selection of the actual service parameters when transmitting a datagram through a particular network.

Field Key: The major choice is a three-way tradeoff between low-delay, high-reliability, and high-throughput.

0 1 2	3	4	5	6	7
Precedence	D	T	R	0	0

Bits 0-2: Precedence

Bit 3: (D)	0 = Normal Delay	1 = Low Delay
Bit 4: (T)	0 = Normal Throughput	1 = High Throughput
Bit 5: (R)	0 = Normal Reliability	1 = High Reliability

Precedence:

111 = Network Control
110 = Internetwork Control
101 = CRITIC/ECP
100 = Flash Overrided
011 = Flash
010 = Immediate
001 = Priority
000 = Routine

Data value (decimal): 0

Data values in other bases:

Hexadecimal	0	0
Binary	0000	0000
Decimal	0	

IP PDU> *Flags* for the selected PING

Field Name: ***Flags***

Purpose and Definition: Flags is a 3-bit field that indicates directions for fragmentation.

Field Key:
Bit 0: reserved, must be 0
Bit 1: (DF) 0 = May Fragment 1 = Don't Fragment
Bit 2: (MF) 0 = Last Fragment 1 = More Fragment

Data value (hexadecimal): 4

Data values in other bases:

Hexadecimal	0	4
Binary	0000	0100
Decimal	4	

IP PDU> *Fragment offset* for the selected PING

Field Name: *Fragment offset*

Purpose and Definition: The Fragment Offset is a 13- bit field indicating where in the Ethernet frame this fragment begins. The Fragment Offset is measured in units of 8 octets, and the first fragment has offset 0.

Field Key: *Not applicable*

Data value (decimal): 0

Data values in other bases:
Binary: 0 0000 0000 0000

IP PDU > *Time to Live* for the selected PING

Field Name: *Time to Live*

Purpose and Definition: Time to Live is an 8-bit field that indicates the maximum time the datagram is allowed to remain in the Internet. If this field contains the value 0, then the datagram must be destroyed. This field is modified in Internet header processing. The time is measure in units of seconds, and is set by the sender to the maximum time the datagram is allowed to be in the Internet. This field is decreased at each point that the Internet header is processed. The intention is to cause undeliverable packets to be discarded, and to bind the maximum datagram lifetime.

Field Key: *Not applicable*

Data value (decimal): 40

Data values in other bases:

Hexadecimal	2	8
Binary	0010	1000
Decimal	40	

IP PDU> *Protocol* for the selected PING

Field Name: *Protocol*

Purpose and Definition: Protocol is an 8-bit field that indicates the next level protocol that is used in the data portion of the Internet diagram.

Field Key:

Dec	Hex	Protocol	Dec	Hex	Protocol
0	00	Reserved	22	16	Multiplexing
1	01	ICMP	23	17	DCN
2	02	Unassigned	24	18	TAC Monitoring
3	03	Gateway-to-Gateway	25-76	19-4C	Unassigned
4	04	CMCC Gateway Monitoring Message	77	4D	Any local network
5	05	ST	100	64	SATNET and Backroom EXPAK
6	06	TCP	101	65	MIT Subnet Support
7	07	UCL	102-104	66-68	Unassigned
10	0A	Unassigned	105	69	SATNET Monitoring
11	0B	Secure	106	6A	Unassigned
12	0C	BBN RCC Monitoring	107	6B	Internet Packet Core Utility
13	0D	NVP	110-113	6E-71	Unassigned
14	0E	PUP	114	72	Backroom SATNET Monitoring
15	0F	Pluribus	115	73	Unassigned
16	10	Telnet	116	74	WIDEBAND Monitoring
17	11	XNET	117	75	WIDEBAND EXPAK
20	14	Chaos	120-376	78-0178	Unassigned
21	15	User Datagram	377	0179	Reserved

Data value (decimal): 1

Data values in other bases:

Hexadecimal	0	1
Binary	0000	0001
Decimal	1	

IP PDU> *Header Checksum* for the selected PING

Field Name: *Header Checksum*

Purpose and Definition: The Header Checksum is a 16-bit field. The Checksum is the 16-bit one's complement sum of all 16-bit words in the header. For purposes of computing the checksum, the initial value of its field is zero. When both header checksums are equal, then the header bits are correct. If either checksums vary, then a new, correct packet will need to be sent.

Field Key: *Not applicable*

Data value (decimal): B8 CC

Data values in other bases:

Hexadecimal	B	8	C	C
Binary	1011	1000	1100	1100

IP PDU> *Source* for the selected PING

Field Name: *Source*

Purpose and Definition: The Source Address is a 32-bit field that contains the IP address of the host that sent the IP Packet.

Field Key: *Not applicable*

Data value (decimal): 192.168.0.39

Data values in other bases:

Hexadecimal	C	0	A	8	0	0	2	7
Binary	1100	0000	1010	1000	0000	0000	0010	0111
Decimal	192		168		0		39	

IP PDU > *Destination* for the selected PING

Field Name: *Destination*

Purpose and Definition: The Destination Address is a 32-bit field that contains the address of the host that is to receive the data contained within the IP packet.

Field Key: *Not applicable*

Data value (decimal): 192.168.0.101

Data values in other bases:

Hexadecimal	C	0	A	8	0	0	6	5
Binary	1100	0000	1010	1000	0000	0000	0110	0101
Decimal	192		168		0		101	

2.7.2 ICMP PDU for the selected PING PDU

IP > ICMP Header > *Type* for the selected PING PDU

Field Name: *Type*

Purpose and Definition: The type is an 8-bit field that identifies what sort of message the ICMP protocol is sending.

Field Key:

Dec	**Hex**	**Message Type**	**Dec**	**Hex**	**Message Type**
0	00	Echo Reply	16	10	Information Reply
1	01	Unassigned	17	11	Address Mask Request
2	02	Unassigned	18	12	Address Mask Reply
3	03	Destination Unreachable	19	13	Reserved (for Security)
4	04	Source Quench	20-29	14-1D	Reserved (for Robustness Experiment)
5	05	Redirect	30	1E	Traceroute
6	06	Alternate Host Address	31	1F	Datagram Conversion Error
7	07	Unassigned	32	20	Mobile Host Redirect
8	08	Echo	33	21	IPv6 Where-Are-You
9	09	Router Advertisement	34	22	IPv6 I-Am-Here
10	0A	Router Solicitation	35	23	Mobile Registration Request
11	0B	Time Exceeded	36	24	Mobile Registration Reply
12	0C	Parameter Problem	37	25	Domain Name Request
13	0D	Timestamp	38	26	Domain Name Reply
14	0E	Timestamp Reply	39	27	SKIP
15	0F	Information Request	40	28	Photuris
			41-255	29-FF	Reserved

Data value: 8 (Echo (ping) Request)

Data values in other bases:

Hexadecimal	0	8
Binary	0000	1000
Decimal	8	

RFC Link: http://www.iana.org/assignments/icmp-parameters

IP > ICMP Header > *Code* for the selected PING PDU

Field Name: *Code*

Purpose and Definition: Code is an 8-bit field that provides further information about the associated type field.

Field Key:

Type	Name
0	Echo Reply (used by “PING”)
	0 No Code
1	Unassigned
2	Unassigned
3	Destination Unreachable
	0 Net Unreachable
	1 Host Unreachable
	2 Protocol Unreachable
	3 Port Unreachable
	5 Fragmentation needed and Don't Fragment was Set
	5 Source Route Failed
	6 Destination Network Unknown
	7 Destination Host Unknown
	8 Source Host Isolated
	13 Communication with Destination Network is Administratively Prohibited
	14 Communication with Destination Host is Administratively Prohibited
	15 Destination Network Unreachable for Type of Service
	16 Destination Host Unreachable for Type of Service
4	Source Quench
	0 No Code
5	Redirect
	0 Redirect Datagram for the Network
	1 Redirect Datagram for the Host
	2 Redirect Datagram for the Type of Service and Network
	4 Redirect Datagram for the Type of Service and Host
6	Alternate Host Address
	0 Alternate Address for Host
7	Unassigned
8	Echo (used by "PING")
	0 No Code
9	Router Advertisement
	0 No Code
10	Router Selection
	0 No Code
11	Time Exceeded
	0 Time to Live exceeded in Transit
	1 Fragment Reassembly Time Exceeded
12	Parameter Problem
	0 Pointer indicates the error
	1 Missing a Required Option
	2 Bad Length
13	Timestamp
	0 No Code
14	Timestamp Reply
	0 No Code
15	Information Request
	0 No Code
16	Information Reply
	0 No Code
17	Address Mask Request
	0 No Code
18	Address Mask Reply
	0 No Code
19	Reserved (for Security)
20-29	Reserved (for Robustness Experiment)
30	Traceroute
31	Datagram Conversion Error
32	Mobile Host Redirect
33	IPv6 Where-Are-You
34	IPv6 I-Am-Here
35	Mobile Registration Request
36	Mobile Registration Reply

Data value (decimal): 0

Data values in other bases:

Hexadecimal	0	0
Binary	0000	0000
Decimal	0	

IP > ICMP Header > *Checksum* for the selected PING PDU

Field Name: *Checksum*

Purpose and Definition: The checksum is the 16-bit one's complement of the one's complement sum of the ICMP message, starting with the ICMP type. For computing the checksum, the checksum field should initially be zero.

Field Key: *Not applicable*

Data value (hexadecimal): C9 15

Data values in other bases:

Hexadecimal	C	9	1	5
Binary	1100	1001	0001	0101
Decimal	201		21	

IP > ICMP Header > *Identifier* for the selected PING PDU

Field Name: *Identifier*

Purpose and Definition: The identifier is a 16-bit field that is used in matching echoes and replies for when the code field is zero.

Field Key: *Not applicable*

Data value (hexadecimal): 70 60

Data values in other bases:

Hexadecimal	7	0	6	0
Binary	0111	0000	0110	0000
Decimal	112		96	

IP > ICMP Header > ***Sequence*** for the selected PING PDU

Field Name: *Sequence*

Purpose and Definition: The sequence is a 16-bit field that is used in matching echoes and replies for when the code field is zero.

Field Key: *Not applicable*

Data value (hexadecimal): 00 00

Data values in other bases:

Hexadecimal	0	0	0	0
Binary	0000	0000	0000	0000
Decimal	0		0	

IP > ICMP Header > *Data* for the selected PING PDU

Field Name: *Data*

Purpose and Definition: The data is a variable-length field that contains the actual information that is sent in the ping packet.

Field Key: *Not applicable*

Data value (hexadecimal): 00 01 03 1E E2 24 00 00 F8 1F 00 85 08 00 45 00 00 54 00 00 40 00 40 01 B8 CC C0 A8 00 27 C0 A8 00 65 08 00 C9 15 70 60 00 00 42 B1 89 3F 00 00 00 00 2C C6 07 00 00 00 00 00 10 11 12 13 14 15 26 27 28 29 2A 2B 2C 2D 2E 2F 30 31 32 33 34 35 36 37

Data values in other bases:

Hexadecimal	0	0	0	1	0	3	1	E	E	2
Binary	0000	0000	0000	0000	000	0011	0001	1110	1110	0010
Decimal	0		1		3		30		226	
ASCII	©		©		©		©		□	

Hexadecimal	2	4	0	0	0	0	F	8	1	F
Binary	0010	0100	0000	0000	0000	0000	1111	1000	0001	1111
Decimal	36		0		0		242		31	
ASCII	$		©		©		□		©	

Hexadecimal	0	0	8	5	0	8	0	0	4	5
Binary	0000	0000	1000	0101	0000	1000	0000	0000	0100	0101
Decimal	0		133		8		0		69	
ASCII	©		□		©		©		E	

Hexadecimal	0	0	0	0	5	4	0	0	0	0
Binary	0000	0000	0000	0000	0101	0100	0000	0000	0000	0000
Decimal	0		0		84		0		0	
ASCII	©		©		T		©		©	

Hexadecimal	4	0	0	0	4	0	0	1	B	8
Binary	0100	0000	0000	0000	0100	0000	0000	0001	1011	1000
Decimal	64		0		64		1		184	
ASCII	@		©		@		©		□	

Hexadecimal	C	C	C	0	A	8	0	0	2	7
Binary	1100	1100	1100	0000	1010	1000	0000	0000	0010	0111
Decimal	204		192		168		0		39	
ASCII	□		□		□		©		‘	

Hexadecimal	C	0	A	8	0	0	6	5	0	8
Binary	1100	0000	1010	1000	0000	0000	0110	0101	0000	1000
Decimal	192		168		0		101		8	
ASCII	□		□		©		e		©	

Hexadecimal	0	0	C	9	1	5	7	0	6	0
Binary	0000	0000	1100	1001	0001	0101	0111	0000	0110	0000
Decimal	0		201		21		112		96	
ASCII	©		□		©		p		‘’	

Hexadecimal	0	0	0	0	4	2	b	1	8	9
Binary	0000	0000	0000	0000	0100	0010	1011	0001	1000	1001
Decimal	0		0		66		177		137	
ASCII	©		©		B		□		□	

Hexadecimal	3	F	0	0	0	0	0	0	0	0
Binary	0011	1111	0000	0000	0000	0000	0000	0000	0000	0000
Decimal	63		0		0		0		0	
ASCII	?		©		©		©		©	

Hexadecimal	2	C	c	6	0	7	0	0	0	0
Binary	0010	1100	1100	0110	0000	0111	0000	0000	0000	0000
Decimal	44		198		7		0		0	
ASCII	,		□		©		©		©	

Hexadecimal	0	0	0	0	0	0	1	0	1	1
Binary	0000	0000	0000	0000	0000	0000	0001	0000	0001	0001
Decimal	0		0		0		16		17	
ASCII	©		©		©		©		©	

Hexadecimal	1	2	1	3	1	4	1	5	2	6
Binary	0001	0010	0001	0011	0001	0100	0001	0101	0010	0110
Decimal	18		19		20		21		38	
ASCII	©		©		©		©		&	

Hexadecimal	2	7	2	8	2	9	2	A	2	B
Binary	0010	0111	0001	1000	0010	1001	0010	1010	0010	1011
Decimal	39		40		41		42		43	
ASCII	‘		(		)		*		+	

Hexadecimal	2	C	2	F	3	0	3	1	3	2
Binary	0010	1100	0010	111	0011	0000	0011	0001	0011	0010
Decimal	44		47		48		49		50	
ASCII	,		/		0		1		2	

Hexadecimal	3	3	3	4	3	5	3	6	3	7
Binary	0011	0011	0011	0100	0000	0101	0011	0110	0011	0111
Decimal	51		52		53		54		55	
ASCII	3		4		5		6		7	

2.8 User Commands – HTTP (AKA "Clickable Buttons")

IP PDU
IP Version
Internet Header Length
Type of Service
Total Length of Ethernet Frame
Identification
Flags
Fragment Offset
Time to Live
Protocol
Header Checksum
Source IP Address
Destination IP Address
Options
Data

TCP PDU
Source Port Number
Destination Port Number
Sequence Number
Acknowledgement Number
Header Lengths
Reserved
Window Size
TCP Checksum
Urgent Pointer
Options
Data

HTTP PDU
Source Port Number
Destination Port Number
Sequence Number
Acknowledgement Number
Header Length
Reserved
Window Size
HTTP Checksum
Urgent Pointer
Options
Data

2.8.1 IP PDU for the selected HTTP PDU

IP PDU > *IP Version* for the selected HTTP PDU

Field Name: *IP Version*

Purpose and Definition: Version is a 4-bit field that indicates the format of the Internet header.

Field Key: 4 = IPv4
6 = IPv6

Data value (decimal): 4

Data values in other bases:

Hexadecimal	4
Binary	0100
Decimal	4

IP PDU> *Internet Header Length* for the selected HTTP PDU

Field Name: *Internet Header Length*

Purpose and Definition: The IHL field is a 4-bit field indicating the length of the Internet header in 32 bit words, and thus points to the beginning of the data. The minimum value of a correct header is 5.

Field Key: *Not applicable*

Data value: The value contained in our field is 20 bytes. This is the hexadecimal and decimal value of 5 multiplied by 4 bits.

Data values in other bases:

Hexadecimal	0	5
Binary	0000	0101
Decimal	5	

IP PDU > *Type of Service* for the selected HTTP PDU

Field Name: *Type of Service*

Purpose and Definition: Type of Service is an 8-bit field that provides and indication of the abstract parameters of the quality of service desired. These parameters guide the selection of the actual service parameters when transmitting a datagram through a particular network.

Field Key: The major choice is a three-way tradeoff between low-delay, high-reliability, and high-throughput.

0 1 2	3	4	5	6	7
Precedence	D	T	R	0	0

Bits 0-2: Precedence		
Bit 3: (D)	0 = Normal Delay	1 = Low Delay
Bit 4: (T)	0 = Normal Throughput	1 = High Throughput
Bit 5: (R)	0 = Normal Reliability	1 = High Reliability

Precedence:

111 = Network Control
110 = Internetwork Control
101 = CRITIC/ECP
100 = Flash Overrided
011 = Flash
010 = Immediate
001 = Priority
000 = Routine

Data value (hexadecimal): 00

Data values in other bases:

Hexadecimal	0	0
Binary	0000	0000
Decimal	00	

IP PDU > ***Total Length of Ethernet Frame*** for the selected HTTP PDU

Field Name: *Total Length of Ethernet Frame*

Purpose and Definition: Total Length is a 16-bit field that indicates the length of the frame, measured in octets, including Internet header and data. The maximum size is 2^{16}-1 or 65,535 octets; however, the recommended maximum size is 576 octets.

Field Key: *Not applicable*

Data values (hexadecimal): 570

Data values in other bases:

Hexadecimal	0	2	3	A
Binary	0000	0010	0011	1010
Decimal	570			

IP PDU > *Identification* for the selected HTTP PDU

Field Name: *Identification*

Purpose and Definition: Identification is a 16-bit field. An identifying value is assigned by the sender to aid in assembling the fragments of a datagram. The identifier is chosen based on the need to provide a way to uniquely identify the fragments and protocol for the time the datagram or any fragment could be alive in the Internet.

Field Key: *Not applicable*

Data value (hexadecimal): 3C 05

Data values in other bases:

Hexadecimal	3	C	0	5
Binary	0011	1100	0000	0101

IP PDU > *Flags* for the selected HTTP PDU

Field Name: *Flags*

Purpose and Definition: Flags is a 3-bit field that indicates directions for fragmentation.

Field Key:
Bit 0: reserved, must be 0
Bit 1: (DF) 0 = May Fragment 1 = Don’t Fragment
Bit 2: (MF) 0 = Last Fragment 1 = More Fragment

Data value (binary): 010

Data values in other bases: *Not applicable*

IP PDU > *Fragment Offset* for the selected HTTP PDU

Field Name: *Fragment Offset*

Purpose and Definition: The Fragment Offset is a 13- bit field indicating where in the Ethernet frame this fragment begins. The Fragment Offset is measured in units of 8 octets, and the first fragment has offset 0.

Field Key: *Not applicable*

Data value (decimal): 0

Data values in other bases:
Binary: 0 0000 0000 0000

IP PDU > *Time to Live* for the selected HTTP PDU

Field Name: *Time to Live*

Purpose and Definition: Time to Live is an 8-bit field that indicates the maximum time the datagram is allowed to remain in the Internet. If this field contains the value 0, then the datagram must be destroyed. This field is modified in Internet header processing. The time is measure in units of seconds, and is set by the sender to the maximum time the datagram is allowed to be in the Internet. This field is decreased at each point that the Internet header is processed. The intention is to cause undeliverable packets to be discarded, and to bound the maximum datagram lifetime.

Field Key: *Not applicable*

Data value (decimal): 64

Data values in other bases:

Hexadecimal	4	0
Binary	0100	0000
Decimal	64	

IP PDU > *Protocol* for the selected HTTP PDU

Field Name: *Protocol*

Purpose and Definition: Protocol is an 8-bit field that indicates the next level protocol that is used in the data portion of the Internet diagram.

Field Key:

Dec	Hex	Protocol	Dec	Hex	Protocol
0	0	Reserved	22	16	Multiplexing
1	1	ICMP	23	17	DCN
2	2	Unassigned	24	18	TAC Monitoring
3	3	Gateway-to-Gateway	25-76	19-4C	Unassigned
4	4	CMCC Gateway Monitoring Message	77	4D	Any local network
5	5	ST	100	64	SATNET and Backroom EXPAK
6	6	TCP	101	65	MIT Subnet Support
7	7	UCL	102-104	66-68	Unassigned
10	A	Unassigned	105	69	SATNET Monitoring
11	B	Secure	106	6A	Unassigned
12	C	BBN RCC Monitoring	107	6B	Internet Packet Core Utility
13	D	NVP	110-113	6E-71	Unassigned
14	E	PUP	114	72	Backroom SATNET Monitoring
15	F	Pluribus	115	73	Unassigned
16	10	Telnet	116	74	WIDEBAND Monitoring
17	11	XNET	117	75	WIDEBAND EXPAK
20	14	Chaos	120-376	78-178	Unassigned
21	15	User Datagram	377	179	Reserved

Data value (hexadecimal): 06

Data values in other bases:

Hexadecimal	0	6
Binary	0000	0110
Decimal	6	

RFC Link: http://www.faqs.org/rfcs/rfc790.html

IP PDU > *Header Checksum* for the selected HTTP PDU

Field Name: *Header Checksum*

Purpose and Definition: The Header Checksum is a 16-bit field. The Checksum is the 16-bit one's complement sum of all 16-bit words in the header. For purposes of computing the checksum, the initial value of its field is zero. When both header checksums are equal, then the header bits are correct. If either checksums vary, then a new, correct packet will need to be sent.

This is a simple way to compute the checksum and experimental evidence indicates that it is adequate, but it is provisional and may be replaced by a CRC procedure, depending on further experience.

Field Key: *Not applicable*

Data value (hexadecimal): 7A 57

Data values in other bases:

Hexadecimal	7	A	5	7
Binary	0111	1010	0101	0111

IP PDU > *Source Address* for the selected HTTP PDU

Field Name: *Source Address*

Purpose and Definition: The Source Address is a 32-bit field that contains the IP address of the host that sent the IP Packet.

Field Key: *Not applicable*

Data value (decimal): 192.168.0.12

Data values in other bases:

Hexadecimal	C	0	A	8	0	0	0	C
Binary	1100	0000	1010	1000	0000	0000	0000	1100
Decimal	192		168		0		12	

IP PDU > *Destination Address* for the selected HTTP PDU

Field Name: *Destination Address*

Purpose and Definition: The Destination Address is a 32-bit field that contains the address of the host that is to receive the data contained within the IP packet.

Field Key: *Not applicable*

Data value (decimal): 192.168.0.101

Data values in other bases:

Hexadecimal	C	0	A	8	0	0	6	5
Binary	1100	0000	1010	1000	0000	0000	0110	0101
Decimal	192		168		0		101	

IP PDU > *Options and Padding* for the selected HTTP PDU

Field Name: *Options and Padding*

Purpose and Definition: The options may or may not appear in Ethernet packets. They must be implemented by all IP modules (host and gateways). What is optional is their transmission in any particular packet, not their implementation.

The option field is variable in length. There may be zero or more options. There are two cases for the format of an option.

Case 1: A single octet of option type
Case 2: An option-type octet, an option-length octet, and the actual option-data octets.

Field Key: *Not applicable*

Data values: *Not applicable*

Data values in other bases: *Not applicable*

IP PDU > *Data* for the selected HTTP PDU

Field Name: *Data*

Purpose and Definition: The Data is a variable length field which contains the actual data that is being sent from one host to another. The data field may start with a Layer 4 header, which will give additional instructions to the application that will be receiving the data; alternately, it may be an ICMP header and not contain any user data at all.

Field Key: *Not applicable*

Data values (hexadecimal) : (TCP) 80 30 00 15 81 A5 16 6C 87 A3 53 5D 80 18 16 D0 11 F4 00 00 01 01 08 0A 1B 25 F3 A1 0b DD 73 58
(FTP) 50 41 53 53 20 66 31 61 32 6B 33 75 73 65 72 0D 0A

Data values in other bases:
Hexadecimal: (TCP) 0 x 80 30 00 15 81 A5 16 6C 87 A3 53 5D 80 18 16 D0 11 F4 00 00 01 01 08 0A 1B 25 F3 A1 0B DD 73 58
(FTP) 50 41 53 53 20 66 31 61 32 6B 33 75 73 65 72 0D 0A

ASCII: (TCP) ↑ 0 © © ↑ ↑ © ↑ ↑ S] ↑ © © ↑ © ↑ © © © © © © © % ↑ ↑ © ↑ s X
(FTP) P A S S S © f 1 a 2 k 3 u s e r © ©

2.8.2 TCP PDU for the selected HTTP PDU

IP > TCP PDU > *Source Port* for the selected HTTP PDU

Field Name: *Source Port*

Purpose and Definition:
This 16-bit number represents the name of the application that sent the data in the IP packet.

Field Key: *Not applicable*

Data value: www (80)

Data values in other bases:

Hexadecimal	0	0	5	0
Binary	0000	0000	0101	0000
Decimal	0		80	

IP > TCP PDU > *Destination Port* for the selected HTTP PDU

Field Name: *Destination Port*

Purpose and Definition:
This 16-bit number represents the name of the application that is to receive the data contained within the IP packet. This is one of the major differences between a Layer 3 and a Layer 4 header: the Layer 3 header contains the IP address of the computer that is to receive the IP packet; once that packet has been received, the port address in the Layer 4 header ensures that the data contained within that IP packet is passed to the correct application on that computer.

Field Key:
This key indicates assigned port number values:

Dec	**Port Numbers**
0	Reserved
1-32767	Internet registered ("well-known") protocols
32768-98303	Reserved, to allow TCPv7-TCPv4 conversion
98304 & up	Dynamic assignment

Data value (decimal): 4255

Data values in other bases:

Hexadecimal	1	0	9	F
Binary	0001	0000	1001	1111
Decimal	4255			

Source: http://www.zvon.org/tmRFC/RFC1475/Output/chapter4.html

IP > TCP PDU > *Sequence Number* for the selected HTTP PDU

Field Name: *Sequence Number*

Purpose and Definition:
TCP is responsible for ensuring that all IP packets sent are actually received. When an application's data is packaged into IP packets, TCP will give each IP packet a sequence number. Once all the packets have arrived at the receiving computer, TCP uses the number in this 32-bit field to ensure that all of the packets actually arrived and are in the correct sequence.

Field Key: *Not applicable*

Data value (decimal): 988014608

Data values in other bases:

Hexadecimal	3	A	E	3	E	8	1	0
Binary	0011	1010	1110	0011	1110	1000	0001	0000
Decimal	58		227		232		16	

IP > TCP PDU > *Acknowledgement Number* for the selected HTTP PDU

Field Name: *Acknowledgement Number*

Purpose and Definition:
This number is used by the receiving computer to acknowledge which packets have successfully arrived. This number will be the sequence number of the next packet the receiver is ready to receive.

Field Key: *Not applicable*

Data value: 1398299764

Data values in other bases:

Hexadecimal	5	3	5	8	5	C	7	4
Binary	0101	0011	0101	0111	0101	1010	0111	0100
Decimal	83		88		92		116	

IP > TCP PDU > *Header Length or Offset* for the selected HTTP PDU

Field Name: *Header Length or Offset*

Purpose and Definition:
This is identical in concept to the header length in an IP packet, except this time it indicates the length of the TCP header.

Field Key: *Not applicable*

Data value (bytes): 32

Data values in other bases:

Hexadecimal	8	0
Binary	1000	0000
Decimal	128	

IP > TCP PDU > *Control Flags* for the selected HTTP PDU

Field Name: *Control Flags*

Purpose and Definition:
Every TCP packet contains this 6-bit value that indicates how many octets it can receive at once. When IP packets are received, they are placed in a temporary area of RAM known as a buffer until the receiving computer has a chance to process them; this value represents how big a buffer the receiving host has made available for this temporary storage of IP packets.

Field Key:

- Urgent (URG)
- Acknowledgement (ACK)
- Push (PSH)
- Reset (RST)
- Synchronize (SYN)
- Finish (FIN)

Data value (binary): 01 1000

Data values in other bases: *Not applicable*

IP > TCP PDU > *Window Size* for the selected HTTP PDU

Field Name: *Window Size*

Purpose and Definition:
Every TCP packet contains this 16-bit value that indicates how many octets it can receive at once. When IP packets are received, they are placed in a temporary area of RAM known as a buffer until the receiving computer has a chance to process them; this value represents how big a buffer the receiving host has made available for this temporary storage of IP packets.

Field Key: *Not applicable*

Data value (decimal): 7504

Data values in other bases:

Hexadecimal	1	D	5	0
Binary	0001	1101	0101	0000
Decimal	7504			

IP > TCP PDU > ***Urgent Pointer*** for the selected HTTP PDU

Field Name: *Urgent Pointer*

Purpose and Definition:
If the Urgent flag is set to on, this value indicates where the urgent data is located.

Information Key: *Not applicable*

Data value: *Not applicable*

Data values in other bases: *Not applicable*

IP > TCP PDU > *Checksum* for the selected HTTP PDU

Field Name: *Checksum*

Purpose and Definition:
Unlike IP, TCP is responsible for ensuring that the entire IP packet arrived intact. TCP will run a CRC on the entire IP packet (not just the header) and place the resulting checksum in this field. When the IP packet is received, TCP re-runs the CRC on the entire packet to ensure the checksum is the same.

Field Key: *Not applicable*

Data value (hexadecimal): F0 F6

Data values in other bases:

Hexadecimal	F	0	F	6
Binary	1111	0000	1111	0110
Decimal	240		246	

IP > TCP PDU > *Options and Padding* for the selected HTTP PDU

Field Name: *Options and Padding*

Purpose and Definition:
Like IP options, this field is optional and represents additional instructions not covered in the other TCP fields. Again, if an option does not fill up a 32-bit word, it will be filled in with padding bits.

Field Key: *Not applicable*

Data value (hexadecimal): 08 0A 39 22 DB 5B 06 2F 44 96

Data values in other bases:

Hexadecimal	0	8	0	A	3	9	2	2	D	B
Binary	0000	1000	0000	1010	0011	1001	0010	0010	1101	1011
Decimal	8		10		57		34		219	
ASCII	©		©		9		“		□	

Hexadecimal	5	B	0	6	2	F	4	4	9	6
Binary	0101	1011	0000	0110	0010	1111	0100	0100	1001	0110
Decimal	91		6		47		68		150	
ASCII	[		©		/		F		□	

2.8.3 HTTP PDU for the selected HTTP PDU

IP > TCP > HTTP PDU > *Content Type* for the selected HTTP PDU

Field Name: *Content Type*

Purpose and Definition: The Content-Type entity-header field indicates the media type of the Entity-Body sent to the recipient.

Field Key: *Not applicable*

Data value (ASCII): text/html; charset=iso – 8859-1\r\n

Data values in other bases:

Hexadecimal	4	3	6	F	6	E	7	4
Binary	0100	0011	0110	1111	0110	1110	0111	0100
Decimal	67		111		110		116	
ASCII	C		o		n		t	

Hexadecimal	6	5	6	E	7	4	2	D
Binary	0110	0101	0110	1110	0111	0100	0010	1101
Decimal	101		110		116		45	
ASCII	E		n		t		-	

Hexadecimal	5	4	7	9	7	0	6	5
Binary	0101	0100	0111	1001	0111	0000	0110	0101
Decimal	84		121		112		101	
ASCII	T		y		p		e	

Hexadecimal	3	A	2	0	7	4	6	5
Binary	0110	1010	0010	0000	0111	0100	0110	0101
Decimal	58		32		116		101	
ASCII	:				t		e	

Hexadecimal	7	8	7	4	2	F	6	8
Binary	0111	1000	0111	0100	0010	1111	0110	1000
Decimal	120		116		47		104	
ASCII	X		t		/		h	

Hexadecimal	7	4	6	D	6	C	3	B
Binary	0111	0100	0110	1101	0110	1100	0011	1011
Decimal	116		109		108		59	
ASCII	T		m		l		;	

Hexadecimal	2	0	6	3	6	8	6	1
Binary	0010	0000	0110	0011	0110	1000	0110	0001
Decimal	32		99		104		97	
ASCII			c		h		a	

Hexadecimal	7	2	7	3	6	5	7	4
Binary	0111	0010	0111	0011	0110	0101	0111	0100
Decimal	114		115		101		116	
ASCII	r		s		e		t	

Hexadecimal	3	D	6	9	7	3	6	F
Binary	0011	1101	0110	1001	0111	0011	0110	1111
Decimal	61		105		115		111	
ASCII	=		i		s		o	

Hexadecimal	2	D	3	8	3	8	3	5
Binary	0010	1101	0011	1000	0011	1000	0011	0101
Decimal	45		56		56		53	
ASCII	-		8		8		5	

Hexadecimal	3	9	2	D	3	1	0	D
Binary	0011	1001	0010	1101	0011	0001	0000	1101
Decimal	57		45		49		13	
ASCII	9		-		1		\r	

Hexadecimal	0	A
Binary	0000	1010
Decimal	10	
ASCII	\n	

IP > TCP > HTTP PDU > *Date* for the selected HTTP PDU

Field Name: *Date*

Purpose and Definition: This field contains the date and time on which the web page was accessed.

Field Key: *Not applicable*

Data value (ASCII): Date: Tue, 03 Feb 2004 23:08:10 GMT\r\n

Data values in other bases:

Hexadecimal	4	6	6	1	7	4	6	5
Binary	0110	0110	0110	0001	0111	0100	0110	0101
Decimal	70		97		116		101	
ASCII	D		a		t		e	

Hexadecimal	3	A	2	0	5	4	7	5
Binary	0010	1010	0010	0000	0101	0100	0111	0101
Decimal	58		32		84		117	
ASCII	:				T		u	

Hexadecimal	6	5	2	C	2	0	3	0
Binary	0110	0101	0010	1100	0010	0000	0011	0000
Decimal	101		44		32		48	
ASCII	e		,				0	

Hexadecimal	3	3	2	0	4	6	6	5
Binary	0011	0011	0010	0000	0100	0110	0110	0101
Decimal								
ASCII	3				F		e	

Hexadecimal	6	2	2	0	3	2	3	0
Binary	0110	0010	0010	0000	0011	0010	0011	0000
Decimal	98		32		50		48	
ASCII	b				2		0	

Hexadecimal	3	0	3	4	3	2	3	3
Binary	0011	0000	0011	0100	0011	0010	0011	0011
Decimal	48		52		50		51	
ASCII	0		4		2		3	

Hexadecimal	3	A	3	0	3	8	3	A
Binary	0011	1010	0011	0000	0011	1000	0011	1010
Decimal	58		48		56		58	
ASCII	:		0		8		:	

Hexadecimal	3	1	3	0	2	0	4	7
Binary	0011	0001	0011	0000	0010	0000	0100	0111
Decimal	49		48		32		71	
ASCII	1		0				G	

Hexadecimal	4	D	5	4	0	D	0	A
Binary	0100	1101	0101	0100	0000	1101	0000	1010
Decimal	77		84		13		10	
ASCII	M		T		\r		\n	

IP > TCP > HTTP PDU > *HTTP* for the selected HTTP PDU

Field Name: *HTTP*

Purpose and Definition: This field displays the category of the page that is being displayed.

Field Key: *Not applicable*

Data value (ASCII): HTTP/1.1 404 Not Found\r\n

Data values in other bases:

Hexadecimal	4	8	5	4	5	4	5	0
Binary	0100	1000	0101	0100	0101	0100	0101	0000
Decimal	72		84		84		80	
ASCII	H		T		T		P	

Hexadecimal	2	F	3	1	2	E	3	1
Binary	0010	1111	0011	0001	0010	1110	0011	0001
Decimal	47		49		46		49	
ASCII	/		1		.		1	

Hexadecimal	2	0	3	4	3	0	3	4
Binary	0010	0000	0011	0100	0011	0000	0011	0100
Decimal	32		52		48		52	
ASCII			4		0		4	

Hexadecimal	2	0	4	E	6	F	7	4
Binary	0010	0000	0100	1110	0110	1111	0111	0100
Decimal	32		78		111		116	
ASCII			N		o		t	

Hexadecimal	2	0	4	6	6	F	7	5
Binary	0010	0000	0100	0110	0110	1111	0111	0101
Decimal	32		70		111		117	
ASCII			F		o		u	

Hexadecimal	6	E	6	4	0	D	0	A
Binary	0110	1110	0110	0100	0000	1101	0000	1010
Decimal	110		100		13		10	
ASCII	n		d		\r		\n	

IP > TCP > HTTP PDU > *Server* for the selected HTTP PDU

Field Name: *Server*

Purpose and Definition: The Server response-header field contains information about the software used by the origin server to handle the request.

Field Key: *Not applicable*

Data value (ASCII): Server: Apache/1.3.24 (Unix) PHP/4.2.1\r\n

Data values in other bases:

Hexadecimal	5	3	6	5	7	2	7	6
Binary	0101	0011	0110	0101	0111	0010	0111	0110
Decimal	83		101		114		118	
ASCII	S		E		r		v	

Hexadecimal	6	5	7	2	3	A	2	0
Binary	0110	0101	0111	0010	0011	1010	0010	0000
Decimal	101		114		58		32	
ASCII	e		R		:			

Hexadecimal	4	1	7	0	6	1	6	3
Binary	0110	0001	0111	0000	0110	0001	0110	0011
Decimal	65		112		97		99	
ASCII	A		P		a		c	

Hexadecimal	6	8	6	5	2	F	3	1
Binary	0110	1000	0110	0101	0010	1111	0011	0001
Decimal	104		101		47		49	
ASCII	h		E		/		1	

Hexadecimal	2	E	3	3	2	E	3	2
Binary	0010	1110	0011	0011	0010	1110	0011	0010
Decimal	46		51		46		50	
ASCII	.		3		.		2	

Hexadecimal	3	4	2	0	2	8	5	5
Binary	0011	0100	0010	0000	0010	1000	0101	0101
Decimal	52		32		40		85	
ASCII	4				(		U	

Hexadecimal	6	E	6	9	7	8	2	9
Binary	0110	1110	0110	1001	0111	1000	0010	1001
Decimal	110		105		120		41	
ASCII	n		i		x		)	

Hexadecimal	2	0	5	0	4	8	5	0
Binary	0010	0000	0101	0000	0100	1000	0101	0000
Decimal	32		80		72		80	
ASCII			P		H		P	

Hexadecimal	2	5	3	4	2	E	3	2
Binary	0010	0101	0011	0100	0010	1110	0011	0010
Decimal	37		52		46		50	
ASCII	/		4		.		2	

Hexadecimal	2	E	3	1	0	D	0	A
Binary	0010	1110	0011	0001	0000	1101	0000	1010
Decimal	46		49		13		10	
ASCII	.		1		\r		\n	

IP > TCP > HTTP PDU > *Data* for the selected HTTP PDU

Field Name: *Data*

Purpose and Definition: This field stores the information that is actually contained in the HTTP Protocol.

Field Key: *Not applicable*

Data value (ASCII): <!DOCTYPE HTML PUBLIC “-//IETF//DTD HTML 2.0//EN”>\n
<HTML><HEAD>\n
<TITLE>404 Not Found</TITLE>\n
</HEAD><BODY>\n
<H1>Not Found</H1>\n
The requested URL /~csis410/2003/bluetech/Requirements Speicfication Document Final-files/image002.gif was not found on this server.<p>\n
<HR>\n
<ADDRESS>Apache/1.3.24 Server at ares.cs.siena.edu Port 80</ADDRESS>\n
</BODY></HTML>\n

Data values in other bases:

Hexadecimal	3	C	2	1	4	4	4	5
Binary	0011	1100	0010	0001	0100	0100	0100	0101
Decimal	60		33		68		69	
ASCII	<		!		D		O	

Hexadecimal	4	3	5	4	5	9	5	0
Binary	0100	0011	0101	0100	0101	1001	0101	0000
Decimal	67		84		89		80	
ASCII	C		T		Y		P	

Hexadecimal	4	5	2	0	4	8	5	4
Binary	0100	0101	0010	0000	0100	1000	0101	0100
Decimal	69		32		72		84	
ASCII	E				H		T	

Hexadecimal	4	D	4	C	2	0	5	0
Binary	0100	1101	0110	1100	0010	0000	0101	0000
Decimal	77		76		32		80	
ASCII	M		L				P	

Hexadecimal	5	5	4	2	4	C	4	9
Binary	0101	0101	0100	0010	0100	1100	0100	1001
Decimal	85		66		76		73	
ASCII	U		B		L		I	

Hexadecimal	4	3	2	0	2	2	2	D
Binary	0100	0011	0010	0000	0010	0010	0010	1101
Decimal	67		32		34		45	
ASCII	C				“		-	

Hexadecimal	2	F	2	F	4	9	4	5
Binary	0010	1111	0010	1111	0100	1001	0100	0101
Decimal	47		47		73		69	
ASCII	/		/		I		E	

Hexadecimal	5	4	4	6	2	F	2	F
Binary	0101	0100	0100	0110	0010	1111	0010	1111
Decimal	84		70		47		47	
ASCII	T		F		/		/	

Hexadecimal	4	4	5	4	4	4	2	0
Binary	0100	0100	0101	0100	0100	0100	0010	0000
Decimal	68		84		68		32	
ASCII	D		T		D			

Hexadecimal	4	8	5	4	4	D	4	C
Binary	0100	1000	0101	0100	0100	1101	0100	1100
Decimal	72		84		77		76	
ASCII	H		T		M		L	

Hexadecimal	2	0	3	2	2	E	3	0
Binary	0010	0000	0011	0010	0010	1110	0011	0000
Decimal	32		50		46		48	
ASCII			2		.		0	

Hexadecimal	2	F	2	F	4	5	4	E
Binary	0010	1111	0010	1111	0100	0101	0100	1110
Decimal	47		47		69		78	
ASCII	/		/		E		N	

Hexadecimal	2	2	3	E	0	A	3	C
Binary	0010	0010	0011	1110	0000	1010	0011	1100
Decimal	34		62		10		60	
ASCII	“		>		\n		<	

Hexadecimal	4	8	5	4	4	D	4	C
Binary	0100	1000	0101	0100	0100	1101	0100	1100
Decimal	72		84		77		76	
ASCII	H		T		M		L	

Hexadecimal	3	E	3	C	4	8	4	5
Binary	0011	1110	0011	1100	0100	1000	0100	0101
Decimal	62		60		72		69	
ASCII	>		<		H		E	

Hexadecimal	4	1	4	4	3	E	0	A
Binary	0100	0001	0100	0100	0011	1110	0000	1010
Decimal	65		68		62		10	
ASCII	A		D		>		\n	

Hexadecimal	3	C	5	4	4	9	5	4
Binary	0011	1100	0101	0100	0100	1001	0101	0100
Decimal	60		84		73		84	
ASCII	<		T		I		T	

Hexadecimal	4	C	4	5	3	E	3	4
Binary	0100	1100	0100	0101	0011	1110	0011	0100
Decimal	76		69		62		52	
ASCII	L		E		>		4	

Hexadecimal	3	0	3	4	2	0	4	E
Binary	0011	0000	0011	0100	0010	0000	0100	1110
Decimal	48		52		32		78	
ASCII	0		4				N	

Hexadecimal	6	F	7	4	2	0	4	6
Binary	0110	1111	0111	0100	0010	0000	0100	0110
Decimal	111		116		32		70	
ASCII	o		t				F	

Hexadecimal	6	F	7	5	6	E	6	4
Binary	0110	1111	0111	0101	0110	1110	0110	0100
Decimal	111		117		110		100	
ASCII	o		u		n		d	

Hexadecimal	3	C	2	F	5	4	4	9
Binary	0011	1100	0010	1111	0101	0100	0100	1001
Decimal	60		47		84		73	
ASCII	<		/		T		I	

Hexadecimal	5	4	4	C	4	5	3	E
Binary	0101	0100	0100	1100	0100	0101	0011	1110
Decimal	84		76		69		62	
ASCII	T		L		E		>	

Hexadecimal	0	A	3	C	2	F	4	8
Binary	0000	1010	0011	1100	0010	1111	0100	1000
Decimal	10		60		47		72	
ASCII	\n		<		/		H	

Hexadecimal	4	5	4	1	4	4	3	E
Binary	0100	0101	0100	0001	0100	0100	0011	1110
Decimal	69		65		68		62	
ASCII	E		A		D		>	

Hexadecimal	3	C	4	2	4	F	4	4
Binary	0011	1100	0100	0010	0100	1111	0100	0100
Decimal	60		66		79		68	
ASCII	<		B		O		D	

Hexadecimal	5	9	3	E	0	A	3	C
Binary	0101	1001	0011	1110	0000	1010	0011	1100
Decimal	89		62		10		60	
ASCII	Y		>		\n		<	

Hexadecimal	4	8	3	1	3	E	4	E
Binary	0100	1000	0011	0001	0011	1110	0100	1110
Decimal	72		49		62		78	
ASCII	H		1		>		N	

Hexadecimal	6	F	7	4	2	0	4	6
Binary	0110	1111	0111	0100	0010	0000	0100	0110
Decimal	111		116		32		70	
ASCII	o		t				F	

Hexadecimal	6	F	7	5	6	E	6	4
Binary	0100	1111	0111	0101	0110	1110	0110	0100
Decimal	111		117		110		100	
ASCII	o		u		n		d	

Hexadecimal	3	C	2	F	4	8	3	1
Binary	0011	1100	0010	1111	0100	1000	0011	0001
Decimal	60		47		72		49	
ASCII	<		/		H		1	

Hexadecimal	3	E	0	A	5	4	6	8
Binary	0011	1110	0000	1010	0101	0100	0110	1000
Decimal	62		10		84		104	
ASCII	>		\n		T		h	

Hexadecimal	6	5	2	0	7	2	6	5
Binary	0110	0101	0010	0000	0111	0010	0110	0101
Decimal	101		32		114		101	
ASCII	e				r		e	

Hexadecimal	7	1	7	5	6	5	7	3
Binary	0111	0001	0111	0101	0110	0101	0111	0011
Decimal	113		117		101		115	
ASCII	q		u		e		s	

Hexadecimal	7	4	6	5	6	4	2	0
Binary	0111	0100	0110	0101	0110	0100	0010	0000
Decimal	116		101		100		32	
ASCII	t		e		d			

Hexadecimal	5	5	5	2	4	C	2	0
Binary	0101	0101	0101	0010	0100	1100	0010	0000
Decimal	85		82		76		32	
ASCII	U		R		L			

Hexadecimal	2	F	7	E	6	3	7	3
Binary	0010	1111	0111	1110	0110	0011	0111	0011
Decimal	47		126		99		115	
ASCII	/		~		c		s	

Hexadecimal	6	9	7	3	3	4	3	1
Binary	0110	1001	0111	0011	0011	0100	0011	0001
Decimal	105		115		52		49	
ASCII	i		s		4		1	

Hexadecimal	3	0	2	F	3	2	3	0
Binary	0011	0000	0010	1111	0011	0010	0011	0000
Decimal	48		47		50		48	
ASCII	0		/		2		0	

Hexadecimal	3	0	3	3	2	F	6	2
Binary	0011	0000	0011	0011	0010	1111	0110	0010
Decimal	48		51		47		98	
ASCII	0		3		/		b	

Hexadecimal	6	C	7	5	6	5	7	4
Binary	0110	1100	0111	0101	0110	0101	0111	0100
Decimal	108		117		101		116	
ASCII	l		u		e		t	

Hexadecimal	6	5	6	3	6	8	2	F
Binary	0110	0101	0110	0011	0110	1000	0010	1111
Decimal	101		99		104		47	
ASCII	e		c		h		/	

Hexadecimal	5	2	6	5	7	1	7	5
Binary	0101	0010	0110	0101	0111	0001	0111	0101
Decimal	82		101		113		117	
ASCII	R		e		q		u	

Hexadecimal	6	9	7	2	6	5	6	D
Binary	0110	1001	0111	0010	0110	0101	0110	1101
Decimal	105		114		101		109	
ASCII	i		r		e		m	

Hexadecimal	6	5	6	E	7	4	7	3
Binary	0110	0101	0110	1110	0111	0100	0111	0011
Decimal	101		110		116		115	
ASCII	e		n		t		s	

Hexadecimal	2	0	5	3	7	0	6	5
Binary	0010	0000	0101	0011	0111	0000	0110	0101
Decimal	32		83		112		101	
ASCII			S		p		e	

Hexadecimal	6	3	6	9	6	6	6	9
Binary	0110	0011	0110	1001	0110	0110	0110	1001
Decimal	99		105		102		105	
ASCII	c		i		f		i	

Hexadecimal	6	3	6	1	7	4	6	9
Binary	0110	0011	0110	0001	0111	0100	0110	1001
Decimal	99		97		116		105	
ASCII	c		a		t		i	

Hexadecimal	6	F	6	E	2	0	4	4
Binary	0110	1111	0110	1110	0010	0000	0100	0100
Decimal	111		110		32		68	
ASCII	o		n				D	

Hexadecimal	6	F	6	3	7	5	6	D
Binary	0110	1111	0110	0011	0111	0101	0110	1101
Decimal	111		99		117		109	
ASCII	o		c		u		m	

Hexadecimal	6	5	6	E	7	4	2	0
Binary	0110	0101	0110	1110	0111	0100	0010	0000
Decimal	101		110		116		32	
ASCII	e		n		t			

Hexadecimal	4	6	6	9	6	E	6	1
Binary	0100	0110	0110	1001	0110	1110	0110	0001
Decimal	70		105		110		97	
ASCII	F		i		n		a	

Hexadecimal	6	C	5	F	6	6	6	9
Binary	0110	1100	0101	1111	0110	0110	0110	1001
Decimal	108		95		102		105	
ASCII	l		-		f		i	

Hexadecimal	6	C	6	5	7	3	2	F
Binary	0110	1100	0110	0101	0111	0011	0010	1111
Decimal	63		101		115		47	
ASCII	l		e		s		/	

Hexadecimal	6	9	6	D	6	1	6	7
Binary	0110	1001	0110	1101	0110	0001	0110	0111
Decimal	105		109		97		103	
ASCII	i		m		a		g	

Hexadecimal	6	5	3	0	3	0	3	2
Binary	0110	0101	0011	0000	0011	0000	0011	0010
Decimal	101		48		48		50	
ASCII	e		0		0		2	

Hexadecimal	2	E	6	7	6	9	6	6
Binary	0010	1110	0110	0111	0110	1001	0110	0110
Decimal	46		103		105		102	
ASCII	.		g		i		f	

Hexadecimal	2	0	7	7	6	1	7	3
Binary	0001	0000	0111	0111	0110	0001	0111	0011
Decimal	32		119		97		115	
ASCII			w		a		s	

Hexadecimal	2	0	6	E	6	F	7	4
Binary	0010	0000	0110	1110	0110	1111	0111	0100
Decimal	32		110		111		116	
ASCII			n		o		t	

Hexadecimal	2	0	6	6	6	F	7	5
Binary	0010	0000	0110	0110	0110	1111	0111	0101
Decimal	32		102		111		117	
ASCII			f		o		u	

Hexadecimal	6	E	6	4	2	0	6	F
Binary	0110	1110	0110	0100	0010	0000	0110	1111
Decimal	110		100		32		111	
ASCII	n		d				o	

Hexadecimal	6	E	2	0	7	4	6	8
Binary	0110	1110	0010	0000	0111	0100	0110	1000
Decimal	110		32		116		104	
ASCII	n				t		h	

Hexadecimal	6	9	7	3	2	0	7	3
Binary	0110	1001	0111	0011	0010	0000	0111	0011
Decimal	105		115		32		115	
ASCII	i		s				s	

Hexadecimal	6	5	7	2	7	6	6	5
Binary	0110	0101	0111	0010	0111	0110	0110	0101
Decimal	101		114		118		101	
ASCII	e		r		v		e	

Hexadecimal	7	2	2	E	3	C	5	0
Binary	0111	0010	0010	1110	0011	1100	0101	0000
Decimal	114		46		60		80	
ASCII	r		.		<		p	

Hexadecimal	3	E	0	A	3	C	4	8
Binary	0011	1110	0000	1010	0011	1100	0100	1000
Decimal								
ASCII	>		\n		<		H	

Hexadecimal	5	2	3	E	0	4	3	C
Binary	0101	0010	0011	1110	0000	0100	0011	1100
Decimal	82		62		10		60	
ASCII	R		>		\n		<	

Hexadecimal	4	1	4	4	4	4	5	2
Binary	0100	0001	0100	0100	0100	0100	0101	0010
Decimal	65		68		68		82	
ASCII	A		D		D		R	

Hexadecimal	4	5	5	3	5	3	3	E
Binary	0100	0101	0101	0011	0101	0011	0011	1110
Decimal	69		83		83		62	
ASCII	E		S		S		>	

Hexadecimal	4	1	7	0	6	1	6	3
Binary	0100	0001	0111	0000	0110	0001	0110	0011
Decimal	65		112		97		99	
ASCII	A		p		a		c	

Hexadecimal	6	8	6	5	2	F	3	1
Binary	0110	1000	0110	0101	0010	1111	0011	0001
Decimal	104		101		47		49	
ASCII	h		e		/		1	

Hexadecimal	2	E	3	3	2	E	3	2
Binary	0010	1110	0011	0011	0010	1110	0011	0010
Decimal	46		51		46		50	
ASCII	.		3		.		2	

Hexadecimal	3	4	2	0	5	3	6	5
Binary	0011	0100	0010	0000	0101	0011	0110	0101
Decimal	52		32		83		101	
ASCII	4				S		e	

Hexadecimal	7	2	7	6	6	5	7	2
Binary	0111	0010	0111	0110	0110	0101	0111	0010
Decimal								
ASCII	r		v		e		r	

Hexadecimal	2	0	6	1	7	4	2	0
Binary	0010	0000	0110	0001	0111	0100	0010	0000
Decimal	32		97		116		323	
ASCII			a		t			

Hexadecimal	3	1	7	2	6	5	7	3
Binary	0011	0001	0111	0010	0110	0101	0111	0011
Decimal	97		114		101		115	
ASCII	a		r		e		s	

Hexadecimal	2	E	6	3	7	3	2	E
Binary	0010	1110	0110	0011	0111	0011	0010	1110
Decimal	46		99		115		46	
ASCII	.		c		s		.	

Hexadecimal	7	3	6	9	6	5	6	E
Binary	0111	0011	0110	1001	0110	0101	0110	1110
Decimal	115		105		101		110	
ASCII	s		i		e		n	

Hexadecimal	6	1	2	E	6	5	6	4
Binary	0110	0001	0010	1110	0110	0101	0110	0100
Decimal	97		46		101		100	
ASCII	a		.		e		d	

Hexadecimal	7	5	2	0	5	0	6	F
Binary	0111	0101	0010	0000	0101	0000	0110	1111
Decimal	117		32		80		111	
ASCII	u				P		o	

Hexadecimal	7	2	7	4	2	0	3	8
Binary	0111	0010	0111	0100	0010	0000	0011	1000
Decimal	114		116		32		56	
ASCII	r		t				8	

Hexadecimal	3	0	3	C	2	F	4	1
Binary	0011	0000	0010	1100	0010	1111	0100	0001
Decimal	48		60		47		65	
ASCII	0		<		/		A	

Hexadecimal	4	4	4	4	5	2	4	5
Binary	0100	0100	0100	0100	0101	0010	0100	0101
Decimal	68		68		82		69	
ASCII	D		D		R		E	

Hexadecimal	5	3	5	3	3	E	0	A
Binary	0101	0011	0101	0011	0011	1110	0000	1010
Decimal	83		83		62		10	
ASCII	S		S		>		\n	

Hexadecimal	3	C	2	F	4	2	4	F
Binary	0011	1100	0010	1111	0100	0010	0100	1111
Decimal	60		47		66		79	
ASCII	<		/		B		O	

Hexadecimal	4	4	5	9	3	E	3	C
Binary	0100	0100	0101	1001	0011	1110	0011	1100
Decimal	68		89		62		60	
ASCII	D		Y		>		<	

Hexadecimal	2	F	4	8	5	4	4	D
Binary	0010	1111	0100	1000	0101	0100	0100	1101
Decimal	47		72		84		77	
ASCII	/		H		T		M	

Hexadecimal	4	C	3	E	0	A
Binary	0100	1100	0011	1110	0000	1010
Decimal	76		62		10	
ASCII	L		>		\n	

2.9 User Commands – SMTP (AKA “Clickable Buttons”)

IP PDU
IP Version
Internet Header Length
Type of Service
Total Length of Ethernet Frame
Identification
Flags
Fragment Offset
Time to Live
Protocol
Header Checksum
Source IP Address
Destination IP Address
Options
Data

TCP PDU
Source Port Number
Destination Port Number
Sequence Number
Acknowledgement Number
Header Lengths
Reserved
Window Size
TCP Checksum
Urgent Pointer
Options
Data

SMTP PDU
Source Port Number
Destination Port Number
Sequence Number
Acknowledgement Number
Header Length
Reserved
Window Size
SMTP Checksum
Urgent Pointer
Options
Data

2.9.1 IP PDU for the selected SMTP PDU

IP PDU > *IP Version* for the selected SMTP PDU

Field Name: *IP Version*

Purpose and Definition: Version is a 4-bit field that indicates the format of the internet header.

Field Key: 4 = IPv4
6 = IPv6

Data value (decimal): 4

Data values in other bases:

Hexadecimal	4
Binary	0100
Decimal	4

IP PDU > *Internet Header Length* for the selected SMTP PDU

Field Name: *Internet Header Length*

Purpose and Definition: The IHL field is a 4-bit field indicating the length of the internet header in 32 bit words, and thus points to the beginning of the data. The minimum value of a correct header is 5.

Field Key: *Not applicable*

Data value: The value contained in our field is 20 bytes. This is the hexadecimal and decimal value of 5 multiplied by 4 bits.

Data values in other bases:

Hexadecimal	0	5
Binary	0000	0101
Decimal	5	

IP PDU > *Type of Service* for the selected SMTP PDU

Field Name: *Type of Service*

Purpose and Definition: Type of Service is an 8-bit field that provides and indication of the abstract parameters of the quality of service desired. These parameters guide the selection of the actual service parameters when transmitting a datagram through a particular network.

Field Key: The major choice is a three-way tradeoff between low-delay, high-reliability, and high-throughput.

0 1 2	3	4	5	6	7
Precedence	D	T	R	0	0

Bits 0-2: Precedence

Bit 3: (D)	0 = Normal Delay	1 = Low Delay
Bit 4: (T)	0 = Normal Throughput	1 = High Throughput
Bit 5: (R)	0 = Normal Reliability	1 = High Reliability

Precedence:

111 = Network Control
110 = Internetwork Control
101 = CRITIC/ECP
100 = Flash Overrided
011 = Flash
010 = Immediate
001 = Priority
000 = Routine

Data value (hexadecimal): 00

Data values in other bases:

Hexadecimal	0	0
Binary	0000	0000
Decimal	00	

IP PDU > *Total Length of Ethernet Frame* for the selected SMTP PDU

Field Name: *Total Length of Ethernet Frame*

Purpose and Definition: Total Length is a 16-bit field that indicates the length of the frame, measured in octets, including internet header and data. The maximum size is 2^{16}-1 or 65,535 octets; however, the recommended maximum size is 576 octets.

Field Key: *Not applicable*

Data values (hexadecimal): 02 12

Data values in other bases:

Hexadecimal	0	2	1	2
Binary	0000	0010	0001	0010
Decimal	2		18	
ASCII	©		©	

IP PDU > *Identification* for the selected SMTP PDU

Field Name: *Identification*

Purpose and Definition: Identification is a 16-bit field. An identifying value is assigned by the sender to aid in assembling the fragments of a datagram. The identifier is chosen based on the need to provide a way to uniquely identify the fragments and protocol for the time the datagram or any fragment could be alive in the internet.

Field Key: *Not applicable*

Data value (hexadecimal): 61 28

Data values in other bases:

Hexadecimal	6	1	2	8
Binary	0110	0001	0010	1000

IP PDU > *Flags* for the selected SMTP PDU

Field Name: *Flags*

Purpose and Definition: Flags is a 3-bit field that indicates directions for fragmentation.

Field Key:

Bit 0: reserved, must be 0

Bit 1: (DF)	0 = May Fragment	1 = Don’t Fragment
Bit 2: (MF)	0 = Last Fragment	1 = More Fragment

Data value (binary): 010

Data values in other bases: *Not applicable*

IP PDU > *Fragment Offset* for the selected SMTP PDU

Field Name: *Fragment Offset*

Purpose and Definition: The Fragment Offset is a 13- bit field indicating where in the Ethernet frame this fragment begins. The Fragment Offset is measured in units of 8 octets, and the first fragment has offset 0.

Field Key: *Not applicable*

Data value (decimal): 0

Data values in other bases:
Binary: 0000 0000 0000

IP PDU > *Time to Live* for the selected SMTP PDU

Field Name: *Time to Live*

Purpose and Definition: Time to Live is an 8-bit field that indicates the maximum time the datagram is allowed to remain in the internet. If this field contains the value 0, then the datagram must be destroyed. This field is modified in internet header processing. The time is measure in units of seconds, and is set by the sender to the maximum time the datagram is allowed to be in the internet. This field is decreased at each point that the internet header is processed. The intention is to cause undeliverable packets to be discarded, and to bind the maximum datagram lifetime.

Field Key: *Not applicable*

Data value (decimal): 64

Data values in other bases:

Hexadecimal	4	0
Binary	0100	0000
Decimal	64	

IP PDU > *Protocol* for the selected SMTP PDU

Field Name: *Protocol*

Purpose and Definition: Protocol is an 8-bit field that indicates the next level protocol that is used in the data portion of the internet diagram.

Field Key:

Dec	Hex	Protocol	Dec	Hex	Protocol
0	00	Reserved	22	16	Multiplexing
1	01	ICMP	23	17	DCN
2	02	Unassigned	24	18	TAC Monitoring
3	03	Gateway-to-Gateway	25-76	19-4C	Unassigned
4	04	CMCC Gateway Monitoring Message	77	4D	Any local network
5	05	ST	100	64	SATNET and Backroom EXPAK
6	06	TCP	101	65	MIT Subnet Support
7	07	UCL	102-104	66-68	Unassigned
10	0A	Unassigned	105	69	SATNET Monitoring
11	0B	Secure	106	6A	Unassigned
12	0C	BBN RCC Monitoring	107	6B	Internet Packet Core Utility
13	0D	NVP	110-113	6E-71	Unassigned
14	0E	PUP	114	72	Backroom SATNET Monitoring
15	0F	Pluribus	115	73	Unassigned
16	10	Telnet	116	74	WIDEBAND Monitoring
17	11	XNET	117	75	WIDEBAND EXPAK
20	14	Chaos	120-376	78-0178	Unassigned
21	15	User Datagram	377	0179	Reserved

Data value (hexadecimal): 06

Data values in other bases:

Hexadecimal	0	6
Binary	0000	0110
Decimal	6	

RFC Link: http://www.faqs.org/rfcs/rfc790.html

IP PDU > *Header Checksum* for the selected SMTP PDU

Field Name: *Header Checksum*

Purpose and Definition: The Header Checksum is a 16-bit field. The Checksum is the 16-bit one's complement sum of all 16-bit words in the header. For purposes of computing the checksum, the initial value of its field is zero. When both header checksums are equal, then the header bits are correct. If either checksums vary, then a new, correct packet will need to be sent.

This is a simple way to compute the checksum and experimental evidence indicates that it is adequate, but it is provisional and may be replaced by a CRC procedure, depending on further experience.

Field Key: *Not applicable*

Data value (hexadecimal): F1 F3

Data values in other bases:

Hexadecimal	F	1	F	3
Binary	1111	0001	1111	0011

IP PDU > *Source Address* for the selected SMTP PDU

Field Name: *Source Address*

Purpose and Definition: The Source Address is a 32-bit field that contains the IP address of the host that sent the IP Packet.

Field Key: *Not applicable*

Data value (decimal): 192.168.0.101

Data values in other bases:

Hexadecimal	C	0	A	8	0	1	0	1
Binary	1100	0000	1010	1000	0000	0001	0010	0001
Decimal	192		168		101			

IP PDU > ***Destination Address*** for the selected SMTP PDU

<u>Field Name:</u> *Destination Address*

<u>Purpose and Definition:</u> The Destination Address is a 32-bit field that contains the address of the host that is to receive the data contained within the IP packet.

<u>Field Key:</u> *Not applicable*

<u>Data value (decimal)</u>: 192.168.100.20

<u>Data values in other bases:</u>

Hexadecimal	C	0	A	8	0	0	6	5
Binary	1100	0000	1010	1000	0000	0000	0110	0101
Decimal	192		168		100		20	

IP PDU > *Options and Padding* for the selected SMTP PDU

Field Name: *Options and Padding*

Purpose and Definition: The options may or may not appear in Ethernet packets. They must be implemented by all IP modules (host and gateways). What is optional is their transmission in any particular packet, not their implementation.

The option field is variable in length. There may be zero or more options. There are two cases for the format of an option.

Case 1: A single octet of option type

Case 2: An option-type octet, an option-length octet, and the actual option-data octets.

Field Key: *Not applicable*

Data values: *Not applicable*

Data values in other bases: *Not applicable*

IP PDU > *Data* for the selected SMTP PDU

Field Name: *Data*

Purpose and Definition: The Data is a variable length field which contains the actual data that is being sent from one host to another. The data field may start with a Layer 4 header, which will give additional instructions to the application that will be receiving the data; alternately, it may be an ICMP header and not contain any user data at all.

Field Key: *Not applicable*

Data values (hexadecimal) : (TCP) 0D 0A 2D 2D 2D 31 34 36 33 37 38 36 32 34 30
2D 37 32 33 37 38 33 33 32 38 2D 31 30 36 37 36 33 34 33 35 30 3D 3A 32 36 36 30 36
0D 0A 43 6F 6E 74 2D 54 79 70 65 3A 20 54 45 58 54 2F 70 6C 61 69 6E 3B 20 6E 61
6D 65 3D 22 6D 69 6d 65 74 65 73 74 2E 74 78 74 22 0D 0A 43 6F 6E 74 65 6E 74 2D
54 72 61 6E 73 66 65 72 2D 45 6E 63 6F 64 69 6E 67 3A 20 42 41 53 45 36 34 0D 0A
43 6F 6E 74 65 6E 74 2D 49 44 3A 20 3C 50 69 6E 65 2E 4C 4E 58 2E 34 2E 32 31 2E
32 31 2E 30 33 31 31 36 30 35 35 30 30 2E 32 36 36 30 36 40 63 62 31 31 38 6B 73 2E
63 73 2E 73 69 65 6E 61 2E 65 64 75 3E 0D 0A 43 6F 6E 74 65 6E 74 2D 44 65 73 63
72 69 70 74 69 6F 6E 3A 20 0D 0A 43 6F 6E 74 65 6E 74 2D 44 69 73 70 6F 73 69 74
69 6F 6E 3A 20 61 74 74 61 63 68 6D 65 6E 74 3B 20 66 69 6C 65 6E 61 6D 65 3D 22
6D 69 6D 65 74 65 73 74 2E 74 78 74 22 0D 0A 0D 0A 56 47 68 70 63 79 42 70 63 79
42 30 61 47 55 67 62 57 56 7A 63 32 46 6E 5A 53 42 30 61 47 46 30 49 48 64 70 62 47
77 67 59 57 78 73 62 33 63 67 64 58 4D 67 64 47 38 67 5A 47 6C 7A 0D 0A 63 47 78
68 65 53 42 33 61 58 52 6F 49 45 56 30 61 47 56 79 5A 57 46 73 49 41 30 4B 59 53 42
4E 53 55 31 46 49 47 46 30 64 47 46 6A 61 47 31 6C 62 6E 51 57 61 57 35 7A 61 57 52
6C 0D 0A 49 47 46 75 49 46 4E 4E 56 46 41 67 5A 6E 4A 68 62 57 55 75 44 51 6F 3D
0D 0A 2D 2D 2D 31 34 36 33 37 38 36 32 34 30 2D 37 32 33 37 38 33 33 32 38 2D 31
30 36 37 36 33 34 33 35 30 3D 3A 32 36 36 30 36 2D 2D 0D 0A 2E 0D 0A

2.9.2 TCP PDU for the selected SMTP PDU

IP > TCP PDU > *Source Port* for the selected SMTP PDU

Field Name: *Source Port*

Purpose and Definition:
This 16-bit number represents the name of the application that sent the data in the IP packet.

Field Key: *Not applicable*

Data value (decimal): 3651

Data values in other bases:

Hexadecimal	0	D	E	9
Binary	0000	1101	1110	1001
Decimal	13		233	
ASCII	/n		↑	

IP > TCP PDU > *Destination Port* for the selected SMTP PDU

Field Name: *Destination Port*

Purpose and Definition:
This 16-bit number represents the name of the application that is to receive the data contained within the IP packet. This is one of the major differences between a Layer 3 and a Layer 4 header: the Layer 3 header contains the IP address of the computer that is to receive the IP packet; once that packet has been received, the port address in the Layer 4 header ensures that the data contained within that IP packet is passed to the correct application on that computer.

Field Key:
This key indicates assigned port number values:

Dec	**Port Numbers**
0	Reserved
1-32767	Internet registered ("well-known") protocols
32768-98303	Reserved, to allow TCPv7-TCPv4 conversion
98304 & up	Dynamic assignment

Data value (decimal): 25 (indicates SMTP)

Data values in other bases:

Hexadecimal	0	0	1	9
Binary	0000	0000	0001	1001
Decimal	25			

Source: http://www.zvon.org/tmRFC/RFC1475/Output/chapter4.html

IP > TCP PDU > ***Sequence Number*** for the selected SMTP PDU

Field Name: *Sequence Number*

Purpose and Definition:
TCP is responsible for ensuring that all IP packets sent are actually received. When an application's data is packaged into IP packets, TCP will give each IP packet a sequence number. Once all the packets have arrived at the receiving computer, TCP uses the number in this 32-bit field to ensure that all of the packets actually arrived and are in the correct sequence.

Field Key: *Not applicable*

Data value (decimal): 2069207327

Data values in other bases:

Hexadecimal	7	B	5	5	9	9	1	F
Binary	0111	1011	0101	0101	1001	1001	0001	1111
Decimal	123		85		153		31	
ASCII	{		U		↑		©	

IP > TCP PDU > *Acknowledgement Number* for the selected SMTP PDU

Field Name: *Acknowledgement Number*

Purpose and Definition:
This number is used by the receiving computer to acknowledge which packets have successfully arrived. This number will be the sequence number of the next packet the receiver is ready to receive.

Field Key: *Not applicable*

Data value (decimal): 3827794966

Data values in other bases:

Hexadecimal	E	4	2	7	8	4	1	6
Binary	1110	0100	0010	0111	1000	0100	0001	0110
Decimal	228		39		132		22	

IP > TCP PDU > *Header Length or Offset* for the selected SMTP PDU

Field Name: *Header Length or Offset*

Purpose and Definition:
This is identical in concept to the header length in an IP packet, except this time it indicates the length of the TCP header.

Field Key: *Not applicable*

Data value (bytes): 32

Data values in other bases:

Hexadecimal	8	0
Binary	1000	0000
Decimal	128	

IP > TCP PDU > *Reserved* for the selected SMTP PDU

Field Name: *Reserved*

Purpose and Definition:
These 6 bits are unused and are always set to 0.

Field Key: *Not applicable*

Data value (binary): 0000 00

Data values in other bases:

Hexadecimal	0	0	0	0	0	0
Binary	0000	0000	0000	0000	0000	0000
Decimal	0		0		0	

IP > TCP PDU > *Control Flags* for the selected SMTP PDU

Field Name: *Control Flags*

Purpose and Definition:
Every TCP packet contains this 6-bit value that indicates how many octets it can receive at once. When IP packets are received, they are placed in a temporary area of RAM known as a buffer until the receiving computer has a chance to process them; this value represents how big a buffer the receiving host has made available for this temporary storage of IP packets.

Field Key:

- Urgent (URG)
- Acknowledgement (ACK)
- Push (PSH)
- Reset (RST)
- Synchronize (SYN)
- Finish (FIN)

Data value (binary): 01 1000

Data values in other bases: *Not applicable*

IP > TCP PDU > *Window Size* for the selected SMTP PDU

Field Name: *Window Size*

Purpose and Definition:
Every TCP packet contains this 16-bit value that indicates how many octets it can receive at once. When IP packets are received, they are placed in a temporary area of RAM known as a buffer until the receiving computer has a chance to process them; this value represents how big a buffer the receiving host has made available for this temporary storage of IP packets.

Field Key: *Not applicable*

Data value (decimal): 32120

Data values in other bases:

Hexadecimal	7	D	7	8
Binary	0111	1101	0111	1000
Decimal	125		120	

IP > TCP PDU > *Checksum* for the selected SMTP PDU

Field Name: *Checksum*

Purpose and Definition:
Unlike IP, TCP is responsible for ensuring that the entire IP packet arrived intact. TCP will run a CRC on the entire IP packet (not just the header) and place the resulting checksum in this field. When the IP packet is received, TCP re-runs the CRC on the entire packet to ensure the checksum is the same.

Field Key: *Not applicable*

Data value (hexadecimal): 72 B5

Data values in other bases:

Hexadecimal	7	2	B	5
Binary	0111	0010	1011	0101
Decimal	114		181	

IP > TCP PDU > *Urgent Pointer* for the selected SMTP PDU

Field Name: *Urgent Pointer*

Purpose and Definition:
If the Urgent flag is set to on, this value indicates where the urgent data is located.

Information Key: *Not applicable*

Data value: *Not applicable*

Data values in other bases: *Not applicable*

IP > TCP PDU > *Options and Padding* for the selected SMTP PDU

Field Name: *Options and Padding*

Purpose and Definition:
Like IP options, this field is optional and represents additional instructions not covered in the other TCP fields. Again, if an option does not fill up a 32-bit word, it will be filled in with padding bits.

Field Key: *Not applicable*

Data value (hexadecimal): 01 01 08 0A 07 AE F6 75 00 21 66 A4

Data values in other bases:

Hexadecimal	0	1	0	1	0	8	0	A	0	7
Binary	0000	0001	0000	0001	0000	1000	0000	1010	0000	0111
Decimal	1		1		8		10		7	
ASCII	©		©		©		©		©	

Hexadecimal	A	E	F	6	7	5	0	0	2	1
Binary	1010	1110	1111	0110	0111	0101	0000	0000	0010	0001
Decimal	174		246		117		0		33	
ASCII	↑		↑		u		©		!	

Hexadecimal	6	6	A	4
Binary	0101	0011	0101	1000
Decimal	102		164	
ASCII	f		↑	

2.9.3 SMTP PDU for the selected SMTP PDU

IP > SMTP Header > *Command* for the selected SMTP PDU

RFC Link: http://www.ietf.org/rfc/rfc0821.txt?number=821

Field Name: *Command*

Purpose and Definition: ASCII messages sent between SMTP hosts.

Field Key:

Command	**Description**
DATA	Begins message composition.
EXPN <string>	Returns names on the specified mail list.
HELO <domain>	Returns identity of mail server.
HELP <command>	Returns information on the specified command.
MAIL FROM <host>	Initiates a mail session from host.
NOOP	Causes no action, except acknowledgement from server.
QUIT	Terminates the mail session.
RCPT TO <user>	Designates who receives mail.
RSET	Resets mail connection.
SAML FROM <host>	Sends mail to user terminal and mailbox.
SEND FROM <host>	Sends mail to user terminal.
SOML FROM <host>	Sends mail to user terminal or mailbox.
TURN	Switches role of receiver and sender.
VRFY <user>	Verifies the identity of a user.

Data value: Content_TEXT\Plain;name="mimetest.txt"

Data values in other bases:

Hexadecimal	4	3	6	F	6	E	7	4
Binary	0100	0011	0110	1111	0110	1110	0111	0100
Decimal	67		111		110		116	
ASCII	C		o		n		t	

Hexadecimal	6	5	6	E	7	4	2	D
Binary	0110	0101	0110	1110	0111	0100	0010	1101
Decimal	101		110		116		45	
ASCII	e		n		t		-	

Hexadecimal	5	4	4	5	5	8	5	4
Binary	0101	0100	0100	0101	0101	1000	0101	0100

Decimal	84		69		88		84	
ASCII	T		E		X		T	
Hexadecimal	2	F	5	0	6	C	6	1
Binary	0010	1111	0101	0000	0110	1100	0110	0001
Decimal	47		80		108		97	
ASCII	/		P		l		a	

Hexadecimal	6	9	6	E	3	B	6	9
Binary	0110	1001	0110	1110	0011	1011	0110	1001
Decimal	105		110		59		110	
ASCII	i		n		;		n	

Hexadecimal	6	1	6	D	6	5	3	D
Binary	0110	0001	0110	1101	0110	0101	0011	1101
Decimal	97		109		101		61	
ASCII	a		m		e		=	

Hexadecimal	2	0	6	3	6	8	6	1
Binary	0010	0000	0110	0011	0110	1000	0110	0001
Decimal	32		99		104		97	
ASCII	“		M		I		m	

Hexadecimal	2	2	7	4	6	5	7	3
Binary	0010	0010	0111	0100	0110	0101	0111	0011
Decimal	34		116		101		115	
ASCII	e		t		e		s	

Hexadecimal	7	4	2	E	7	4	7	8
Binary	0111	0100	0010	1110	0111	0100	0111	1000
Decimal	116		46		116		120	
ASCII	t		.		t		x	

Hexadecimal	7	4	2	0
Binary	0111	0100	0010	0000
Decimal	116		32	
ASCII	t		“	

IP > SMTP Header > *Message* for the selected SMTP PDU

Field Name: *Message*

Purpose and Definition: Response messages consist of a response code followed by explanatory text

Field Key:

Response Code	Explanatory Text
211	(Response to system status or help request).
214	(Response to help request).
220	Mail service ready.
221	Mail service closing connection.
250	Mail transfer completed.
251	User not local, forward to <path>.
354	Start mail message, end with <CRLF><CRLF>.
421	Mail service unavailable.
450	Mailbox unavailable.
451	Local error in processing command.
452	Insufficient system storage.
500	Unknown command.
501	Bad parameter.
502	Command not implemented.
503	Bad command sequence.
504	Parameter not implemented.
550	Mailbox not found.
551	User not local, try <path>.
552	Storage allocation exceeded.
553	Mailbox name not allowed.
554	Mail transaction failed.

Data value: *Not applicable.*

2.10 User Commands – SNMP (AKA “Clickable Buttons”)

IP PDU
IP Version
Internet Header Length
Type of Service
Total Length of Ethernet Frame
Identification
Flags
Fragment Offset
Time to Live
Protocol
Header Checksum
Source IP Address
Destination IP Address
Options
Data

UDP PDU
Source Port
Destination Port
Length
SNMP Checksum
Data

SMTP PDU
Source Port
Destination Port
Length
SNMP Checksum
Data

2.10.1 IP PDU for the selected SNMP PDU

IP PDU > *IP Version* for the selected SNMP PDU

Field Name: *IP Version*

Purpose and Definition: Version is a 4-bit field that indicates the format of the internet header.

Field Key: 4 = IPv4
6 = IPv6

Data value (decimal): 4

Data values in other bases:

Hexadecimal	4
Binary	0100
Decimal	4

IP PDU > *Internet Header Length* for the selected SNMP PDU

Field Name: *Internet Header Length*

Purpose and Definition: The IHL field is a 4-bit field indicating the length of the internet header in 32 bit words, and thus points to the beginning of the data. The minimum value of a correct header is 5.

Field Key: *Not applicable*

Data value: The value contained in our field is 20 bytes. This is the hexadecimal and decimal value of 5 multiplied by 4 bits.

Data values in other bases:

Hexadecimal	0	5
Binary	0000	0101
Decimal	5	

IP PDU > *Type of Service* for the selected SNMP PDU

Field Name: *Type of Service*

Purpose and Definition: Type of Service is an 8-bit field that provides and indication of the abstract parameters of the quality of service desired. These parameters guide the selection of the actual service parameters when transmitting a datagram through a particular network.

Field Key: The major choice is a three-way tradeoff between low-delay, high-reliability, and high-throughput.

0	1	2	3	4	5	6	7
Precedence			D	T	R	0	0

Bits 0-2: Precedence
Bit 3: (D) 0 = Normal Delay 1 = Low Delay
Bit 4: (T) 0 = Normal Throughput 1 = High Throughput
Bit 5: (R) 0 = Normal Reliability 1 = High Reliability

Precedence:

111 = Network Control
110 = Internetwork Control
101 = CRITIC/ECP
100 = Flash Overrided
011 = Flash
010 = Immediate
001 = Priority
000 = Routine

Data value (hexadecimal): 10

Data values in other bases:

Hexadecimal	1	0
Binary	0001	0000
Decimal	16	

IP PDU > *Total Length of Ethernet Frame* for the selected SNMP PDU

Field Name: *Total Length of Ethernet Frame*

Purpose and Definition: Total Length is a 16-bit field that indicates the length of the frame, measured in octets, including internet header and data. The maximum size is 2^{16}-1 or 65,535 octets; however, the recommended maximum size is 576 octets.

Field Key: *Not applicable*

Data values (decimal): 109

Data values in other bases:

Hexadecimal	6	D
Binary	110	1101
Decimal	109	

IP PDU > *Identification* for the selected SNMP PDU

Field Name: *Identification*

Purpose and Definition: Identification is a 16-bit field. An identifying value is assigned by the sender to aid in assembling the fragments of a datagram. The identifier is chosen based on the need to provide a way to uniquely identify the fragments and protocol for the time the datagram or any fragment could be alive in the internet.

Field Key: *Not applicable*

Data value (hexadecimal): D5 1A

Data values in other bases:

Hexadecimal	D	5	1	A
Binary	1101	0101	0001	1010

IP PDU > *Flags* for the selected SNMP PDU

Field Name: *Flags*

Purpose and Definition: Flags is a 3-bit field that indicates directions for fragmentation.

Field Key:
Bit 0: reserved, must be 0
Bit 1: (DF) 0 = May Fragment 1 = Don't Fragment
Bit 2: (MF) 0 = Last Fragment 1 = More Fragment

Data value (binary): 010

Data values in other bases: *Not applicable*

IP PDU > *Fragment Offset* for the selected SNMP PDU

Field Name: *Fragment Offset*

Purpose and Definition: The Fragment Offset is a 13- bit field indicating where in the Ethernet frame this fragment begins. The Fragment Offset is measured in units of 8 octets, and the first fragment has offset 0.

Field Key: *Not applicable*

Data value (decimal): 0

Data values in other bases:
Binary: 0000 0000 0000

IP PDU > *Time to Live* for the selected SNMP PDU

Field Name: *Time to Live*

Purpose and Definition: Time to Live is an 8-bit field that indicates the maximum time the datagram is allowed to remain in the internet. If this field contains the value 0, then the datagram must be destroyed. This field is modified in internet header processing. The time is measure in units of seconds, and is set by the sender to the maximum time the datagram is allowed to be in the internet. This field is decreased at each point that the internet header is processed. The intention is to cause undeliverable packets to be discarded, and to bind the maximum datagram lifetime.

Field Key: *Not applicable*

Data value (decimal): 64

Data values in other bases:

Hexadecimal	4	0
Binary	0100	0000
Decimal	64	

IP PDU > *Protocol* for the selected SNMP PDU

Field Name: *Protocol*

Purpose and Definition: Protocol is an 8-bit field that indicates the next level protocol that is used in the data portion of the internet diagram.

Field Key:

Dec	Hex	Protocol	Dec	Hex	Protocol
0	00	Reserved	22	16	Multiplexing
1	01	ICMP	23	17	DCN
2	02	Unassigned	24	18	TAC Monitoring
3	03	Gateway-to-Gateway	25-76	19-4C	Unassigned
4	04	CMCC Gateway Monitoring Message	77	4D	Any local network
5	05	ST	100	64	SATNET and Backroom EXPAK
6	06	TCP	101	65	MIT Subnet Support
7	07	UCL	102-104	66-68	Unassigned
10	0A	Unassigned	105	69	SATNET Monitoring
11	0B	Secure	106	6A	Unassigned
12	0C	BBN RCC Monitoring	107	6B	Internet Packet Core Utility
13	0D	NVP	110-113	6E-71	Unassigned
14	0E	PUP	114	72	Backroom SATNET Monitoring
15	0F	Pluribus	115	73	Unassigned
16	10	Telnet	116	74	WIDEBAND Monitoring
17	11	XNET	117	75	WIDEBAND EXPAK
20	14	Chaos	120-376	78-0178	Unassigned
21	15	User Datagram	377	0179	Reserved

Data value (hexadecimal): 06

Data values in other bases:

Hexadecimal	1	1
Binary	1	0001
Decimal	17	

RFC Link: http://www.faqs.org/rfcs/rfc790.html

IP PDU > *Header Checksum* for the selected SNMP PDU

Field Name: *Header Checksum*

Purpose and Definition: The Header Checksum is a 16-bit field. The Checksum is the 16-bit one's complement sum of all 16-bit words in the header. For purposes of computing the checksum, the initial value of its field is zero. When both header checksums are equal, then the header bits are correct. If either checksums vary, then a new, correct packet will need to be sent.

This is a simple way to compute the checksum and experimental evidence indicates that it is adequate, but it is provisional and may be replaced by a CRC procedure, depending on further experience.

Field Key: *Not applicable*

Data value (hexadecimal): 22 F0

Data values in other bases:

Hexadecimal	2	2	F	0
Binary	10	0010	1111	0000

IP PDU > *Source Address* for the selected SNMP PDU

Field Name: *Source Address*

Purpose and Definition: The Source Address is a 32-bit field that contains the IP address of the host that sent the IP Packet.

Field Key: *Not applicable*

Data value (decimal): 192.168.0.39

Data values in other bases:

Hexadecimal	C	0	A	8	0	0	2	7
Binary	1100	0000	1010	1000	0000	0000	0010	0111
Decimal	192		168		0		39	

.

IP PDU > *Destination Address* for the selected SNMP PDU

Field Name: *Destination Address*

Purpose and Definition: The Destination Address is a 32-bit field that contains the address of the host that is to receive the data contained within the IP packet.

Field Key: *Not applicable*

Data value (decimal): 192.168.0.143

Data values in other bases:

Hexadecimal	C	0	A	8	0	0	8	f
Binary	1100	0000	1010	1000	0000	0000	1000	1111
Decimal	192		168		0		143	

2.10.2 UDP PDU for the selected SNMP PDU

IP > UDP PDU > *Source Port* for the selected SNMP PDU

RFC Link: http://www.ietf.org/rfc/rfc0768.txt?number=768

Field Name: *Source Port*

Purpose and Definition: Source Port is an optional field, when meaningful, it indicates the port of the sending process, and may be assumed to be the port to which a reply should be addressed in the absence of any other information. If not used, a value of zero is inserted.

Field Key: *Not applicable*

Data value (decimal): 161

Data values in other bases:

Hexadecimal	A	1
Binary	1010	0001
Decimal	161	

IP > UDP PDU> D*estination Port* for the selected SNMP PDU

Field Name: *Destination Port*

Purpose and Definition: Destination Port has a meaning within the context of a particular internet destination address.

Field Key: *Not applicable*

Data value (decimal): 1034

Data values in other bases:

Hexadecimal	40	0A
Binary	0010	1101
Decimal	1034	

IP > UDP *Length* for the selected SNMP PDU

Field Name: *Length*

Purpose and Definition: Length is the length in octets of this user datagram including this header and the data (This means the minimum value of the length is eight).

Field Key: *Not applicable*

Data value (decimal): 89

Data values in other bases:

Hexadecimal	5	9
Binary	0101	1001
Decimal	89	

IP > UDP PDU > *Checksum* for the selected SNMP PDU

Field Name: *Checksum*

Purpose and Definition: Checksum is the 16-bit one's complement of the one's complement sum of a pseudo header of information from the IP header, the UDP header, and the data, padded with zero octets at the end (if necessary) to make a multiple of two octets.

Field Key: *Not applicable*

Data value (hexadecimal): 9A25

Data values in other bases:

Hexadecimal	9	A	2	5
Binary	1001	0000	0010	0101
Decimal	154		37	

IP > UDP PDU > *Data* for the selected SNMP PDU

Field Name: *Data*

Purpose and Definition:

Field Key: *Not applicable*

Data value (hexadecimal): see SNMP

Data values in other bases:
(ASCII): ↑ Extended ASCII

2.10.3 SNMP PDU for the selected SNMP PDU

IP > UDP > SNMP Header > *Version* for the selected SNMP PDU

Field Name: *Version*

Purpose and Definition: Version is a 6-bit field that indicates the format of the protocol

Field Key: *Not applicable*

Data value (hexadecimal): 02 01 00

Data values in other bases:

Hexadecimal	0	2	0	1	0	0
Binary	0000	0010	0000	0001	0000	0000
Decimal	2		1		0	

IP > UDP > SNMP Header > *Community* for the selected SNMP PDU

Field Name: *Community*

Purpose and Definition:

Field Key: Public: all users
Private: Selected users

Data value: The value contained in our field determines who view the information

Data values in other bases:

Hexadecimal	0	6	7	0	7	5	6	2	6	C
Binary	0000	0110	0111	0000	0111	0101	0110	0010	0110	1100
Decimal	1		1		8		10		7	
ASCII	©		©		©		©		©	

Hexadecimal	6	9	6	3
Binary	0110	1001	0110	0011
Decimal	105		99	
ASCII	i		c	

IP > UDP > SNMP Header > *PDU Type* for the selected SNMP PDU

Field Name: *PDU Type*

Purpose and Definition: The type of data.

Field Key: *Not applicable*

Data value (hexadecimal): A2 42

Values in other bases:

Hexadecimal	A	2	4	2
Binary	1010	0010	0100	0010
Decimal	162		66	
ASCII	↑		B	

IP > UDP > SNMP Header > *Request ID* for the selected SNMP PDU

Field Name: *Request ID*

Purpose and Definition: ID of the requester.

Field Key: *Not applicable*

Data value (hexadecimal): 51 EB

Data values in other bases:

Hexadecimal	5	1	E	B
Binary	0101	0001	1110	1011
Decimal	81		235	
ASCII	Q		↑	

IP > UDP > SNMP Header > *Error Status* for the selected SNMP PDU

Field Name: *Error Status*

Purpose and Definition: If there is an error, it will show here

Field Key: *Not applicable.*

Data value: No error

Data values in other bases: *Not applicable*

IP > UDP > SNMP Header > *Error ID* for the selected SNMP PDU

Field Name: *Error Index*

Purpose and Definition: How the error is defined.

Field Key: *Not applicable.*

Data value (hexadecimal): 02 01 00

Data values in other bases:

Hexadecimal	0	2	0	1	0	0
Binary	0000	0010	0000	0001	0000	0000
Decimal	2		1		0	

Programming Hint: The name for this variable in code will be IP_UDP_SNMP_ErrorIndex.

IP > UDP > SNMP Header > *Object ID* for the selected SNMP PDU

Field Name: *Object ID*

Purpose and Definition: How the packet is identified.

Field Key: *Not applicable*

Data value: 1.3.6.1.2.1.25.3.5.1.1.1

Data values in other bases:

Hexadecimal	1	3	6	1	2	1	2	5	3	5
Binary	0000	0011	0110	0001	0010	0001	0010	0101	0011	0101
Decimal	1	3	6	1	2	1	37		3	5
ASCII	©	©	©	©	©	©	%		©	©

Hexadecimal	1	1	1
Binary	0001	0001	0001
Decimal	1	1	1
ASCII	©	©	©

IP > UDP > SNMP Header > *Value Integer* for the selected SNMP PDU

Field Name: *Value Integer*

Purpose and Definition: The size of the integer

Field Key: *Not applicable.*

Data value (hexadecimal): 3

Data values in other bases:

Hexadecimal	3
Binary	11
Decimal	3

Programming Hint: The name for this variable in code will be

IP > UDP > SNMP Header > *Object ID* for the selected SNMP PDU

Field Name: *Object ID*

Purpose and Definition: How the packet is identified.

Field Key: *Not applicable*

Data value: 1.3.6.1.2.1.25.3.5.1.1.1

Data values in other bases:

Hexadecimal	1 3 6 1 2 1 25 3 5 1 1 1	
Binary	0001 0011 0110 0001 0010 0001 11001 0011 0101 0001 0001 0001	
Decimal	n/a	

3.0 GUI Testing Checklist

3.1. WINDOWS COMPLIANCE TESTING

3.1.1 For Each Application

- Start Application by Choosing a Protocol by clicking on its corresponding button
- No Login is necessary

3.1.2 For Each Window in the Application

- If Window has a Minimize Button, click it.
- Double Click the Icon to return the Window to its original size.
- The window caption for every application should have the name of the application and the window name - especially the error messages. These should be checked for spelling, English and clarity, especially on the top of the screen. Check does the title of the window make sense.
- Check all text on window for Spelling/Tense and Grammar
- If a field is disabled (grayed) then it should not have link within it. It should not be possible to select them with the mouse. Try this for every grayed control.

3.1.3 Command Buttons (AKA "Clickable Buttons")

- Click each button once with the mouse - This should activate
- Tab to each button - Press SPACE - This should activate
- Tab to each button - Press RETURN - This should activate

The above are **VERY IMPORTANT**, and should be done for **EVERY** command Button.

- Tab to another type of control (not a command button). One button on the screen should be default (indicated by a thick black border). Pressing Return in ANY no command button control should activate it.

3.2 Tester's Screen Validation Checklist

3.2.1 AESTHETIC CONDITIONS:

1. Is the general screen background the correct color?
2. Are the field prompts the correct color?
3. Are the field backgrounds the correct color?
4. In read-only mode, are the field prompts the correct color?
5. In read-only mode, are the field backgrounds the correct color?
6. Are all the screen prompts specified in the correct screen font?
7. Is the text in all fields specified in the correct screen font?
8. Are all the field prompts aligned perfectly on the screen?
9. Are all the fields edit boxes aligned perfectly on the screen?
10. Are all group boxes aligned correctly on the screen?
11. Should the screen be resizable?
12. Should the screen be minimizable?

13. Are all the field prompts spelt correctly?
14. Are all character or alphanumeric fields left justified? This is the default unless otherwise specified.
15. Are all numeric fields right justified? This is the default unless otherwise specified.
16. Is all the micro help text spelt correctly on this screen?
17. Is all the error message text spelt correctly on this screen?
18. Is all users input captured in UPPER case or lowercase consistently?
19. Where the database requires a value (other than null) then this should be defaulted into fields.
20. Assure that all windows have a consistent look and feel.
21. Assure that all dialog boxes have a consistent look and feel.

3.2.2 VALIDATION CONDITIONS:

1. Does a failure of validation on every field cause a sensible user error message?
2. Is the user required to fix entries, which have failed validation tests?
3. Have any fields got multiple validation rules and if so are all rules being applied?
4. Is validation consistently applied at screen level unless specifically required at field level?
5. For all numeric fields check whether negative numbers can and should be able to be entered.
6. For all numeric fields check the minimum and maximum values and also some mid-range values allowable?
7. For all character/alphanumeric fields check the field to ensure that there is a character limit specified and that this limit is exactly correct for the specified database size?
8. Do all mandatory fields require user input?
9. If any of the database columns don't allow null values then the corresponding screen fields must be mandatory. (If any field, which initially was mandatory, has become optional then check whether null values are allowed in this field.)

3.2.3 NAVIGATION CONDITIONS:

1. Can the screen be accessed correctly from the GUI?
2. Can the screen be accessed correctly from the toolbar?
3. Can the screen be accessed correctly by clicking on a list control on the previous screen?
4. Can all screens accessible via buttons on this screen be accessed correctly?
5. Can all screens accessible by double clicking on a list control be accessed correctly?
6. Is the screen modal. i.e. Is the user prevented from accessing other functions when this screen is active and is this correct?
7. Can a number of instances of this screen be opened at the same time and is this correct?

3.2.4 DATA INTEGRITY CONDITIONS:

1. Check the maximum field lengths to ensure that there are no truncated characters?

2. Where the database requires a value (other than null) then this should be defaulted into fields. The user must either enter an alternative valid value or leave the default value intact.

3. Check maximum and minimum field values for numeric fields?

4. If numeric fields accept negative values can these be stored correctly on the database and does it make sense for the field to accept negative numbers?

5. If a particular set of data is saved to the database check that each value gets saved fully to the database. i.e. Beware of truncation (of strings) and rounding of numeric values.

3.2.5 MODES (EDITABLE NON-IMPLEMENTED) CONDITIONS:

1. Are the screen and field colors adjusted correctly for those not implemented?

2. Can the screen be accessed from the previous screen?

3. Can all screens available from this screen be accessed?

3.2.6 GENERAL CONDITIONS:

1. Assure that the proper commands and options are in each menu.

2. Ensure the proper usage of the escape key (which is to undo any changes that have been made) and generates a caution message "Changes will be lost – Continue yes/no"

3. Assure that only command buttons, which are used by a particular window, or in a particular dialog box, are present. - i.e. make sure they don't work on the screen behind the current screen.

4. When command buttons is used sometimes and not at other times, assure that it is grayed out when it should not be used.

5. Assure that command button names are not abbreviations.

6. Assure that all field labels/names are not technical labels, but rather are names meaningful to system users.

7. Assure that command buttons are all of similar size and shape, and same font & font size.

8. Assure that each window/dialog box has a clearly marked default value (command button, or other object), which is invoked when the Enter key is pressed.

9. Assure that focus is set to an object/button, which makes sense according to the function of the window/dialog box.

10. Assure consistency of mouse actions across windows.

11. Assure that the color red is not used to highlight active objects (many individuals are red-green color blind).

12. Assure that the user will have control of the desktop with respect to general color and highlighting (the application should not dictate the desktop background characteristics).

13. Assure that the screen/window does not have a cluttered appearance

14. Banner style & size & display exact same as existing windows
15. All fonts to be the same
16. Alt+F4 will close the tabbed window and return you to main screen or previous screen (as appropriate), generating "changes will be lost" message if necessary.
17. Ensure all fields are disabled in read-only mode

3.3 Specific Field Tests

3.3.1 Numeric Fields

Assure that lowest and highest values are handled correctly
Assure that invalid values are logged and reported
Assure that valid values are handles by the correct procedure
Assure that numeric fields with a blank in position 1 are processed or reported as an error
Assure that fields with a blank in the last position are processed or reported as an error an error
Assure that both + and - values are correctly processed
Assure that division by zero does not occur
Include value zero in all calculations
Include at least one in-range value
Include maximum and minimum range values
Include out of range values above the maximum and below the minimum
Assure that upper and lower values in ranges are handled correctly

3.3.2 Alpha Field Checks

Use blank and non-blank data
Include lowest and highest values
Include invalid characters & symbols
Include valid characters
Include data items with first position blank
Include data items with last position blank

4.0 Appendix

4.1 Glossary

ASCII:

American Standard Code for Information Interchange: a code for representing English characters as numbers, with each letter assigned a number from 0 to 127.

Attribute:

A named value or relationship that exists for some or all instances of some entity and is directly associated with that instance.

Binary:

Pertaining to a number system that has just two unique digits, 0 and 1. Computers operate on a binary number system.

Code:

The symbolic arrangement of data or instructions in a computer program or the set of such instructions.

Data Flow Diagram:

A graphical notation used to describe how data flows between processes in a system. They are a representation of the functional decomposition of a system.

Decimal:

Refers to numbers in base 10—the numbers we use in everyday life.

Dynamic Combo Menu:

Menu showing all actions possible at the current moment.

Frame:

A feature that divides a browser's window into separate segments that can be scrolled independently of each other; a single step in a sequence of programmed instructions

GUI:

Graphical User Interface: A user interface based on graphics (icons, pictures, and menus) instead of text; uses a mouse as well as a keyboard as an input device.

Gantt Chart:

A chart that depicts progress in relation to time, often used in planning and tracking a project

HTML:

Hypertext Transfer Markup Language: A markup language used to structure text and multimedia documents and to set up hypertext links between documents, used extensively on the World Wide Web.

Hexadecimal:

Refers to the base-16 number system which consists of 16 unique symbols: the numbers 0 to 9 and the letters A to F.

Hypertext:

A computer-based text retrieval system that enables a user to access particular locations in web pages or other electronic documents by clicking on links within specific web pages or documents.

Internet:

An interconnected system of networks that connects computers around the world via the TCP/IP protocol.

Linear Sequential Model:

Sometimes called the *classic life cycle* or the *waterfall model*, this model suggests a systematic, sequential approach to software development that begins at the system level and progresses through analysis, design, coding, testing, and support.

Linux:

A trademark for an open-source version of the UNIX operating system.

Network:

A group of two or more computer systems linked together.

Open-Source:

A method and philosophy for software licensing and distribution designed to encourage use and improvement of software written by volunteers by ensuring that anyone can copy the source code.

PHP:

PHP Hypertext Preprocessor (server-side scripting language)

Packet:

A short block of data transmitted in a packet switching network.

PDU:

Protocol Data Unit: A packet of data passed across a network.

Protocol:

A set of formal rules describing how to transmit data, especially across a network.

Prototype:

An original type, form, or instance serving as a basis or standard for later stages.

RFC:

Request for Comments: One of a long-establish series of numbered Internet informational documents and standards widely followed by commercial software and freeware in the Internet and Unix communities.

Software:

The code executed by a computer, as opposed to the physical device which they run on.

TCP/IP:

Transmission Control Protocol/Internet Protocol: A suite of protocols for communication between computers, used as a standard for transmitting data over networks and as the basis for standard Internet protocols.

UNIX:

A powerful operating system developed at the ATT Bell Laboratories.

Use Case:

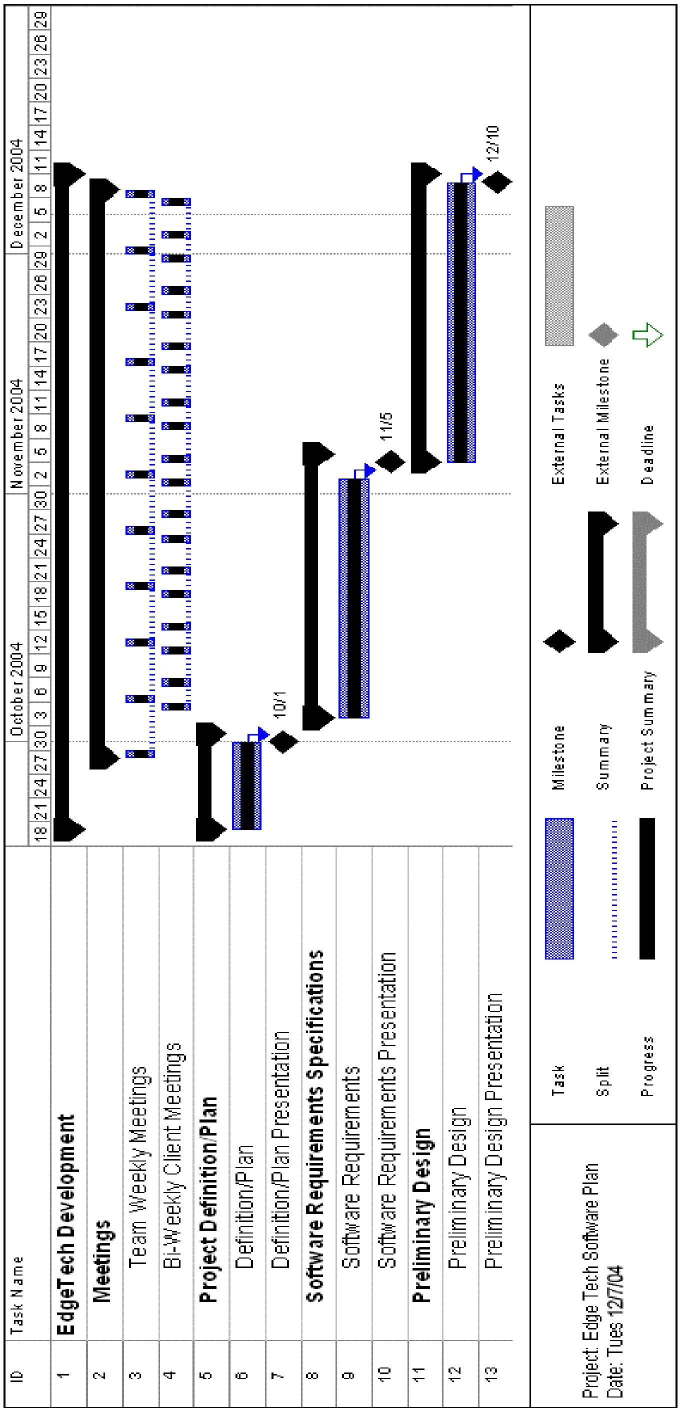
The specification of sequences of actions that a system, subsystem, or class can perform by interacting with outside actors.

Visible Analyst:

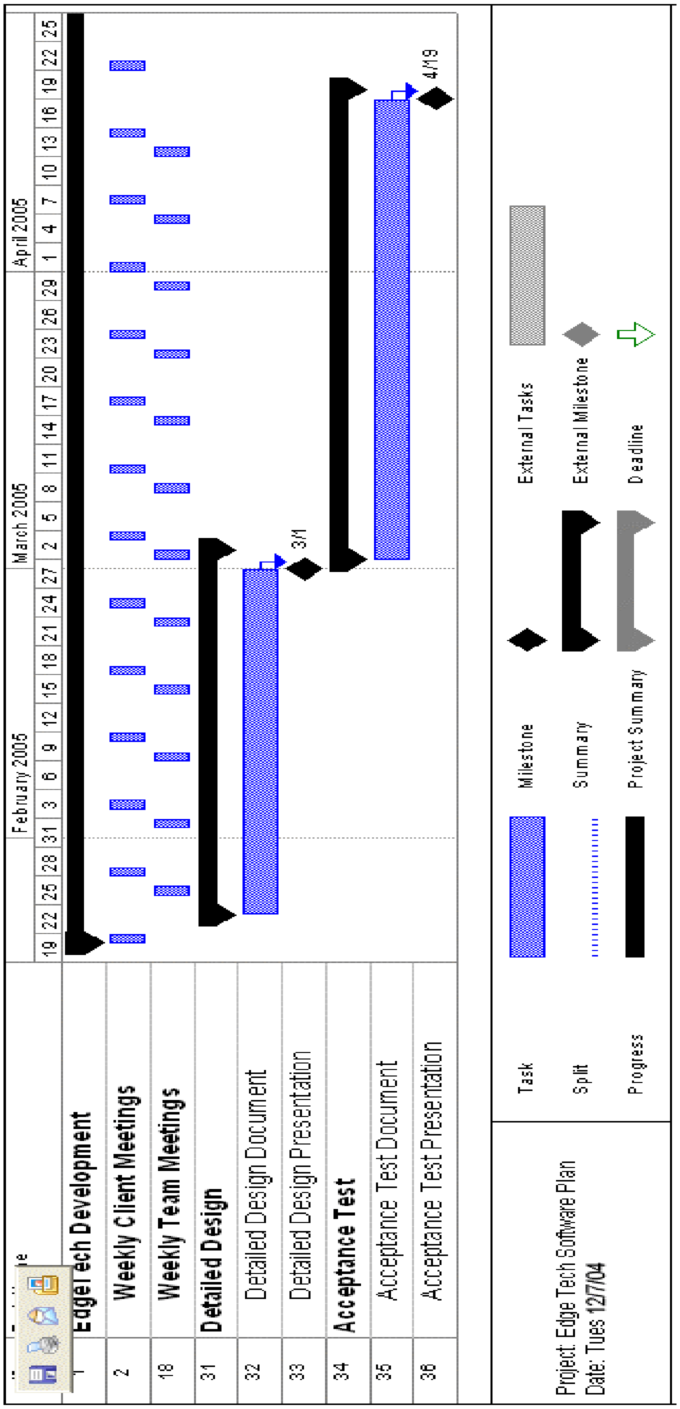
Project management software used in Computer-Aided Software Engineering (CASE) to create such illustrations as the data flow diagrams.

3.2 Gantt Charts

Fall Gantt Chart:



Spring Gantt Chart:



1	Edge ech Development
2	Weekly Client Meetings
18	Weekly Team Meetings
31	Detailed Design
32	Detailed Design Document
33	Detailed Design Presentation
34	Acceptance Test
35	Acceptance Test Document
36	Acceptance Test Presentation

Project: Edge Tech Software Plan
Date: Tues 12/7/04