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## DECLARATION

The maximum duty cycle of the Sony LAN card model ERA-201D1 for use in AIBO (toy dog) is declared to be 30%.

Please see Conclusion & Comment section on page 4 for the attached report (test and measurement conducted by Sony Corporation) as evidence of this declaration.

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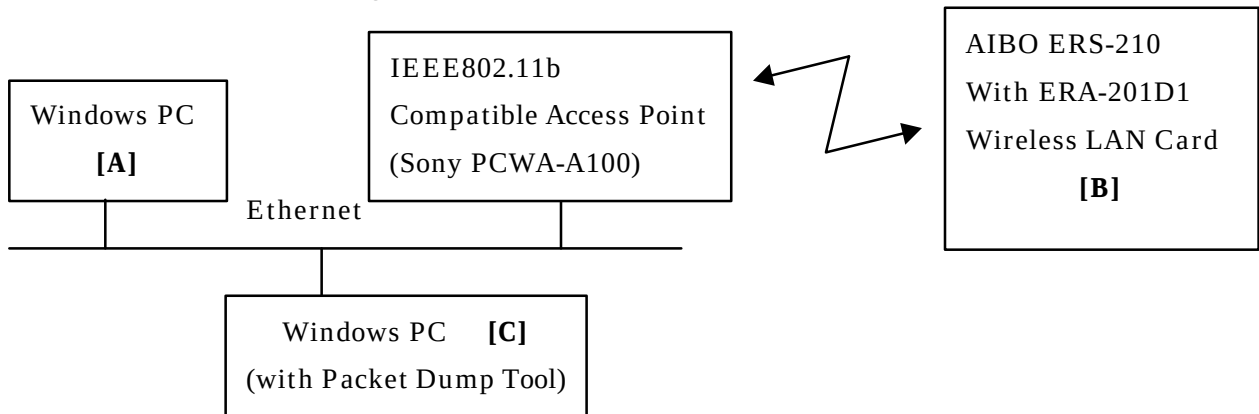
## MEASUREMENT RESULTS OF DUTY RATIO OF AIBO WIRELESS LAN CARD

### Purpose:

This report describes a measurement results regarding duty ratio of communications between ERA-201D1 AIBO wireless LAN card and a host computer in condition of typical application.

### Measurement Block Diagram:

The measurement block diagram is shown as below:



[A] : Hostname is “hirata03.erc.sony.co.jp” and connects to the Ethernet.

[B] : Hostname is “900h-ice1.erc.sony.co.jp” and completes a connection to the IEEE 802.11b access point with the Ethernet over radio.

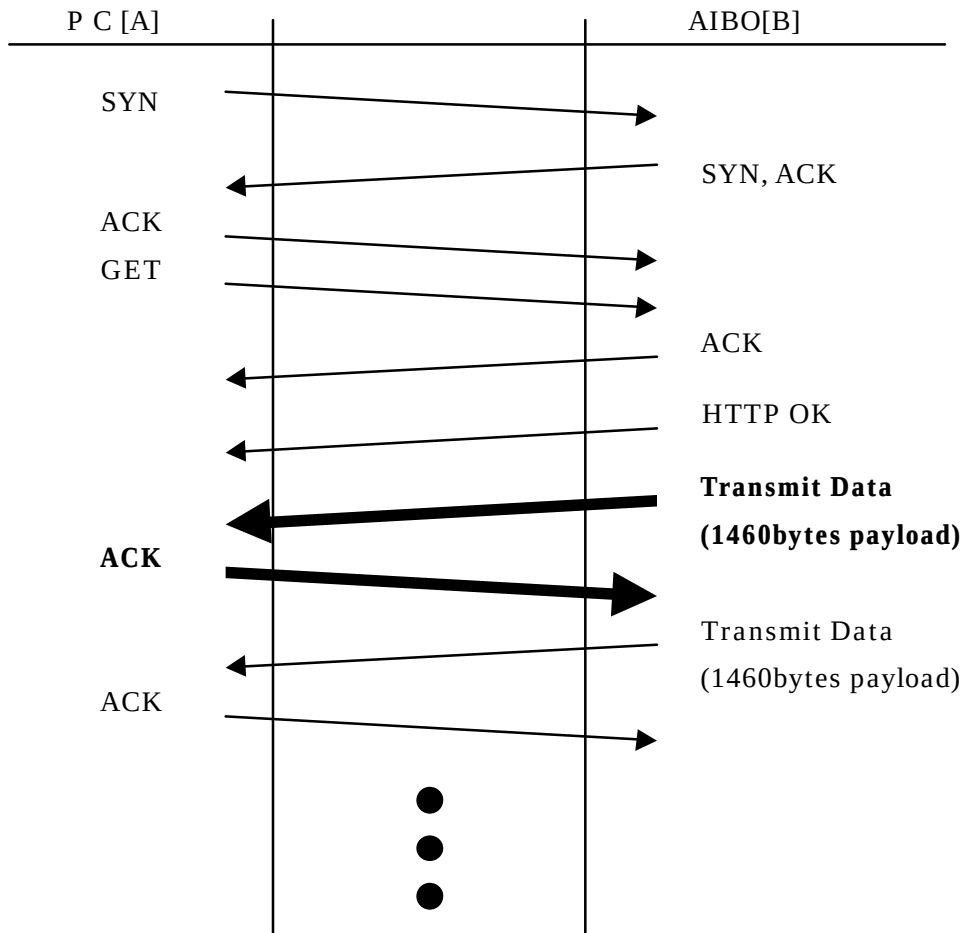
[C] : This computer monitors communications between the host computer and the AIBO.

### Conditions of Communication Test:

The AIBO ERS-210 and AIBO wireless LAN card ERA-201D1 are supported communications each other using TCP/IP protocol.

The measurement flow for the measurement is shown as below and a file with 6924 byte is transmitted on HTTP(Hyper Text Transfer Protocol).

The flow shows the transmission from AIBO to the host computer and vice versa.



The maximum payload length of Ethernet(IEEE802.3) is 1460 bytes.

In TCP transmission, when the receiver receive a data, the receiver side always returns the acknowledgement data. Transaction period between the host and AIBO is measured as time shown with bold line in above flow chart in condition of transmitting the maximum length packet from AIBO.

### Calculation procedure:

Maximum transmitting duty ratio from AIBO is calculated as follows:

$$(\text{Max. Duty Ratio}) = (\text{Transmit Period for Maximum Payload Data}) / (\text{Transaction Period (described the previous page)})$$

AIBO wireless LAN card, ERA-201D1, is applicable to 4 transmitting speeds, 11, 5.5, 2 and 1 Mbps in accordance with IEEE802.11b.

The transmitting data comprise of those shown as following expression;

$$(\text{Transmitting Data Length}) = (\text{HR/DSSS Frame Length}) + (\text{Ethernet Frame Length})$$

$$(\text{HR/DSSS Frame Length}) = 192\text{bits} \text{ --- (i)}$$

$$\begin{aligned} (\text{Ethernet Frame Length}) &= (\text{Ethernet Header Length}) + (\text{IP Header Length}) \\ &\quad + (\text{TCP Header Length}) + (\text{Payload Data}) \\ &= 14 + 20 + 20 + 1460 \\ &= 1514 \text{ bytes} \\ &= 12112\text{bits} \text{ --- (ii)} \end{aligned}$$

Where, transmitting period of HR/DSSS Frame Length of expression (i) is constant in 1Mbps transmission speed and transmitting period of Ethernet Frame Length of expression (ii) is variable with change of transmission speeds.----- (this period changes adaptively depending on radio condition)

Therefore, transmitting period is calculated as follows:

$$(\text{transmitting period of data}) = (\text{transmitting period of (i)}) + (\text{transmitting period of (ii)})$$

$$\begin{aligned} &= 192 / 1.0 \times 10^{-6} + 12112 / (\text{transmitting speed [bps]}) \\ &= (192 + 12112 / (\text{transmitting speed [Mbps]})) [\text{us}] \text{ --- (iii)} \end{aligned}$$

(1) 11Mbps transmitting speed

$$(\text{Transmitting Period}) = 192 + 12112 / 11 = 1293\text{us}$$

(2) 5.5Mbps transmitting speed

$$(\text{Transmitting Period}) = 192 + 12112 / 5.5 = 2394\text{us}$$

(3) 2Mbps transmitting speed

$$(\text{Transmit Period}) = 192 + 12112 / 2 = 6248\text{us}$$

(4) 1Mbps transmitting speed

$$(\text{Transmit Period}) = 192 + 12112 / 1 = 12304\text{us}$$

## Measurement result:

Measurement result of ethereal tool is as below.

| Speed   | Transaction<br>Start Time [s] | Transaction<br>End Time [s] | Transaction<br>Period [s]<br><b>(I)</b><br>(End – Start) | Max.<br>Payload<br>Transmit<br>Period [s]<br><b>(II)</b> | Duty Ratio<br>( (II) / (I) ) |
|---------|-------------------------------|-----------------------------|----------------------------------------------------------|----------------------------------------------------------|------------------------------|
| 11Mbps  | 0.324660                      | 0.349816                    | 0.025156                                                 | $1293 \times 10^{-6}$                                    | 0.051                        |
| 5.5Mbps | 0.324302                      | 0.350305                    | 0.026003                                                 | $2394 \times 10^{-6}$                                    | 0.092                        |
| 2Mbps   | 0.333636                      | 0.358180                    | 0.024544                                                 | $6248 \times 10^{-6}$                                    | 0.25                         |
| 1Mbps   | 1.844316                      | 1.873928                    | 0.029612                                                 | $12304 \times 10^{-6}$                                   | 0.42                         |

## Conclusion & Comment:

Maximum Transmitting Duty Rate is variable depending on the communication speed of Wireless LAN card as below.

11Mbps : 5.1% < 30%

5.5Mbps : 9.2% < 30%

2Mbps : 25% < 30%

1Mbps : 42% > 30% (NOTE: 1Mbps Communication is unstable)

Maximum Duty Rate of 30% that we indicated is the value of which stable transmitting is put into practice at the rate of 2Mbps, 5.5Mbps and 11Mbps. Transmitting rate of 1Mbps is an impracticable rate for this wireless LAN card because of transmitting error due to the unqualified transmitting. Also, if the transmitting error of frequent occurrence, transmitting window size of TCP is switched over to smaller rate by the regulation of its software. Therefore, transmission at maximum payload on 1Mbps is not carried out continuously. From a practical standpoint, performance faster than 2Mbps is considered reasonable and proper for this wireless LAN card. We hereby declare that the maximum duty rate of this device is 30%.

In addition to the above, under conditions using actual application, data transmission from PC to the wireless LAN card in AIBO and data transmission from the wireless LAN card to PC are transmitted simultaneously. The duty rates in this report are maximum value based on this measurement method. Due to characteristic features of bi-directional transmission of this wireless LAN card, actual duty rate of this wireless LAN card is less than the rates measured and shown in this report.

**Wireshark - Packet #8 (1514 on wire, 1514 captured)**

| No. | Time     | Source                | Destination           | Protocol | Info                      |
|-----|----------|-----------------------|-----------------------|----------|---------------------------|
| 1   | 0.000000 | 900h-ice1.erc.sony.co | hirata03.erc.sony.co  | ARP      | 43.3.71.121 is at 00:02:2 |
| 2   | 0.000108 | hirata03.erc.sony.co  | 900h-ice1.erc.sony.co | TCP      | 1149 > 80 [SYN] Seq=41753 |
| 3   | 0.004252 | 900h-ice1.erc.sony.co | hirata03.erc.sony.co  | TCP      | 80 > 1149 [SYN, ACK] Seq= |
| 4   | 0.004414 | hirata03.erc.sony.co  | 900h-ice1.erc.sony.co | TCP      | 1149 > 80 [ACK] Seq=41753 |
| 5   | 0.004988 | hirata03.erc.sony.co  | 900h-ice1.erc.sony.co | HTTP     | GET /header.gif HTTP/1.1  |
| 6   | 0.012241 | 900h-ice1.erc.sony.co | hirata03.erc.sony.co  | TCP      | 80 > 1149 [ACK] Seq=11926 |
| 7   | 0.324660 | 900h-ice1.erc.sony.co | hirata03.erc.sony.co  | HTTP     | HTTP/1.1 200 OK           |
| 8   | 0.349540 | 900h-ice1.erc.sony.co | hirata03.erc.sony.co  | HTTP     | Continuation              |
| 9   | 0.349816 | hirata03.erc.sony.co  | 900h-ice1.erc.sony.co | TCP      | 1149 > 80 [ACK] Seq=41754 |
| 10  | 0.351362 | 900h-ice1.erc.sony.co | hirata03.erc.sony.co  | HTTP     | Continuation              |
| 11  | 0.351382 | 900h-ice1.erc.sony.co | hirata03.erc.sony.co  | TCP      | 80 > 1149 [ACK] Seq=11926 |
| 12  | 0.360233 | 900h-ice1.erc.sony.co | hirata03.erc.sony.co  | HTTP     | Continuation              |
| 13  | 0.360552 | hirata03.erc.sony.co  | 900h-ice1.erc.sony.co | TCP      | 1149 > 80 [ACK] Seq=41754 |
| 14  | 0.362533 | 900h-ice1.erc.sony.co | hirata03.erc.sony.co  | HTTP     | Continuation              |
| 15  | 0.362555 | 900h-ice1.erc.sony.co | hirata03.erc.sony.co  | HTTP     | Continuation              |
| 16  | 0.362788 | hirata03.erc.sony.co  | 900h-ice1.erc.sony.co | TCP      | 1149 > 80 [ACK] Seq=41754 |
| 17  | 0.372587 | 900h-ice1.erc.sony.co | hirata03.erc.sony.co  | HTTP     | Continuation              |
| 18  | 0.372606 | 900h-ice1.erc.sony.co | hirata03.erc.sony.co  | TCP      | 80 > 1149 [ACK] Seq=11926 |
| 19  | 0.568467 | hirata03.erc.sony.co  | 900h-ice1.erc.sony.co | TCP      | 1149 > 80 [ACK] Seq=41754 |
| 20  | 0.916033 | 0.0080923163cf        | 0.devsvr01.erc.sony.c | IPX SAP  | Nearest Query             |
| 21  | 0.916133 | 0.0080923163cf        | 0.devsvr01.erc.sony.c | IPX SAP  | Nearest Query             |

**Packet Details:**

- ☒ Frame 8 (1514 on wire, 1514 captured)
  - ☒ Ethernet II
  - ☒ Internet Protocol
  - ☒ Transmission Control Protocol, Src Port: 80 (80), Dst Port: 1149 (1149), Seq: 1192656562, A
  - ☐ Hypertext Transfer Protocol
    - Data (1460 bytes)

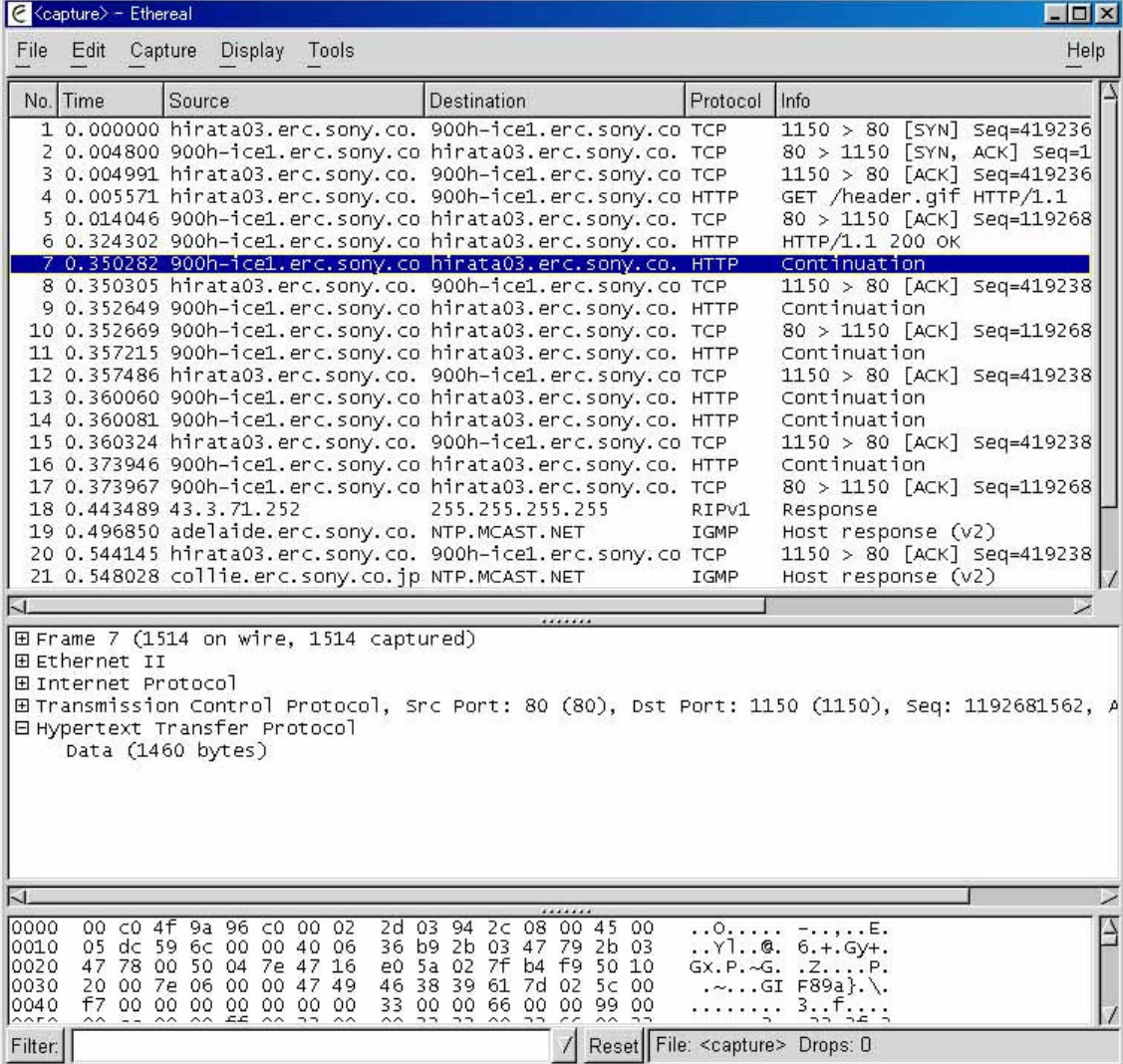
**Packet Bytes:**

```

0000  00 c0 4f 9a 96 c0 00 02 2d 03 94 2c 08 00 45 00  ..O.....-.....E.
0010  05 dc 59 61 00 00 40 06 36 c4 2b 03 47 79 2b 03  ..Ya..@. 6.+ Gy+.
0020  47 78 00 50 04 7d 47 16 7e b2 02 7d 1e 4c 50 10  Gx.P.}G. ~..}LP.
0030  20 00 76 5f 00 00 47 49 46 38 39 61 7d 02 5c 00  .v...GI F89a}.\.
0040  f7 00 00 00 00 00 00 00 33 00 00 66 00 00 99 00  ..... 3..f.....
  
```

**Filter:**  **Reset** **File:** <capture> **Drops:** 0

## Display of the measurement: 5Mbps



The screenshot shows the Wireshark interface with a packet capture of 21 packets. The selected packet is Frame 7, which is an HTTP continuation packet. The details pane shows the packet structure: Ethernet II, Internet Protocol, Transmission Control Protocol (Src Port: 80, Dst Port: 1150, Seq: 1192681562), and Hypertext Transfer Protocol (Data: 1460 bytes). The packet bytes pane shows the raw data in hexadecimal and ASCII.

| No. | Time     | Source                | Destination           | Protocol | Info                       |
|-----|----------|-----------------------|-----------------------|----------|----------------------------|
| 1   | 0.000000 | hirata03.erc.sony.co. | 900h-ice1.erc.sony.co | TCP      | 1150 > 80 [SYN] Seq=419236 |
| 2   | 0.004800 | 900h-ice1.erc.sony.co | hirata03.erc.sony.co. | TCP      | 80 > 1150 [SYN, ACK] Seq=1 |
| 3   | 0.004991 | hirata03.erc.sony.co. | 900h-ice1.erc.sony.co | TCP      | 1150 > 80 [ACK] Seq=419236 |
| 4   | 0.005571 | hirata03.erc.sony.co. | 900h-ice1.erc.sony.co | HTTP     | GET /header.gif HTTP/1.1   |
| 5   | 0.014046 | 900h-ice1.erc.sony.co | hirata03.erc.sony.co. | TCP      | 80 > 1150 [ACK] Seq=119268 |
| 6   | 0.324302 | 900h-ice1.erc.sony.co | hirata03.erc.sony.co. | HTTP     | HTTP/1.1 200 OK            |
| 7   | 0.350282 | 900h-ice1.erc.sony.co | hirata03.erc.sony.co. | HTTP     | Continuation               |
| 8   | 0.350305 | hirata03.erc.sony.co. | 900h-ice1.erc.sony.co | TCP      | 1150 > 80 [ACK] Seq=419238 |
| 9   | 0.352649 | 900h-ice1.erc.sony.co | hirata03.erc.sony.co. | HTTP     | Continuation               |
| 10  | 0.352669 | 900h-ice1.erc.sony.co | hirata03.erc.sony.co. | TCP      | 80 > 1150 [ACK] Seq=119268 |
| 11  | 0.357215 | 900h-ice1.erc.sony.co | hirata03.erc.sony.co. | HTTP     | Continuation               |
| 12  | 0.357486 | hirata03.erc.sony.co. | 900h-ice1.erc.sony.co | TCP      | 1150 > 80 [ACK] Seq=419238 |
| 13  | 0.360060 | 900h-ice1.erc.sony.co | hirata03.erc.sony.co. | HTTP     | Continuation               |
| 14  | 0.360081 | 900h-ice1.erc.sony.co | hirata03.erc.sony.co. | HTTP     | Continuation               |
| 15  | 0.360324 | hirata03.erc.sony.co. | 900h-ice1.erc.sony.co | TCP      | 1150 > 80 [ACK] Seq=419238 |
| 16  | 0.373946 | 900h-ice1.erc.sony.co | hirata03.erc.sony.co. | HTTP     | Continuation               |
| 17  | 0.373967 | 900h-ice1.erc.sony.co | hirata03.erc.sony.co. | TCP      | 80 > 1150 [ACK] Seq=119268 |
| 18  | 0.443489 | 43.3.71.252           | 255.255.255.255       | RIPv1    | Response                   |
| 19  | 0.496850 | adelaide.erc.sony.co. | NTP.MCAST.NET         | IGMP     | Host response (v2)         |
| 20  | 0.544145 | hirata03.erc.sony.co. | 900h-ice1.erc.sony.co | TCP      | 1150 > 80 [ACK] Seq=419238 |
| 21  | 0.548028 | collie.erc.sony.co.jp | NTP.MCAST.NET         | IGMP     | Host response (v2)         |

Frame 7 (1514 on wire, 1514 captured)

- Ethernet II
- Internet Protocol
- Transmission Control Protocol, Src Port: 80 (80), Dst Port: 1150 (1150), Seq: 1192681562, A
- Hypertext Transfer Protocol
  - Data (1460 bytes)

Filter: / Reset File: <capture> Drops: 0

## Display of the measurement: 2Mbps

The screenshot shows the Wireshark interface with a packet capture of 21 packets. The packet list pane shows the following details:

| No. | Time     | Source                | Destination           | Protocol | Info                       |
|-----|----------|-----------------------|-----------------------|----------|----------------------------|
| 1   | 0.000000 | hirata03.erc.sony.co. | 900h-ice1.erc.sony.co | TCP      | 1159 > 80 [SYN] Seq=435277 |
| 2   | 0.004396 | 900h-ice1.erc.sony.co | hirata03.erc.sony.co. | TCP      | 80 > 1159 [SYN, ACK] Seq=1 |
| 3   | 0.004565 | hirata03.erc.sony.co. | 900h-ice1.erc.sony.co | TCP      | 1159 > 80 [ACK] Seq=435277 |
| 4   | 0.005132 | hirata03.erc.sony.co. | 900h-ice1.erc.sony.co | HTTP     | GET /header.gif HTTP/1.1   |
| 5   | 0.015449 | 900h-ice1.erc.sony.co | hirata03.erc.sony.co. | TCP      | 80 > 1159 [ACK] Seq=161316 |
| 6   | 0.210109 | 43.3.71.252           | ALL-ROUTERS.MCAST.NET | HSRP     | Hello (state standby)      |
| 7   | 0.213732 | 900h-ice1.erc.sony.co | hirata03.erc.sony.co. | TCP      | 80 > 1159 [ACK] Seq=161316 |
| 8   | 0.333636 | 900h-ice1.erc.sony.co | hirata03.erc.sony.co. | HTTP     | HTTP/1.1 200 OK            |
| 9   | 0.357902 | 900h-ice1.erc.sony.co | hirata03.erc.sony.co. | HTTP     | Continuation               |
| 10  | 0.358180 | hirata03.erc.sony.co. | 900h-ice1.erc.sony.co | TCP      | 1159 > 80 [ACK] Seq=435279 |
| 11  | 0.369911 | 900h-ice1.erc.sony.co | hirata03.erc.sony.co. | HTTP     | Continuation               |
| 12  | 0.369931 | 900h-ice1.erc.sony.co | hirata03.erc.sony.co. | TCP      | 80 > 1159 [ACK] Seq=161316 |
| 13  | 0.378304 | 900h-ice1.erc.sony.co | hirata03.erc.sony.co. | HTTP     | Continuation               |
| 14  | 0.378572 | hirata03.erc.sony.co. | 900h-ice1.erc.sony.co | TCP      | 1159 > 80 [ACK] Seq=435279 |
| 15  | 0.393627 | 900h-ice1.erc.sony.co | hirata03.erc.sony.co. | HTTP     | Continuation               |
| 16  | 0.394989 | 900h-ice1.erc.sony.co | hirata03.erc.sony.co. | HTTP     | Continuation               |
| 17  | 0.395106 | hirata03.erc.sony.co. | 900h-ice1.erc.sony.co | TCP      | 1159 > 80 [ACK] Seq=435279 |
| 18  | 0.409266 | 900h-ice1.erc.sony.co | hirata03.erc.sony.co. | HTTP     | Continuation               |
| 19  | 0.410517 | 900h-ice1.erc.sony.co | hirata03.erc.sony.co. | TCP      | 80 > 1159 [ACK] Seq=161317 |
| 20  | 0.594214 | hirata03.erc.sony.co. | 900h-ice1.erc.sony.co | TCP      | 1159 > 80 [ACK] Seq=435279 |
| 21  | 1.733479 | 00:30:b6:34:69:74     | devsvr01.erc.sony.co. | ARP      | who has 43.3.71.92? Tell   |

The packet details pane for packet 9 (selected) shows:

- Frame 9 (1514 on wire, 1514 captured)
- Ethernet II
- Internet Protocol
- Transmission Control Protocol, Src Port: 80 (80), Dst Port: 1159 (1159), Seq: 1613164566, A
- Hypertext Transfer Protocol
  - Data (1460 bytes)

The packet bytes pane shows the raw data in hexadecimal and ASCII:

```

0000  00 c0 4f 9a 96 c0 00 02 2d 03 94 2c 08 00 45 00  ..O....-....E.
0010  05 dc ca be 00 00 40 06 c5 66 2b 03 47 79 2b 03  .....@. .f+.Gy+.
0020  47 78 00 50 04 87 60 26 f0 16 02 98 2f 30 50 10  GX.P..`& .... /OP.
0030  20 00 da e1 00 00 47 49 46 38 39 61 7d 02 5c 00  ....GI F89a}.\.
0040  f7 00 00 00 00 00 00 33 00 00 66 00 00 99 00  .... 3..f....
  
```

The filter bar at the bottom shows: Filter: / Reset File: <capture> Drops: 0

## Display of the measurement:1Mbps

The screenshot displays the Wireshark interface with a packet capture of a 1Mbps measurement. The packet list shows various protocols including IGMP, HSRP, STP, and HTTP. Packet 8 is selected, showing details for Ethernet II, Internet Protocol, Transmission Control Protocol, and Hypertext Transfer Protocol. The packet bytes pane shows the raw data in hexadecimal and ASCII.

| No. | Time     | Source                | Destination           | Protocol | Info                                 |
|-----|----------|-----------------------|-----------------------|----------|--------------------------------------|
| 1   | 0.000000 | rhino.erc.sony.co.jp  | NTP.MCAST.NET         | IGMP     | Host response (v2)                   |
| 2   | 0.064448 | 43.3.71.253           | ALL-ROUTERS.MCAST.NET | HSRP     | Hello (state Active)                 |
| 3   | 0.114781 | 00:01:97:10:57:3b     | 01:80:c2:00:00:00     | STP      | Conf. Root = 32768/00:01:97:10:57:3b |
| 4   | 1.524971 | hirata03.erc.sony.co. | 900h-ice1.erc.sony.co | HTTP     | GET /header.gif HTTP/1.1             |
| 5   | 1.620935 | 43.3.71.252           | ALL-ROUTERS.MCAST.NET | HSRP     | Hello (state Standby)                |
| 6   | 1.649344 | 900h-ice1.erc.sony.co | hirata03.erc.sony.co. | TCP      | 80 > 1164 [ACK] Seq=220137           |
| 7   | 1.844316 | 900h-ice1.erc.sony.co | hirata03.erc.sony.co. | HTTP     | HTTP/1.1 200 OK                      |
| 8   | 1.873643 | 900h-ice1.erc.sony.co | hirata03.erc.sony.co. | HTTP     | Continuation                         |
| 9   | 1.873928 | hirata03.erc.sony.co. | 900h-ice1.erc.sony.co | TCP      | 1164 > 80 [ACK] Seq=441839           |
| 10  | 1.880569 | 900h-ice1.erc.sony.co | hirata03.erc.sony.co. | HTTP     | Continuation                         |
| 11  | 1.880704 | 900h-ice1.erc.sony.co | hirata03.erc.sony.co. | HTTP     | Continuation                         |
| 12  | 1.880820 | hirata03.erc.sony.co. | 900h-ice1.erc.sony.co | TCP      | 1164 > 80 [ACK] Seq=441839           |
| 13  | 1.894020 | 900h-ice1.erc.sony.co | hirata03.erc.sony.co. | HTTP     | Continuation                         |
| 14  | 1.900777 | 900h-ice1.erc.sony.co | hirata03.erc.sony.co. | HTTP     | Continuation                         |
| 15  | 1.900844 | 900h-ice1.erc.sony.co | hirata03.erc.sony.co. | HTTP     | Continuation                         |
| 16  | 1.901061 | hirata03.erc.sony.co. | 900h-ice1.erc.sony.co | TCP      | 1164 > 80 [ACK] Seq=441839           |
| 17  | 1.905473 | 900h-ice1.erc.sony.co | hirata03.erc.sony.co. | HTTP     | Continuation                         |
| 18  | 1.905493 | 900h-ice1.erc.sony.co | hirata03.erc.sony.co. | TCP      | 80 > 1164 [ACK] Seq=220144           |
| 19  | 1.906139 | 900h-ice1.erc.sony.co | hirata03.erc.sony.co. | TCP      | 80 > 1164 [ACK] Seq=220144           |
| 20  | 1.911034 | 900h-ice1.erc.sony.co | hirata03.erc.sony.co. | TCP      | 80 > 1164 [ACK] Seq=220144           |
| 21  | 2.073277 | hirata03.erc.sony.co. | 900h-ice1.erc.sony.co | TCP      | 1164 > 80 [ACK] Seq=441839           |

Frame 8 (1514 on wire, 1514 captured)

- Ethernet II
- Internet Protocol
- Transmission Control Protocol, Src Port: 80 (80), Dst Port: 1164 (1164), Seq: 220137489, Ac
- Hypertext Transfer Protocol
  - Data (1460 bytes)

0000 00 c0 4f 9a 96 c0 00 02 2d 03 94 2c 08 00 45 00 ..O.....-...E.  
 0010 05 dc 00 1b 00 00 40 06 90 0a 2b 03 47 79 2b 03 .....@...+.Gy+.  
 0020 47 78 00 50 04 8c 0d 1f 08 11 02 a2 31 a5 50 10 Gx.P....1.P.  
 0030 20 00 13 6b 00 00 47 49 46 38 39 61 7d 02 5c 00 ..k..GI F89a}.\.  
 0040 f7 00 00 00 00 00 00 33 00 00 66 00 00 99 00 .....3..f....

Filter: / Reset File: <capture> Drops: 0