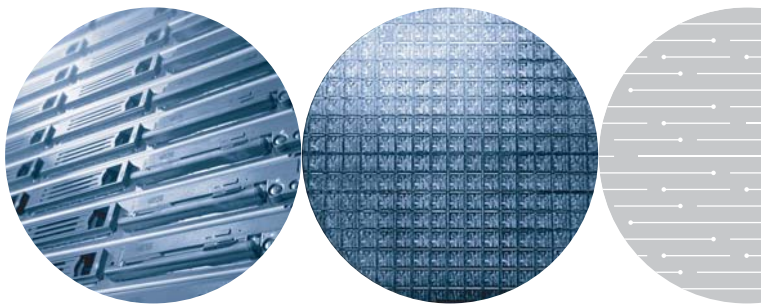
Application Note

Performance Characteristics of an Intel® NetStructure™ SS7HDP SS7 Board

Intel in Communications



Abstract

This application note shows the achievable performance of an Intel® NetStructure™ SS7HDP board: the SS7HDPD4TE. The board was tested in a controlled environment to

- Characterize the board's performance while processing Message Signaling Units (MSUs) of different representative sizes
- Demonstrate the maximum performance achieved

The results documented in this application note demonstrate the versatility of the SS7HDPD4TE board as a modular, standards-based Signaling System 7 (SS7) building block which can process in excess of 20,000 MSUs/s. Whether these are short ISUP messages used for call control/call routing or longer messages used for Intelligent Networking (IN) or messaging, this board can fully support the MSU traffic load on all SS7 links running through the board, giving developers a flexible solution for all their communication solutions.

These results also demonstrate the maximum performance and flexibility this product can achieve and the benefit it offers to system developers who require SS7 technology for call control, wireless messaging, and intelligent networking applications.

Introduction

During testing, the MSU throughput was tested at different message sizes, representing the different message sizes present in a real-life application. The results of those tests are provided in this application note, as well as the test methodology and setup. As different MSU lengths were tested, the board was able to process message rates approaching the theoretical maximum for the number of SS7 links terminated. Additionally, these results were achieved without significant host CPU loading, freeing CPU resources for alternative applications. The test was performed with 16 and 64 SS7 links, which corresponds to the SS7 licenses available for this product.

Purpose

Understanding the performance characteristics of the board will enable system designers and integrators of advanced communications solutions to lower costs while better utilizing the SS7 links. As mentioned previously, different applications that require the use of SS7 signaling will have different signaling traffic requirements.

Circuit/Call Control Related Applications

ISUP and other circuit-related signaling protocols tend to use larger number of messages per call, but each message is typically shorter. For shorter messages there may be enough link bandwidth to support the message, but the system still needs to be capable of handling the actual message rate.

Intelligent Networking (IN) and Messaging Applications

For IN and mobile applications, the SS7 messages themselves are typically longer in length and therefore the amount of available link bandwidth may be the limiting factor rather than the message rate. If the messages are longer, then less of them can be sent on a single link in a single second. Therefore, to support higher message rates, many more links are required.

Methodology

During testing, the system was connected to an INET Spectra protocol analyzer running in a passive monitoring mode. This validated that the message rates on individual links were consistent with the message rates of the overall system described in this application note.

Hardware and Software Components

- Linux* host system
  - — Intel® TSRLT2 Carrier Grade Server (Dual Pentium® III processors running at 1.26 GHz)
  - — Red Hat* 7.2 Linux operating system, kernel version 2.4.7-10
- A single SS7HDPD4TE SS7 board using
  - — V2.00 of the SS7 binary for SS7HD
  - — V3.01 of the SS7 Development Package for Linux

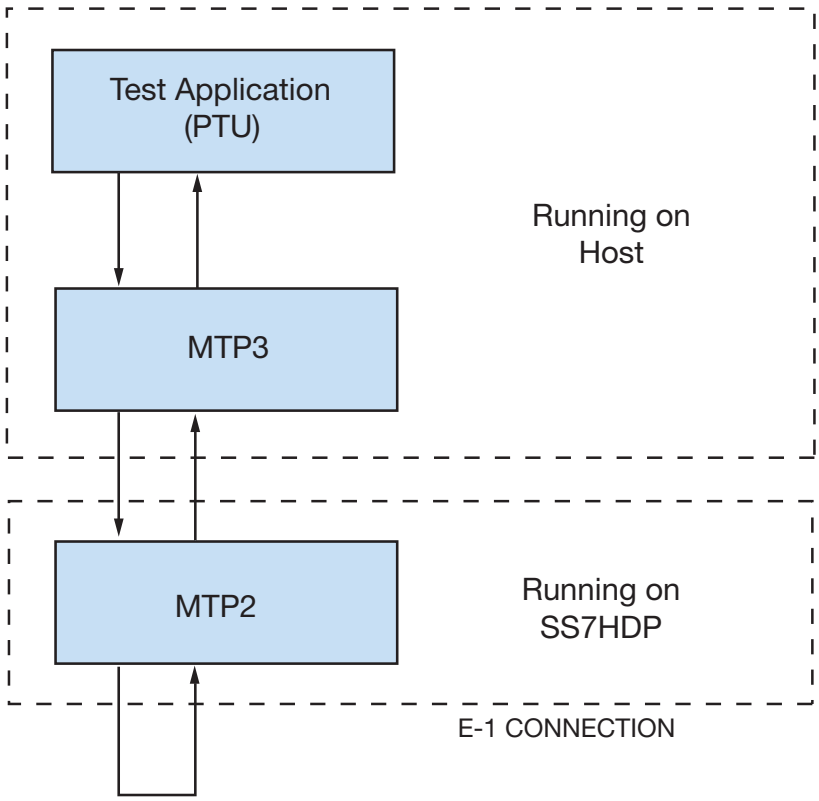


Figure 1: Protocol Stack for Message Rate Tests

Test Configuration

For the purpose of the test, the SS7HDPD4TE network interface board was exercised by repeatedly sending MSUs into the MTP3 module running on the host system (see Figure 1.) The messages were then passed down to the MTP2 module running on the board and then out onto the links. The links are themselves looped back on the board and the received message passed back up through to the test application.

- Routes — Four local point codes and the routes between the point codes are defined. Point code 1 is connected to point code 2; point code 3 is connected to point code 4.
- Links and linksets — Four linksets configured with 16 links per linkset
- Ports and cabling — The test configuration was set up with each of the four T-1/E-1 ports looped back (L1 to L2, L3 to L4). The cables were connected via a T-piece to the INET Spectra protocol analyzer.
- Message Length — This defines the length of the MSU sent during the test. Different message lengths were used in the testing to simulate different SS7 applications. Message sizes shown are the size of the data on the line. Calculations do not take in to account bit stuffing or additional fill in signaling units (FISUs) which may be sent. This accounts for the performance achieved being slightly less than 100% link utilization (1 Erlang). Actual SS7 networks will have messages with different lengths; these controlled tests used messages with fixed length which characterized the board's performance under different loads.

Message Lengths and Link Utilization

In order to support the full range of SS7 applications, a board must be able to handle high messages rates for shorter messages, but also handle enough links to support the link bandwidth requirements for longer messages. To simulate the range of different applications, the tests were repeated with

MSUs of different message lengths. The message rates shown in Tables 1 and 2 are the maximum rates supported by the board at the particular message length in order to characterize the performance of the board. In some cases this means the link utilization may approach the theoretical maximums for the links in use. For normal operation, the system should be provisioned to run with a lower average link utilization, in line with standard operating practices. Understanding the maximum performance of this board will let system designers accommodate applications with high-volume SS7 traffic and failover scenarios.

The maximum theoretical rate is determined by the number of links used and was calculated by this formula. It assumes 64 kbps and 8 bits/frame which gives 8000 bytes/s.

maximum theoretical rate = (number of links x 8000) / message length

The message rate tests are designed to show the maximum performance of the system when sending and receiving messages directly above MTP3 (as shown in Figure 1). A single system is used with the links looped back and the rate of MSU send/received is recorded.

Findings

Tables 1 and 2 show the MSUs/s which was achieved for different message lengths. This was done with the board running 16 SS7 links and 64 SS7 links.

Table 1: SS7HDPD4TE Performance Utilizing 64 SS7 Links

Message Length (octets or bytes)	Number of SS7 Links	MSUs/s	Maximum Message Rate	Message Rate as % of Maximum	Average Host CPU Load
20	64	22,819	25,600	89.1	51%
40	64	12,580	12,800	98.2	33%
48	64	10,540	10,667	98.8	28%
64	64	7,932	8,000	99.1	20%
96	64	5,260	5,333	98.6	15%
128	64	3,980	4,000	99.5	12%
192	64	2,656	2,667	99.6	8%
256	64	1,988	2,000	99.4	6%

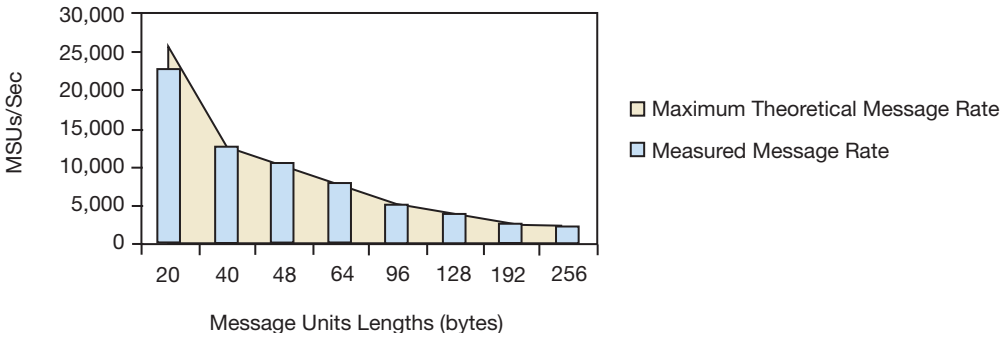
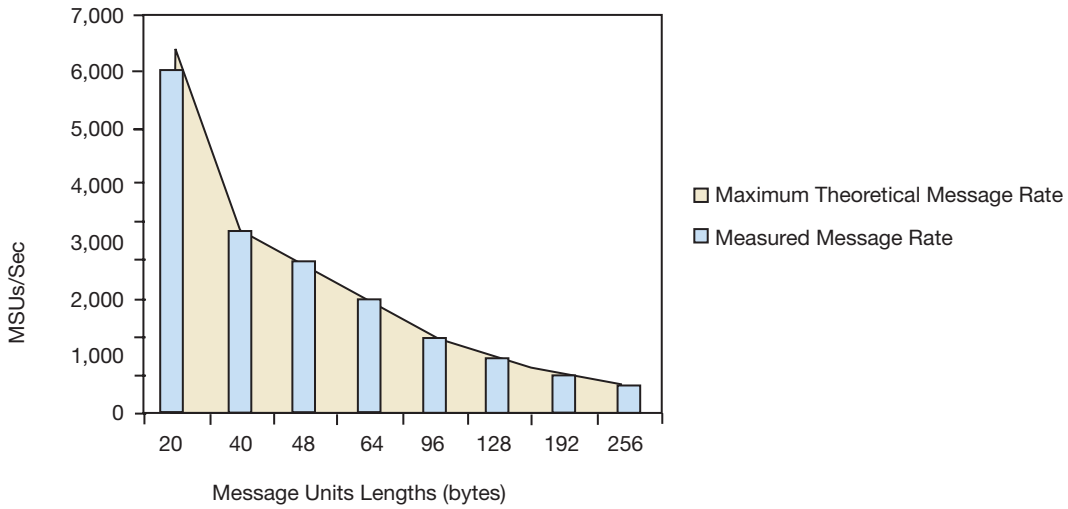


Table 2: SS7HDPD4TE Performance Utilizing 64 SS7 Links

Message Length (octets or bytes)	Number of SS7 links	MSUs/s	Maximum Message Rate	Message Rate as % of Maximum	Average Host CPU Load
20	16	6,040	6,400	94.3	16%
40	16	3,192	3,200	99.7	8%
48	16	2,660	2,667	99.7	7%
64	16	1,992	2,000	99.6	6%
96	16	1,328	1,333	99.6	5%
128	16	996	1,000	99.6	4%
192	16	664	667	99.6	3%
256	16	496	500	99.2	3%



These measurements show that the SS7HDPD4TE board can accommodate the full traffic load of the SS7 links terminating on the board. This simulates the highest utilization that the board would be required to serve and shows that it can meet this demand which is in excess of normal provisioning specification for SS7 traffic.

Product List

Boards SS7HDPD4TE SS7 Board from Intel

Host Intel TSRLT2 Carrier Grade Server
(Dual Pentium III processors running at 1.26GHz)

Software SS7 Development Package for Linux (V3.01)
SS7 Binary for SS7HD (V2.00)
Intel NetStructure: SS7 Protocol MTP3 for Linux (V2.00)
Test Application: Performance Test Utility (V1.03)

Operating system Red Hat 7.2 Linux, kernel version 2.4.7-10

Additional Equipment INET Spectra Protocol Analyser (Software Version 4.03)

Technical documentation on Intel telecommunication products can be found at
http://developer.intel.com/design/network/products/telecom/index.htm

For more information, contact your Intel account manager.

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