Department of Electronics and Communication Engineering

INTERNSHIP REPORT ON

Microsemi Synchronization of FONS BD Ltd.

Prepared By:

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April 2016

Letter of Transmittal

21 April 2016

To
Md. Asif Hossain
Senior Lecturer
Department of Electronics and Communication Engineering
East West University

Subject: Submission of Project Report as Internship (ETE-498)

Dear Sir,

I am pleased to let you know that I have completed my Internship program at FONS BD Ltd, New Beily Road, and Dhaka. The attaché contain of the internship report that has prepared for your evaluation and consideration. The internship has given me a great opportunity to work with the networking system closely and also gave me the opportunity to apply the theoretical knowledge in real life situation which I have acquired since last four years from you and the other faculty of EWU, which would be a great help for me in future.

I am very grateful to you for your guidance throughout the internship period, which helped me a lot to acquire practical knowledge.

Thanking You.

Yours Sincerely

Sarder Johir Islam

ID# 2011-2-55-002
Dept. Of ECE

East West University

Declaration

This is certified that the internship report is done by me under the course "Research/Internship (ETE-498)". It has not been submitted elsewhere for the requirement of any degree or any other purpose except for publication.

Sarder Johir Islam

ID: 2011-2-55-002

Dept. Of ECE

Acceptance

This internship report is submitted to the **Department of Electronics and Communication Engineering, East West University** is submitted in partial fulfillment of the requirements for the degree of **B.Sc** in **ECE** under complete supervision of the undersigned.

_____

Md. Asif Hossain
Senior Lecturer
Dept. Of ECE

_____

Jahirul Islam Shishir
Manager
FONS BD Ltd.

Acknowledgement

At first I wish to convey my cordial thanks and gratitude to Almighty Allah for everything. I would like to thank my parents and everyone else who has supported me all the way through to complete the Internship program successfully and also to those who rendered their cooperation in making this report.

I would like to thank **Md. Asif Hossain (Senior Lecturer, Dept. Of ECE, EWU)** for guided me with lots of effort and time to perform the internship program.

I want to convey my gratefulness to **Jahirul Islam Shishir (Manager, FONS BD Ltd.)** who helped me greatly by providing valuable suggestion whenever required my internship report **"Microsemi Synchronization of Robi Axiata Ltd."** They also gave the opportunity to hold that flagship of the topic.

I would also like give to acknowledgments everyone of the IT Management Department of **FONS BD Ltd**. For providing suggestion on how to work and what is the procedure to work in a practical manner and also how to make the internship report in a better way. They helped me in many ways by allowing whatever assistance I needed. Otherwise it was not possible for me to complete my report.

ABSTRACT

This report focuses on the synchronization system of an Telecom Company. This synchronization system build with a synchronizer called microsemi. A GPS system connects it with a power cable and earthing cable. This Synchronizer system connected to BSC and MSC and it confirm that the whole time system in worldwide may connect with our country time. It also confirm and remain same our local time from on BTS to other. If this system does not work properly then we cannot connect on local distance and also worldwide connection through mobile. So this important thing for our telecom company and also very interesting for me because I intern on this project from the first of the beginning.

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Chapter-1

Introduction

ABOUT FONS BD LTD

FONS BD (Fiber Optic Network Solution Ltd) is the only manufacturer in Bangladesh to Export Fiber Optic Product for last 18 years. It's a Joint Venture with USA & Danish Fiber Company. It is located at 143/1 New Baily Road, Dhaka- 1000 Bangladesh.

FONSBD Specializes with the Following Network Products and Components:

- Fiber Optic Patch Cords and Pigtails
- All Type Fiber Optic Connectors and Adapters
- Fiber Optic Cables
- ISP, NTTN, FTTX, FTTB Products
- Cable Management Products
- CATV Product
- Wireless & Wi-Il Products
- All Types of Switches & Routers
- OPGW Cable for Power sector
- Fiber Optic Signaling Products for Rail road
- After Sales Service
- Service & Installation
- LAN &WAN Products

Test Equipments and tools (Splice machine, OTDR. Analyzers'. Monitoring Systems, etc)

- Energy Storage

FONSBD emphasizes to PDCA (Plan, Do, Correct & Act) System to ensure all customers get the products with optimum cost efficiency and on time solutions of the highest quality of international standard by achieving zero defect in quality. It is an ISO**9001:2004** certified company for Quality and Environmental Management.

FONSBD is exporting products to Australia, Denmark. France, Germany, Ireland, the Netherland, USA and other Countries.

Manufacturing capacity

- FC/LC/MTRJ/SC/ST/E2000/ Lx, 5 Termination/year 850 000 pcs
- Connector (ST/SC) Assembly/ year 2,184 000 pcs
- Adapter (ST) Assembly/year 1248 000 pcs
- Adapter (ST) Assembly/year 168 480 pcs
- Light Guide/year 40000 pcs

In the broadest terms, people like to view the Internet as a cloud, you put your data in one place, it comes out the place you want it to on the other side. In reality the internet is tens of thousands kilometers of fiber optic cable, hundreds of thousands to millions of kilometers of copper wire, and hardware and software connecting them all together in a redundant, fast, and self-sufficient network. But not to worry, it's not that bad: you only have to worry about a very small portion of the network, you can let someone else worry about the rest, and you even get someone to yell at when things go wrong.

I had an opportunity to work with most leading IT and Optic Solution service provider that is FONS BD Limited. I consider myself timely to get a chance to take a deep look to their development methods, working models, deals and industrial behavior. And I was intending to look into the Networking Industry and how it looks like practically, how they interact with their clients, how they design a system and what are their rules in their environmental work.

I got the chance to work in ROBI Microsemi project through FONS BD Limited. We know mobile networking is the principal part of our modern life. I decided to know about mobile networking and how does it work, how to set a synchronizer and backbone network, what are the important keys to design a beneficial network, how can I design cost effective network and how to mitigate downtime of a network.

Chapter-2

PTP

In Telecommunications, a point-to-point connection refers to a communications connection between two nodes or endpoints. An example is a telephone call, in which one telephone is connected with one other, and what is said by one caller can only be heard by the other.

This is contrasted with a point-to-multipoint or broadcast communication topology, in which many nodes can receive information transmitted by one node. Other examples of point-to-point communications links are leased lines, microwave relay links, and two way radio. Examples of point-to-multipoint communications systems are radio and television broadcasting.

Figure 1:-PTP

The term is also used in computer networking and computer architecture to refer to a wire or other connection that links only two computers or circuits, as opposed to other network topologies such as buses or crossbar switches which can connect many communications devices. Point-to-point is sometimes abbreviated as P2P, Pt2Pt. This usage of P2P is distinct from P2P referring to peer-to-peer file sharing networks.

In (2003), the term point-to-point telecommunications relates to fixed wireless data communications for Internet or voice over IP via radiofrequencies in the multi-gigahertz range. It also includes technologies such as laser for telecommunications but in all cases expects that the transmission medium is line of sight and capable of being fairly tightly beamed from transmitter to receiver. The Telecommunications Industry Association's engineering committees develop U.S. standards for point-to-point communications and related cellular tower structures. Online tools help users find if they have such line of sight.

Protocol Dependencies

UDP: Typically, PTP uses UDP as its transport protocol (although other transport protocols are possible). The well known UDP ports for PTP traffic are 319 (Event Message) and 320 (General Message).

Ethernet: Starting with IEEE1588 Version2, a native Layer2 Ethernet implementation was designed. PTP can use Ethernet as its transport protocol. The well known Ethernet type for PTP traffic is 0x88F7

NTP

Network Time Protocol (**NTP**) is a networking protocol for clock synchronization between computer systems over packet-switched, variable-latency data networks. In operation since before 1985, **NTP** is one of the oldest Internet protocols in current use.

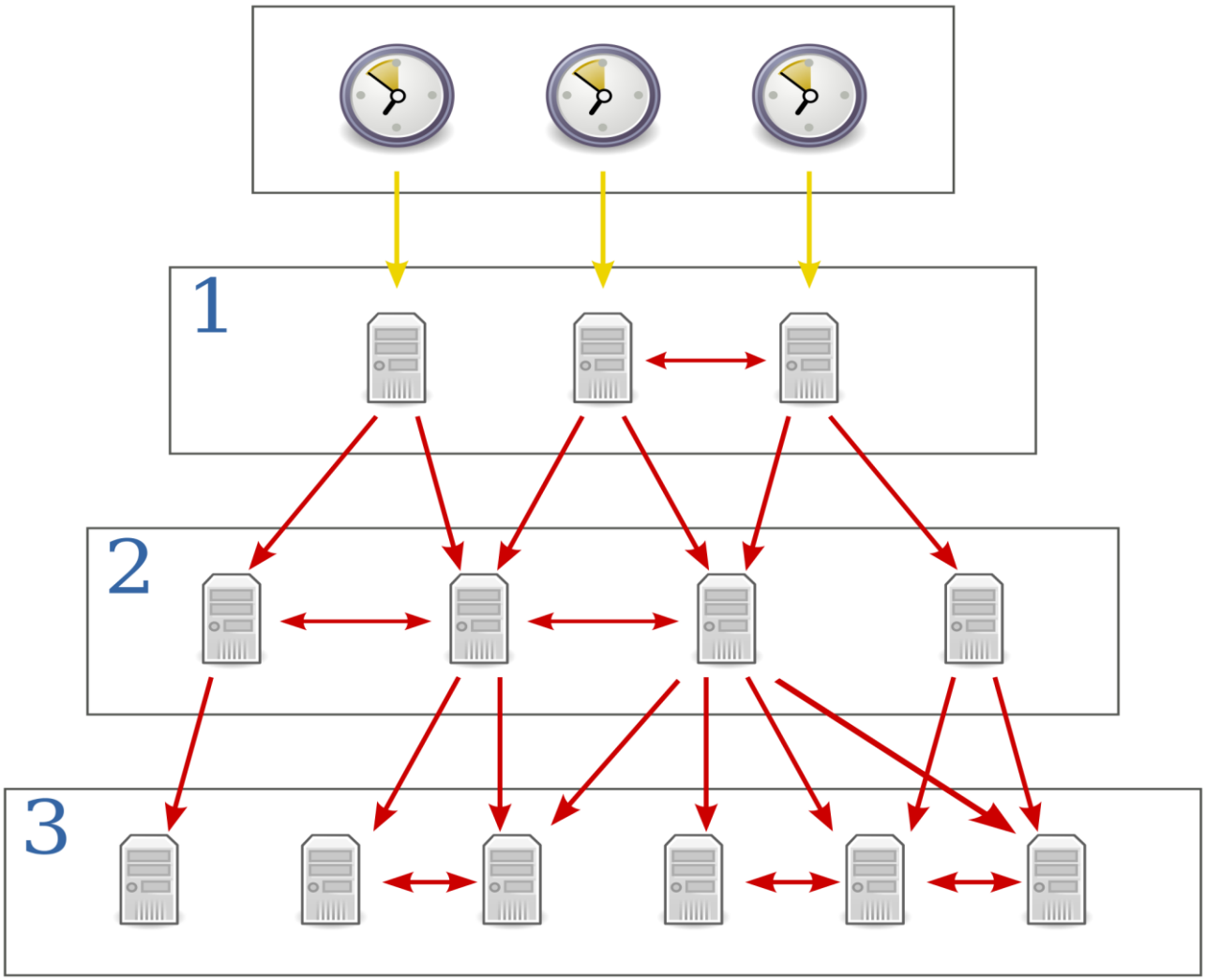


Figure 2:-Network Time Protocol Model

In computer networking, **NTP** is a system to synchronize time of day computer clocks across the Internet. The NTP system is based on Internet *time servers*, computers with access to atomic clocks such as those operated by the U.S. government. These NTP servers run a software service that provides the clock's time of day to client computers over UDP port 123. NTP supports a hierarchy of multiple server levels to handle a large load of client requests.

In 1979, network time synchronization technology was used in what was possibly the first public demonstration of Internet services running over a trans-Atlantic satellite network, at the National Computer Conference in New York. The technology was later described in the 1981 Internet Engineering Note (IEN) 173 and a public protocol was developed from it that was documented in RFC 778. The technology was first deployed in a local network as part of the Hello routing protocol and implemented in the Fuzzball, an experimental operating system used in network prototyping, where it ran for many years.

Other related network tools were available both then and now. They include the Daytime and Time protocols for recording the time of events, as well as the ICMP Timestamp and IP Timestamp option (RFC 781). More complete synchronization systems, although lacking NTP's data analysis and clock disciplining algorithms, include the Unix daemon *timed*, which uses an election algorithm to appoint a server for all the clients; and the Digital Time Synchronization Service (DTSS), which uses a hierarchy of servers similar to the NTP stratum model.

In 1985, NTPv0 was implemented in both Fuzzball and Unix, and the NTP packet header and round-trip delay and offset calculations, which have persisted into NTPv4, were documented in RFC 958. Despite the relatively slow computers and networks available at the time, accuracy of better than 100 milliseconds was usually obtained on Atlantic spanning links, with accuracy of 10s of milliseconds on Ethernet networks.

In 1988, a much more complete specification of the NTPv1 protocol, with associated algorithms, was published in RFC 1059. It drew on the experimental results and clock filter algorithm documented in RFC 956 and was the first version to describe the client-server and peer modes. In 1991, the NTPv1 architecture, protocol and algorithms were brought to the attention of a wider engineering audience with the publication of an article by David L. Mills in the IEEE Transactions on Communications.

Cable Tester

A **cable tester** is an electronic device used to verify the electrical connections in a cable or other wired assembly. Generally a cable tester consists of:

A source of electric current,

A volt meter,

A switching matrix used to connect the current source and the voltmeter to all of the contact points in a cable.

In addition to these parts a cable tester may also have a microcontroller and a display to automate the testing process and show the testing results.

A cable tester is used to verify that all of the intended connections exist and that there are no unintended connections in the cable being tested. When an intended connection is missing it is said to be "open". When an unintended connection exists it is said to be a "short" (assorts). If a connection "goes to the wrong place" it is said to be "miswired" (the connection has two faults: it is open to the correct contact and shorted to an incorrect contact).

Figure 3: LAN Cable Tester

Generally, the testing is done in two phases. The first phase, called the "opens test" makes sure each of the intended connections is good. The second phase, called the "shorts test" makes sure there are no unintended connections.

There are two common ways to test a connection:

A continuity test. Current is passed down the connection. If there is current the connection is assumed to be good. This type of test can be done with a series combination of a battery (to provide the current) and a light bulb (that lights when there is a current).

A resistance test. A known current is passed down the connection and the voltage that develops is measured. From the voltage and current the resistance of the connection can be calculated and compared to the expected value.

There are two common ways to test for a short:

A low voltage test. A low power, low voltage source is connected between two conductors that should not be connected and the amount of current is measured. If there is no current the conductors are assumed to be well isolated.

A high voltage test. Again a voltage source is connected but this time the voltage is of several hundred volts. The increased voltage will make the test more likely to find connections that are nearly shorted since the higher voltage will cause the insulation of nearly shorted wires to break down.

Patch Cable

A **patch cable** or **patch cord** or **patch lead** is an electrical or optical cable used to connect ("patch-in") one electronic or optical device to another for signal routing. Devices of different types (e.g., a switch connected to a computer, or a switch to a router) are connected with patch cords. Patch cords are usually produced in many different colors so as to be easily distinguishable, and are relatively short, perhaps no longer than two meters. Types of patch cords include microphone cables, headphone extension cables, XLR connector, Tiny Telephone (TT) connector, RCA connector and ¼" TRS phone connector cables (as well as modular Ethernet cables), and thicker, hose-like cords (snake cable) used to carry video or amplified signals. However, patch cords typically refer only to short cords used with patch panels.

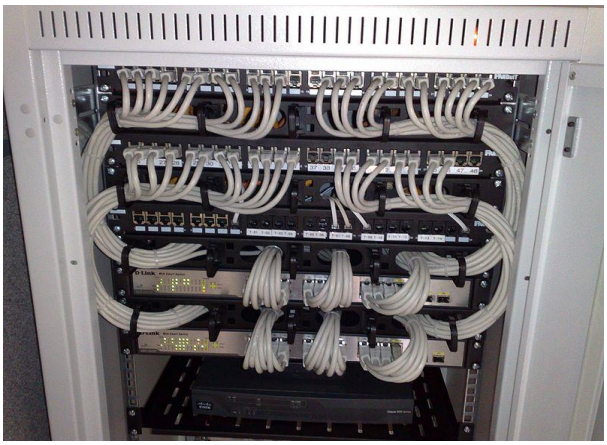


Figure 4: Patch Cable

Patch cord cable differs from standard structured cabling cable in that Patch cable is stranded for flexibility, whereas standard cable is solid copper. Because the patch cord is stranded copper construction the attenuation (signal loss) is higher on patch cords than solid cable so short lengths should be adhered to

Patch cords can be as short as 3 inches (ca. 8 cm), to connect stacked components or route signals through a patch bay, or as long as twenty feet (ca. 6 m) or more in length for snake cables. As length increases, the cables are usually thicker and/or made with more shielding, to prevent signal loss (attenuation) and the introduction of unwanted radio frequencies and hum (electromagnetic interference).

Patch cords are often made of coaxial cables, with the signal carried through a shielded core, and the electrical ground or earthed return connection carried through a wire mesh surrounding the core. Each end of the cable is attached to a connector so that the cord may be plugged in. Connector types may vary widely, particularly with adapting cables.

Patch cords may be:

Single-conductor wires using, for example, banana connectors (or pin plugs)

Coaxial cables using, for example, BNC connectors

Shielded or unshielded Cat5, Cat5e, Cat6 or Cat6A cables using 8P8C (RJ-45) modular connectors with straight-through T568A orT568B wiring. Modular cables wired to T568A at one end and T568B on the other are more commonly referred to as crossover cables.

A patch cord is always fitted with connectors at both ends. A **pigtail** is similar to a patch cord and is the informal name given to a cable fitted with a connector at one end and bare wires (or bare fiber) at the other. In the context of copper cabling, these cables are sometimes referred to as **blunt patch cords** and the non-connectorized end ("the pigtail") is intended to be permanently attached to a component or terminal.

Optical fiber pigtails, in contrast to copper pigtails, can be more accurately described as a connector than a cable or cord. A fiber pigtail is a single, short, usually tight-buffered, optical fiber that has an optical connector pre-installed on one end and a length of exposed fiber at the other end. The end of the fiber pigtail is stripped and fusion spliced to a single fiber of a multi-fiber trunk. Splicing of pigtails to each fiber in the trunk "breaks out" the multi-fiber cable into its component fibers for connection to the end equipment.

Chapter-3

TimePictra

The TimePictra is a web-based management system for time, frequency and synchronization network elements. It features a modular architecture that will scale and evolve with operational requirements. As timing and synchronization grow in importance in critical infrastructure networks, centralized visibility and control of this vital function has become essential to network operations. With a multi-tier architecture—server, client, and database—TimePictra can provide scalability and performance to meet growing network services and business needs.

The secure web browser client provides easy access and eliminates the complexity of client installation and VPN access. The application server, in conjunction with the database, provides comprehensive business logic to support management of network functions.TimePictra is server platform and database independent—allowing cost-effective deployment of the management system using any server or database platform meeting the specified requirements.

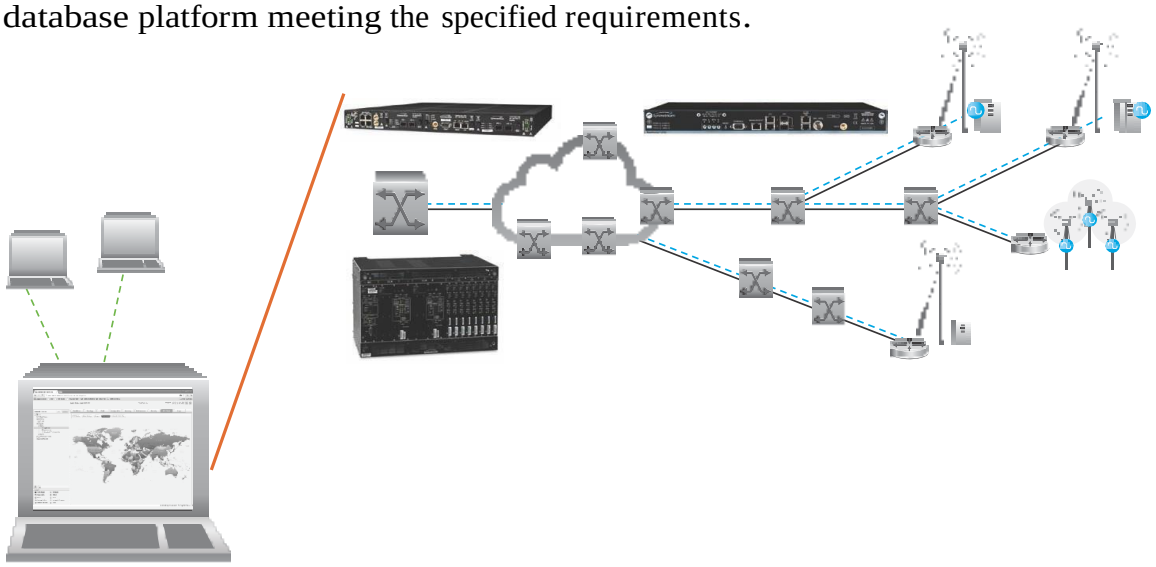


Figure 5: TimePictra Synchronization Element Management System

As an element management system, TimePictra provides comprehensive FCAPS functions for managing your network include;Fault Management, Configuration Management, Accounting (Inventory) Management, Performance Management, and Security Management.TimePictra is comprised of basic software and software options. The basic software includes the standard FCAPS functions as well as geographical topology map, navigation tree with domain hierarchy, dashboard reporting of alarms, inventory, user login, and license installation information. Software options include advanced FCAPS functions. Each option is enabled by a software license key with no additional installation required.

Web–Based Graphical User Interface

Authorized users can have secure access to TimePictra, and manage their sync network from anywhere at any time. It enables connectivity to the mission-critical sync network from remote locations. The low bandwidth requirements of a thin client web- based GUI implies no special client-side installation. The thin clients can be invoked over a dial-up connection or a Virtual Private Network.

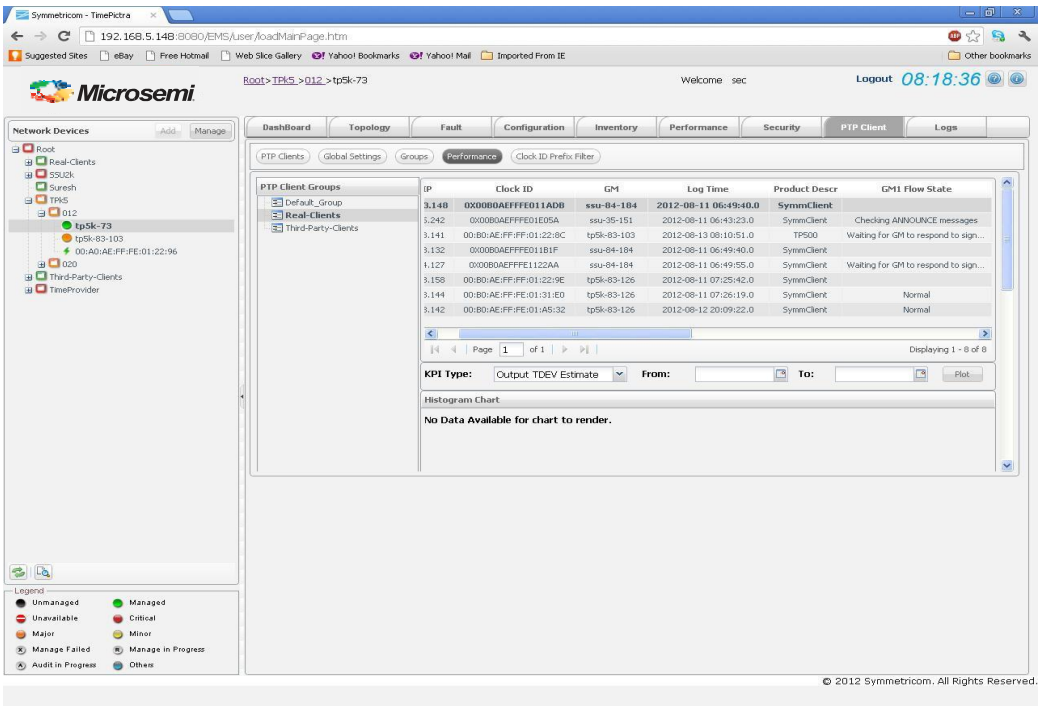


Figure 6: TimePictra Performance Manager, PTP Sync Flow Monitoring

With increased reliance on accurate timing and synchronization in critical Ethernet networks such as in the communications, power utility and financial services industries, the IEEE .1588-2008 Precision Time Protocol (PTP) has emerged as the protocol of choice. TimePictra provides end-to-end PTP management including device auto discovery, navigation tree display with hierarchy domain, sync flow monitoring, and key performance index monitoring. This end-to-end management enables network operators to have full visibility of PTP timing.

TimePictra monitors and trends IEEE 1588-2008 (PTP) remote clients and boundary clocks, located throughout the network—including clients not supplied by Microsemi.TimePictra will automatically add new PTP clients and ensure they maintain connection to a Grandmaster and with the possibility to collect PDV and performance statistics from every client in the Network, TimePictra provides to only end to end monitoring solution for PTP clients.

Dashboard

A user dashboard simplifies the display of network health, including alarm counts with severity, network element inventory, logged in users and license information. With the Group Pack option, the dashboard can be customized with user preferences.

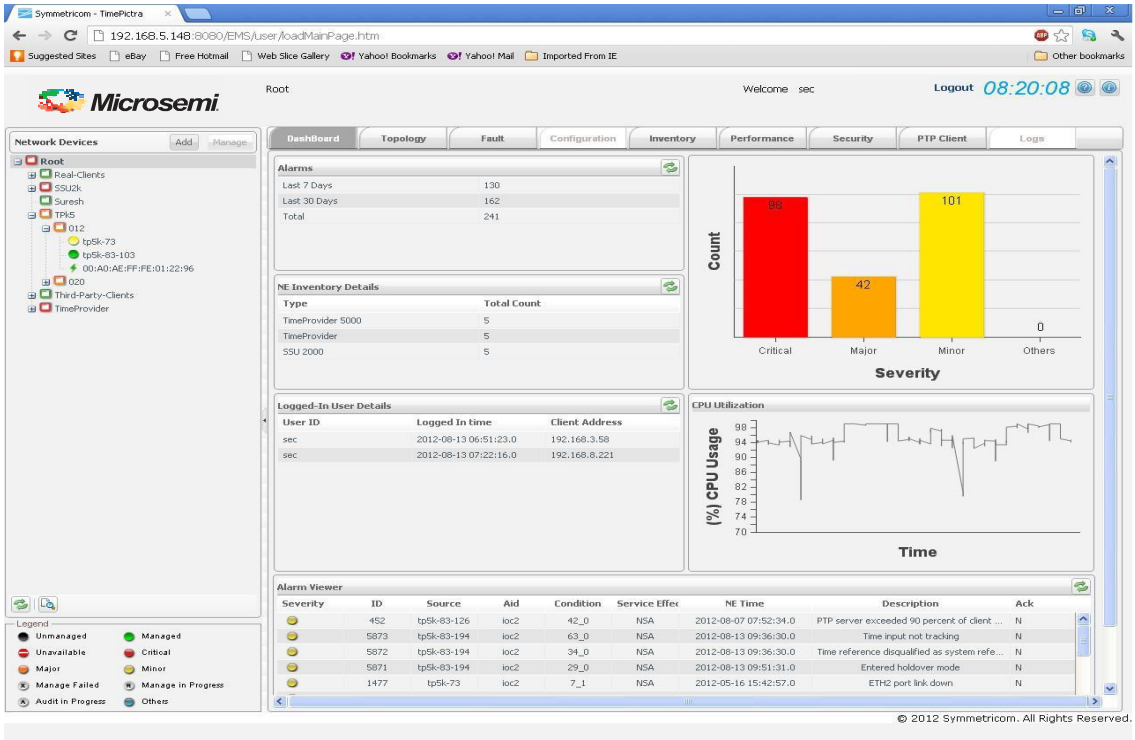


Figure 7: TimePictra Dashboard

Network Operations Integration

Many network operators integrate element management with their operating systems for overall management of multi- vendor, diverse equipment environments. TimePictra enables integration of its northbound interface using SNMP for alarm integration and ASCII northbound for alarm and topology integration. TimePictra High Availability option supports two geographically diverse servers to replicate the database and synchronization management functions; removing any single point of failure. The convergence of formerly distinct network technology platforms – take telephony systems and LANs, for example – is precipitating a major networking operations transition, including alterations in IT organizational structure. Gartner recommends network managers adopt an ITIL approach, creating an organization centered around processes that deliver IT services. To enhance end-to-end IT service delivery, consider greater integration of the Network Operations Center (NOC) with IT infrastructure operations. This trend is driving complex IT organization changes, subordinating technology to processes, with the ultimate goal of seamless service delivery across all of IT.

Chapter-4

Fault Manager

The fault manager provides access to the entire network element. Events and alarms are displayed using a color-coded format complaint with ITU-T standards notifications are easily intelligible. Whether in the office or field network personnel have the ability to readily access the entire suit of information about any of the synchronization Network Elements.

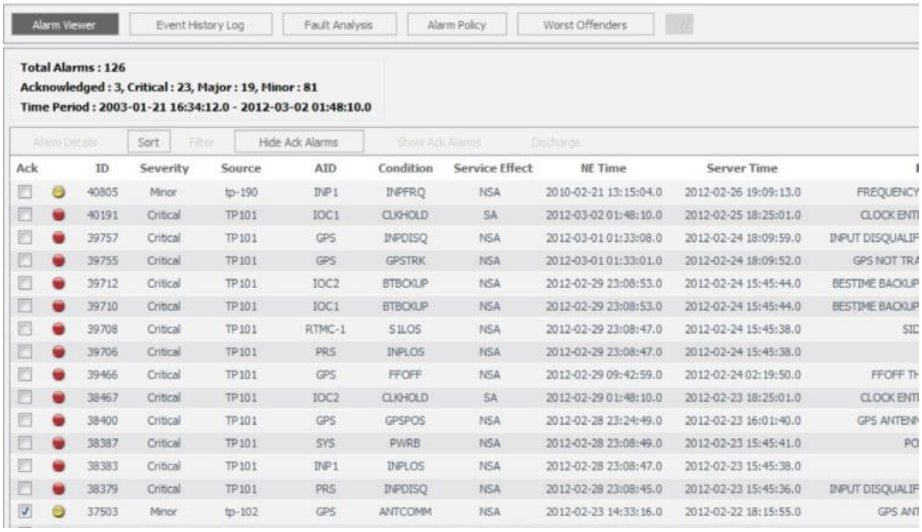


Figure 8: TimePictra Fault Manager

Configuration Manager

The Configuration Manager allows network personnel to access NE data and update their configurations from within this single application. Information is provided graphically at system, port and card levels. The optional Group Management Pack increases efficiency by defining groups with common users, resources and policies for such things as configurations and alarm mapping.

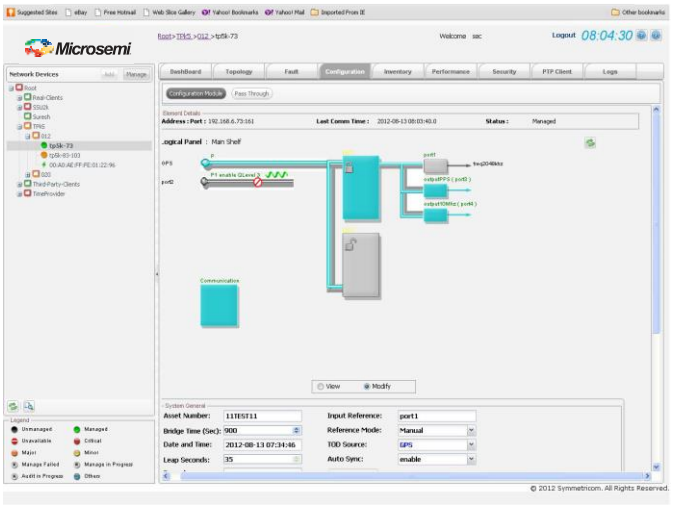


Figure 9: TimePictra Configuration Manager

Accounting (Inventory) Manager

This manager provides inventory information on any of the managed elements in the synchronization network. Information is provided down to the lowest level of granularity, including such information as location, serial number, part number, type of equipment, software and hardware revision levels.

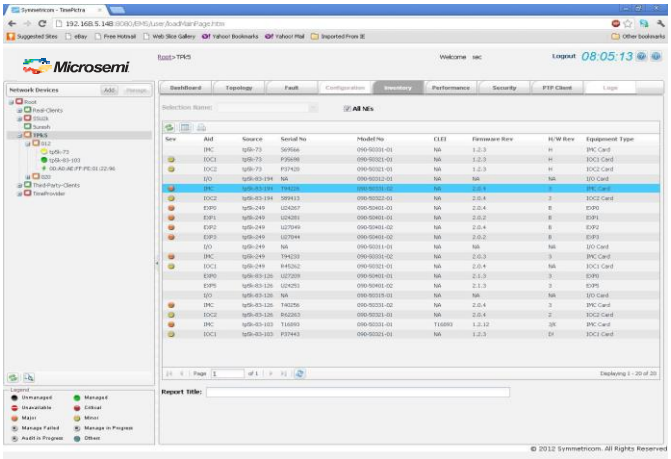


Figure 10: TimePictra Accounting Manager

Performance Manager

The Performance Manager graphically displays a variety of standard performance data such as MTIE, TDEV and phase, in order to proactively identify and correct problems in the synchronization network. TimePictra enables users to compare current readings to stored industry standard masks and previously stored data. With the Performance Pack option TimePictra will also display PTP performance metrics and PTP sync flow monitoring.

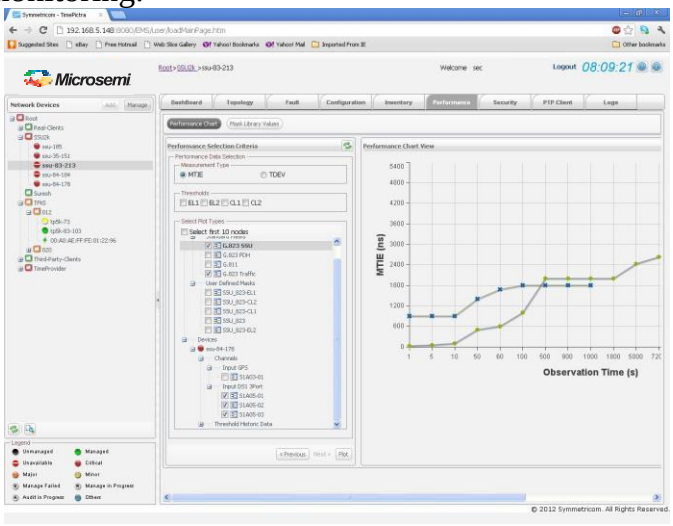


Figure 11: TimePictra Performance Manager

Performance Manager, PTP client visibility

TimePictra end-to-end PTP management includes visibility of slave clocks distributed throughout the network. When the slave is a Microsemi product, TimePictra will provide PTP performance metrics—delivering an advanced end-to-end value. Slaves from other vendors will also be monitored. If their sync flow disappears, an alarm will notify network administrators. These unique and valuable tools are included in the Performance Pack option

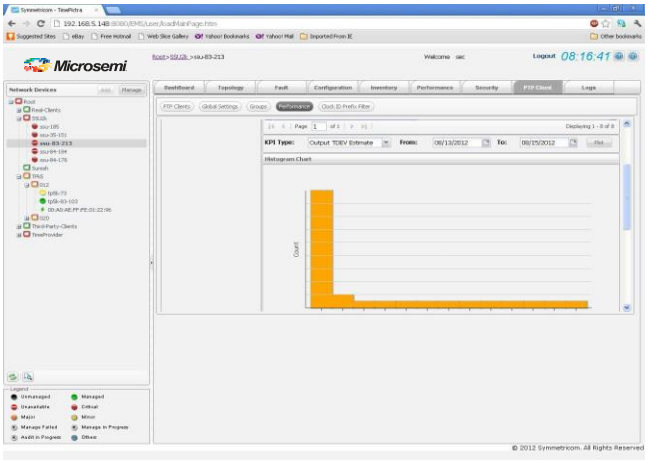
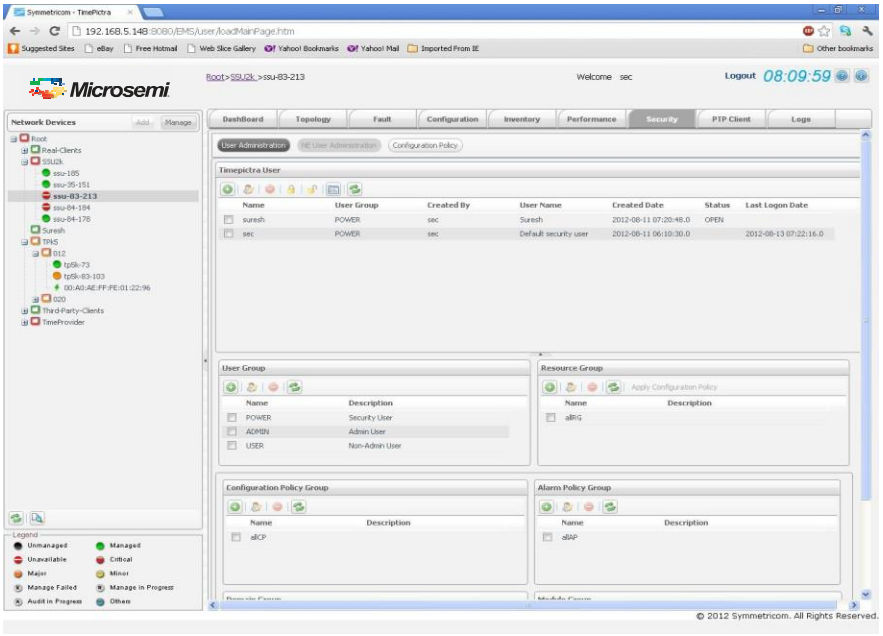


Figure 12: Performance Manager PTP client visibility

Security Manager

TimePictra offers several modes of security for managing synchronization networks. Multi-level, role-based access enforced by passwords and login requirements guarantees only authorized users can access the system. Securely administered permissions control access to domains and functionality. These management domains add both a level of security and organizational structure. SSL and data encryption communications ensures secure access over the Internet. Transaction logs ensure all activities by users are documented and logged.



Chapter-5

Synchronization Supply Unit (SSU) for Carrier-Grade Networks

The Microsemi SSU 2000 and SSU 2000e are fully manageable synchronization systems used by communications network operators to generate and distribute superior synchronization signals for their networks. The SSU 2000 conforms to ANSI standards and is NEBS certified, while the SSU 2000e is ETSI certified. Both systems use the same plug-in cards.

In addition to traditional frequency network timing capabilities for SDH/SONET networks, the SSU 2000/SSU 2000e supports packet network synchronization with carrier-grade Network Time Protocol (NTP) server and IEEE 1588 Precision Time Protocol (PTP) Grandmaster capabilities. The platform supports the seamless introduction of SyncE output capabilities elements into your network through the optical Ethernet port on the PTP grandmaster card. The SSU 2000 and SSU 2000e use the latest hardware and software integration technologies to provide a complete synchronization system for current and future network needs.

The SSU 2000/SSU 2000e is a key element in the Microsemi synchronization distribution architecture (SDA) for LTE networks, synchronizing frequency for backhaul networks with SyncE, supplying PTP sync for the 4G/LTE mobile stations, and providing NTP sync for residential small cells.

SSU 2000

SSU 2000e

High Capacity, High Availability Architecture

The SSU 2000/SSU 2000e architecture is designed to integrate intelligent, functional cards into a flexible, fully redundant system to satisfy current capacity and synchronization technology requirements and allow incremental capacity growth and deployment of new capabilities with additional plug-in cards as they are needed. The SDU 2000/SDU 2000e Synchronization Distribution Unit (SDU) expansion shelves connect to a corresponding SSU 2000/ SSU 2000e main shelf to provide additional output signals. The expansion shelves use the framing and synchronization features of the main shelf to drive an array of output cards. Any combination of T1, E1/2048 kHz, Composite Clock and RS-422 output cards, as well as NTP and PTP server cards may be installed.

T1 and E1 output cards may be configured in redundant pairs providing 20 1+1 fully protected outputs per pair. A fully configured SSU 2000 system provides T1/E1 output total capacity of up to 1280 unprotected ports or 640 protected ports. A fully configured SSU 2000e system supports up to 460 protected or unprotected ports. Both shelf systems support high capacity NTP and PTP cards in single server or 1:1 protected configurations. Additional server cards grow total system client capacity.SyncE is available as an option on the PTP cards. Frequency input signals are passed through in case of multiple internal failures, including clock failures. The shelves accept dual DC power and provide independent power conversion on each card. All cards are individually fused to protect the system in case of a short circuit on any one card.

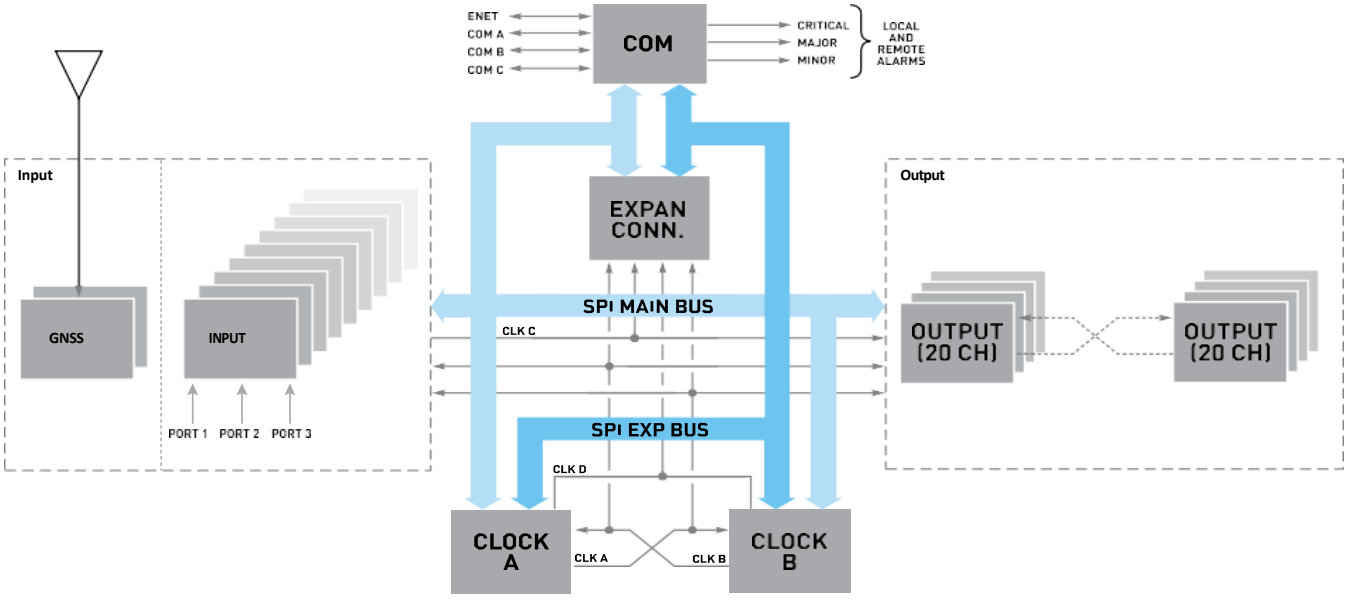


Figure 13: SSU 2000/2000e block Diagram

Industry Standards Compliance, NEBS Level 3 Certification

The SSU 2000 and SSU 2000e are designed to meet the latest and evolving industry standards, including ANSI, Telcordia, ITU-T G.811, G812, G.823, G.703, G.704, ETSI, IEEE 1588 and CE.The SSU 2000 is fully Network Equipment Building System (NEBS) Level 3 certified. NEBS (Network Equipment-Building System) describe the environment of a typical United States RBOC Central Office. NEBS are the most common set of safety, spatial and environmental design guidelines applied to telecommunications equipment in the United States. It is an industry requirement, but not a legal requirement.

NEBS were developed by Bell Labs in the 1970s to standardize equipment that would be installed in a central office. The objective was to make it easier for a vendor to design equipment compatible with a typical Regional Bell Operating Company (RBOC) central office (CO). This would result in lower development costs and ease the equipment's introduction into the network. Telcordia now manages the NEBS specifications. The four then-largest US Telecommunications companies (AT&T, Verizon, BellSouth, and Century Link) created the Telecommunications Carrier Group (TCG), a group formed to synchronize NEBS standards across the industry in the US. The TCG checklist specifies the individual NEBS requirements of each of its members in a matrix, making it simple to compare them.

Chapter-6

Intelligent Cards

Each card has an integrated CPU with software for superior reliability, flexibility and functionality. Cards can be hot-swapped while the unit is operating without any degradation of the output signals. Each intelligent card supports the management of critical, major and minor alarms. Powerful management can be performed to and within each card through the communication card, including in-service upgrades of software and programmable logic devices. Auto-reconfiguration: If a card is removed and a like card installed in the same slot, the new card will be automatically configured to the same settings as the previous card.

GNSS Cards

The SSU 2000/SSU 2000e integrates single or dual satellite system receiver cards to meet primary reference clock requirements. Integrated capability delivers these key benefits:

Flattens the number of levels in the synchronization distribution hierarchy

Improves the overall performance of the network

Lowers the overall OAM&P costs (Opera- tion, Administration, Maintenance, and Provisioning).

Single unit PRS

UTC traceable time source for integrated PTP grandmaster clocks and NTP servers

Two cards are available: The GNSS card supports GPS and GLONASS signals and can be locked to either one or both simultaneously. Also available is a dedicated GPS-only card.

Input Cards

The SSU 2000 accepts up to nine input cards; the SSU 2000e accepts up to three input cards. The platform supports the following input signals:

T1 (framed)

E1 (framed)

SSM quality

JSW and JCC (Japan)

1 MHz (sine or square)

1.544 MHz (sine or square)

2.048 MHz (sine or square)

5 MHz (sine or square)

10 MHz (sine or square)

In the SSU 2000e each input slot supports connections for termination, bridging, monitoring and traffic pass-thru. These connectors provide performance monitoring, impedance termination and traffic pass through to network elements and input references. Various input impedance panels are available for the SSU 2000 to support the following balanced or unbalanced signal impedances:

50 ohms (sine)

• 75 ohms (T1/E1)

• 100 ohms (T1)

• 120 ohms (E1)

133 ohms (CC)

High impedance for timing extraction only

(Bridging mode)

Panel/adapter connection interfaces:

Wire wrap

BNC

Siemens

DE-9

Intelligent Clock Cards, Superior Holdover Performance

The SSU 2000/SSU 2000e accepts single or dual clocks. Three clock cards are available to meet different international standards and specific holdover requirements: ITU-T Type 1 (ETSI Slave Clock, enhanced quartz oscillator), Type II (Stratum 2E, enhanced rubidium oscillator), and Type III (Stratum 3E, enhanced quartz oscillator). Redundant configurations may use a mix of technologies. In case of loss of GNSS and input references, the SSU 2000/SSU 2000e use intelligent software to provide enhanced output performance beyond the required holdover stability. Its superior holdover capability retains stratum G.812 performance for three weeks during holdover conditions with Microsemi rubidium technology.

E1/2.048 MHz Output Card

The E1/2.048 MHz output card has 20 ports that are software-selectable for either E1 or

2.048 MHz output signals. The E1 signal has a multiframe format, with selectable Channel Associated Signaling (CAS) or Common Channel Signaling (CCS).

T1 (DS1) Output Cards and Capabilities

The T1 output card has 20 ports. The T1 output card generates phase-locked output signals of 1.544 MHz

E1 and T1 Line Retiming Units (LRU)

The SSU 2000 supports both E1 and T1 line retiming units (LRU). The LRU is comprised of a Line Re-timing Module (LRM) and a Cut-Through Assembly (CTA). The LRU is a four-port (quad) card. The LRU inserts E1 or T1 signals on both sides of a cross connect panel in a central office. Side 1 of there-timer provides "3R" (Re-shape, Re-amplify, and Re-time) for the signal to a client network element. When the LRU receives a data stream, it re-times the data with the transmit clock signal. The clock signal is inserted into the line route between two path-terminating elements.Side 1 is the direction in which timing is applied, and contains the line performance reporting and AIS generator. Side 2 provides "2R", which Re-shapes and Re-amplifies (regenerates) the signal from the client network element.

NTP Performance	Enterprise Class	SSU 2000
Time Stamping Precision	Software (10μs)	Hardware (10ns)
Scalability	Fixed	Card based
Holdover	√	√
Redundancy		√
TL1 Management		√
NEBS		√

Figure 14: SSU 2000/SSU 2000e carrier-grade NTP meets high Quos requirements for NGN telecommunications network.

Composite Clock Output Card

The Composite Clock output card generates 20 signal pairs (TIP and RING signal pairs). Each output is a transformer- coupled symmetrical pair. Each output pair can be turned off independently of other channels. Relays on each output allow for disconnecting the driver output from the output pins.

RS-422 Output Card

The RS-422 output card generates 10 balanced square-wave outputs (TIP and RING signal pairs on ports 1-10) and 10 single-ended (RING) TTL square wave outputs on ports 11-20. Each output can be turned off independently of other ports. Relays on each output disconnect the driver output from the output pins.

NTP Server Card

NTP requirements in telecommunication networks have rapidly evolved from a “best effort” utility to mission critical. With high performance NTP server cards the SSU 2000/SSU 2000e platform delivers carrier-grade NTP to meet demanding next generation network requirements. The NTP server cards provide the performance, scale, availability and security that assure high Quos delivery of advanced services such as IPTV, multimedia content delivery and residential small cells, as well as distributed BSS/OSS operations. The NTP server cards are fully integrated into the SSU 2000/SSU 2000e platform. NTP cards can be installed as single servers or redundant pairs in any available master or expansion shelf output slot. NTP capacity scales up at a rate of up to 1000 fully authenticated transactions per second (TPS) or up to 1500 unauthenticated TPS for each added card. Front-access NTP traffic ports utilize Small Form-factor Pluggable (SFP) modules for flexibility to support 100/1000BaseT electrical or 1000Base-X optical interfaces.

NTP server cards can support both independent public and private network domains, providing added security and flexibility. All configuration and management is consolidated through SSU 2000 system management ports to maintain security and isolation from NTP traffic ports.NTP cards for SSU 2000/SSU 2000e provide superior stability and protection through direct connection to the system backplane. NTP Stratum level 1 UTC (Universal Coordinated Time) traceability is established through the GNSS or GPS input card. NTP Cards for SSU 2000 can also operate at NTP Stratum level 2 with UTC time traceability back to a NTP Stratum 1 card located in another office.

Figure 15: NTP cards

Chapter-7

Synchronization Status Messages (SSM)

The input card reads and processes SSM in accordance with ITU-T and ANSI standards to determine the traceability of inputs. This traceability information is then used by the clock cards in selecting a reference signal, and is embedded into the system's outputs. An embedded, editable table allows upgrades as standards evolve.

Communications, Management and Security

The SSU 2000/SSU 2000e operates with a single communications card, available with basic features or with an enhanced security and SNMP option. The communications card supports TL1 and the Interactive Command Set (ICS), ASCII management interfaces. Coupled with Microsemi's advanced management software solutions, the communication module provides powerful fault, configuration, accounting/ inventory, performance, security, and other optional management functions. Network administrators can schedule automatic firmware upgrades.

System firmware in the master and expansion shelves can be scheduled for automatic updates without further human intervention. Using a secure FTP (SFTP) connection, the communications card can automatically download firmware from a remote server to upgrade the SSU 2000/ SSU 2000e system (NTP and PTP cards must be individually updated using their management Ethernet port). Two system images can be stored on the card, giving the user the ability to update or revert to a standby image with a simple command.

Time Craft

Available to support the SSU 2000/SSU 2000e, Time Craft is an easy-to-use Graphical User Interface (GUI) management tool that reduces the complexity of using TL1 or CLI commands. Its intuitive GUI allows the operator to supervise and control a network element either remotely or locally through icons and simple point and click operations. Time Craft capabilities include support for remote firmware upgrades and provisioning to the port level, event- driven fault management, physical and logical configuration management, and performance and security management.

TimePictra

The SSU 2000/SSU 2000e is fully supported by Microsemi's TimePictra advanced Synchronization Management System. TimePictra provides full FCAPS capabilities (fault, configuration, accounting/inventory, performance and security) as well as an array of advanced management features, including the ability to monitor PTP clients. With a multi-tier architecture (server, client, and database) TimePictra provides scalability and performance to meet growing network services and business needs. The secure web browser client provides easy access and eliminates the complexity of client installation and VPN access.

Microsemi Global Services

Microsemi provides synchronization services that assist customers with the planning, deployment and maintenance of synchronization infrastructure. Services are designed to help lower costs, streamline processes, ensure quality, and deliver the highest level of performance from your synchronization network. The Platform Maintenance service bundles together Microsemi's industry leading technical support along with all software maintenance. As part of Platform Maintenance, customer will receive all updates as well as all upgrades including all patches, point releases, maintenance releases and related documentation for your purchased version of software during the contract period.

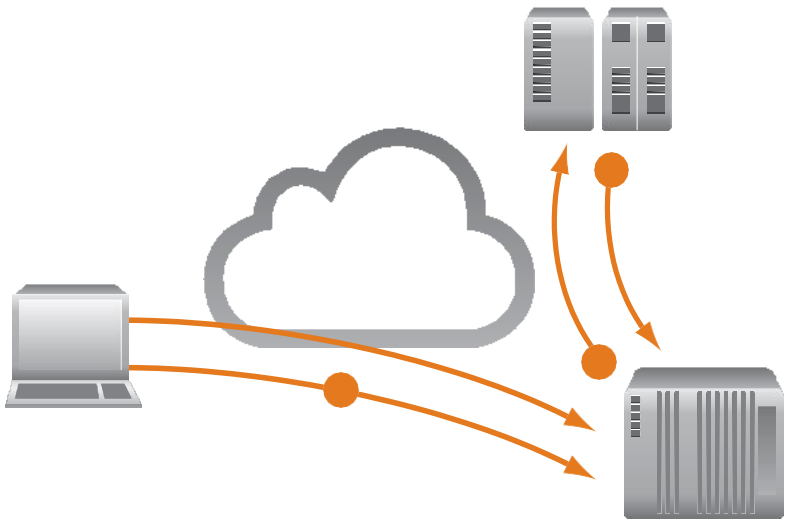


Figure 16: SSU 2000 with Radius Capable Communication Card

Connectivity

For the SSU 2000, there are a variety of input and output panels available with several types of connectors. These include DE9, wire-wrap, BNC, and Siemens type connectors. Also available are high density wire wrap panels in both 80 and 100 output versions. For the SSU2000e, DE9 connectors are included in the shelf design.

Synchronous Ethernet

The IEEE 1588 PTP card offers an option for SyncE physical layer frequency synchronization through the 1000Base-X optical Ethernet output port. Ethernet Synchronization Message Channel (ESMC) per the OSSP protocol is supported. Fully standards compliant SyncE with PTP makes the SSU 2000/SSU 2000e platform an excellent solution for next generation 4G/ LTE and mobile backhaul networks. The Microsemi PTP cards are fully integrated into the SSU 2000/SSU 2000e system. They can be installed as single servers or redundant pairs in any available master or expansion shelf output slot. PTP capacity scales from 125 full-rate clients to higher capacities per card upon request. Front-access PTP traffic ports utilize Small Form-factor Pluggable (SFP) modules for flexibility to support 100/1000Base-T electrical or 1000Base-X optical interfaces. All configuration and management is consolidated through SSU 2000/SSU 2000e system management ports to maintain security and isolation from PTP ports. The PTP cards provide superior stability and protection through direct connection to the SSU 2000/SSU 2000e system backplane. PTP cards operate either in arbitrary (ARB) timescale mode or in International Atomic Time (TAI) timescale with full UTC traceability through the SSU 2000/SSU 2000e integrated GNSS or GPS input card.

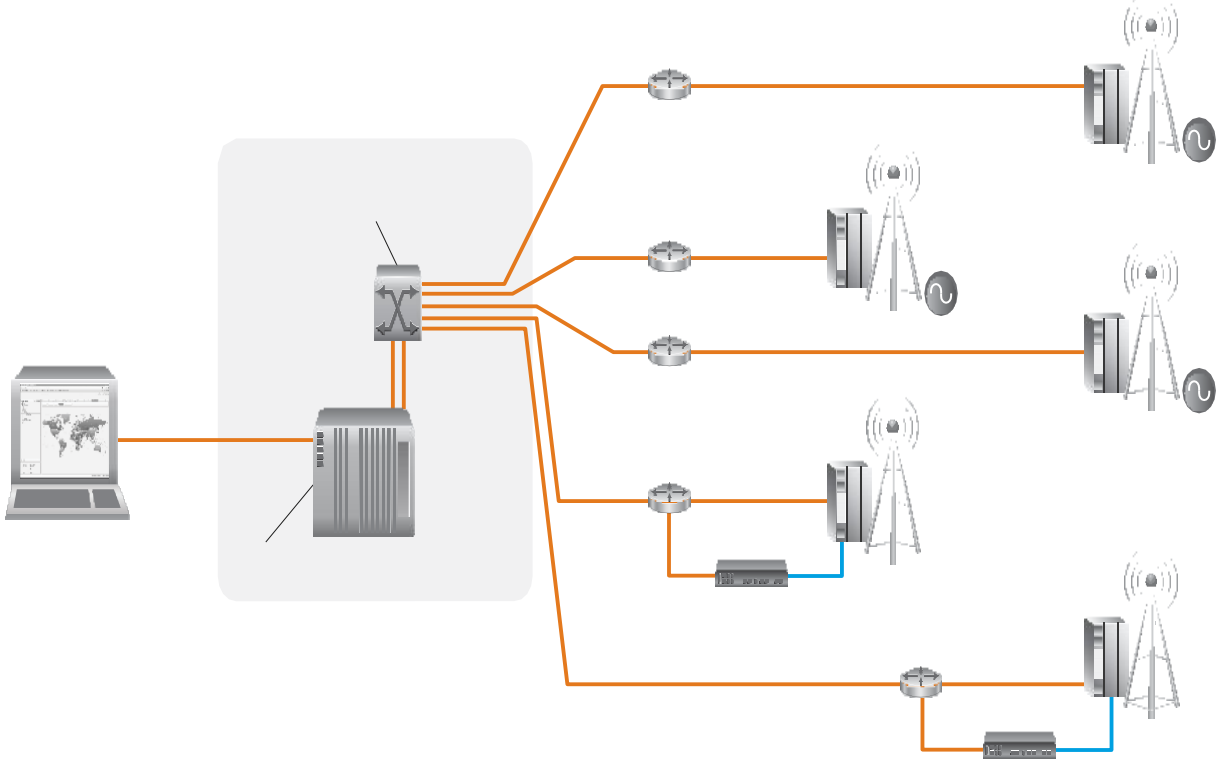


Figure 17: IEEE 1588 (PTP) Grandmaster Server Cards provide synchronization traceability over Ethernet to PTP client clocks in remote base station.

CONCLUSION

Internship is an opportunity to acquire a real life experience of what I learned in my academic life. Working as an intern in the Networking Solution of FONS BD Ltd. I have learnt to be dedicated to the job. Dedicative mindset is the most important thing to work in such a sophisticated environment. It is beyond mere official matter. For working in FONS BD Ltd microsemi project I learnt about working process of multinational company and their rules and regulation. I also experience about the office working in 24x7 monitoring network taught me about how to handle extreme pressure. Everyday makes a new challenge to us this speech now I believe because I experience about this on intern this project. My confident level now getting high day by day now I think that I could make better in my life. I have learned so many significant procedures from my supervisors and colleagues and conducted some tasks on a regular basis throughout my entire Internship period and ultimately earned the confidence to deal with Assignment myself. It is a great opportunity to use the knowledge and skills that I had acquired. I also learned how to handle critical faults and got the new ideas. Doing this kind of work is really helpful for my career and I like to do this kind of work again.