

Nortel Communications Server 1000

A guide to Building & Running a CS1K
System

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Course Objective

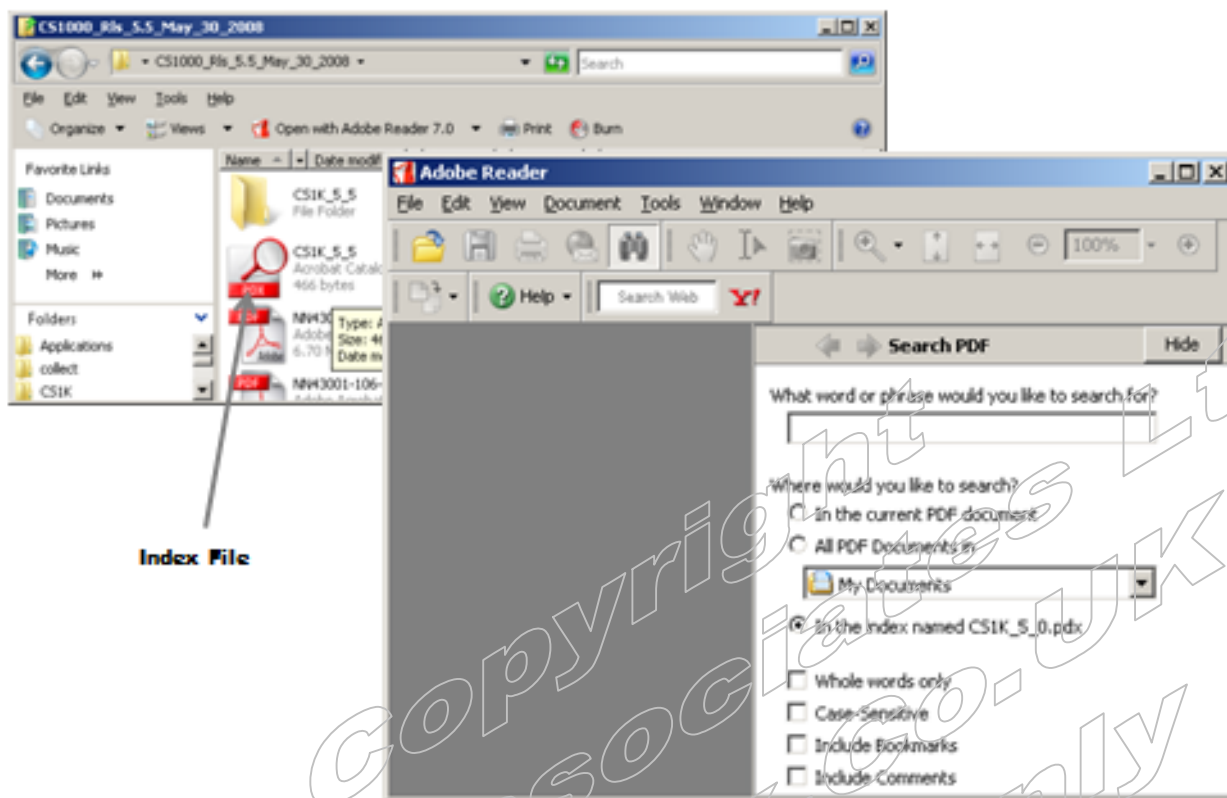
- This course is designed for Engineers & Technicians who need to understand how the CS1K system is Installed and Configured.
- By the end of the course you should be able to
 - Describe the CS1K Architecture and Components
 - Install the Hardware and link the components together
 - Install the Software and configure it so it will support
 - IP Telephones
 - Analogue or Digital Telephones
 - IP Virtual Trunks

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Documentation – NTP's



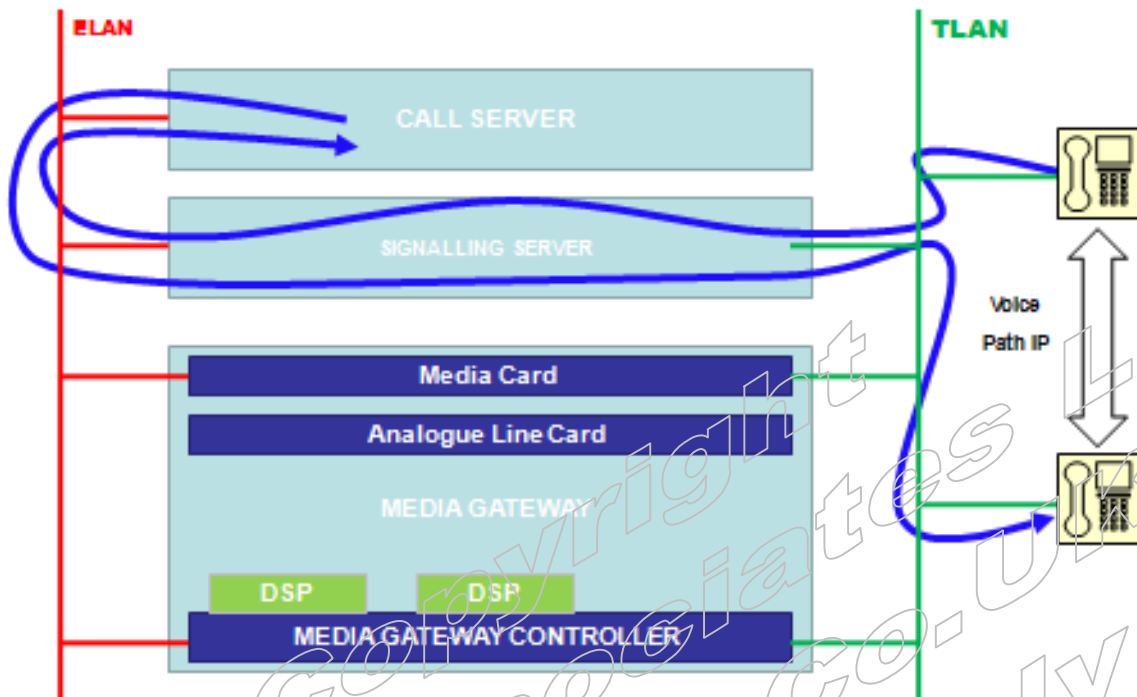
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Nortel produces a very comprehensive range of documentation for all of their systems.

Previously they supplied an application known as Helmsman which was used to search the archive of documentation for the relevant information. However with the advent of CS1K Release 5, the Helmsman application was discontinued and NTP's (Nortel Technical Publications) are delivered with an Adobe Acrobat Index file which is used as the search tool.

By opening the .PDX Index file you will be offered the search dialogue seen above. By selecting the option to search in the Index file, all documents will be referenced and all occurrences returned.

1. CS1000 Architecture



The CS1000 Architecture is as shown above. The ELAN is a private management network whilst the TLAN is connected to the "Public" side. Telephones may be connected to the TLAN directly or to a network routed from the TLAN (Sometimes referred to as the CLAN Customer LAN).

IP Sets sit on the TLAN or a network attached to the TLAN. They need to communicate with the Call Server to make and receive calls and this is done by registering with the Signalling server. The Signalling server runs several pieces of software but the sets use the TPS, Telephone Proxy Server to register with and to communicate with the call server.

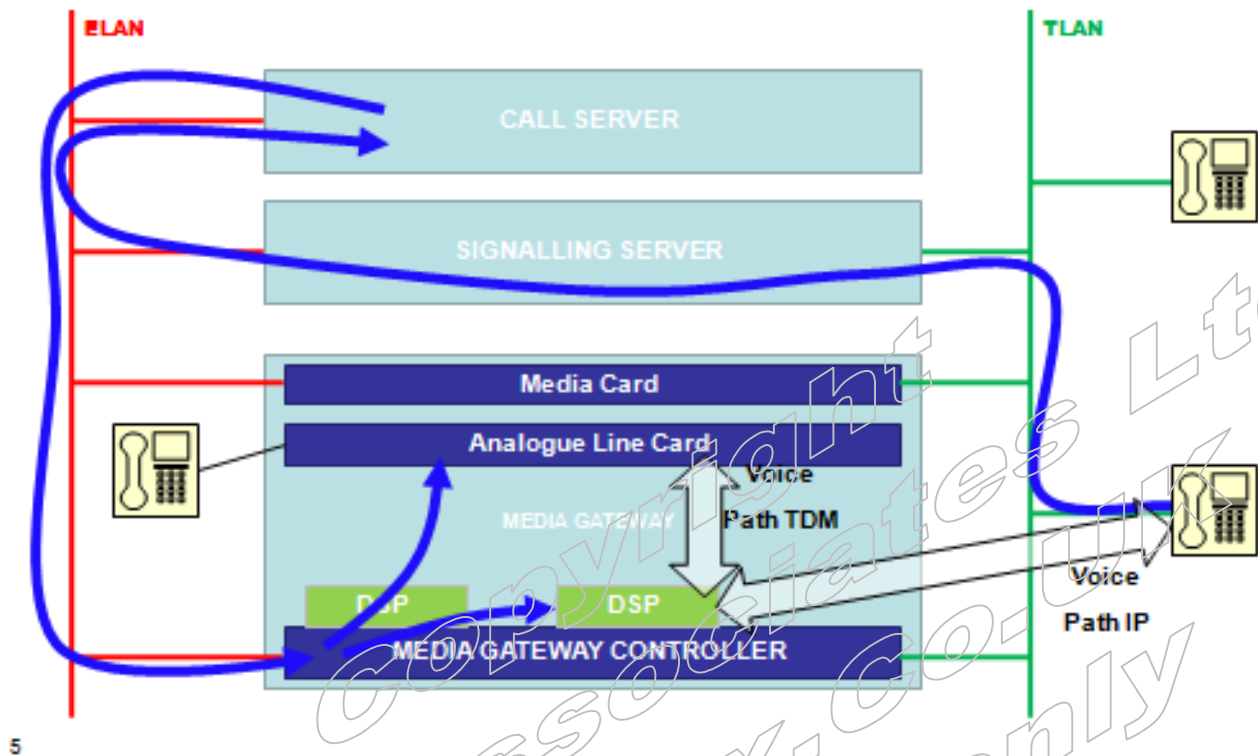
When a set registers TPS records its Virtual TN and IP address so it can identify it. In the call server the set is defined using the Virtual TN.

The Media Gateway is used to provide card slots for Digital & Analogue cards and any others required. It also provides other services but importantly the IP/TDM conversion via "Media Cards". This the Media Gateway is the path to traditional TDM phone sets and the PSTN.

When an IP set makes a call it messages the Call Server via the TPS on the Sig server. The Call server locates the endpoint for the call and manages the connection. If it is from one IP set to another the call server will signal the destination via the TPS. When the call is established the voice travels directly from IP Set to IP Set and NOT via the sig server or call server.

If the end point is a TDM set the call server messages the Media Gateway to allocate TDM/IP resource as well as signalling the traditional set. The Voice path for the completed call would be via a Media Card.

IP to TDM Call



If the end point is a TDM set the call server messages the Media Gateway to allocate TDM/IP resource as well as signalling the traditional set. The Voice path for the completed call would be via a Media Card as shown.

IP ⇄ IP

IP Set to TPS with Dialed no.
 TPS passes to Call Server
 Call Server looks up Dialed No.
 Call Server returns VTN to TPS
 TPS signals Destination IP set
 Codecs agreed
 Zone Bandwidth Allocated
 Destination picks up
 Voice path established directly IP-IP

IP ⇄ TDM

IP Set to TPS with Dialed no.
 TPS passes to Call Server
 Call Server looks up Dialed No.
 Call Server contacts Media Gateway with TN of set
 Media Gateway signals destination & allocates DSP (Media Card) resource
 Codecs agreed
 Zone Bandwidth Allocated
 Destination picks up
 Voice path established directly IP-DSP
 DSP-TDM resource

Functions of Devices

- **Call Server** - Holds the Customer database processes calls
- **Signalling Server** - Hosts up to 5 applications
 - **Terminal Proxy Server**
 - Links IP sets to Call server
 - Uses UNISTIM Protocol (Nortel Proprietary)
 - **H.323 & SIP Signalling Gateway**
 - Provides Standards based signalling for Virtual Trunks
 - **Element Manager**
 - Creates GUI for Call server Management
 - **NRS - Network Routing Service**
 - SIP – Redirect Server
 - H.323 – Gatekeeper
 - UNISTIM – NCS Network Connect Server
 - **Personal Directory**
- **Media Gateway** - Houses IPE Cards
 - Provides IP to TDM conversion via Media Cards
 - No Media gateways in CS1000M (opt 81 & 61) IPE Shelves provide card slots etc

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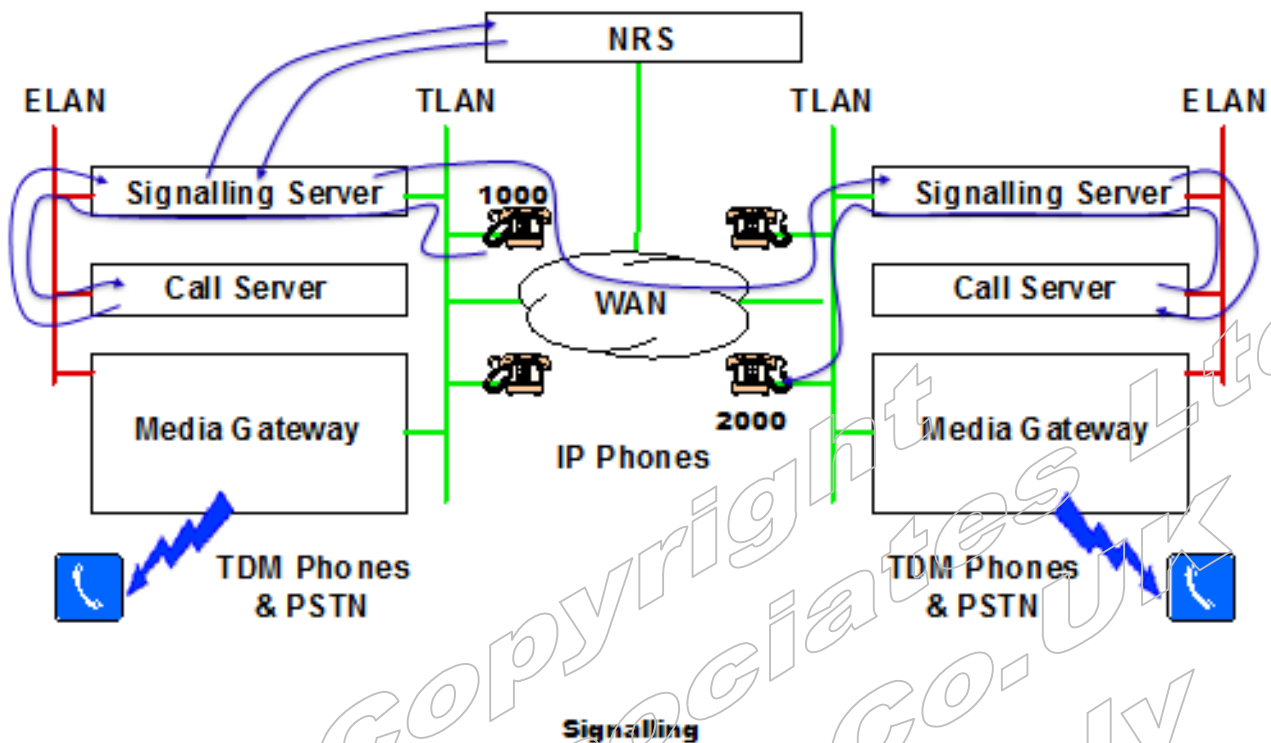
Call Server processes all calls and generates CDR etc. All configuration of the system is done on the call server as it contains the customer database. However the voice path for IP calls does not actually connect to the call server and ideally it takes the shortest path possible between endpoints.

The Signalling server provides the various signal paths for call setup as well as some other applications.

TPS	Provides a path for UNISTIM messages from the IP sets to the call server. It also tracks the IP Set VTN against its current IP address.
Element Mgr	Provides a GUI to manage the calserver. Most commands can be executed through the Element manager interface and the Sig server creates the pages by interrogating the calserver.
H323/SIP G/W	Is the signalling gateway for Virtual Trunk calls between systems. It takes requests from the calserver across the ELAN, encodes them in either one of the two standard protocols and then transmits them to the destination endpoint.
NRS	Is the resolver of DN to IP addresses for H323/SIP & UNISTIM
Personal Dir	A directory of up to 100 names specific to any IP set User.

The Media Gateway contains the card space for Analogue and Digital set cards and also provides for the conversion from IP (Packet Voice) to TDM (Traditional Time Division Multiplexing Voice). In this way IP sets can work in with both environments.

CS 1000 Network



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In a Networked environment with IP Virtual trunks all systems TLAN's are connected together either over the WAN or the LAN.

If a call is made from an IP set on the Left hand system to another IP set on the right hand system then the call server uses the Signalling gateway on the Signalling server (Either H323 or SIP) to set up the trunk. The Gateway needs to establish where the destination endpoint is and to do this it requests resolution from the NRS.

When it is aware of the destination endpoint it signals directly to it (Signalling gateway to signalling gateway) to set the call up. The destination signalling gateway will pass the inbound request to its call server and try to complete the call.

Assuming all is correct, the call will be set up from IP Set to IP set even though the inter system signalling has passed via the signalling servers.

Exercise 1

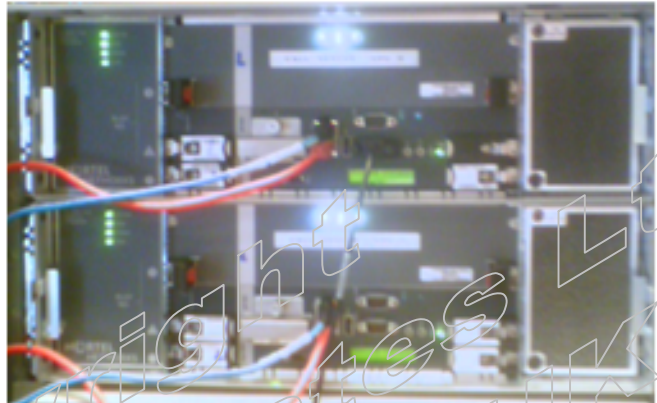
1. Where is the Customer database held in the CS1K system ?
2. What is the function of the Media Gateway
3. In an IP Set to IP Set call what route does the media path take ?
4. What are the two LAN's utilised by the CS1K system ?
5. What is the purpose of the signalling server in the CS1K system ?
6. What is the name of the LAN which interconnects the Call Server and Media Gateway ?
7. What is the device which converts TDM to IP ?
8. In a Network of CS1K systems which LAN would be connected to the WAN ?

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2. CS1000 Components Call Server – Pentium IV

- Pentium IV Processors
 - Redundant Only
 - PKG 410 in Keycode
 - Separate Chassis
 - Use Utility Card
 - CPU0 / CPU1 (DIP s/w)
 - Security Device (Dongle)
- Campus Redundancy
 - CPU's up to 40Km apart
- Pentium II
 - Upgrade Only
 - Utility Card
 - Drive Card for Floppy CD & HD



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Pentium IV call servers are only supplied as a redundant pair in discrete chassis.

Currently they can support up to 50 Media Gateways or 22500 IP sets or a combination of the two. Pentium processors still use the Utility card to house the security dongle and to set the "side" of the switch. Each CPU will either be 0 or 1 and this is set on DIP switches on the utility card.

Pentium IV systems have a 1Gb Fixed Media device on the board instead of a hard drive and use a 512 Mb compact flash (Removable Media Device – RMD) for software installation.

Call Servers – CPPM

- Common Platform Pentium Mobile
 - 1Gb DDR RAM Exp to 2Gb
 - Compact Flash RMD
 - 3 x Ethernet ports
 - 2 x SDI Ports
 - Used for Call Server & Sig Server
- Call Server
 - High or Standard Availability
 - Security Device On-Board
 - No Utility Card Required
 - 1Gb Compact Flash FMD
- Resides in slot in Cabinet or Chassis



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CPPM call servers are a single board solution and can be used for Standard availability (SA) & High availability (HA) systems. The security device is carried on the board itself and the "Side" information is set in the software.

As a call sever the CPPM has a 1GB Compact flash as its FMD (fixed Media Device – hard drive) and uses a 512 Mb compact flash for software installation, RMD (Removable Media Device). To set the board to boot from the compact flash the onboard switch is set to position 1.

CPPM devices use a standard IPE slot in a Media Gateway but only receive power from it and connect to the console port through it. They do not communicate with other cards in the chassis or cabinet across the backplane.

A High Availability CPPM based system will support a combination of up to 50 Media gateways or 22500 IP Sets.

Signalling Servers

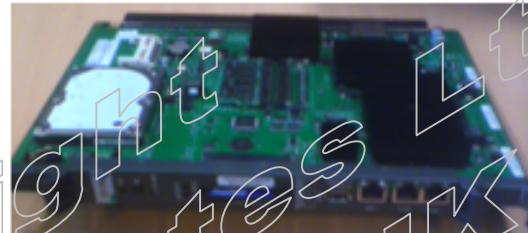
- 2 Form Factors
 - Card
 - 1U Server
- 2 Operating Systems
 - VX Works
 - LINUX
 - Only on HP & IBM
- Linux Servers
 - Enterprise Common Manager
 - SIP Proxy NRSM
- ISP 1100
 - Upgrade Only not new system
 - Must have 1GB Memory



IBM X306m



HP-DL320

CPPM
IPE Card

ISP 1100

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HP & IBM servers are known as COTS (Commercial of the Shelf) servers. They come with 2 Gb or memory and one hard drive. They have 2 Ethernet ports for ELAN & TLAN and can run either Linux or VXWorks.

The CPPM Sig server is the same board as the call server but it is now equipped with a 40Gb laptop hard drive instead of the 1Gb compact flash and the onboard switch is set to position 2 to ensure it boots from the hard disk.

CPPM devices use a standard IPE slot in a Media Gateway but only receive power from it and connect to the console port through it. They do not communicate with other cards in the chassis or cabinet across the backplane. If you are using a CPPM sig server in a 1000M it must be the dual width device to avoid fouling other cards.

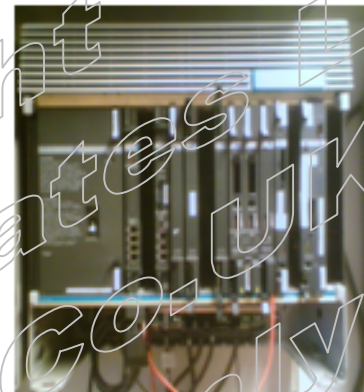
Single width CPPM for use in Media gateways NTDW61

Dual width CPPM for use in CS1000M NTDW66

The ISP1100 is supported for upgrades but must have a memory upgrade to 1Gb to be used with release 5 or 5.5.

Media Gateway MG 1000E

- Chassis or Cabinet
- Media Gateway Controller Card
 - Controls Card slots
 - Communicates with CS
 - Supports PRI Cards
 - 3 SDI Ports
 - Multi Homing Option for ELAN & TLAN
 - Always Slot 0
- Upgrade Only SSC can be used
 - NO PRI
 - NO SDI PORTS
 - NO MULTI HOME



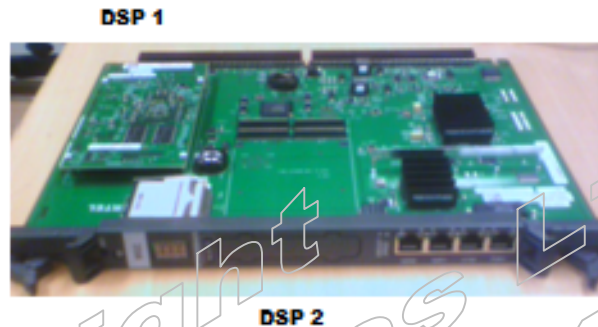
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Either the Chassis or Cabinet can be used for the Media gateway on a CS1000E system. The Chassis is a 5 slot main unit with an optional 4 slot Expander cabinet. The two are connected using 2 copper cables. The expander is a part of the main media gateway and only adds the 4 card slots, no other functionality.

Each Chassis or Cabinet uses a Media Gateway Controller card to control the cards in the gateway and to communicate across the ELAN to the Call server.

Media Gateway Controller Card

- MGC Card
 - 128 Mb Compact Flash
 - No Software load
 - Uses Gold Image
 - Stores Updates on Compact Flash
 - Option for 2 DSP Daughter Boards (Media Cards)
 - Slot 1 (TOP) 32 or 96 Port
 - Slot 2 (MID) 32 Port Only
 - Multi-Homing Option
 - Pass through ports CE CT
 - Dual ELAN & TLAN ports
- Always SLOT 0



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Always sits in slot 0 in Media Gateway and is keyed so it won't fit in any other slot.

Provides support for PRI cards in Media gateways

Use a Gold Image to boot from and connect to the call server, this means no software has to be loaded to the card. Updates are downloaded and stored on the 128Mb Compact flash card on the board.

Has 3 SDI ports on the board which are presented on the triple cable from the normal Serial port on the cabinet or chassis. The first port is used to configure the card initially but after that they can be configured as extra TTY ports for the call server.

The MGC has space for 2 DSP daughterboards which come as either 32port or 96 port boards. The maximum configuration is 1 x 96 port in card position 1 and 1 x 32 port in card position 2 making a total of 128 DSP ports (TDM/IP ports).

32 port card NTDW62xx

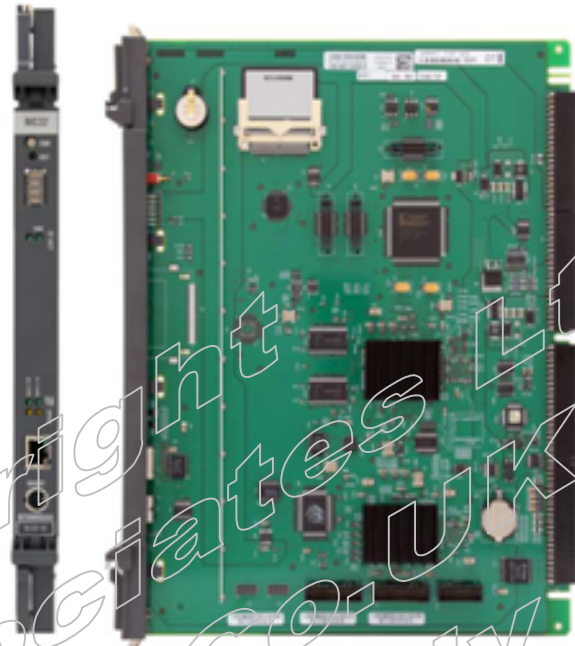
96 port card NTDW64xx

Has the ability to multihome the ELAN & TLAN ports to increase redundancy for Call servers or Sig servers connected to the passthrough ports CT & CE on the front panel.

The 4 digit display on the front of the card displays the LOOP & SHELF when it is connected to a call server. At boot up it reports its self test BOOT, POST (Power on self test), PASS (Pass self test), LOAD (Application Loading). In the event of an error it will display Exxx where xxx is the error number.

Media Card 32S

- Replaces existing VGMC Media card
 - 32 Ports TDM/IP Conversion
 - IPE Format Card
 - Fits 1000M or Media Gateway
- Adds SRTP to media card
 - Secure Voice
- Uses BOOTP to obtain IP information
- Support Set Registration
 - Fallback only
 - Max sets 4xNo. Ports



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The Media Card 32 S provides TDM to IP conversion as did its predecessor the VGMC (Voice Gateway Media Card) . However it has the additional functionality to encrypt the voice media using Secure Real Time Protocol (SRTP).

This card can be used where there is no opportunity to use the DSP daughter boards of a MGC (Upgraded Media Gateway still retaining the SSC controller) , or in a CS1000M configuration where there are no Media Gateways at all.

The MC32S does support TPS and will allow set registration as a fallback if all other signalling server members of its IP telephony node are down. It will support 4 x the no. of ports i.e. 4 x 32 =128 sets.

It is configured as a part of the IP telephony node as it is running TPS.

The ELAN & TLAN connections for the card are achieved using a specialised adaptor which plugs into the 25 pair connector for the card. The Ethernet port on the faceplate is currently unused.

Telephone Sets

- IP Sets
 - 1200 Series
 - 1100 Series
 - I200x Series
- Standard Analogue
 - Flexible Analogue card
- Digital Sets
 - Digital line card



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Command Line Interface - CLI

Call Server 1000 and Meridian1 use an Overlay structure

90% of operations can be achieved in CLI

- Login
 - >logi "Username"
 - >pass "Password"
- To Load Overlay
 - LD 117
- To Repeat a Prompt
 - *
- To return to REQ prompt
 - **
- To Exit Overlay
 - ****
- To Logout
 - LOGO
- To get a list of options when prompt is :
 - Ld 20
 - PRT:
 - TYPE: ?
- Command list in LD 117
 - => ?
- Allow backspace in Overlays
 - >OVL000
 - lon line editor on
 - lof- Line editor off

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The call server is configured through both the command line interface (CLI) as well as the Element Manager (EM).

The command line is based on "Overlays" and to interact with the system you need to be in the correct "Load" (LD) or "Overlay".

To login you need to type "LOGI" (Not case sensitive) at the prompt, and either add the username you wish to use on the same line or hit enter and it will prompt you for a USERID.. The system will then request a password.

When you have gained access to the CLI you can change "Overlays" by typing LD and the number of the overlay you wish to use. The system requires you to exit an overlay before you can enter another and this is done by typing ****.

Multi User – Error Help

- Use Multi User to allow more than one login & Error lookup
 - (must have for CS1K)
 - Setup in LD 17 – CHG – OVLY
- Allows Lookup of Error Codes within Overlay

```
REQ test
SCH0101
REQ !
>err sch0101
>

SCH0101
Unable to match input fields with stored mnemonics.
Severity: Info
```

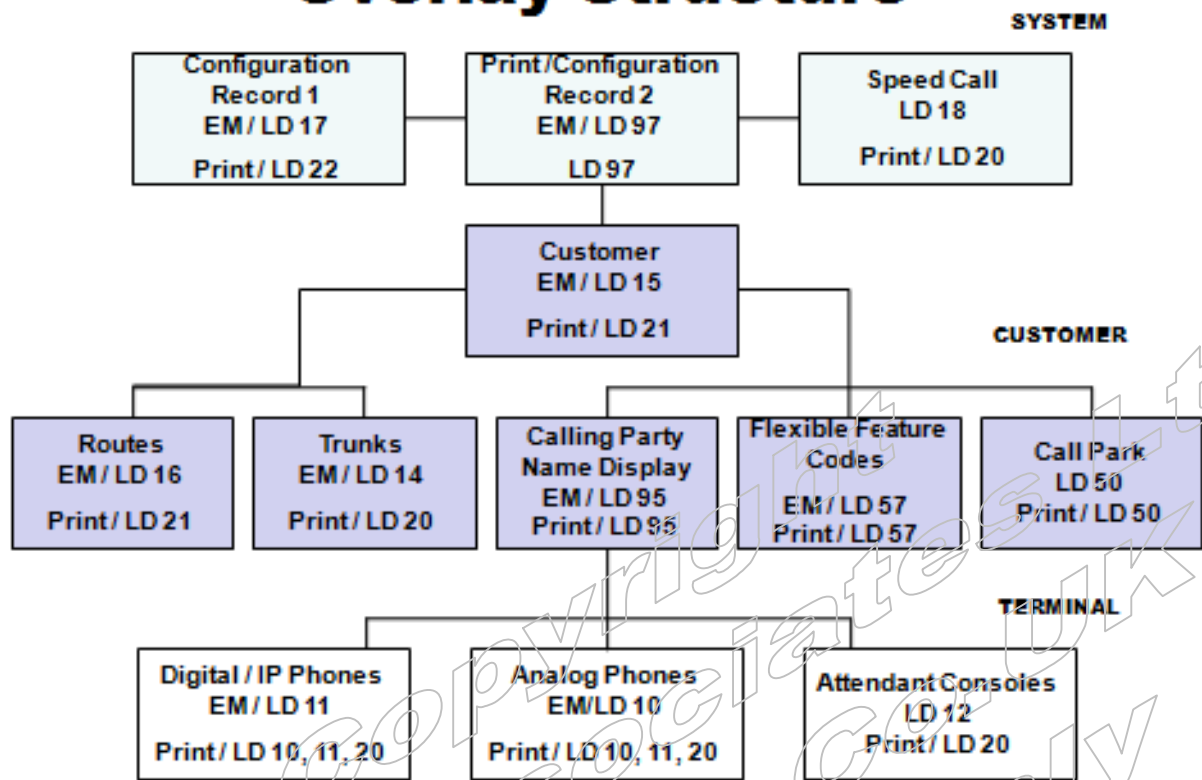
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When the call server is used as part of a CS1000 system we need to turn on the MULTI User functionality which is done in LD 17. However, only one user can execute a command in the overlays at any one time, if two users try to access overlays at the same time an OVERLAY CONFLICT message will be generated. This applies to Element Manage and CLI Users also. Users do not need to log out but do need to exit to Overlay 0 (****) to avoid this problem.

Multi user allows a user to login more than once and also allows us to look up error messages in the CLI without exiting the current Overlay. This is done as shown above by typing:

!err "The Error Code to look up".

Overlay Structure



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The overlay structure is organised as shown into three primary areas.

System

Which deals with the Configuration records, such things as Superloops.

Customer

Most systems only have one customer but there can be several. This deals with the setup of specifics for a particular customer e.g. Routes and Trunks and CPND information.

Terminal or Set

Relates to the actual set properties. Whilst it shows LD 10 & 11 which still exist it is wise to remember that LD 20 is now a linked overlay allowing operations to be carried out for LD 10, LD 11 & LD 32.

Reviewing Configuration Data

- If it has a TN
 - Print in LD 20
- LD 15 and 16
 - Print in LD 21
- LD 17
 - Print in 22
- Overlays above 22
 - Print in same overlay

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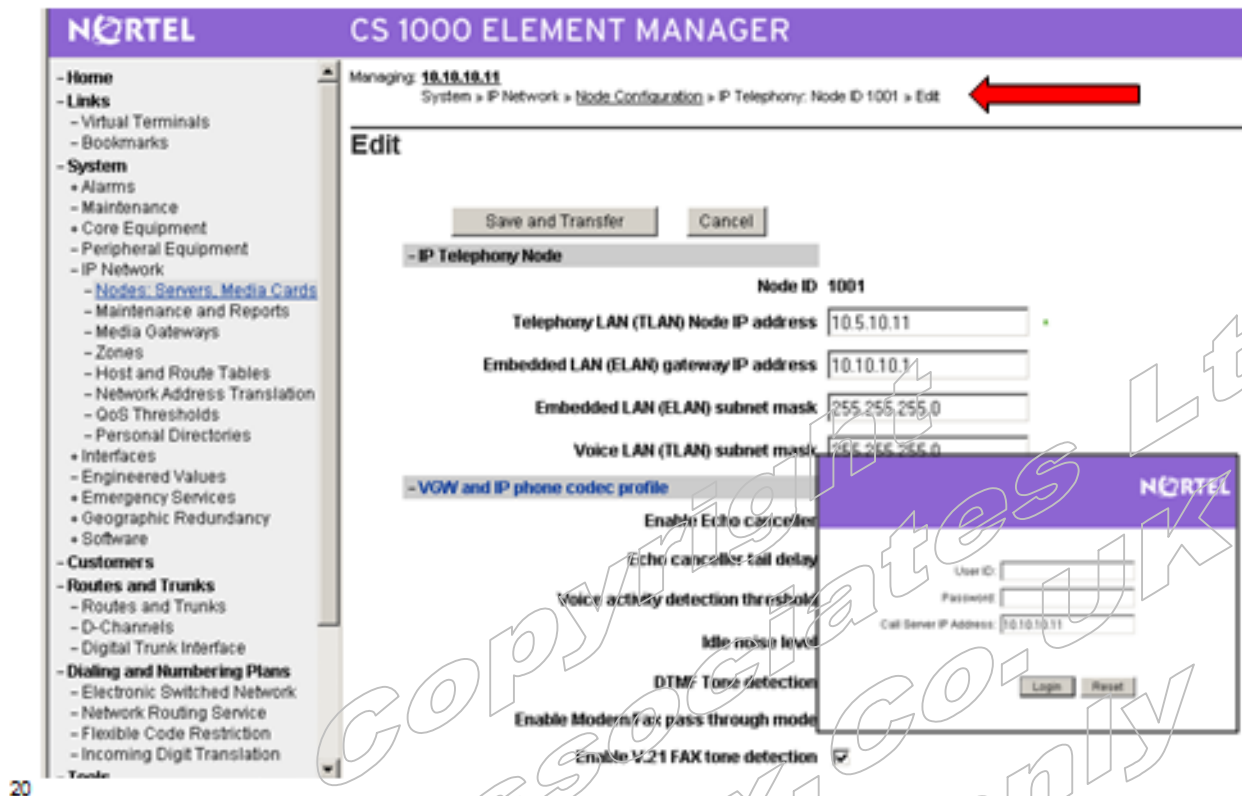
The debate rages as to which interface, the CLI or the Element Manager is the easiest to use for configuring and administering the CS1000. In truth it is probably down to how long you have used the system, and the CLI does have a speed advantage if you know exactly what you want to do.

However one area that the Element manager probably wins on is reviewing configuration information as it is presented in web page format with some explanation.

If you want to review configuration information through the CLI then the slide here is a useful one to remember as it points you to the relevant overlay for printing data.



Element Manager



Element manager (EM) is the standard option with CS1000 to manage the system in conjunction with the CLI. It can allow you to access 80%-90% of the system through its GUI however some commands are not available most notably the ability to create and edit Sets.

Some users who have used the CLI in the past find EM a slower way of navigating the system but it does have some advantages when you are reviewing setup information.

ECM & NRSm

- Only available on LINUX
 - HP DL320 or IBM x306
- Enterprise Common Manger
 - ECM
 - Single point of sign on
 - Security Server
 - EM has Phone configuration
- NRSm
 - SIP Proxy Server
 - Incorporates NRS (Network Routing Service.)
 - Backup Security Server



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With the advent of Release 5 Nortel launched 2 new servers which run on the new COTS platforms under Linux. These are the Enterprise Common Manager (ECM) and the SIP Proxy Server or NRSm.

ECM offers a centralised resource for managing multiple systems in a network with the advantage of a single point of logon and authentication. Because of this the ECM also hosts a Security Server to ensure all connections between devices are secure and protected by certificates etc. In addition the ECM adds Phone configuration to the Element Manager functionality (see above) thus allowing for editing and creation of sets through the GUI.

The SIP Proxy server is a backup security server and the two are usually deployed together. Its function is to act as a SIP Proxy for the network channelling all SIP requests and responses through one device and thus protecting the network. In addition it needs to manipulate the contents of SIP signalling messages to ensure the IP addresses embedded within them are correct and will make sense at the destination. This usually means substituting internal addresses for the external IP address of the SIP Proxy for outbound messages and vice versa for inbound.

NB Note that Linux based servers do not run TPS so do not register IP sets.

Terminal Numbers TN's

Loops & Superloops

- Superloops are the internal mechanism for connecting the call server together and provide the Terminal Numbers (TN's) which are the unique internal addresses which each device will need.
 - A Large switch has 256 Loops 0-255
 - Each Superloop created consumes 4 Loops
 - A TN on a large switch comprises of :
 - LOOP SHELF CARD UNIT
 - E.G. 8040
 - Virtual TN's are used for IP Sets & Virtual Trunks as there is no physical port
 - A Virtual Superloop can have the maximum number of TN's available
- | | | | |
|--|-------|------|------|
| – LOOP | SHELF | CARD | UNIT |
| – 1 | 1-0 | 0-15 | 0-31 |
| – Total TN's/Superloop = $1 \times 2 \times 16 \times 32 = 1024$ | | | |

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The internal addressing of the system is done using Terminal Numbers.

These are defined by the number of LOOPS a system has. On all new CS1000E systems this will be 256, however on CS1000M systems this may be smaller.

TN's are used to address cards & units on the cards. A normal TN can be traced to a physical port on the system itself.

Virtual TN's on the other hand are used to address devices where there is no discrete physical connection port such as IP telephones and Virtual Trunks. This does mean that some correlation needs to be made between the Virtual TN of an IP Set and its IP address. This is done by the Terminal Proxy Server on the Signalling server at set registration time.

Exercise 2

1. Which processors can be used to build a High Availability (HA) system ?
2. Which processors can be used to build a Standard Availability (SA) system ?
3. Which slot can a Media Gateway Controller occupy ?
4. What is the TN or Terminal Number used for in a CS1K system ?
5. How many TN's are there in a Virtual Superloop ?
6. List the cards where Compact Flash memory is used and the capacities ?
7. Which slot can a CPPM Call Server occupy ?
8. What is the Utility card used for in the Pentium IV processor chassis ?

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3. Hardware Installation

- **Most Equipment Rack Mounted**
 - Pentium IV Call servers
 - Signalling Servers
 - Not CPPM – Uses a card slot in a Media Gateway
 - Media Gateway Chassis
- **Cabinets Wall Mounted**
- **CS1000M Single & Multi Group (Option 61 & 81)**
 - Use existing Chassis
 - CPPM Sig Servers can use IPE card slot
 - Must use dual width card

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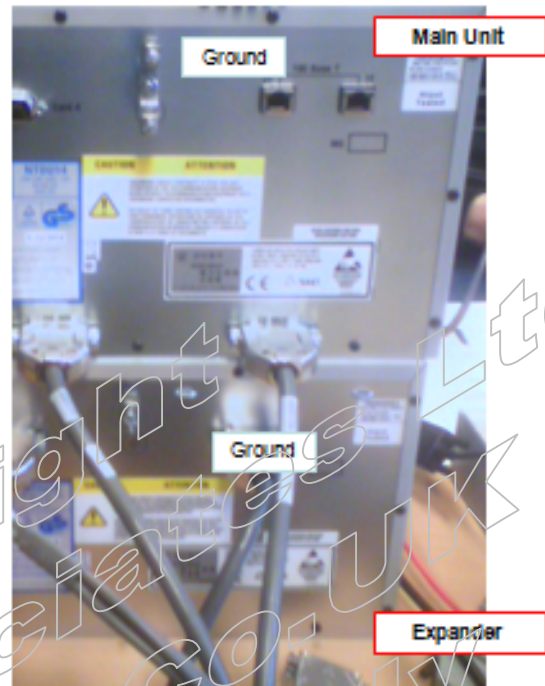
The CS1000E is either Chassis or Cabinet based. The Chassis systems are all rack mounted and depending on the Sig Servers used may or may not have other rack mounted items to complete them. Notably all systems will need IP switches, either Layer 2 or Layer 3 and these will end to be rack mount items.

Cabinet based systems are wall mounted but again if ISP 1100 or COTS servers are used as sig servers they will have a requirement for standard racks. A system can mix both Cabinet and Chassis based media gateways.

CS1000M Single or Multi Group systems will use their own chassis as normal and the only requirement then is to house sig servers. If CPPM servers are used then the need for racks is reduces to any ethernet switching required.

Grounding

- NTBK80 Ground Bar
 - Up to 6 Media Gateways
 - With expander
- NTDU6201 Ground Bar
 - Bridging point for up to 36 #6 AWG cables
- Grounding Via AC Outlet
 - Signalling Servers (1U)
 - Pentium IV



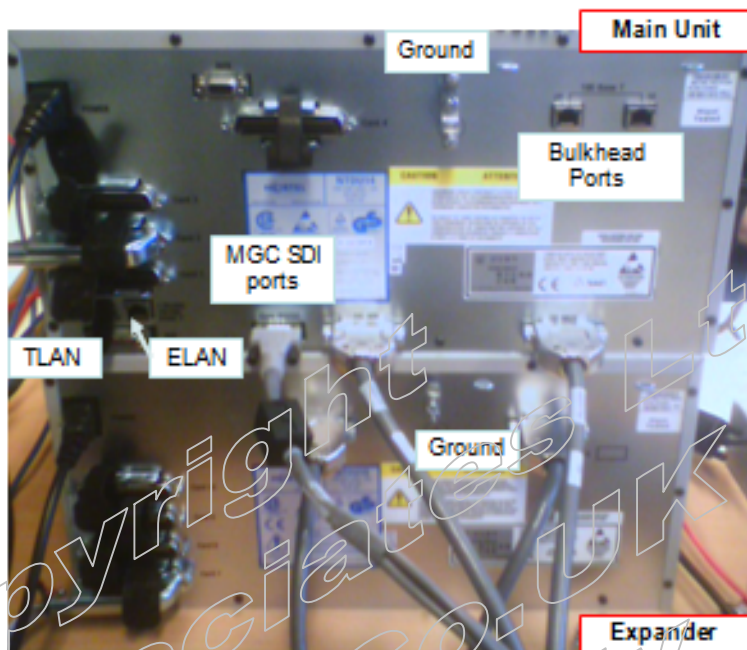
25

Grounding is important for chassis based media gateways and each has a grounding post (Main & Expander for this purpose. Check the NTPs for your country requirements.

Sig Servers (Non CPPM) and the Pentium IV chassis is sufficiently grounded by the AC connection outlet.

Media Gateway Chassis

- Chassis & Expander
 - Interconnect with
 - CEMUX & DS-30
- 8 Cards use 25 Pair Connectors to MDF
- SDI Ports from MGC
 - 3 x TTY ports from CS
- ELAN & TLAN
 - Bottom Left on Main Unit
- Bulkhead Ports
 - Connect to sockets
Bottom right of Main Unit



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If using the Media Gateway chassis then the above shows the relevant ports for connection. The cards in the units will use the 25 Pair connectors to link to the MDF. In a chassis configuration the Main unit & Expander are linked by 2 copper cables.

MGC SDI (Serial Data Interface) ports are connected using the "Triple Cable" these ports are used for the initial configuration of the MGC card itself but once it has been integrated and has registered with the call server they can be configured as further TTY ports on the call server itself for access or CDR collection etc.

The ELAN & TLAN ports on the back of the chassis are the redundant connections for the MGC and mirror the 1E & 2T ports on the faceplate of the card itself. If you are not using multihoming then either connection maybe used. Swapping between these ports is controlled by the MGC itself and is not reliant upon any other network interaction.

Media Gateway Chassis

- Bulkhead Ports
 - Connect to sockets on rear
- Power switch on front of Chassis
- DIP Switches
 - for setting Ring Frequency etc



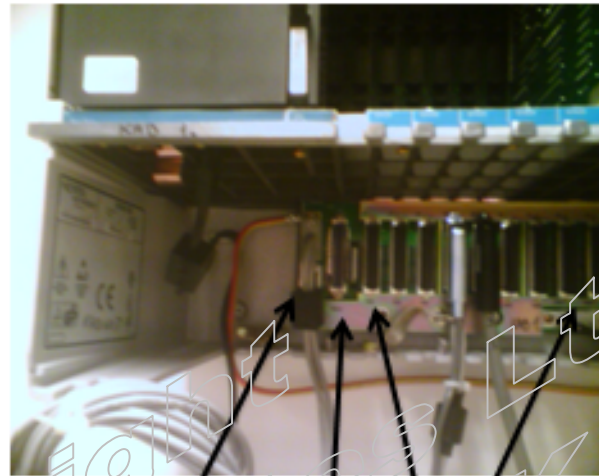
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The Bulkhead ports on the Media Gateway are used purely for connecting to the back of the chassis. They act like an extension cable only and can be used by any connection ELAN or TLAN on the system.

The DIP switches are used to set the ring frequency etc and should be set according to the relevant NTP.

Media Gateway Cabinet

- Cards use 25 Pair Connectors to MDF
- SDI Ports from MGC
 - 3 x TTY Ports from CS
- ELAN & TLAN Ports
 - Dual Homed ports Via Adaptor Duplicate ELAN & TLAN on MGC Facelate



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The Media Gateway cabinet is similar in requirements to the chassis as far as card connections go but the location of connectors is at the bottom of the cabinet.

The SDI ports are connected again using the triple cable and the ELAN & TLAN redundant ports are connected using a specialised adaptor similar but not the same as the Media card adaptor. This allows for the duplication of the 1E & 2T ports on the faceplate of the MGC itself in slot 0.

CPPM Installation

- CPPM Call Server or Sig Server only use power & console connection from card slot
 - Requires Special cable
 - 25 Pair Connector to 2 x 25 Pin "D Type"
- CPPM Card placement
 - Chassis & Cabinet
 - Any slot except 0 (MGC only)
 - CS1000M Signalling Server
 - Any IPE slot but use Dual width card



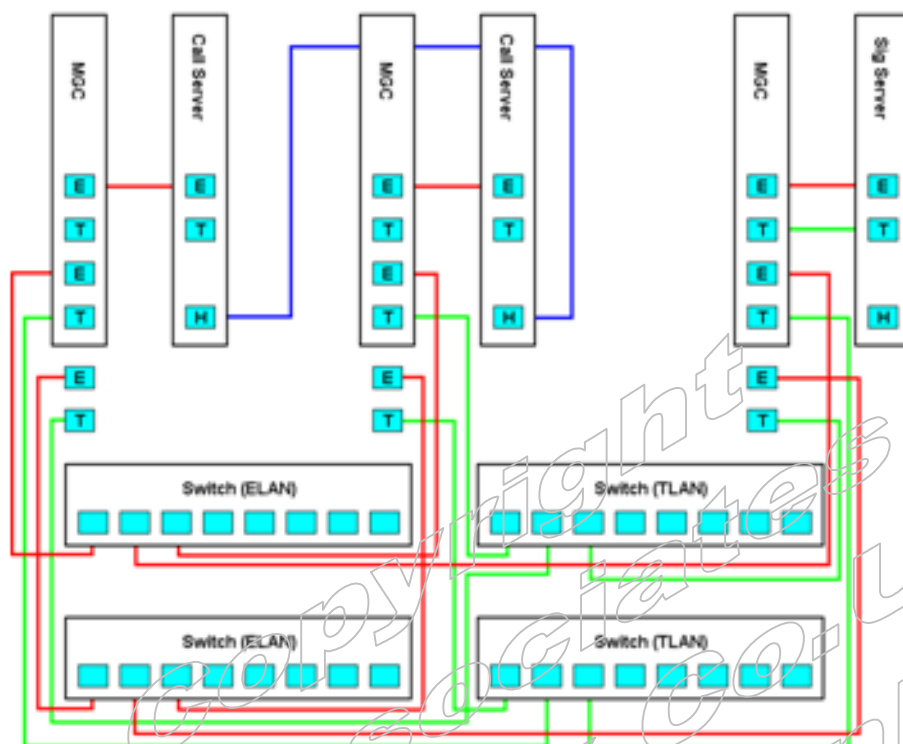
29

A special cable is required to connect to the 2 SDI ports on any CPPM board. This uses the 25 pair card connector and delivers 2 25 pin "D type" serial ports for connection to a terminal.

This is the same for both CPPM call servers and sig servers. The default baud rate is 9600 for these boards.

Network Connections

MGC Dual Homed Redundancy



30

The LAN connections for the system are important and in order to maximise the redundancy of the switch you can take advantage of the multi homing aspects of the MGC cards.

The diagram above shows 3 media gateways schematically and their MGC cards. These are connected to redundant ELAN & TLAN Ethernet switches via the front faceplate and "rear" redundant ports. This allows the MGC to continue to function even if one of the ELAN or TLAN switches fails.

NB Note that the interconnection between the Ethernet switches has been omitted for clarity.

To fully utilise this redundancy the Call Server ELAN connections have been connected to the network using the pass through ports (CE) on the front of the MGC. Similarly the Sig Server has both ELAN & TLAN connections to CE & CT on the front of its MGC card.

Exercise 3

1. How is a CS1000 Pentium IV processor ground connected to ground?
2. Which ground bar is used to connect together up to six Media Gateways?
3. Where is the ground connected on a Media Gateway?
4. Where is the console cable for a MGC connected?
5. Which slot can a CPPM Processor be located in?
6. How does the console port of a CPPM board connect?
7. Which CPPM card would you use in a CS1000 MG and for what?
8. What connections join a Main Unit Chassis and an Expander Chassis together?

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4. Software Installation Call Server

WARNING:

This software does not support TNs configured on PE/EPE shelves. Upgrading to this software release will permanently disable all TNs configured on PE/EPE and will not allow new TNs to be configured.

Proceed with the upgrade? (Y/N) y

WARNING:

Upgrading from pre-Release 4.5 software to Release 4.5 or higher will result in the system PDT passwords being reset to default.

Proceed with the upgrade? (Y/N) y

<CR> -> <u> - To Install Menu.

<t> - To Tools Menu.

<q> - Quit.

The following keycode files are available on the removable media:

<1> - CPPM_5_50_J_GRSEC.kcd

<2> - CPPM_5_50_J_HA.kcd

<3> - CPPM_5_50_J_SA.kcd

Please confirm that this keycode matches the System S/W on the RMD.

Please enter:

<CR> -> <y> - Yes, the keycode matches. Go on to Install Menu.

<n> - No, the keycode does not match. Try another keycode.

32

To Install the software the Server is reset and booted from the installation device by pressing "F" for the faceplate Compact flash on both the CPPM and Pentium IV processors. If you are upgrading an existing Pentium II then you will still have to press F but this is to boot from the floppy drive where the installer disk is located. You will also need the CD with the software on it and a keycode diskette.

If the server is a CPPM and has been installed previously it may require a second "F" at a second prompt to avoid it booting from the hard drive.

Once the installer menu is displayed hit the return key and you will be asked a couple of questions to which you reply "y".

This will bring you to the main menu where you will type a "u" to proceed to the install menu. You will then be asked to select the keycode you wish to install. Usually you will only have one. The system will check you are happy with the keycode before proceeding.

Call Server Install

Please enter:

<CR> -> <a> - To Install Software, CP-BOOTROM.
 - To Install Software, Database, CP-BOOTROM.
 <c> - To Install Database only.
 <d> - To Install CP-BOOTROM only.
 <f> - To go to the Tools Menu.
 <k> - To Install Keycode only.
 For Feature Expansion, use OVL143.
 <p> - To Install 3900 Set Languages.
 <q> - Quit.

This CS 1000 Call Processor is currently located in the IPMG configured as:

loop 0
 shelf 0

Please confirm that the IPMG loop and shelf information is correct.

This CS 1000 Call Processor is set to side 0

Please confirm that the side information is correct.

Please enter:

<CR> -> <y> - Yes, the side information is correct.
 <n> - No, the side information is incorrect. Go on to Side Setting Menu.

33

Once you have confirmed the keycode the installer will ask you what you want to install. This is usually option "b", the software BootROM and a customer database.

On the CPPM call server it will then ask about the "Side" information, this is the CPU designation for a Dual CPU system. If you have a Dual CPU system (HA) then one processor must be set to 0 and the other set to 1 so they can work together correctly. If you only have a Standard Availability (SA) system with one CPU then it is always side 0.

Also on the CPPM card it will ask where the board is situated, i.e. in which Media Gateway it is housed. Thus you will need to give it the Loop and Shelf number. This information is purely for inventory purposes and can be reset later in LD 117 should you get it wrong. It will not affect the system performance should you report it incorrectly.

If you are installing a Pentium system you will not be prompted for this information as the Side is set using DIP switches on the utility board.

Other questions will be asked about adding Dependency lists and Centralised software upgrade which you should take the default choices for. When the install is complete select the option to quit and reboot. If the system you are building is a dual processor you repeat the install on the other core at this point.

Call Server Initial Configuration

- ELAN IP address
 - Configure the network connection
 - Add Default Route if required
- Additional Users & Passwords
- Add PTY's
 - Required for system to talk to Sig Server
- Turn on Multi User Support
- Create a Customer Data Block (CDB)

34

The call server needs to be prepared to communicate with the signalling server and thus provide our IP telephony environment. The first thing required is an IP address on the ELAN connection and if required a default Route.

You will need to create at least two Pseudo TTY (Teletype) Ports. TTY ports are how the system addresses the Serial Data Interface ports. When we connect using the Network rather than a serial connection we need PTY's to define these paths into the system. PTY's are used by the Element Manager, Virtual Terminals & Telephony Manager. We also turn on Multi User Support for the call server to enable multiple logins.

Finally we need to create a Customer Data Block which is like a main index for services on the system. It is possible to share the CS1000 between various customers each having different functionality.

LD 17
REQ
TYPE
ADAN

CTYP
PORT

DES

FLOW
USER
TTYLOG
BANR

To add 2 PTY's
chg
adan
new tty 10 & 11

pty
<cr>

comment

<cr>
mtc sch bug
<cr>
<cr>

LD 17
REQ
TYPE

MULTI_USER

Turn on Multi User
chg
ovly

on

LD 15
REQ
TYPE
CUST

<cr> to the end

Add a Customer Data Block
new
cdb
0

I/O ports and Call Registers

- **LD 22**
 - REQ PRT Print option
 - TYPE CFN Prints the configuration

- **Check Values for 500B sets and Call Registers**
 - Change to minimum values if required

- **LD 17 Load program**
- **REQ CHG Change**
- **TYPE PARM**
- **500B 1000** Use 1000 as a minimum value
- **NCR 20000** Use 20000 as a minimum value.

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When installing a new system you should check the Call Register and 500B settings as outlined in the NTP. These could need updating if you are converting from an old system.

Call Server ELAN Configuration

```

>LD117                                     => Chg mask 255.255.255.0   Sets Subnet Mask
NEWHOST "HOSTNAME" "IP ADDRESS"
=> new host csact 10.10.10.11              => new route 0.0.0.0 10.10.10.1
INET Data Added
=> new host csinact 10.10.10.13           => prt route
INET Data Added                           Call Server
                                           ID Network   Gateway
Two Hosts are created for a Dual CPU system 1 0.0.0.0     10.10.10.1

=> chg elnk active csact                  Enables Active
=> chg elnk inactive csinact              Enables Inactive
=> prt host                               => enl route 1
Call Server                               ROUTE: "0.0.0.0" "10.10.10.1" enabled
                                           OK
                                           => update dbs
ID Hostname   IP Address
3 LOCAL_PPP_IF 137.135.192.4
4 REMOTE_PPP_IF 100.1.1.1
9 CSACT        10.10.10.11
10 CSINACT     10.10.10.13
>LD137                                           To enable/disable ELAN
>DIS ELNK
>ENL ELNK
>STAT ELNK                                       Status of ELAN

```

36

The Call Server will need to have an IP address if it is to be the centre of a VoIP system. This address will be an ELAN address and is set on the call server in load 117. Dependent on the configuration either one or two addresses may be required. If the system is Standard availability then only one address is needed but if it is High Availability (Dual CPU) then an address will be required for each of the processors.

The process is to assign an IP address to a Hostname using the
NEW HOST "Hostname" "IP Address"
command. The Subnet Mask can be set using the command
CHG MASK "Subnet Mask"

Once this is done the Address is brought into service by command

CHG ELNK ACTIVE (or INACTIVE) "Hostname"

A Default Route is added using the commands

```

=>NEW ROUTE 0.0.0.0 "IP Addr of Router"
=>PRT ROUTE
=>ENL ROUTE "Route ID from list"

```

In LD 137 there are commands to enable & Disable the ELAN as well as seeing its status
ENL ELNK / DIS ELNK / STAT ELNK

Exercise 4

1. What must be installed before loading software on a Call Server ?
2. What is the purpose of the Keycode ?
3. What size is the install Compact Flash for a Pentium IV ?
4. How many IP Addresses do you need for call Servers in a HA system ?
5. What configuration must you add to a Call Sever so it can work with Element Manger ?
6. Where would you configure IP addresses (Overlay)?
7. How would you disable the ELAN ?
8. What size is the install Compact Flash for a CPPM Call Server ?

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5. Signalling Server Installation

CS 1000 Signalling Server Software Install Tool (sse-5.50.12)

MAIN MENU

The Install Tool will install Signalling Server software and related files. You will be prompted throughout the installation.

Please enter:

<CR> -> <a> - To perform a complete Installation/upgrade (Signalling Server s/w, Internet Telephone f/w, Voice Gateway Media Card f/w, basic Signalling Server configuration).

 - To Install/upgrade Signalling Server software only.

<c> - To copy Internet Telephone firmware only.

<d> - To copy Voice Gateway Media Card loadware only.

<e> - To perform basic Signalling Server configuration only.

<f> - To selectively change initial system parameters.

<g> - To change board location information (CPPM only).

<t> - To go to the Tools Menu.

<q> - Quit.

**Select Option A for a new Sig Server
and select Yes for Dependency Lists**

Do you want to Install Dependency Lists?

Please enter:

<CR> -> <y> - Yes, Do the Dependency Lists Installation

<n> - No, Continue without Dependency Lists Installation

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Once the Call Server is up & Running and the basic configuration has been done then its time to add the Leader signalling server.

The Server is reset and booted from the installation device by either pressing "F" for the faceplate Compact flash on the CPPM Sig Server or C for CD-ROM on the 1U IBM or HP Servers (or existing ISP1100).

If the server has been installed previously it may require a second "F" at a second prompt to avoid it booting from the hard drive.

When the installation screen is seen respond to the prompts till you reach the main installation menu. Generally you will use option "a" to do a full software install including Firmware and Loadware.

However if you are only changing the server configuration and don't need to install the software you can choose option "e".

Before the installation starts you will be asked further questions. If this is a CPPM sig server you will be asked for the Location of the card I.E. the Loop and Shelf numbers. In addition you will be asked if you want to add any Dependency Lists on the installer. You should reply "Y" yes to this to ensure you have the latest updates.

Selecting "t" for the Tools Menu will give you some other useful options discussed later.

Signalling Server Config

Please Insert the database diskette in the removable drive to restore the IP configuration to the hard disk.

Please enter:

<CR> -> <a> - Diskette is now in the removable drive.

Continue.

 - Continue without restoring the IP configuration

<q> - Quit.

Enter Choice> b

<CR> -> <a> - Set this Signaling Server as a Leader.

 - Set this Signaling Server as a Follower.

<q> - Quit.

Please select the application configuration for this Signaling Server.

Please enter:

<CR> -> <a> - Co-resident (LTPS/VTRK/NRS).

 - Standalone (NRS only - no Call Server).

<q> - Quit.

Please select the Network Routing Service (NRS) configuration for this Signaling Server.

Please enter:

<CR> -> <a> - H.323 Gatekeeper and SIP Redirect/Proxy Server.

 - H.323 Gatekeeper only.

<c> - SIP Redirect/Proxy Server only.

<d> - None.

Please select the type of Network Routing Service (NRS) for this Signaling Server.

Please enter:

<CR> -> <a> - Primary.

 - Alternate.

<c> - Failfast.

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Once the software has been loaded the installer will ask you for a copy of the configuration. If you are replacing a sig server check to see if a copy was made when the first installation was done.

If this is the first installation or you don't have a copy of the configuration choose option "b" to continue without restoring and the installer will proceed to set the configuration up manually.

Every system needs a Leader sig server, so if this is the only or first server it should be a Leader. The installer will then ask about the applications to be run (TPS, Virtual Trunks and NRS) and the protocol for the virtual trunks and the NRS role.

Applications on Sig Server

- **Telephony Proxy Server**
 - Acts as conduit between IP Sets & Call Server
- **Element Manager**
 - GUI for Call Server Runs
- **Signalling Gateways**
 - H.323 & SIP signalling for Virtual Trunks
- **Network Routing Service (NRS)**
 - Part of Dial Plan external to Call Server specifically for Virtual Trunks (DN – IP Resolution)
- **Personal Directory**
 - 100 Personal Numbers for each IP user
 - Redial & Callers List

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Signalling Server Software Installation

- ELAN IP address, subnet mask, and gateway
- TLAN IP address, subnet mask, and gateway
- ELAN IP address of the Call Server
- Node ID for the IP Telephony node
- Node IP address for the IP Telephony node
- Hostname for the Signalling Server
- NRS role
- Primary and Alternate NRS IP addresses

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The information the installer will ask for is shown above.

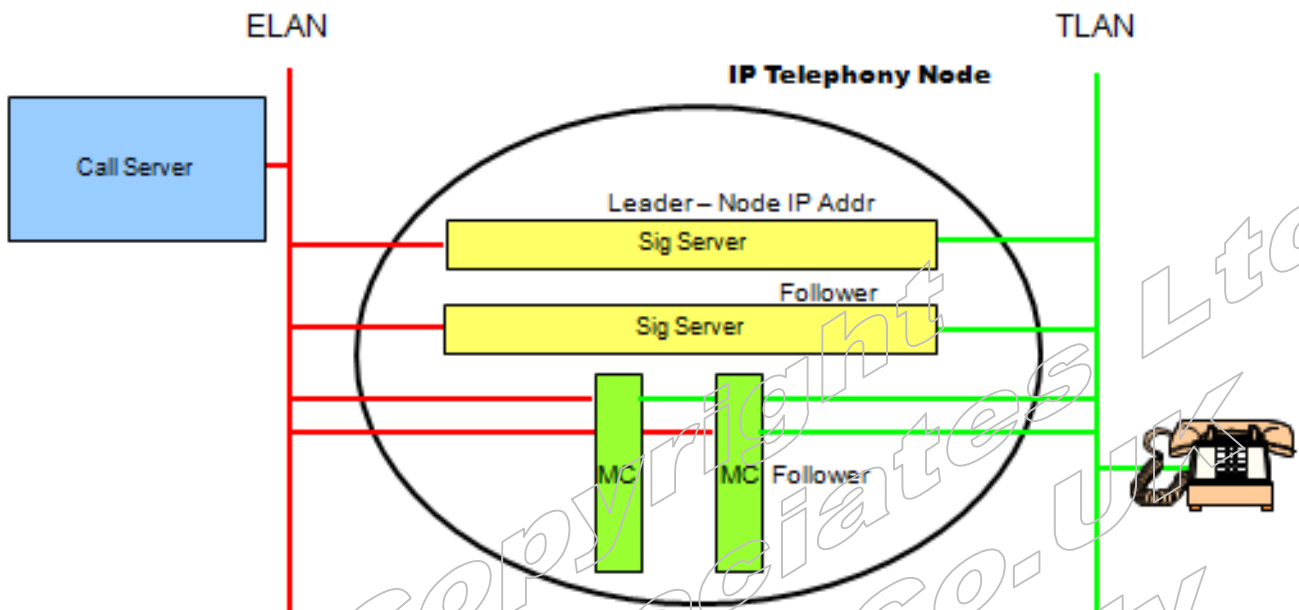
The IP addresses for the ELAN & TLAN are straightforward as is a Hostname which just identifies the sig server. Also the Call server ELAN address will be needed for communications between the devices.

The NRS role is either Primary, Alternate or Failsafe and will be discussed more later on. The Primary and Alternate IP addresses are the TLAN IP addresses of the relevant Sig servers.

The IP Telephony node is discussed on the next page.



IP Telephony Node



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The Node IP address is held by the Leader of the IP telephony node. This will normally be a signalling server. However in the event that there are no signalling servers running a Media Card maybe elected leader. In this instance the Media Card will also register IP sets. The capacity of the card is four times the number of ports on the Media card. Thus for a 32 port SMC card this is 128

Sets can not be prioritised for registration to the media card. It is done on a first come first served basis.

The IP sets are configured with the IP Node address, thus even in the event of a Sig server failure the IP Node address will still be available via the Node leader even if that should be a Media card.

All of the devices running TPS (Sig servers, MC32S, VGMC) are included in the IP Telephony node. A system can have multiple IP nodes. The Node ID is a number to identify the node and can be up to 4 digits. The Node IP address is a TLAN address but is different to the TLAN address of the sig server itself.

Signalling Server Config

Please enter the data networking and IP Telephony parameters for this Leader Signalling Server.

Node ID : 1000

Hostname : System

ELAN IP : 10.10.10.2

ELAN subnet mask 255.255.255.0

ELAN gateway IP : 10.10.10.1

TLAN IP : 10.5.10.2

TLAN subnet mask 255.255.255.0

TLAN gateway IP : 10.15.10.1

Node IP : 10.5.10.5

Call Server IP : 10.10.10.5

CS 1000 Signalling Server Software Install Tool (see 5.50.12)

If you know it, please enter the Alternate NRS IP address.

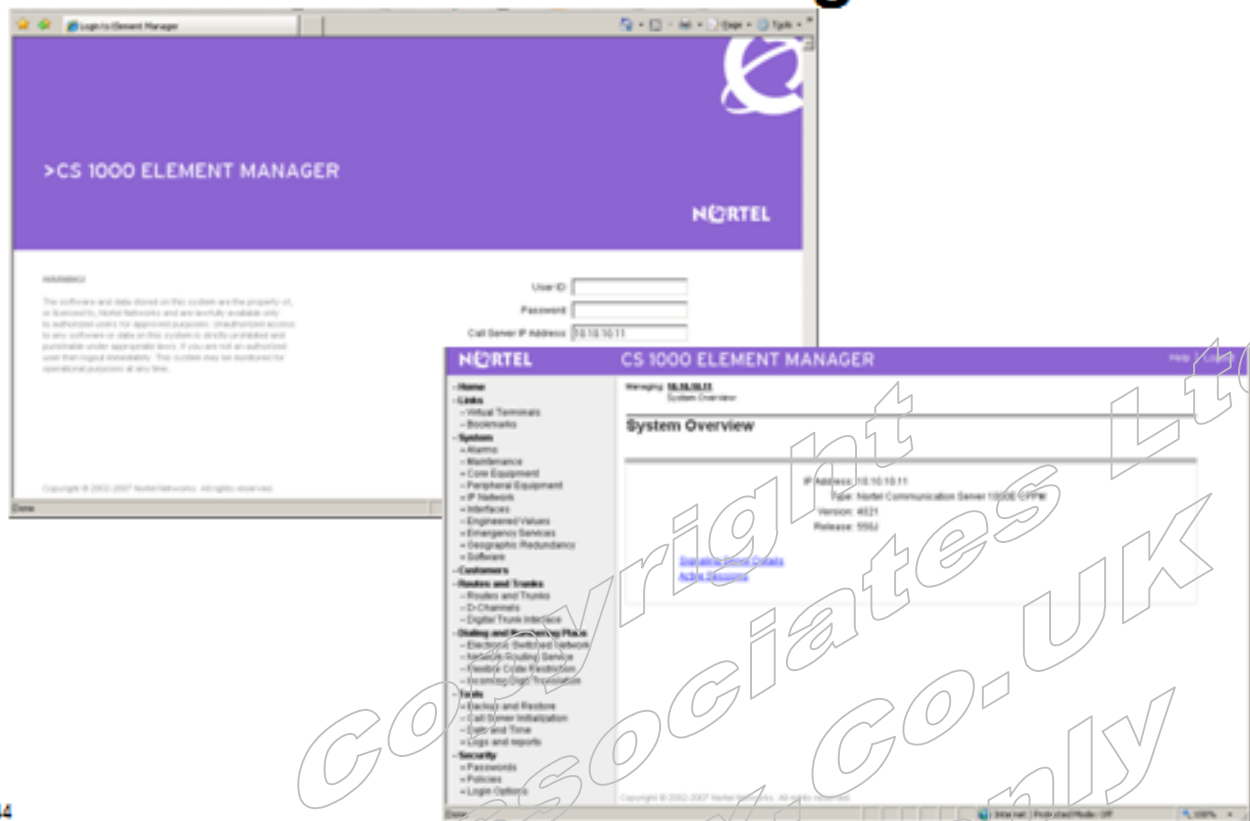
Alternate NRS IP : 10.5.15.2

43

Once you have added all the required information the installer will ask you to verify it and give you the option to change it before continuing.

Once complete you can quit the installer and let the sig server reboot.

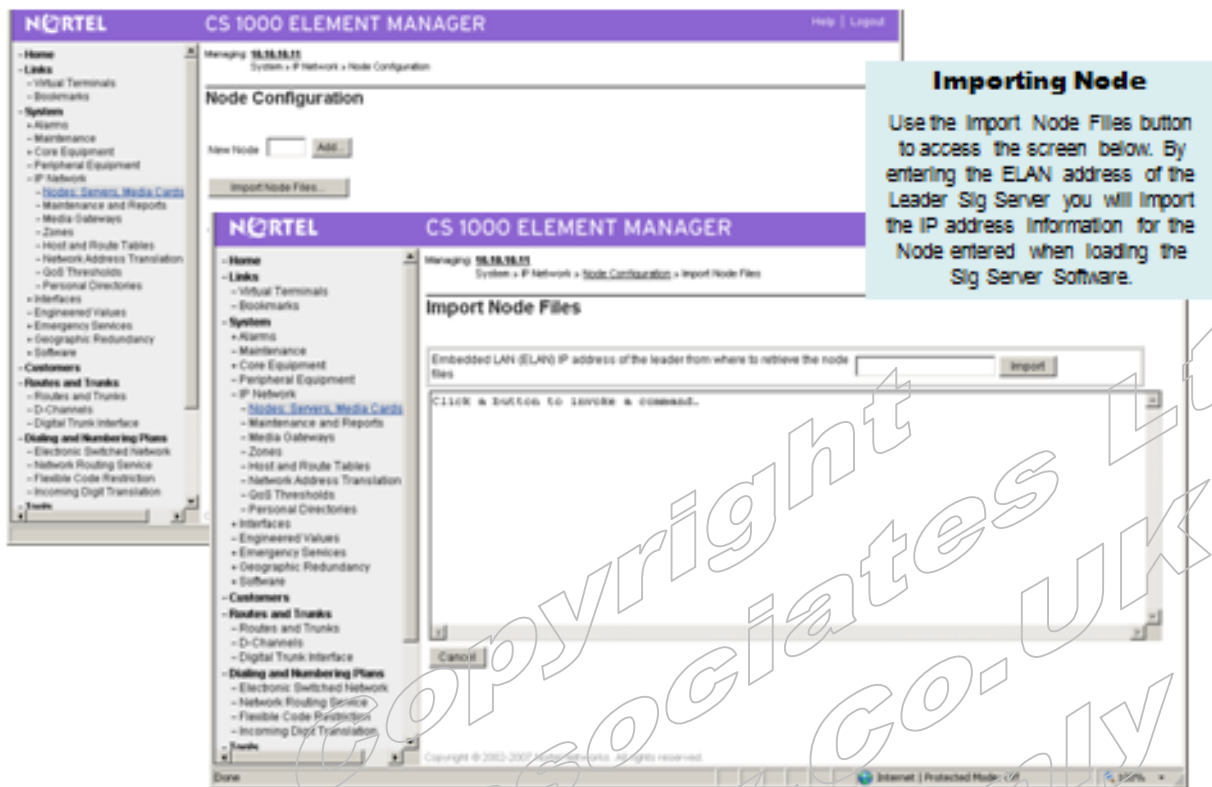
Element Manager



The Element Manager is accessed from Internet Explorer by entering one of the IP addresses of the signalling server, ELAN, TLAN or NODE IP (This is dependent on the network you are attached to and how it is connected).

On a new system the first thing to do is to import the IP Telephony Node information from the Leader Sig server.

Importing Telephony Node



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To import the node go to IP Network / Nodes, Servers, Media Cards .

If there is no node already the system will prompt you and offer import the node. This is done using the dialogue above and entering the ELAN IP address of the Leader sig server. This will copy the files from the Leader Sig server to the FMD of the call server. Because the node files are held on the call server they are backed up with the rest of the system during a normal system backup (LD 43 EDD).

Editing IP Node

TRANSFER/STATUS
This button will be yellow after the initial import of data & will turn grey after a successful Save & Transfer. In the event of a failure to transfer the button will turn red.

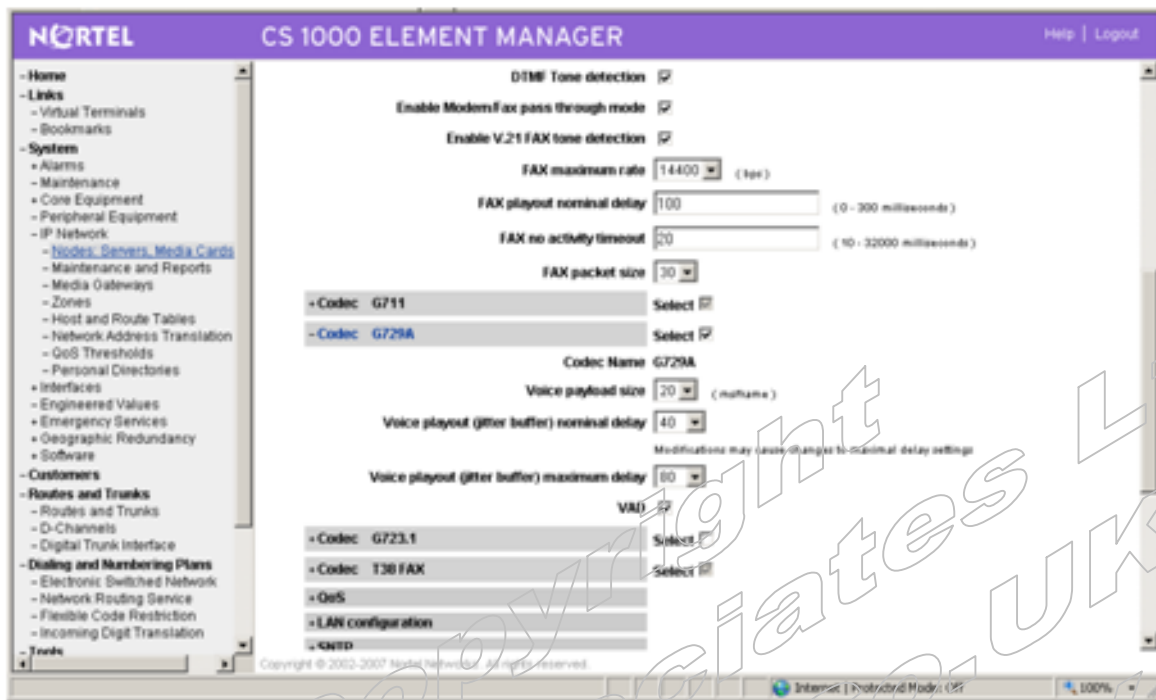
SAVE and TRANSFER
This saves the Node information to the Call server FMD and also copies it out to all the members of the IP Telephony Node.

45

Once the Node is imported it will be displayed and can be edited using the EDIT button.

When the edits are completed the information is stored to the call server hard drive by using the SAVE & TRANSFER button. In addition the information is transferred out to all devices making up the IP Node i.e. Signalling servers and Media cards.

Codec Selection



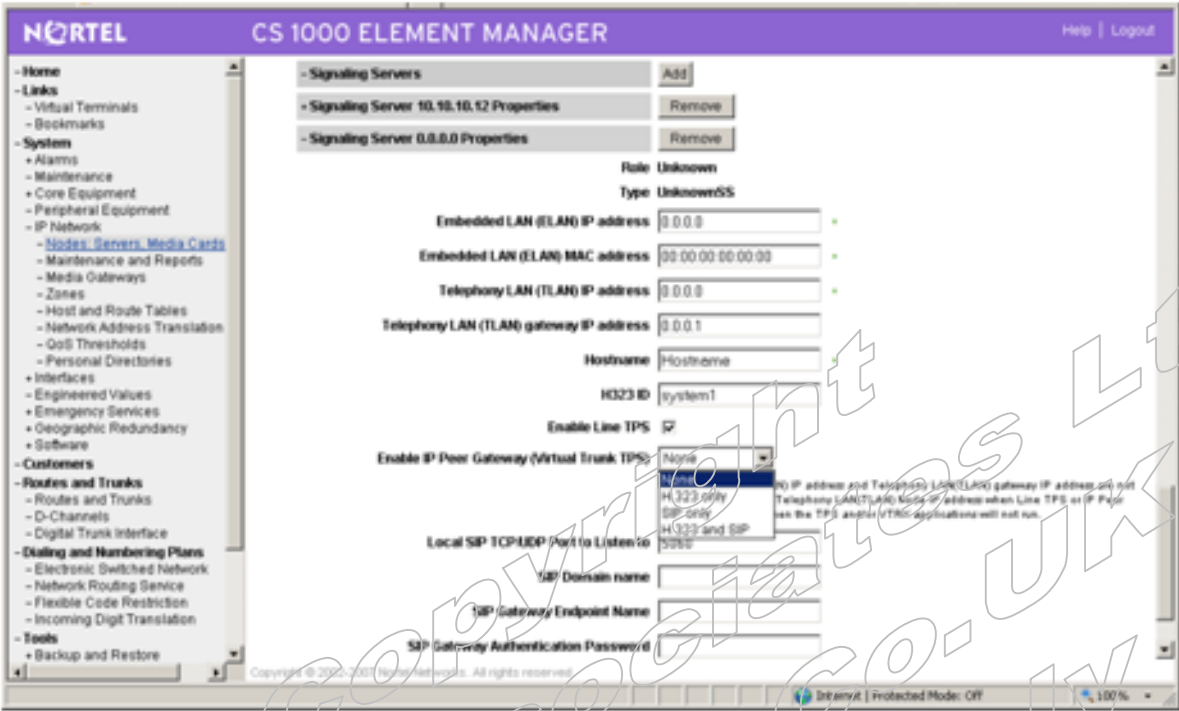
47

One of the things contained in the IP Telephony Node is the codec selection.

The default codecs used are G711 and T38 (Fax), these cannot be deselected. However you can add other codec support such as G729 and also you can edit the payload size used by the system. This will change the amount of bandwidth required for each call.

When a change has been made here you must Save & Transfer to store it.

Sig Server Properties



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Right at the bottom of the IP Telephony node you will find a Signalling Server tab which when expanded will show the information entered during the installation.

You may wish to turn off the IP PEER GATEWAY functionality at this point until we are ready to configure it.

Note also the MAC address of the leader sig server has been inserted automatically.



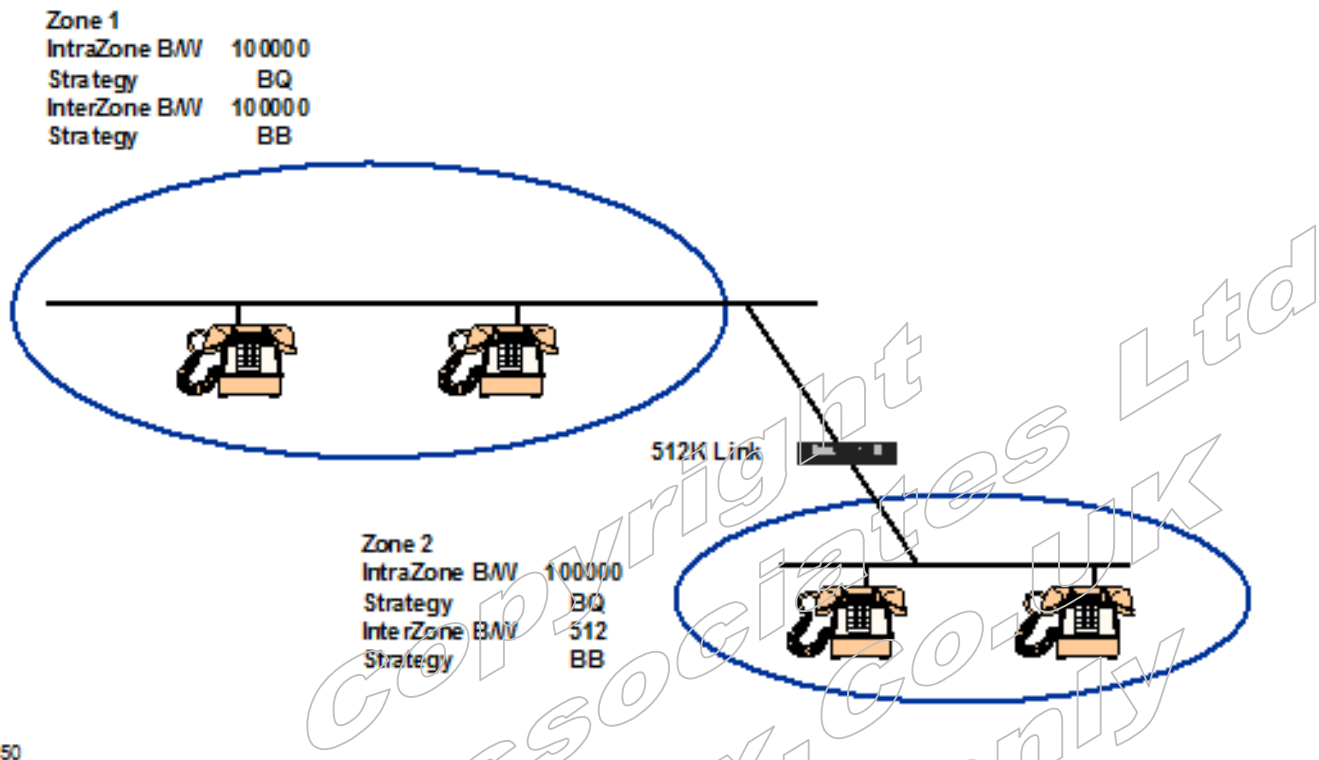
Exercise 5

1. Which IP address is used to import the IP Node ?
2. How do you install the software on a Sig Server?
3. What IP addresses will you need during the install of a Leader Sig Server ?
4. Which device holds the Node IP address ?
5. What happens in the IP Telephony Node if the Leader fails ?
6. What is VAD and what does it do ?
7. Which codecs are always selected in the IP Node ?
8. What are the applications running on the Sig Server and what are they for ?

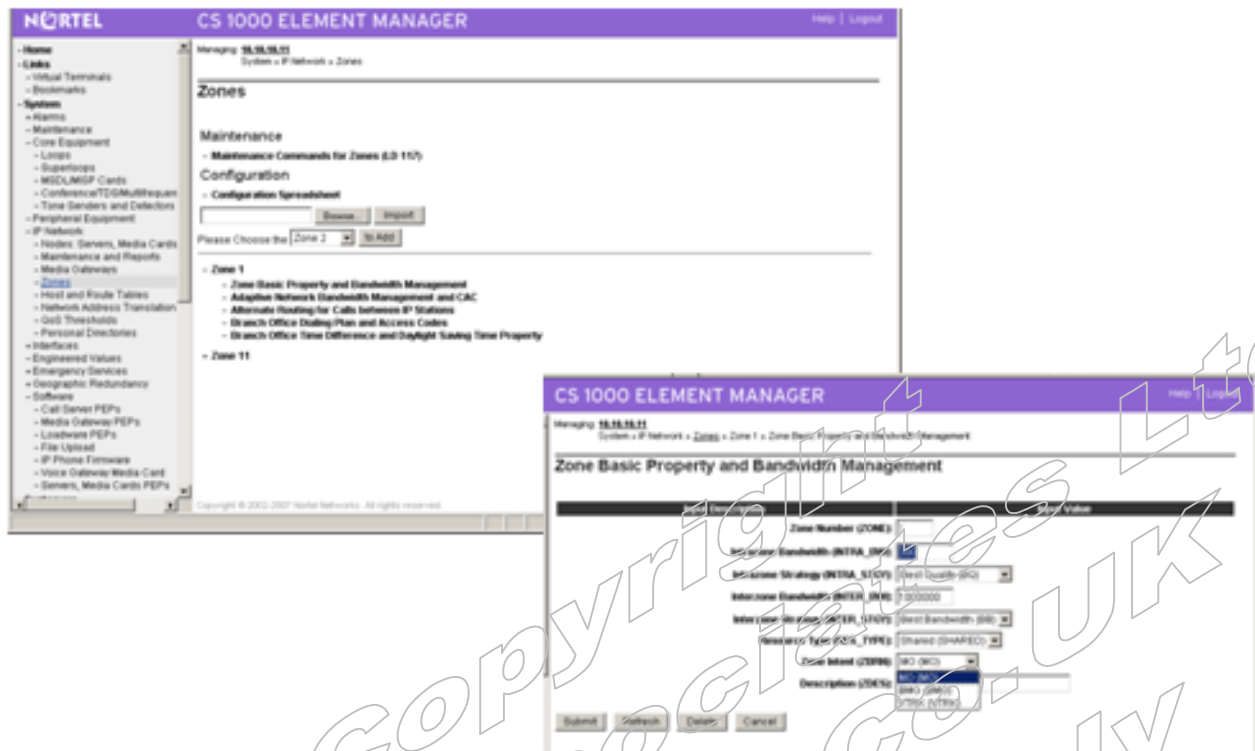
49

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6. Media Gateway Zones



Zones - Configuring



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Zone creation and selection through the Element Manager.

There are three types of Zone, the MO Main office zone for most applications, the VTRK, Virtual Trunk zone for Virtual Trunks and the BMG, Branch Media Gateway zone for Branch office networks.

There is also the option to make a zone private or shared, Private zones do not allow Media card resources to be shared to another zone, this can be useful in certain configurations e.g. Inbound call centres where you need to keep all IP/TDM resources available.

Zones can also be configured and printed in LD 117.

Media Gateway Configuration

Add MG using ELAN address of MGC

Configure other addresses for MG & Submit. Don't click VGW CHANNELS at this point

Once MG is created add TDS & Conference loops

Select the MG and use the DIGITAL TRUNKING button to move to the correct page.

52

To add the Media Gateway select the link IP NETWORK / MEDIA GATEWAYS.

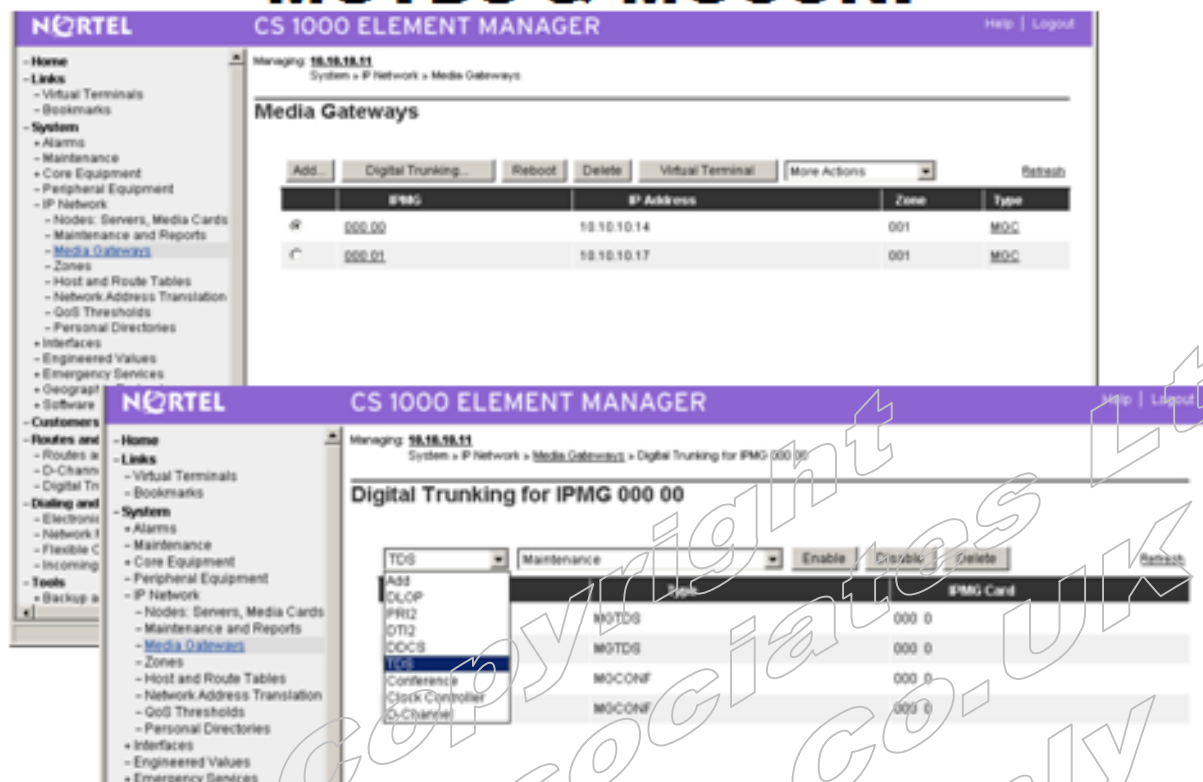
Using the ADD button select the Superloop and shelf for the MG to be allocated to. Remember that 1 superloop supports 2 Media Gateways, one on shelf 0 and the other on shelf 1. You will need to enter the ELAN IP address of the MGC card controlling the Media Gateway.

When you submit this you will be asked if you want to add the full media gateway configuration. This will open the second dialogue where you can add all of the IP addresses for the MGC card and the daughter boards installed on it. Submit the information – do not click on VGW CHANNELS at this point.

Once the MG is created you will need to add TDS & Conference loops to it

Select the MG to add loops to and use the DIGITAL TRUNKING button to move to the correct dialogue. You will then have the option to add 2 x TDS loop and 2 x Conference loop.

MGTDS & MGCONF



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Every Media Gateway requires Tone and conference resource. These functions are handled by the MGC card but must be addressed by the system using a Loop number. Hence when you configure the m you must allocate a single loop to each resource. There is no set strategy to which Loop number is used but you need to choose a suitable number that will not interfere with other system components. A suitable option would be Loop 120.

Each Media Gateway supports up to two MGTDS & MGCONF Loops. Each Conference resource supports 30 conference circuits allowing up to 60 circuits in total per media gateway.

Select the MG to add loops to and use the DIGITAL TRUNKING button to move to the correct dialogue. You will then have the option to add 2 x TDS loop and 2 x Conference loop.

Conference and TDS loops can also be added through LD17.

Add IP Addresses to MGC

- MGC Card needs IP addresses to register with CS
- If card is new or cleared mgcSetup initiated automatically
- Card should reboot with new addresses and register with CS
 - Downloads updates to Loadware
- Addresses can be cleared or changed
 - mgcIPClear
 - mgcsetup
 - diskFormat

```
ELAN IP      : 10.10.10.14
ELAN subnet mask : 255.255.255.0
ELAN gateway IP : 10.10.10.1
Primary CS IP  : 10.10.10.11
Change MGC advanced parameters? (y/n) : y
```

```
TLAN is set to auto negotiate, change? (y/n) :
ELAN is set to auto negotiate, change? (y/n) :
ELAN security Disabled, change? (y/n) :
```

You have entered the following parameters for this MGC 1000E:

```
ELAN IP      : 10.10.10.14
ELAN subnet mask : 255.255.255.0
ELAN gateway IP : 10.10.10.1
Primary CS IP  : 10.10.10.11
TLAN set to auto negotiate.
ELAN set to auto negotiate.
ELAN security Disabled
Is this correct? (y/n[a]bort) : y
```

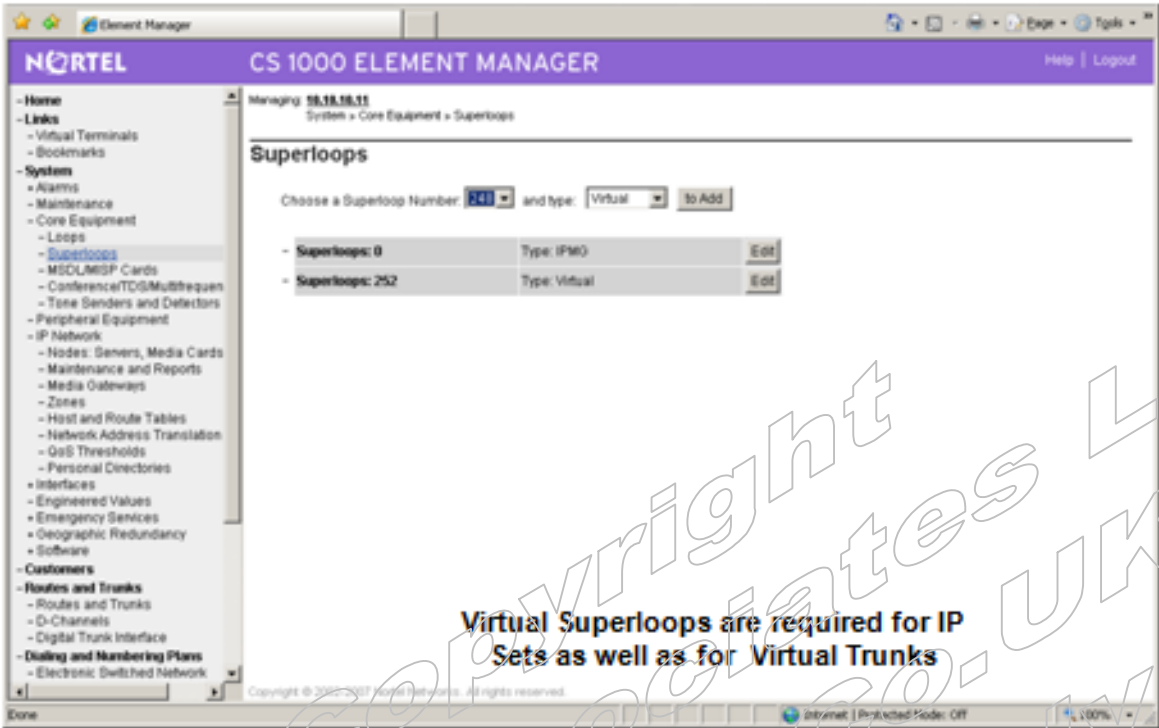
54

Once the Media Gateway is configured into the Element Manager you need to configure the actual MGC with IP addresses so it can communicate with the call server and the rest of the system.

To do this on a new card or one that has been cleared you simply need to power it on with a terminal connected to the Console port 0 of the card. If there are no IP addresses configured the card will automatically run "mgcsetup" which will prompt you for the relevant information.

The advanced parameters are used to configure the ELAN & TLAN ports and to select ELAN security. Intra System Signalling Security is based on the IPsec protocol and is used on the ELAN to protect the signalling between different devices. Ensure you build your system and ensure it is working correctly before attempting to use ISSS.

Configuring Superloops



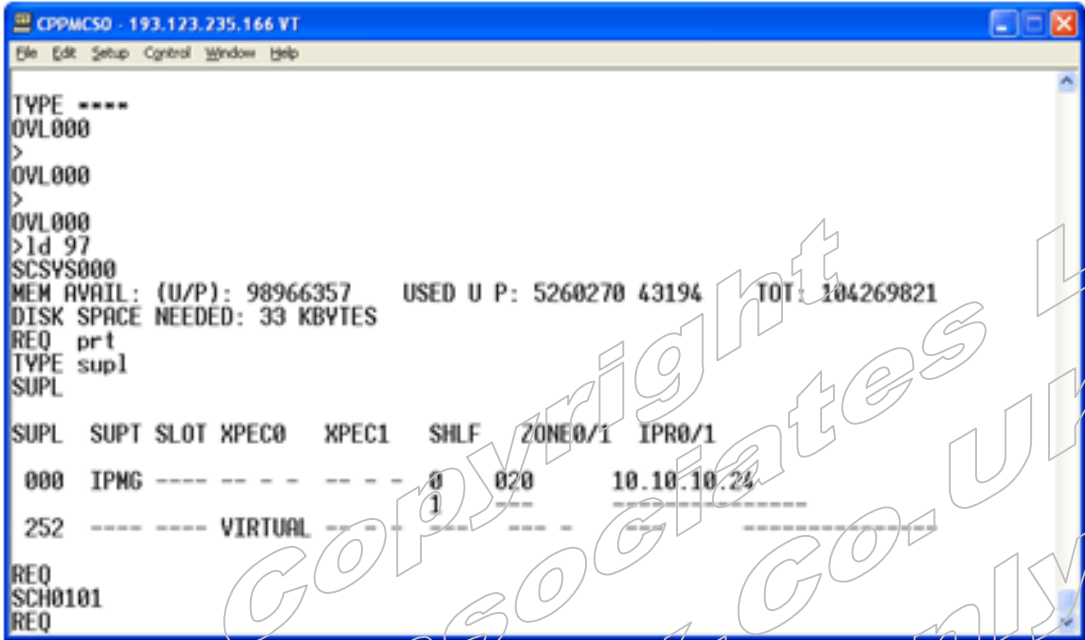
55

In the Element Manager Superloops can be listed and also created . Above you can see the IPMG Superloop used to define the Media Gateways and the Virtual Superloop which is used for the IP sets and Virtual Trunks.



Superloops

- LD 97
 - Printing Superloops configured



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A Virtual Superloop can also be configured using LD97

```
>chg
TYPE supl
SUPL V252
```

This will create superloop 252 as a Virtual superloop which can be used for IP sets or Virtual trunks.

Configuring an IP Set

ld 20

REQ: new

TYPE: 1140

TN 252 0 0 10

DES 1140

CUST 0

NUID

NHTN

KEM

ZONE 1

ERL

ECL

FDN

TGAR 0

LDN

NCOS

RNPG

SSU

SGRP

SFLT

CAC_MFC

SET Type

Virtual TN

Bandwidth Zone

CLS

HUNT

SCI

PLEV

DANI

AST

IAPG

MLWU_LANG

MLNG

DNDR

KEY 0 scr 1000

MARP

CPND

VMB

KEY 1 scr 1100

MARP

CPND

VMB

KEY

MGMT001 TNB NEW TYPE:1140 TN:252 00 10

DN for Key 0

DN for Key 1

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Phone Sets can be configured in LD 10 (Analogue), LD 11 (Digital & IP) or LD 20 (Either). Below is a configuration for an analogue (500) set, the FALC (Flexible Analogue Card) is located in Media Gateway 0 0 card slot 2

REQ NEW

TYPE:

TYPE 500

TN 00 2 1

CDEN

DES 500

CUST 0

ERL

WRLS NO

DN 1200

MIX

MARP ON TN 000 0 02 00

MARP

CPND

VMB

Analogue set on FALC

AST

IAPG

HUNT

TGAR 0

LDN

NCOS

RNPG

SGRP

SFLT

CAC_MFC

CLS

SCI

MLWU_LANG

PLEV

FTR

MIX

MGMT001 TNB NEW TYPE:500 TN:0 0 2 1

IP Set Configuration



58

IP sets need configuration so they will register to the correct call server. This can be done using the DHCP server and sending a full string of configuration parameters to the set. It can also be done manually by accessing the configuration menu.

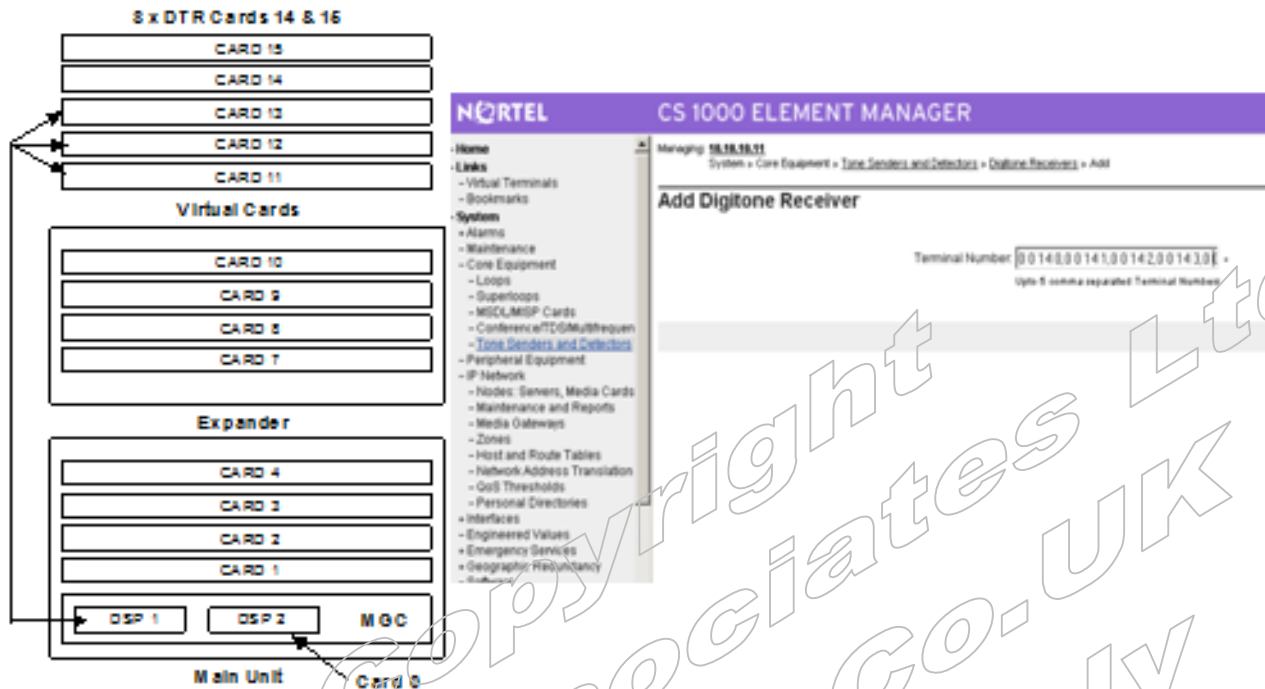
On the 1100 series phones this can be done by pressing twice on the services key which will present a further menu. Select Network configuration from this menu and use the navigation keys to select the parameters to change using the central select key.

On the 200X sets press the 4 keys below the display when the set restarts and "NORTEL" is displayed. This will then allow you to step through the configuration parameters.

To reset a phone either power it down and back up or use the following key sequence:-
MUTE UP DOWN UP DOWN UP MUTE 9 RELEASE.

S1	Points to the Node IP Address of the system
S1 Port	4100
S1 Action	1
S1 Retry Count	Number of times to try registering

MG Card Assignment & Digitone Receivers



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The diagram above shows how the cards in the Media Gateway are arranged and addressed by the system.

As well as the eight physical card slots there are "Virtual" cards as shown (slot 0 and Slots 11-15). These are used to address the DSP daughterboard cards and also the Digitone Receivers required on the Media Gateway.

DSP Daughter Board 1

Cards 11,12 & 13

DSP Daughter Board 2

Card 0

Digitone Receivers

Cards 14 & 15 (8 per card units 0-7)

Digitone receivers are required to interpret the DTMF dialling from analogue sets registered to the Media Gateway. The functionality is hosted on the MGC on the virtual cards as described above. The DTR's can be configured through the Element Manager or via LD 13.

PAD Table Configuration

Before adding VGW channels you need to create a DDB (Digital Data Block)
Use the default values

Once the DDB is created you can edit the PAD Table 15 under 1.5Mb PRI or DTI.
This should be configured with country specific settings

The screenshots show the 'Digital Trunk Interface' configuration page and the 'PAD Category for 1.5Mb DTI/PRI cards' table. The table lists various digital trunk interface types and their corresponding values.

Input Description	Input Value
Pad-Category Table (PDCAT)	15
Terminal Number List (TNLS)	Category 1
Use default codes from this pad category table (DCLT)	Category 1
On-Premises Extension (OPNE)	0 10
Off-Premises Extension (OPPE)	0 20
Digital CO, FCK, WKT, and DD Trunks (DCCO)	4 10
Variable Loss (VLS)	5 10
Trunking CO and WKTs trunks (ACCO)	0 20
Maximum Digital Set (DSM)	0 10
Digital TE Trunks (DTE)	0 20
Satellite Digital TE Trunks (SDTE)	0 20
1.5 Mins DTMFO Digital (DCL)	0 10
Satellite Analog TE Trunks (SATTE)	0 10
Analog TOLL Office trunks (ATCO)	0 10
1.5 Mins PRI/DTI trunks (PDCO)	0 20
2.0 Mins PRI/DTI trunks (PDCO)	0 20
Extended Peripheral Equipment Universal Trunk (DETE)	0 10

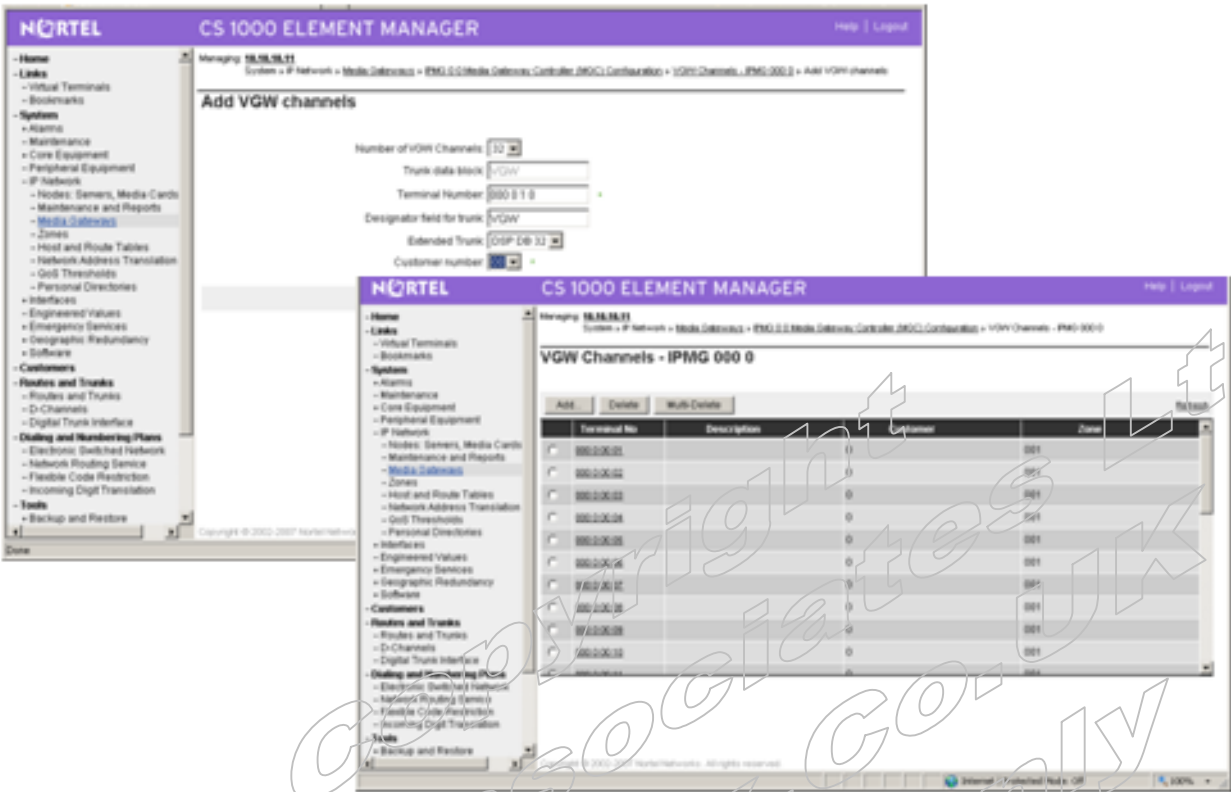
60

A PAD table is required before you can add the VGW Channels.

PAD Tables provide gain or attenuation values to condition the level of the digitised transmission signal according to the network loss plan. The PAD table should be configured with the country specific values as defined in the NTP's. (See Appendix)

First create the DDB using the default values (EM or LD 73). This will create a pad table 15 which can be edited to the correct values.

VGW Channels



VGW channels can be added from the Media Gateway screen or through the overlays (LD14). These are the actual channels that will be used to convert the IP calls to TDM and vice versa.

NOTE: If you are using Media Gateway 0 0 then the DSP Daughter board in position 2 of the MGC will have as its first TN 0 0 0 0. As this is a reserved TN you have to configure from TN 0 0 0 1 and lose one channel.

Exercise 6a

1. Why do we have Intra & Inter Zone bandwidth settings ?
2. How does the system select different codecs for different calls ?
3. How many Media Gateways are assigned to a Superloop ?
4. What do we need to configure on a MG to ensure support of Sets ?
5. What card numbers does the DSP board in position 1 on the MGC use ?
6. What sort of Superloop do we need for IP Sets ?
7. What do we use the PAD table for ?
8. What IP address is used in the S1 & S2 parameters for IP Sets ?

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Exercise 6b

- Create two zones
- Put both phones into one zone
- Reduce Intra Zone B/W till no is call possible.
-
- Move one phone to the second zone
- Test Inter Zone B/W useage
- What are the two B/W figures for G.729 ?
-
- To view Zone Bandwidth useage
- *In Element Manager*
- • System/Maintenance/By Functionality/Zone Diagnostics
- *In CLI*
- • LD 117 / PRT InterZone or IntraZone
-
- **To reset a phone**
- • **Mute Up Down Up Down Up Mute 9 Release**

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7. Follower Signalling Server

- Follower Signalling Server provides TPS and Signalling Gateway Redundancy
- TPS redundancy also brings Load Sharing and thus sets will be evenly distributed across all Sig Servers running TPS
- Redundancy for the TPS is on the basis of $N + 1$ where N is the minimum number of Sig Servers to support the number of sets required.
- Maximum number of Set registrations is 5000 per Sig Server
 - Thus for 6000 sets you would require 3 Sig servers to ensure redundancy (Subject to other Limits)
 - i.e. Normally 2000 sets per Sig Server due to load balancing, but 3000 per Sig Server in the event of the loss of one server.
- NOTE: Media Cards provide a fallback for Set registration only.

• [IP Telephony Node](#)

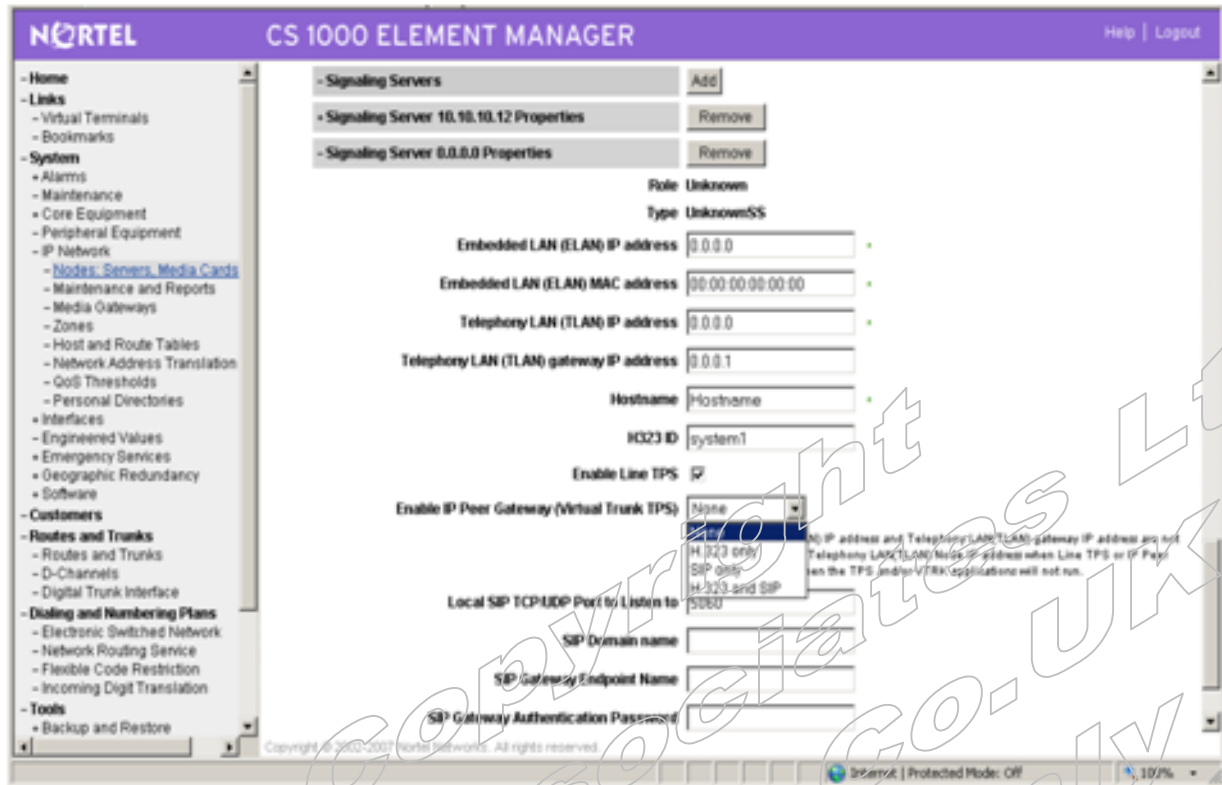
64

Signalling servers have a limit for IP Set registrations of 5000 units and therefore to support more than this a system will require multiple devices. In addition a system may have redundant servers to allow for failures.

The follower sig server uses the BOOTP protocol to collect its IP information from the Leader sig server. After it has established its identity it works as a normal server and sets will load balance across all available units.

In the event of a failure of the Leader sig server a follower will be "Elected" as the new leader and it will assume the Node IP address as well.

Follower Sig Server Install - EM



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First of all edit the IP Telephony Node as shown above. Scroll down to the Signalling Server section

Use the ADD button to create a new Signalling Server. As you can see it has only zero's initially so you must add the IP addresses for the server as required. In addition you will need the MAC address of the ELAN port.

Follower Signalling Servers Use BOOTP to obtain their IP configuration from the Leader signalling by sending out a request at Boot time. Thus the MAC address is required to identify the Follower server.

Once the configuration is added carry out a save and transfer to ensure the information is on the leader signalling server. The Save and Transfer will fail to the Follower Signalling server as it will not yet be loaded with software and running.

Then move to the Server itself to configure the installed software.

Follower Sig Server Install

If this Signalling Server will be a Follower then its data networking and IP Telephony parameters must be configured through Element Manager later.

Please enter:

<CR> -> <a> - Set this Signalling Server as a Leader.
 - Set this Signalling Server as a Follower.
<q> - Quit.

Enter Choice> b

This Follower Signalling Server will obtain its data network and IP Telephony configuration from the Leader Signalling Server at boot.

To identify this Signalling Server, please enter a Hostname.

Hostname : system1

<CR> -> <y> - Yes, these parameters are correct.

<n> - Re-enter all of the parameters

<a> - Node ID :
 - Hostname : system1
<c> - ELAN IP :
<d> - ELAN subnet mask :
<e> - ELAN gateway IP :
<f> - TLAN IP :
<g> - TLAN subnet mask :
<h> - TLAN gateway IP :
<i> - Node IP :
<j> - Call Server IP :
NRS configuration
<k> - Primary NRS IP :
<l> - Alternate NRS IP :

Enter Choice> y

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Once the configuration has been added to the Element Manager you can install the software to the server itself. This is the same basic process as the Leader signalling server.

Once the software has loaded and the system prompts you for the configuration enter as shown above for a Follower.

As the Follower will be using BOOTP as stated before you will only need to enter the Hostname of the Leader signalling server for identification purposes. The list on the right will be shown with only the Hostname entry. If it is correct enter <Y> to accept it then select options to quit the installation menus and reboot the server.

As the server boots this time it should request and receive its IP configuration from the Leader signalling server. If you observe the command line of the server as it boots you will see a series of plus signs(+++) as it tries to obtain its information. If it is successful it will continue to boot and you can then return to the Element Manager screen and transfer the IP Node information to it.

You will probably have to reset the Follower after this to ensure that the TPS is correctly initialised.

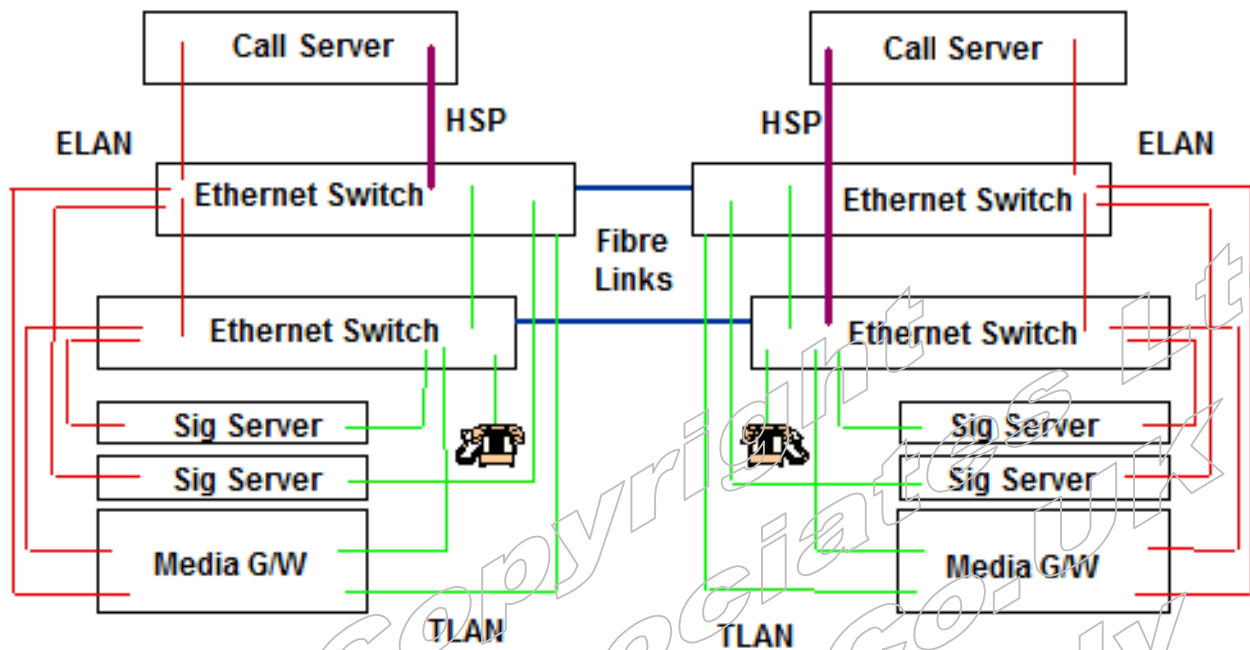
Exercise 7a

- o Once the Follower is running test the registration of the IP Sets. Ensure that you have one set registered on each Sig Server.
- o Next test what happens when a failure occurs.
- o Go to IP Telephony/Maintenance & Reports expand the node to see both Leader and Follower.
- o Using the GEN CMD button run ISET ISETSHOW on the Sig Server to see the sets registered.
- o Run the TPS FORCE DISABLE command to stop the TPS running on the Leader sig server
- o What happens when you try to make a call?
- o Which is now the LEADER node? (try GEN CMD ELECTION ELECTSHOW).
- o Next use the TPS ENABLE command to restart the TPS on the Leader Sig server and either reset the phones or try a TPS Load Balance. Where are they now registered?
- o Once the IP sets are registered back to both Sig Servers carry on to the next task
- o Set up a call between your IP sets. Restart the Leader Sig Server and type a <CTRL>B to halt the boot up. What's the difference from before? Did the call survive? Try ElectShow again
- o Type "@" on the CLI of the Halted Sig Server to restart it and use the GEN CMD's to view election & sets.

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Campus Redundancy



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By using multiple Ethernet switches configured with VLAN's for ELAN TLAN and the High Speed Pipe (HSP) the Campus Redundant system can offer a very high level of availability from a Dual CPU system.

Campus redundancy is only applicable to the CS1000E system not 1000M systems. Also it should be remembered that Campus Redundancy is a single Dual Processor system unlike Branch Office or Geographic Redundancy which require two or more systems.

Campus Redundancy

```

>ld 135
CCED000
.stat cpu

cp 1 4 PASS -- ENBL

SYSTEM STATE = REDUNDANT
DISK STATE = REDUNDANT
HEALTH = 14
VERSION = Feb 6 2008, 21:32:16
Side = 1, DRAM SIZE = 1024 MBytes

CP[1] located at IPMG [0 1 4]

cp 0 4 PASS -- STDBY

SYSTEM STATE = REDUNDANT
DISK STATE = REDUNDANT
HEALTH = 14
VERSION = Feb 6 2008, 21:32:16
Side = 0, DRAM SIZE = 1024 MBytes

CP[0] located at IPMG [0 0 4]

CCED000
.SCPU
OK

SRPT048 DR: Master asked to stop updates and flush file system.
0x2325020 (tSwotask): RMD is now OFFLINE
Starting to Send to dst Mac 0:19:e1:e8:3:5, IP 0x7f020001
0x23c7e744 (tRootTask): logging started to /tyCo0 [3], queue size
256
usrAtainitusrAtainit trying controller 0usrAtainit: Adding block device
/dev/hda = 0x3716ce8usrAtainit doneFound device : INTEL
82365SL
0x23c7e744 (tRootTask): before usrNetinit()
Host Name: bootHost
Target Name: wTarget
User: target
Attaching interface lo0... done
Starting usrNetAutoConfig
usrNetAutoConfig: 10.232.14.125#000000
Completed usrNetAutoConfig
Attached IPv4 Interface to fel unit 0
0x23c7e744 (tRootTask): after usrNetinit()
Loading symbol table from /pload/mainos.sym ...

```

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Campus Redundancy is a single High Availability system where the two call servers have been placed at some distance from each other. This can be as much as 40Km using Fibre connected switches.

High Availability/Campus Redundancy allows for both Fault Tolerance as well as planned maintenance and upgrades.

Exercise 7b

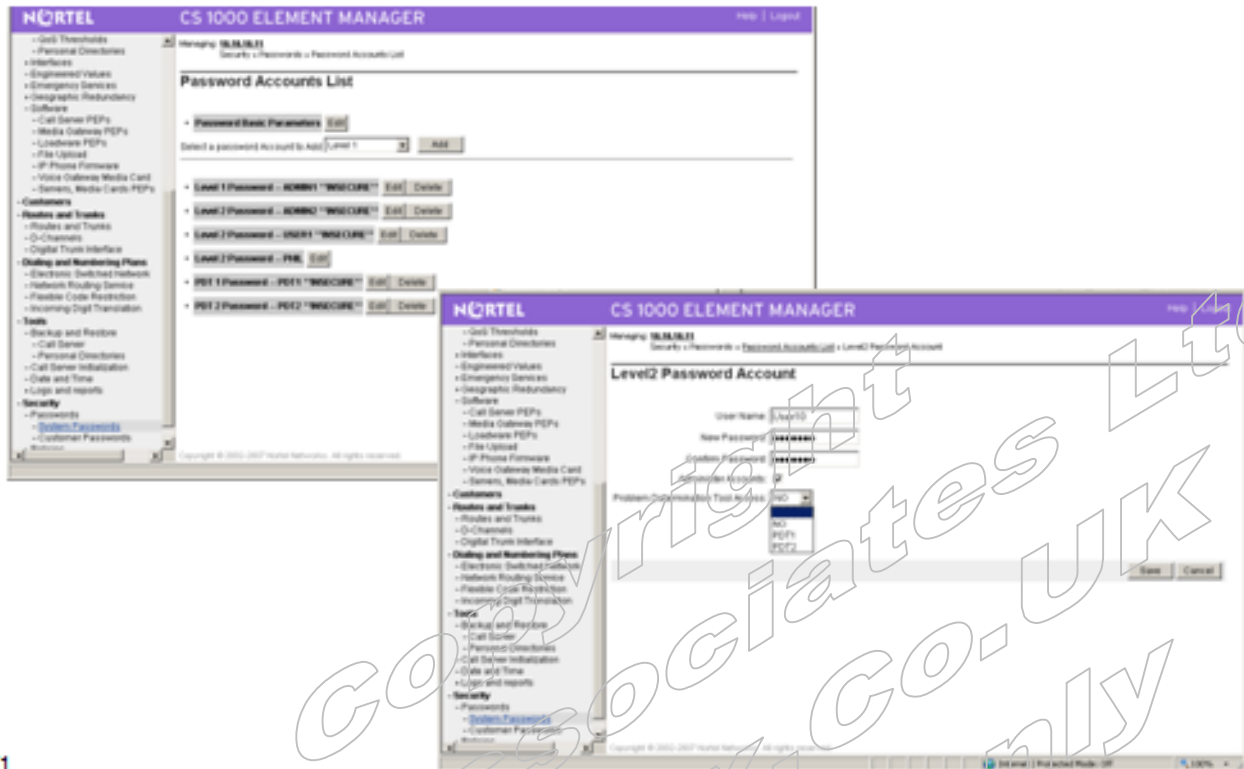
1. Which protocol does a Follower Sig Server use to gain its IP information ?
2. How many Sig servers (min) would you need to support 9000 IP sets with redundancy ?
3. What happens when the Leader Sig server fails in an IP Node ?
4. Where is the IP Telephony stored on the system ?
5. What extra licenses are required for Campus redundancy if you have a dual processor system ?
6. Which package do you need for High Availability?
7. Which Hostname is configured on the Actual Follower Sig Server at install ?
8. What packet loss & latency are acceptable on a campus redundancy link ?

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8. Maintenance & Admin Access Control



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New accounts and passwords can be added via the Element Manager or Overlay 17

PWD2 (Default Account ADMIN2) is the user with security access and this is the account to use to create new users.

In addition you now have the option to add PDT access to an account and this is useful to enable patching to be carried out.

LD 117 - STAT SERV

stat serv

NODE INK ID	HOSTNAME PBXLINK	ELANIP CONNECTID	LDR	SRV	APPS	PBXLINK STATE	PBXL DATE
1001 1/2009	system1 16:05:55	10.10.10.12 51623b8	YES	CPPM	LTPS	LINK UP	30/0
VTRK							
Sets: [reg - 00001] [busy - 00000]							
VTRK: [reg - 00000] [busy - 00000]							
SIGNALLING SERVER CAPACITY (SSRC): 2048							
Type: CPPM							
Location: 0 0 3							
Product Eng.Code: NTDW61BAE50003							
Serial Number: NNTMG19Y1YF5CPP							
Memory Size: 1024 MB							
Disk Size 37 GB							
1001 1/2009	System11 16:06:10	10.10.10.19 51622b8	NO	ISP1100	LTPS	LINK UP	30/0
Sets: [reg - 00001] [busy - 00000]							
Type: ISP1100							
Location: 0 0 0							
Product Eng.Code: NTDU27xx							
Serial Number: NNTMxxxxxxx							
Memory Size: 1024 MB							
Disk Size 37 GB							
1001 1/2009	MGC 16:07:53	10.10.10.17 51620b8	NO	DSPLD	VGW	LINK UP	30/0
VGWs: [reg - 00032] [busy - 00000]							

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STAT SERV is a very useful command to show the status of connections to the components of the system. Note particularly the PBXLINK STATE column.

STAT IPMG will list the configured and registered Media Gateways on the system.

Disabling & Enabling Devices

- **LOOPS / CARDS / UNITS**

- Also certain features DIS / ENL

- **LOOP**

- enll (TN) Enable disl (TN) Disable

- **CARD**

- enlc (TN) Enable disc (TN) Disable

- **UNIT**

- enlu (TN) Enable disu (TN) Disable

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One thing to always try when devices seem to be okay but still function incorrectly is to DISABLE them and then ENABLE.

Depending on the device you are working on you need to choose the right command as shown here. For a single phone you can use the unit option DISU command in LD 20 (or LD 32). Be aware that on a set the display will remain as if the set is working however you wont be able to pick up a line to dial with.

Whilst you can do this with a single digital set it often better to disable the whole card and then re-enable it. This ensures that it re-initialises with the Call Server correctly. Use the DISC for this option.

All cards should be disabled before removal.

Some devices such as PRI, Tone and Conference circuits are addressed as Loops. Thus you use the DISL command to disable these in specific overlays:-

PRI – 60 / TDS – 34 / CONF - 38

Hunt Groups

- | | |
|---|--|
| ➤ LD 17 | ➤ LD 57 |
| ➤ CHG PARM | ➤ REQ CHG |
| ➤ MSCL XX (no of lists allowed) | ➤ TYPE FFC |
| | ➤ CUST 0 |
| | ➤ CODE PLDN |
| | ➤ PLDN (Pilot DN, which must be a unique) |
| ➤ LD 18 | ➤ USE GPHT (Group Hunting) |
| ➤ REQ NEW | ➤ LSNO (List number created in LD 18) |
| ➤ TYPE GHT | ➤ HTYP (RRB=Round Robin, LIN = Linear) |
| ➤ CUST 0 | ➤ CFWI (NO = Skip Extn if CFW Activated YES = Terminate on Extn if CFW Activated) |
| ➤ LSNO (Next List Number) | ➤ MQUE (ALL = No limit on queued Calls 0 = No calls to be queued 1 = Maximum of 1 call queued) |
| ➤ DNSZ (DN Size) | |
| ➤ SIZE (Size of list, entries) | |
| ➤ STOR 00 XXXX (XXXX = DN) | |
| ➤ WRT (C/R) | |
| ➤ STOR 01 XXXX (XXXX = DN) | |
| ➤ Continue with store entries until list completed. | |

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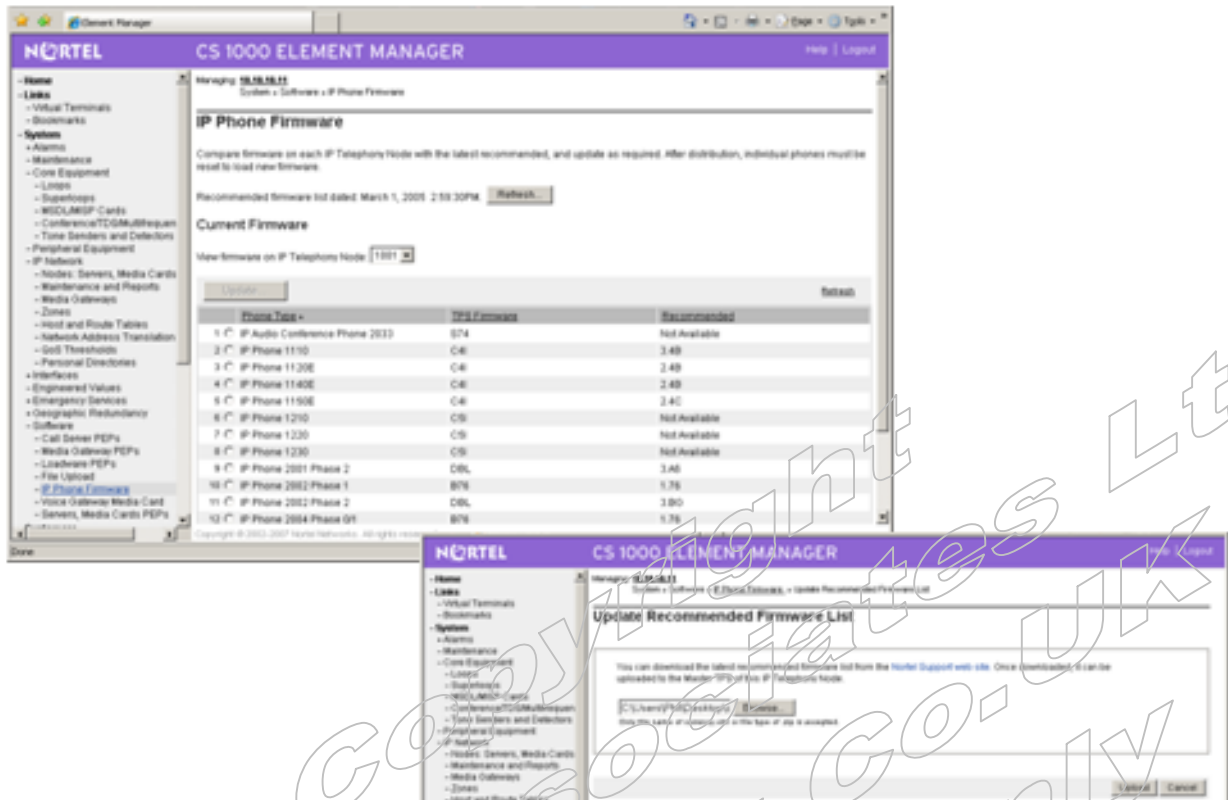
Hunt groups use a list in the overlays which needs to be allocated, so if its a new switch you may need to define the number of lists in LD 17 before you start.

If you have lists allocated already then the next step is to define the Hunt Group in LD 18 as shown.

You will need to know the list number you are going to use, the length of the DN's included and the number of entries to be included. Then you simply add the DN entries.

Once the list is created you need to assign it to a DN (PLDN) in the system which of course must be unique. This is done in LD 57 (FFC)

IP Phone Firmware



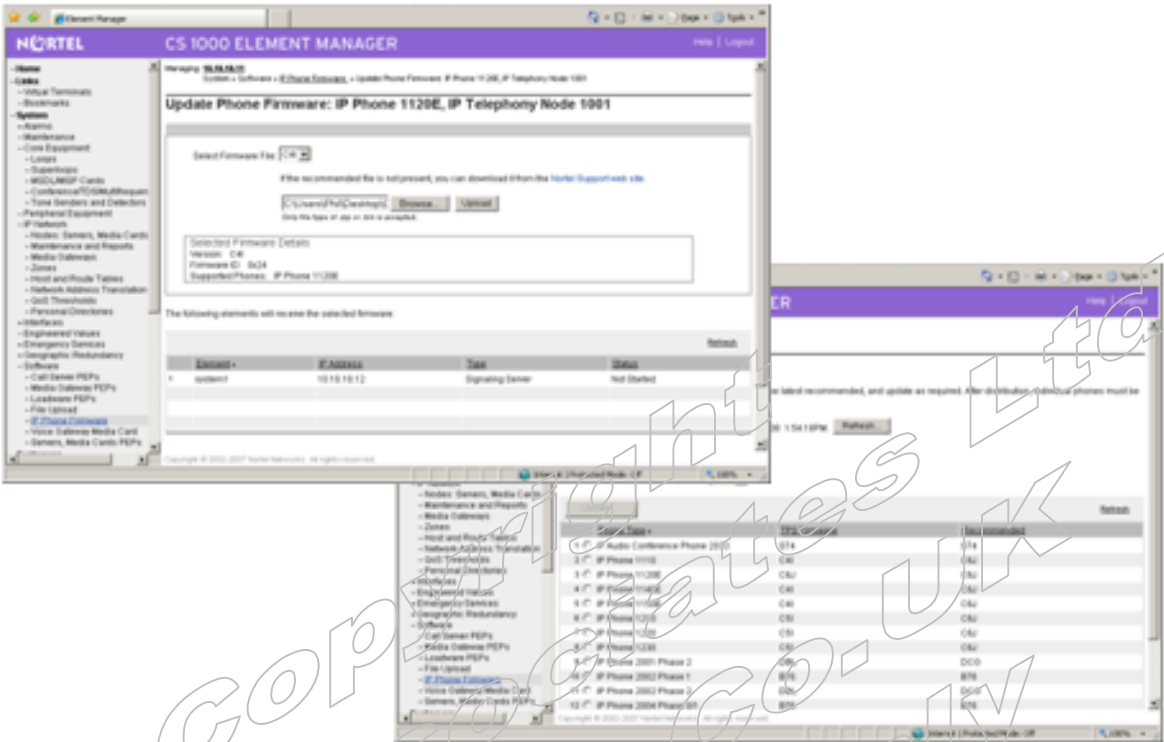
75

Phone Firmware is an important part of the system and needs to be kept current.

This can be done using a terminal linked to both the EM and the Internet. By clicking on the Links (In Blue) the system will automatically try to download the requested file.

The Currency file is a list of the latest firmware available and this should be updated first. From this you can select which devices need new firmware.

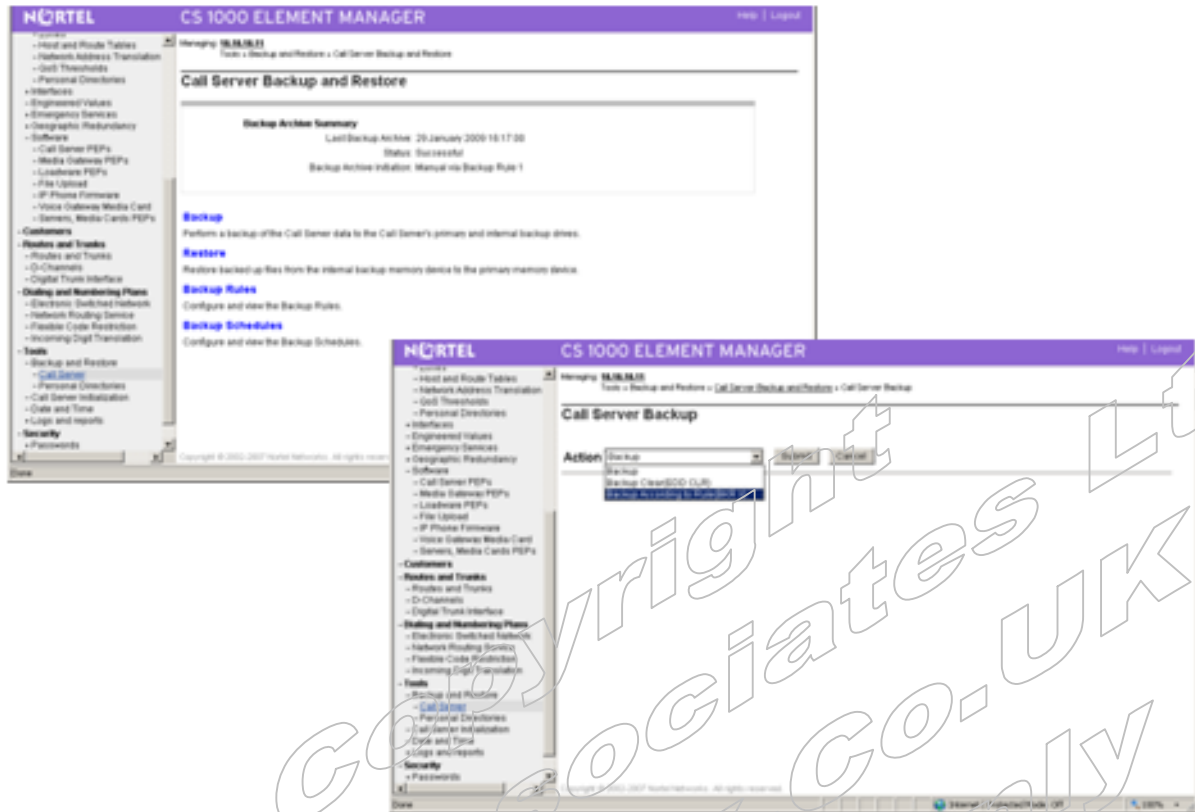
IP Phone Firmware - Currency



You can see from these slides that both the recommended list and the TPS Firmware for the Node has now been upgraded.

It is necessary to reset the IP phone to force it to upgrade the firmware it is using. This can be done manually by restarting the set or remotely by using the `isetReset` command on the signalling server.

Backup Options

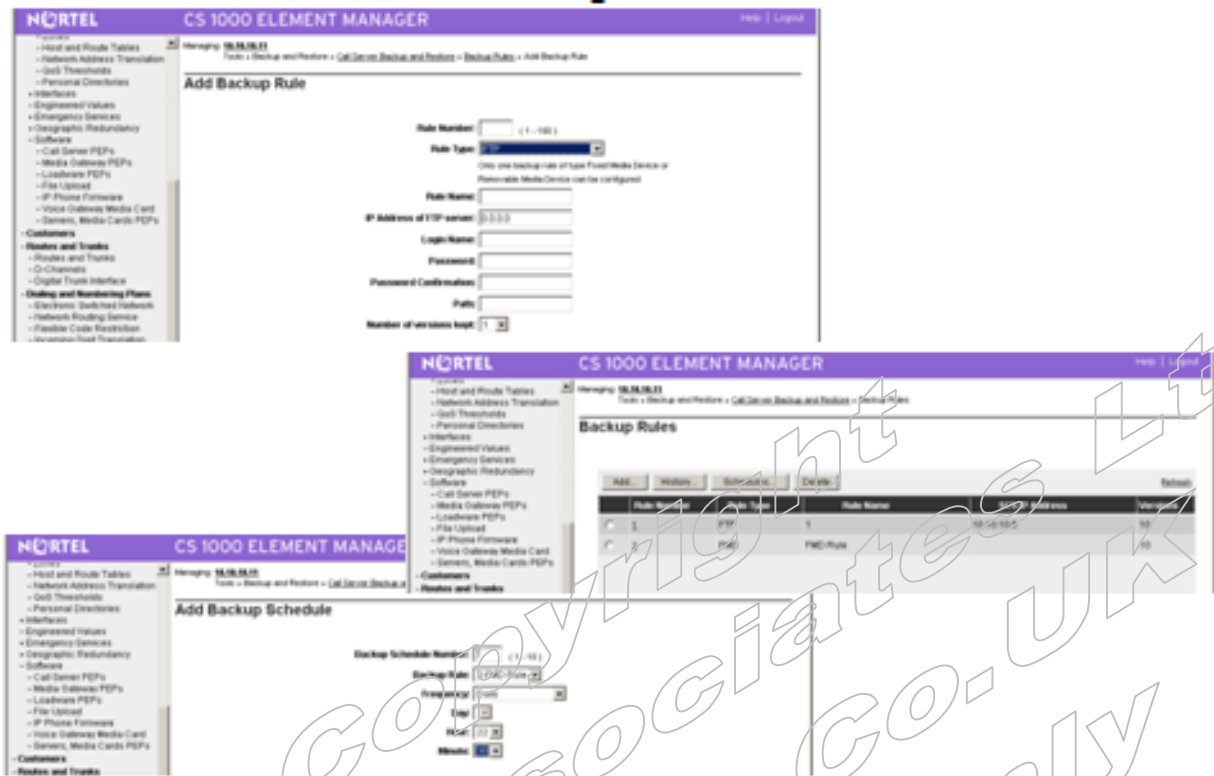


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Backups can be carried out through both the overlays and the Element Manager.

In addition there are several backup rules which can be created to backup to a FTP server or the FMD or RMD. Multiple backups can also be created up to a maximum of 10.

Backup Rules

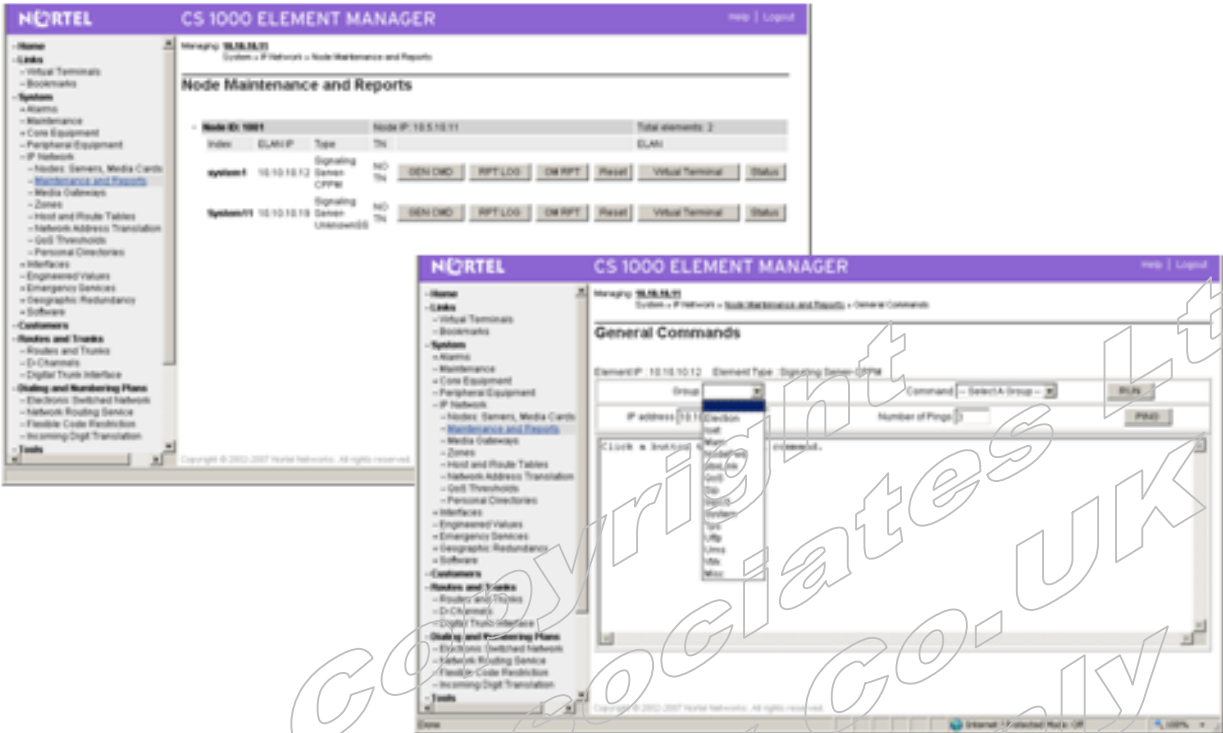


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Once you have a backup rule you can create a schedule to execute it at particular times.



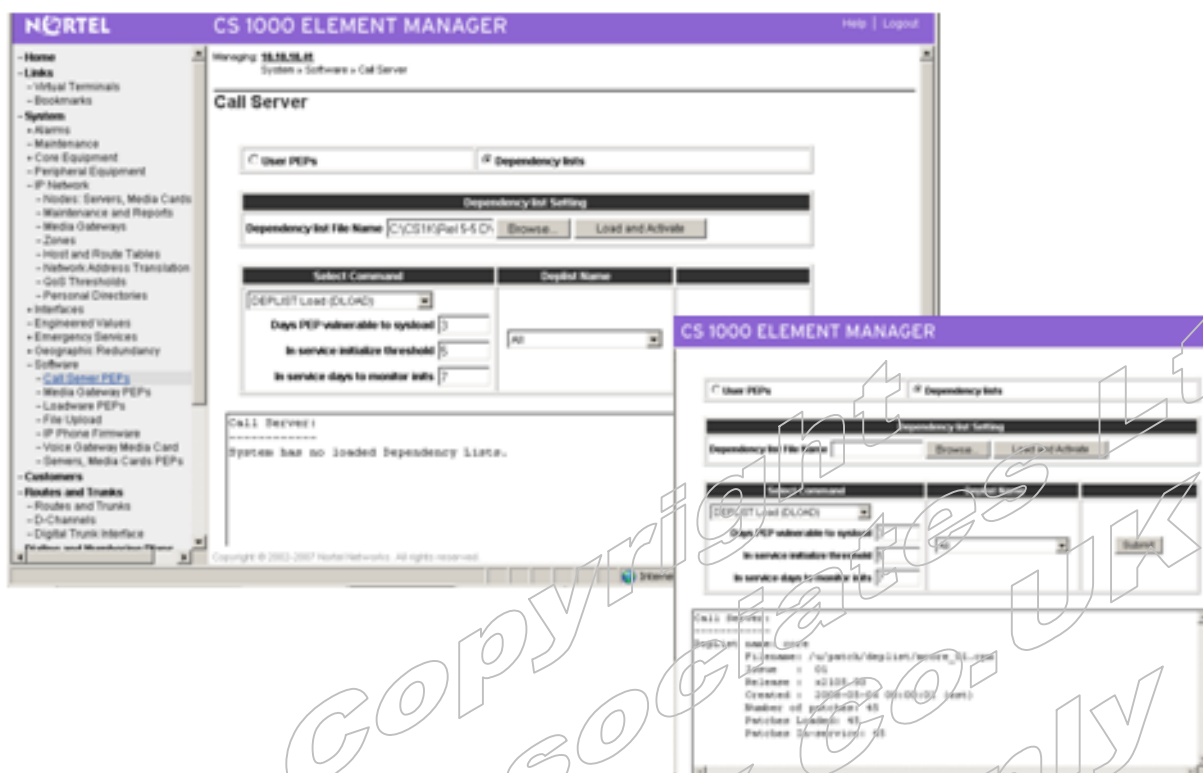
Node Maintenance & Rpts



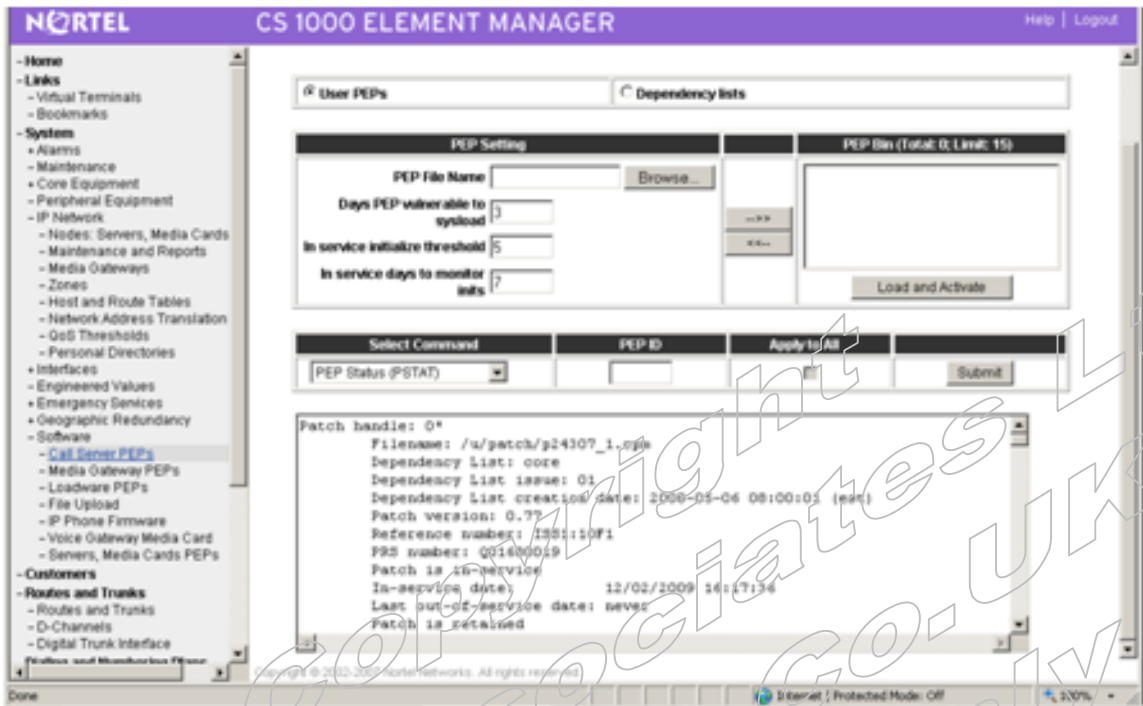
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Dependency Lists



PEP's



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CPPM Call Server LED's



- **Main Status LED**

- RED: Hardware/Bios
- Flashing Red: Bootrom and OS before Sysload Phase 1
- YELLOW: SysloadPhase 1
- Flashing Yellow: Sysload Phase 2
- Flashing Green: Software loading (on Active Core)
- GREEN: Normal operation
- OFF: No Power

- **Redundancy Status LED**

- Green: Redundant Mode, Active
- Flashing Green: Split Mode Active
- Solid Yellow: Redundant Mode, Standby
- Flashing Yellow: Split Mode, Standby
- Red: Single Mode

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CPPM Sig Server LED's



- **Main Status LED**
 - GREEN: PBXlink established
 - Flashing Green: PBXlink down
 - YELLOW: Applications being loaded
 - Flashing Yellow: Applications loaded successfully
 - Orange: Selftest Error
 - RED: BIOS self-test is running
 - Flashing Red: Bootrom and Operating System being loaded
- **Redundancy Status LED**
 - **(CS RED)**
 - Not used on CPPM Sig Server

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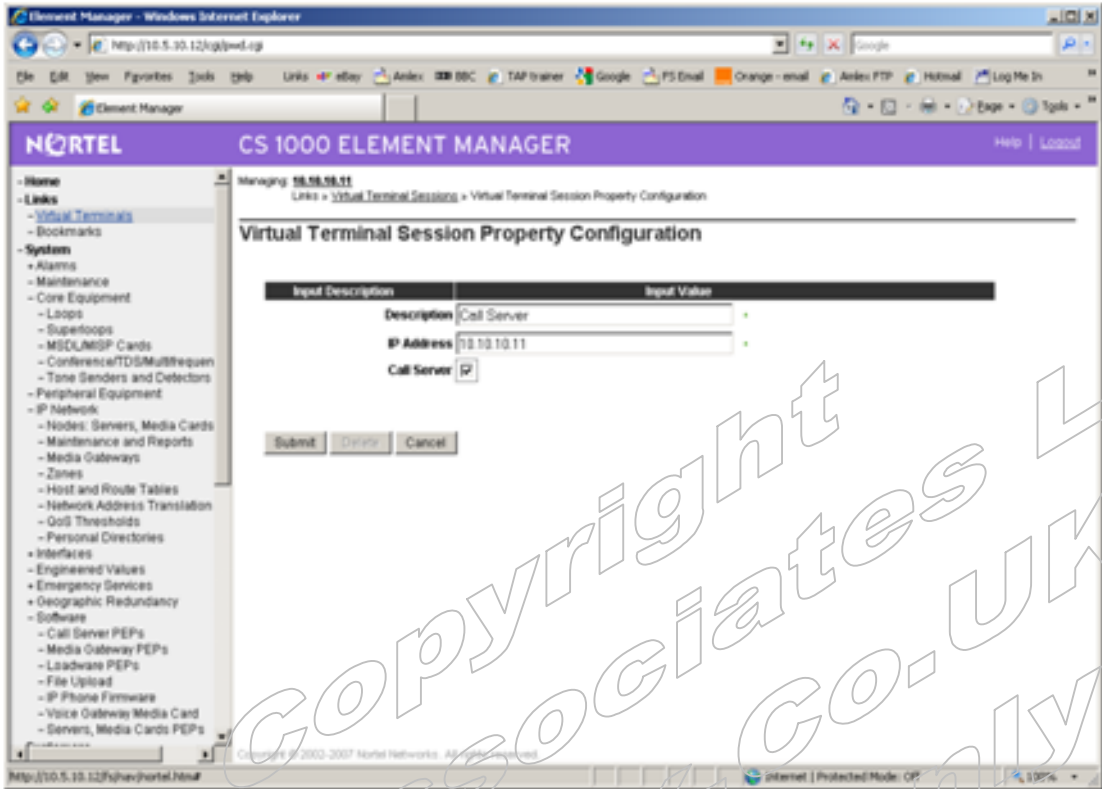
MGC Display

- MGC Display Sequence
 - BOOT
 - At power up
 - POST
 - Power on selftest
 - PASS
 - Selftest passed
 - LOAD
 - Application Loading
 - LLLS
 - Superloop & Shelf – Normal
 - Exxx
 - Error code (xxx is error number)
 - UNRG
 - Unregistered – No IP info



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Creating a Virtual Terminal



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Signalling Server Tools Menu

TOOLS MENU

This is the Tools Menu. Please select one of the options below.

Please enter:

<CR> -> <a> - To set system date and time.

 - To re-partition and re-initialize the hard disk.

<c> - To reload Default Accounts.

<d> - To test the hard disk.

<e> - To change the web server security flag.

<f> - To initialize unprotected (/u) partition.

<g> - Clear the boot sector to allow re-installation of the previous release

<h> - Copy the IP configuration from the removable media to the hard disk

<i> - Backup the IP configuration from the hard disk to the removable media

<j> - To replace CPU board BIOS (CPPM only).

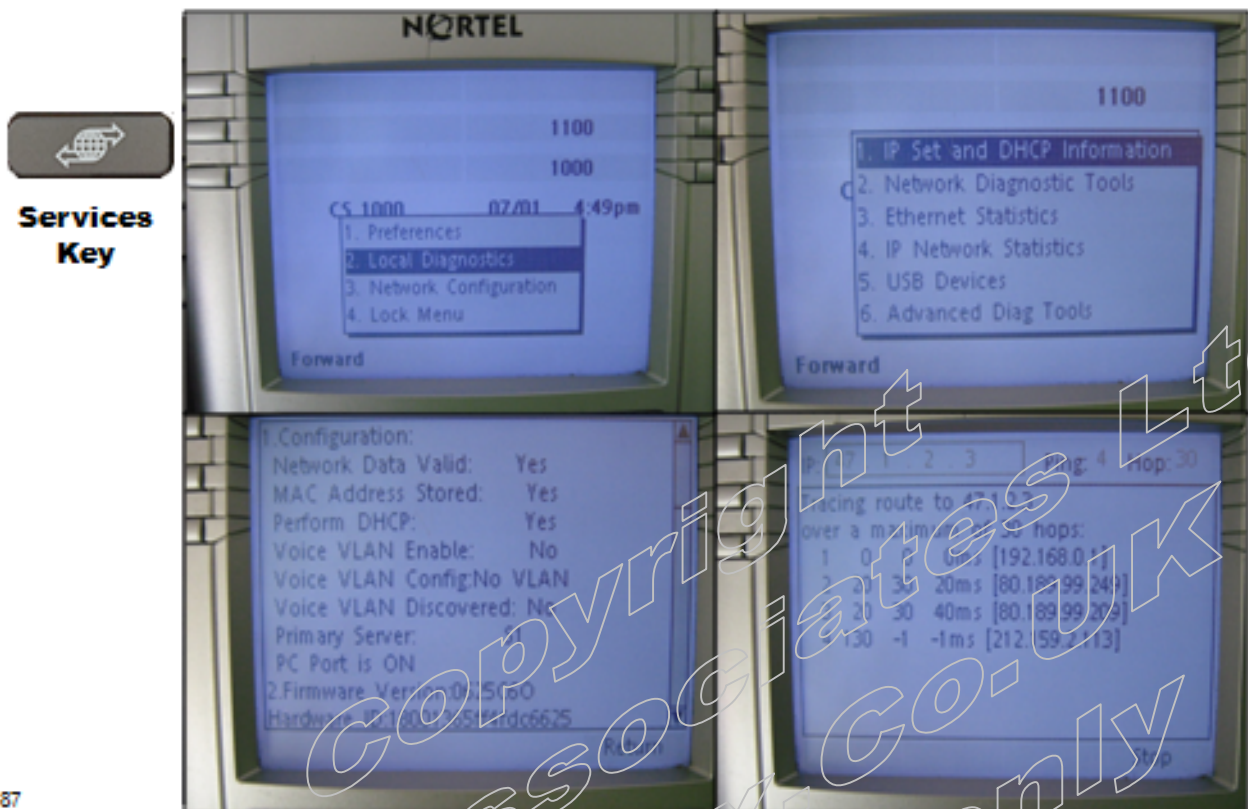
<m> - To return to the Main Menu.

Enter Choice> m

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IP Set Diagnostics



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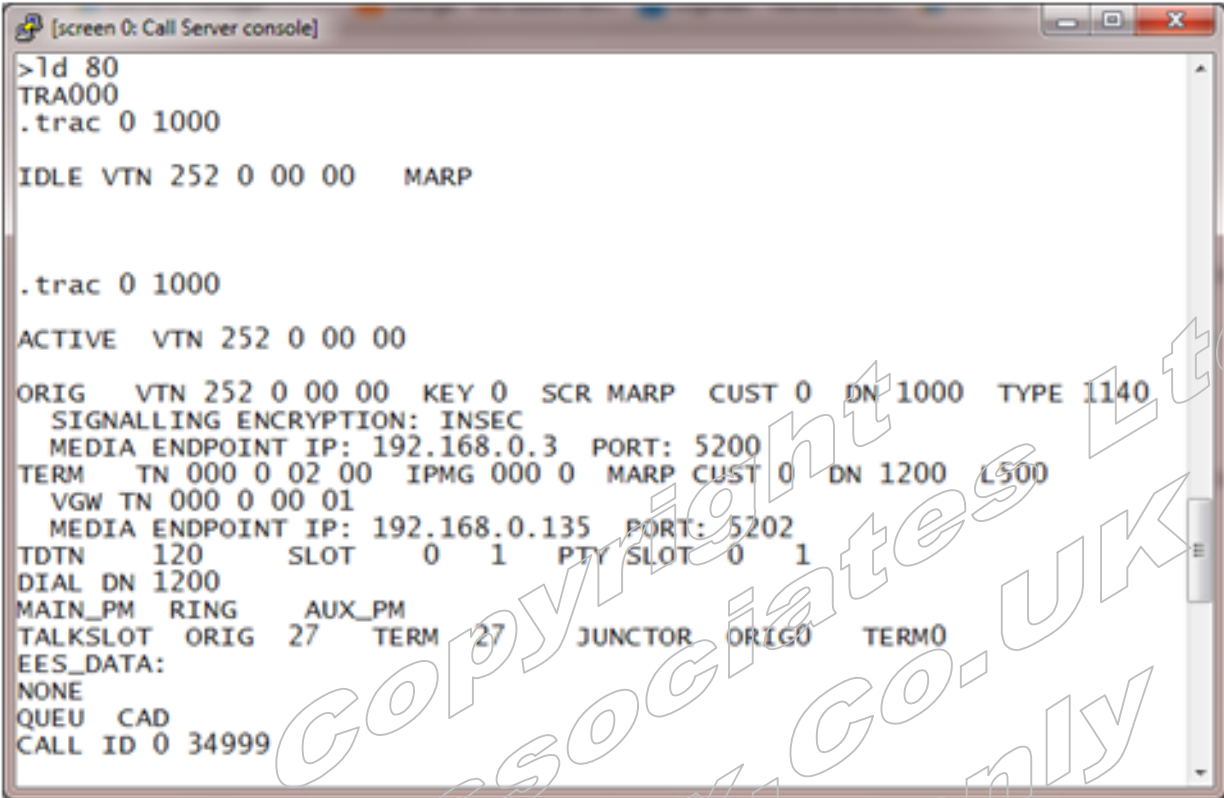
On the IP set itself you can perform several simple checks and Diagnostics.

Access the Local Tools menu by a swift double press on the services key (A Globe with two arrows). From there select Local Diagnostics which will offer you a selection of information and diagnostics.

In the figure you can see the configuration information displayed as well as a TRACEROUTE from the set itself.

Using PING and TRACEROUTE from the Set can help to resolve issues on the sets especially things like one way speech.

Tracking Calls



```

[screen 0: Call Server console]
>ld 80
TRA000
.trac 0 1000

IDLE VTN 252 0 00 00   MARP

.trac 0 1000

ACTIVE VTN 252 0 00 00

ORIG VTN 252 0 00 00 KEY 0 SCR MARP CUST 0 DN 1000 TYPE 1140
SIGNALLING ENCRYPTION: INSEC
MEDIA ENDPOINT IP: 192.168.0.3 PORT: 5200
TERM TN 000 0 02 00 IPMG 000 0 MARP CUST 0 DN 1200 L500
VGW TN 000 0 00 01
MEDIA ENDPOINT IP: 192.168.0.135 PORT: 5202
TDTN 120 SLOT 0 1 PTY SLOT 0 1
DIAL DN 1200
MAIN_PM RING AUX_PM
TALKSLOT ORIG 27 TERM 27 JUNCTOR ORIG TERM
EES_DATA:
NONE
QUEU CAD
CALL ID 0 34999
  
```

The TRAC command in LD 80 can be a very useful tool for investigating problems on the system.

The syntax of the command is :-
TRAC <Customer No.> <DN>

```

>ld 80
TRA000
.trac 0 1200
  
```

```
ACTIVE TN 000 0 02 00 IPMG 000 0
```

```
ORIG VTN 252 0 05 10 KEY 0 SCR
```

Or
TRAC <TN>

```
.trac 100 0 0 0
```

```

VTN 100 0 00 00
KEY 0 SCR MARP IDLE
KEY 1 SCR MARP IDLE
KEY 2 NUL IDLE
  
```

Monitoring D-Channel

```

[screen 0: Call Server console]
OVL000
>ld 96

DCH000
.stat mon

TRACE OUTPUT
  DCH LOG : OFF
  DCH TTY : OFF
ACTIVE TRACES
DCH 010 : MSGI - DSBL  MSGO - DSBL

.enl msgi 10

.enl msgo 10

.enl mon tty

.stat mon

TRACE OUTPUT
  DCH LOG : OFF
  DCH TTY : ON
ACTIVE TRACES
DCH 010 : MSGI - ENBL  MSGO - ENBL

```

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Monitoring the D-Channel is an extremely helpful tool in understanding what is happening to a routed call. However you need to be careful using this tool on a busy switch as it can generate a lot of output which could have an impact on performance.

The STAT MON command in LD 96 shown displays the current monitoring status. Monitoring is a two part operation as of Release 5:-

1. Enable the messages for DCH
2. Enable the output to either TTY a LOG file or both.

(In Previous Releases there was no option for the Trace Output)

To trace a D-Channel, firstly enable the inbound and/or outbound messages for the channel in question.

>enl msgi <DCH no.>

>enl msgo <DCH no.>

D-Channel Output

```

[screen 0: Call Server console]
>
OVL000
>
OVL000
>
  DCH 10 OMSG SETUP      REF 0000018F CH 200 0 0 14 TOD  19:30:56
FEAT :CRID
FEAT :CDS
FEAT :NCID
PROGRESS: ORIG ADDR IS NOT ISDN
CALLED  #:2000          NUM PLAN: PRIVATE/ABBREVIATED (CDP)

  DCH 10 IMSG CALLPROC REF 0000018F CH 200 0 0 14 TOD  19:30:56
  DCH 10 IMSG DISC     REF 0000018F CH 200 0 0 14 TOD  19:30:56
CAUSE :CALL REJECTED

  DCH 10 OMSG RELEASE   REF 0000018F CH 200 0 0 14 TOD  19:30:56
  DCH 10 IMSG REL COMP REF 0000018F CH 200 0 0 14 TOD  19:30:56

OVL000
>
  
```

Once the messages are turned on, you need to enable the output and this can be sent to either the TTY screen, a LOG file or both. This is also done in LD 96:-

>enl mon tty TTY

>enl mon log LOG file

>enl mon all TTY+LOG

When using the log option the file is created in /U/TRACE/DCH.LOG.

The output shows a message sent out on TN 200 0 0 14 (A SIP virtual Trunk) from DCH 10, call type CDP. The inbound message shows a rejection and subsequent release of the channel.

Exercise 8a

1. What sort of login do you need to be able to create new accounts ?
2. Which overlay would you use to add a new user or change a password ?
3. How many versions of backup can you save using an FTP rule ?
4. What happens when you change a password or add an account ?
5. How can you create a system backup twice a day and store it centrally ?
6. What sort of account must you have to be able to apply PEP's or Deplists ?
7. How do you find out the latest release of Phone firmware ?
8. How would you reset the default passwords on the system if you lost access ?

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Exercise 8b

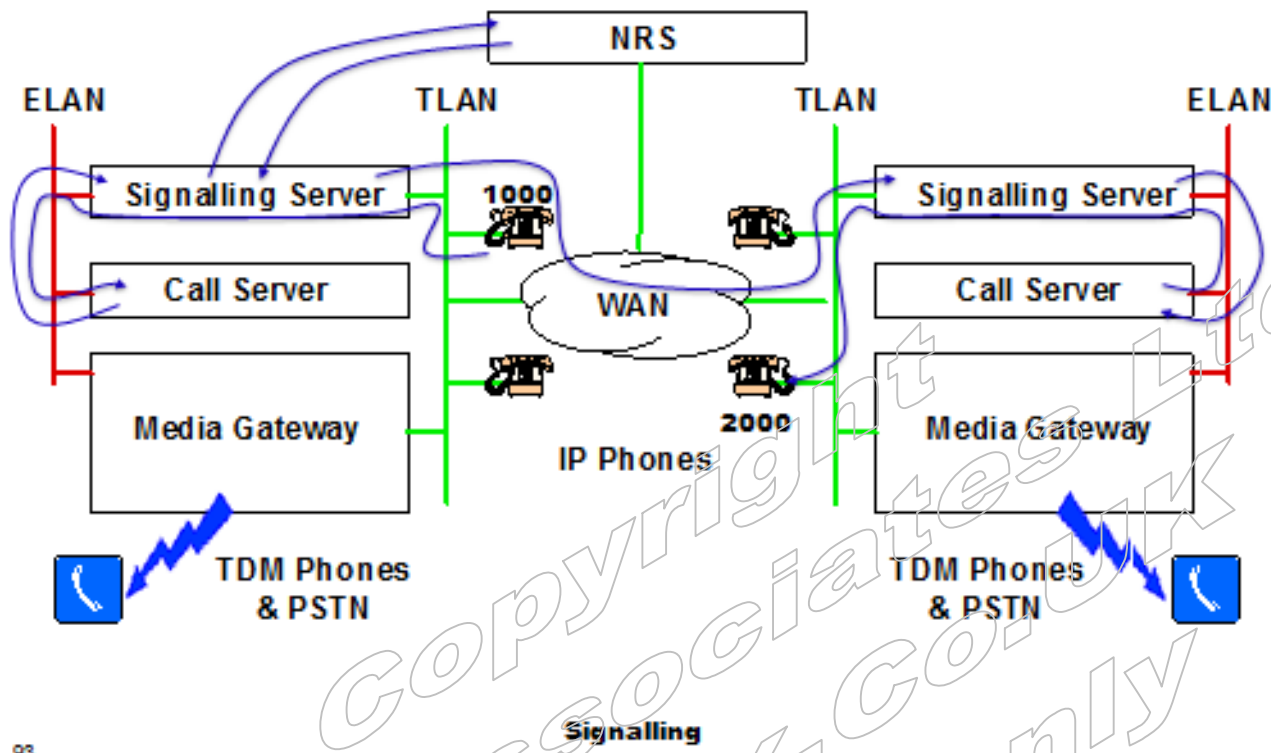
1. Update the currency file on your system and also the firmware for the sets you are using.
2. List how many SIP access ports are available on your system.
3. Add a PWD1 user and a PWD2 user. Both should have PWT2 Access.
5. Create a backup rule to save to an FTP Server. Add schedules to run the rule at 12:30 and 22:30.

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9. IP Virtual Trunks& NRS



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SIP & H.323

- **H.323**
 - Telephony Standard
 - Originates from Video Conf.
- **Less flexibility**
 - Written in ASN1
 - Difficult to Adapt
- **Mature**
 - Many H.323 G/W
- **Upto 1200 H.323 Trunks per Sg Server**
- **SIP**
 - Session Initiation Protocol
 - IETF standard
 - Domain based
- **Flexible and Extensible**
 - Additions can be made
 - “HTML of Telephony”
 - Text Based messages
- **Microsoft Support**
 - OCS uses SIP
- **Upto 1800 SIP Trunks per Sg Server**

94

Both H.323 and SIP are available on CS1K to create Virtual Trunks.

SIP was introduced at Release 4 but is now the preferred option and more development has been done in Release 5. Much of this is relates to the integration with Microsoft OCS.

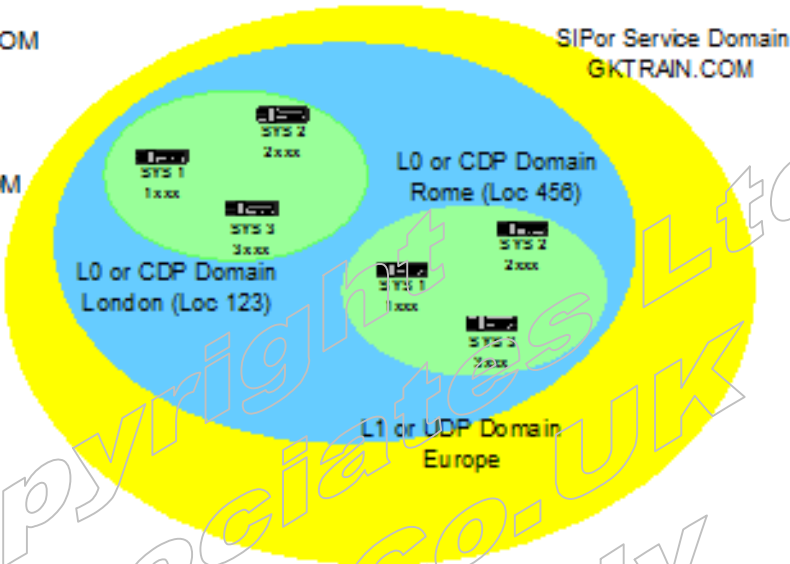
SIP Domains & URI

CDP Calls

In London
3000
Context = London.Europe.GKTRAIN.COM

In Rome
3000
Context = Rome.Europe.GKTRAIN.COM

UDP Calls
From London to Rome
(AC2) + Loc + Extn
6 456 3000
Context = Europe.GKTRAIN.COM



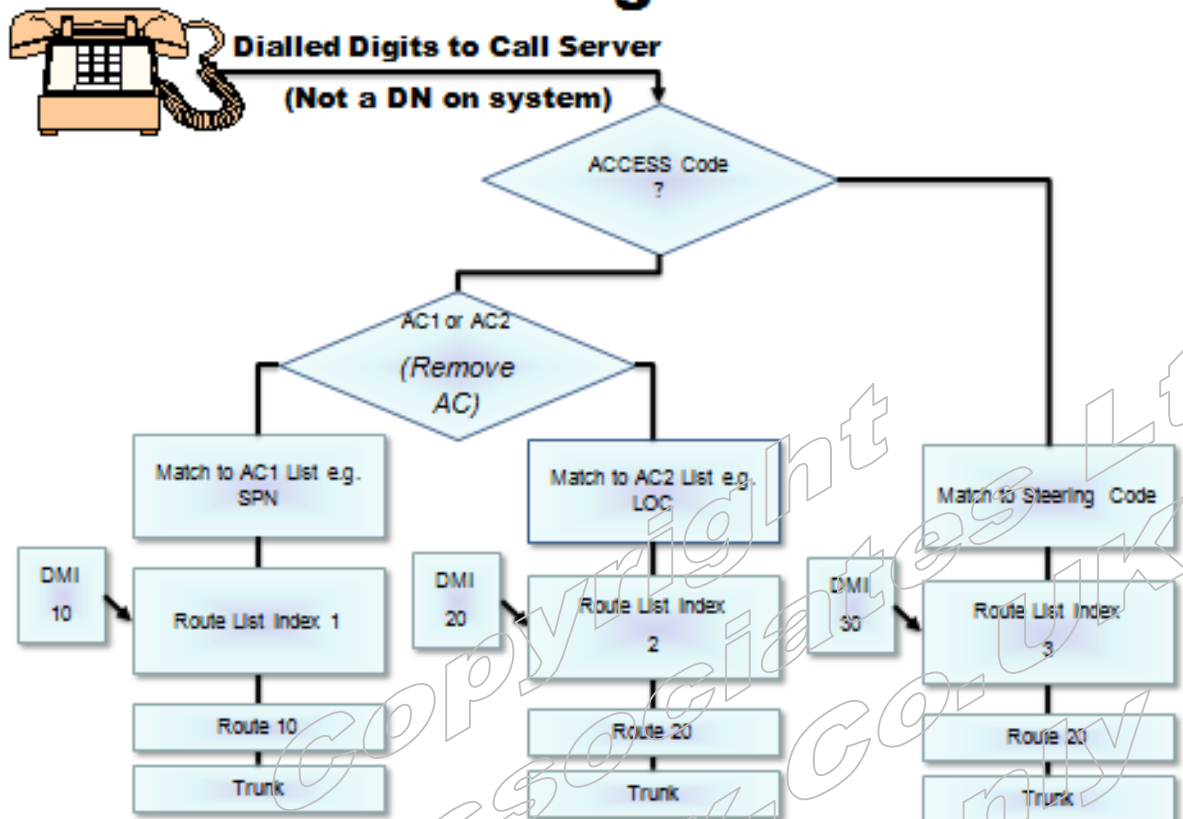
95

CDP COORDINATED DIAL PLAN
UDP UNIFORM DIAL PLAN

SIP is very much Domain based and therefore we need to add this information into the system as well as aligning the SIP domains to the Dialling plans within the CS1K .



The Routing Process



96

The Routing Process for a dialled number that isn't a DN on the systems is outlined here. Existing DN's could be Extensions, Hunt groups, Phantom numbers etc.

First the system checks whether an Access code (AC1 or AC2) has been dialled. If it has, it will firstly remove the AC code and then restrict its search for a match to the relevant list.

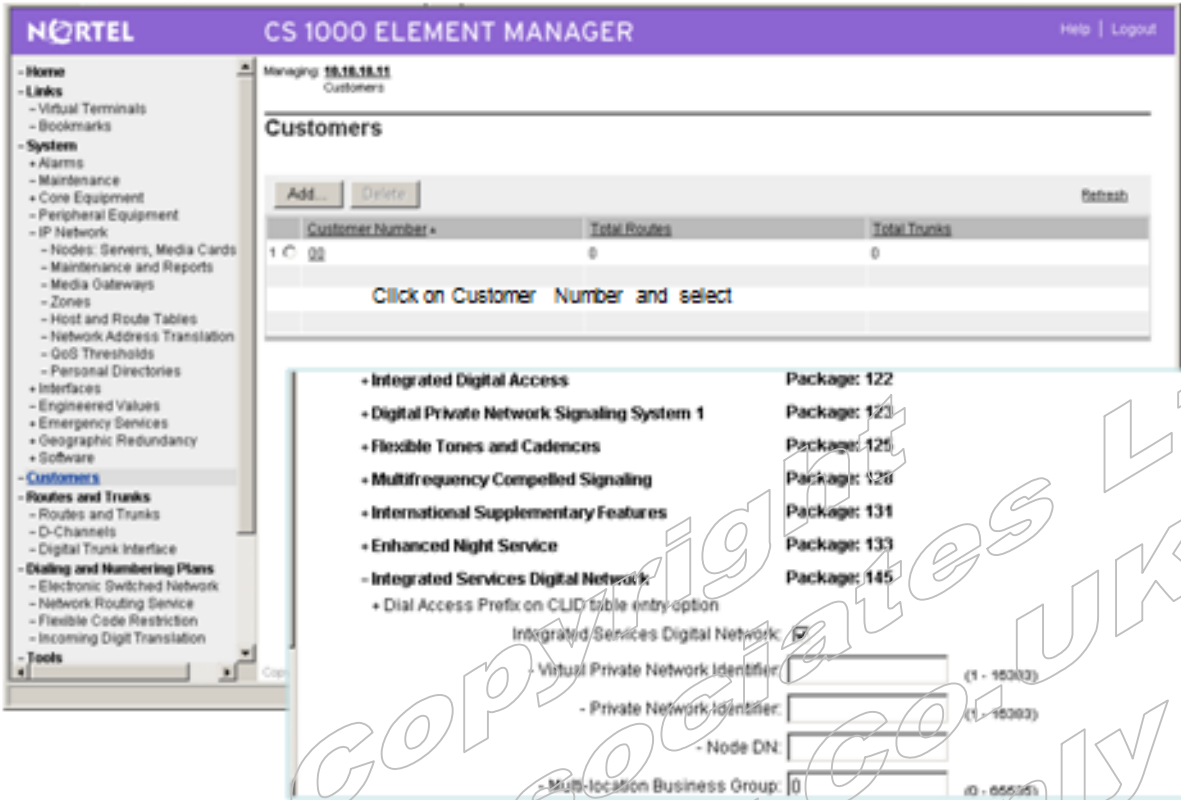
The subsequent match will also attach a Call Type to the call which is carried along with it.

If the first digit dialled is neither of the two AC codes then the system will search through the Steering codes (Distance, Local & Trunk) for a match again with a call type being added.

The generated match will point to a Route List Index, (RLI) this is a table which directs the call to the right Route off the system. It will also apply a Digit Manipulation (DMI) before forwarding to the route and finally the trunk.

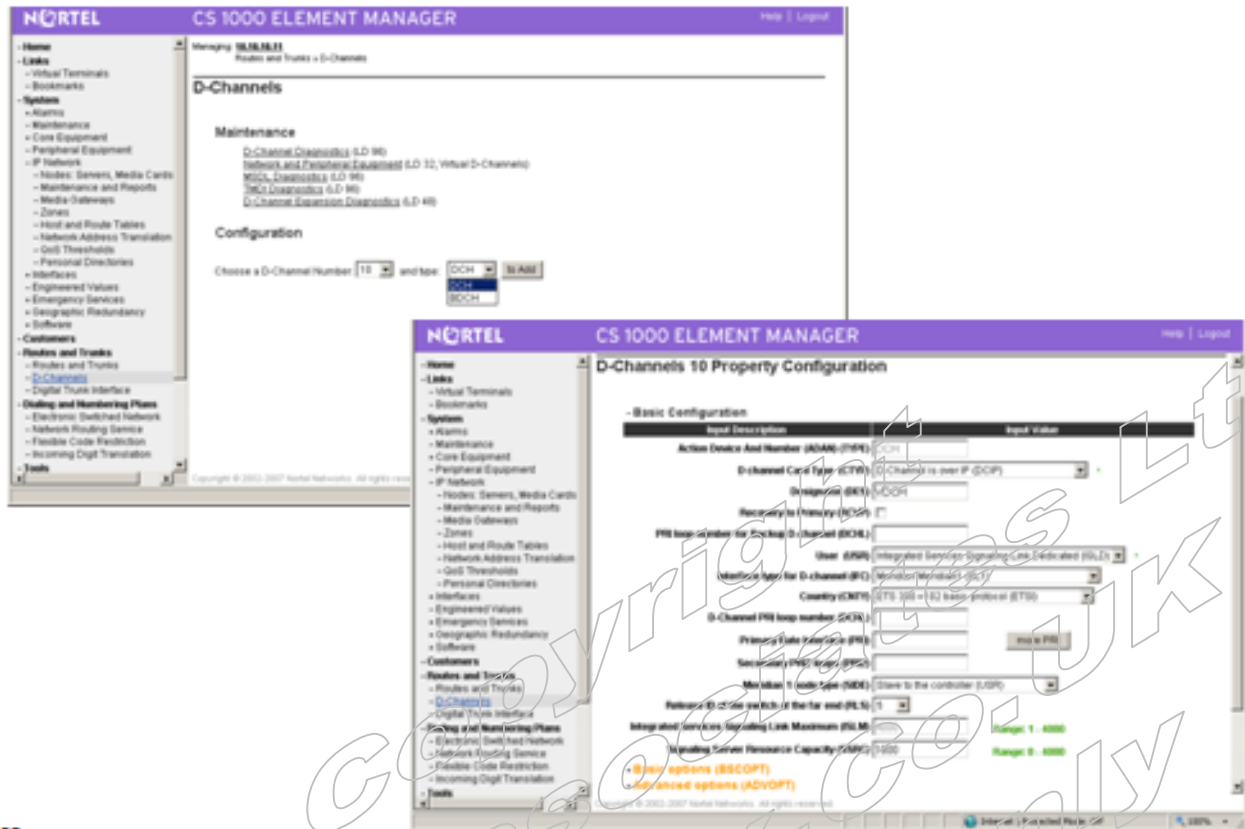
The DMI will delete and insert digits as required .

Enable ISDN



Firstly Enable ISDN (Package 145) for the customer.

D Channel



98

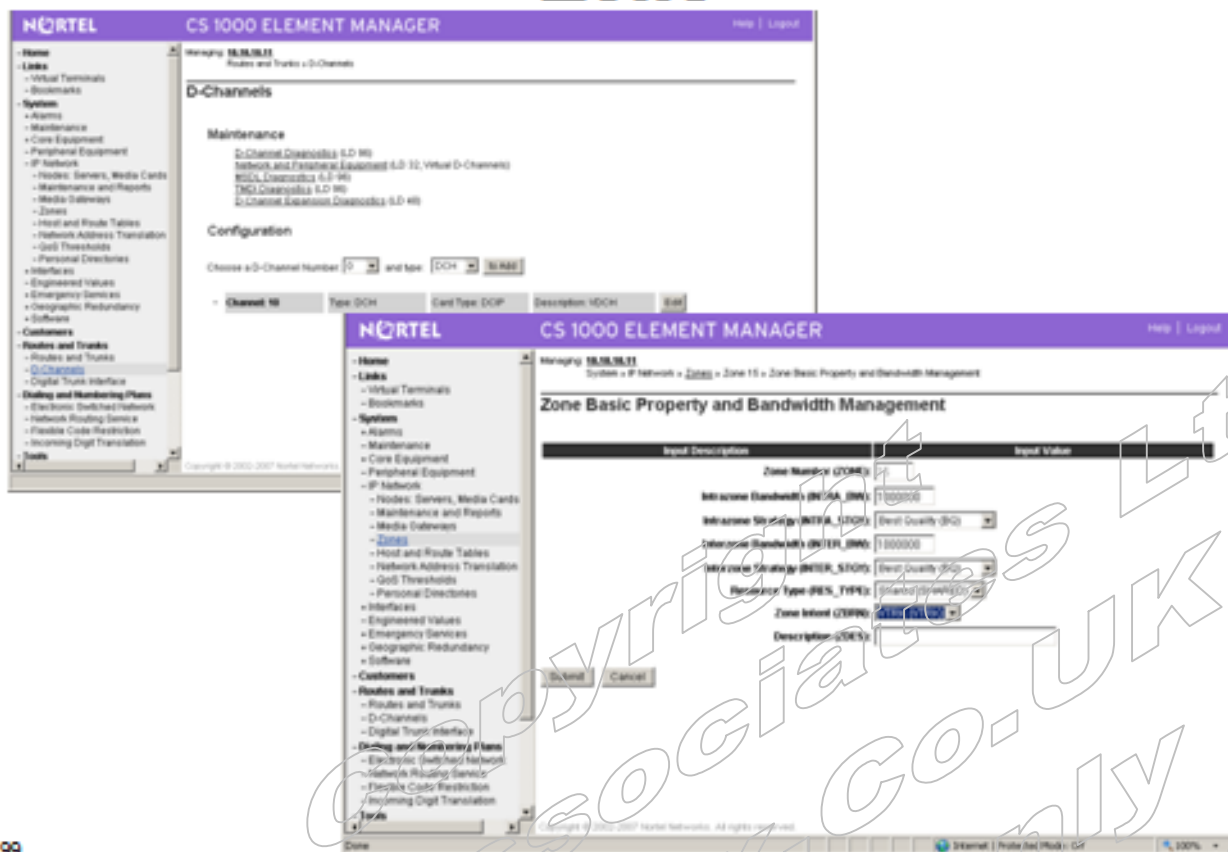
We need to create a Virtual D-Channel for the Virtual Trunks. Navigate to the D-Channel screen and select the DCH number to add.

This D-Channel can be used for all IP Trunks even if you are running both SIP & H.323 Trunks. The Channel ID number configured on the Trunks themselves will identify exactly which to use.

The D-Channel type will be DCIP (D-Channel over IP)

Select the USER as ISLD and the interface as SL1 as we will be sending MCDN over the IP Peer trunks.

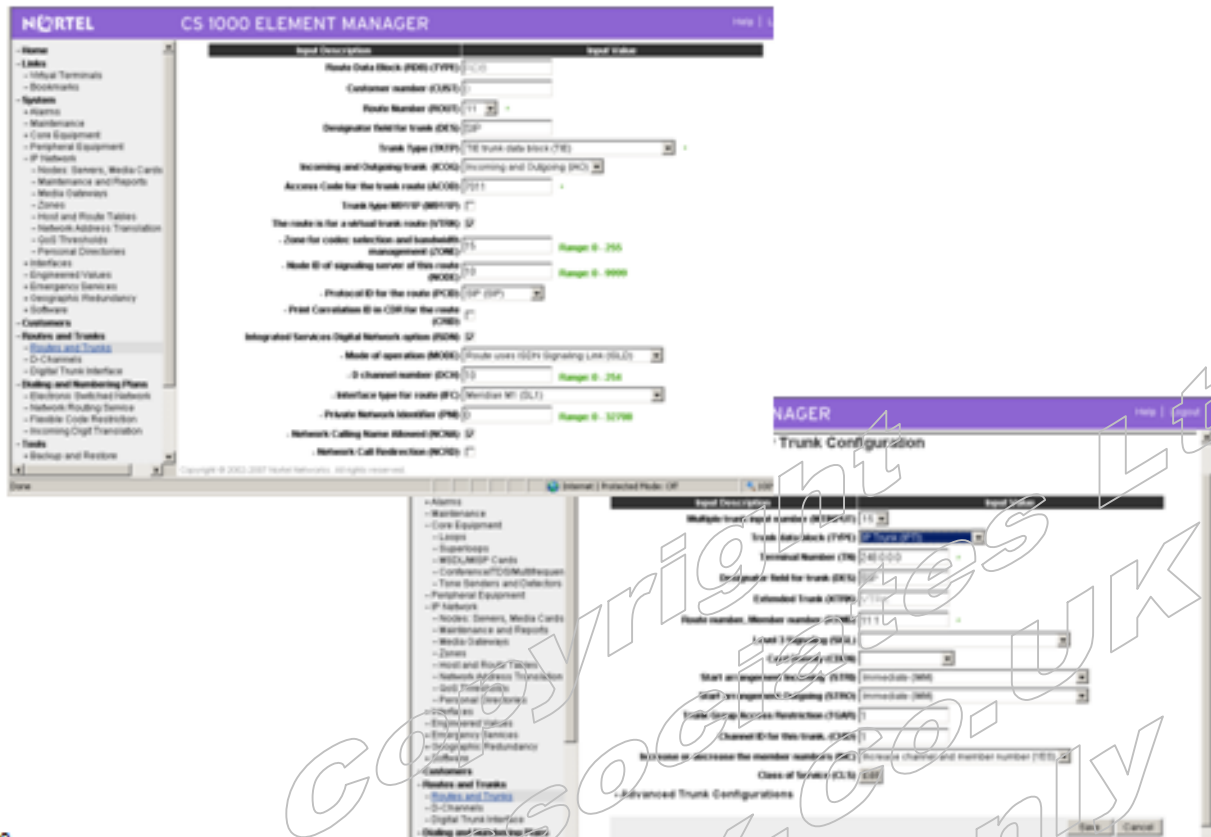
Zone



Once the DCH is created we will need a VTRK Zone before we can create the route.

The Zone is much the same as the Main Office zone created for IP sets but its Zone intent must be set to VTRK or it will not be accepted when you configure the Route.

Route & Trunks



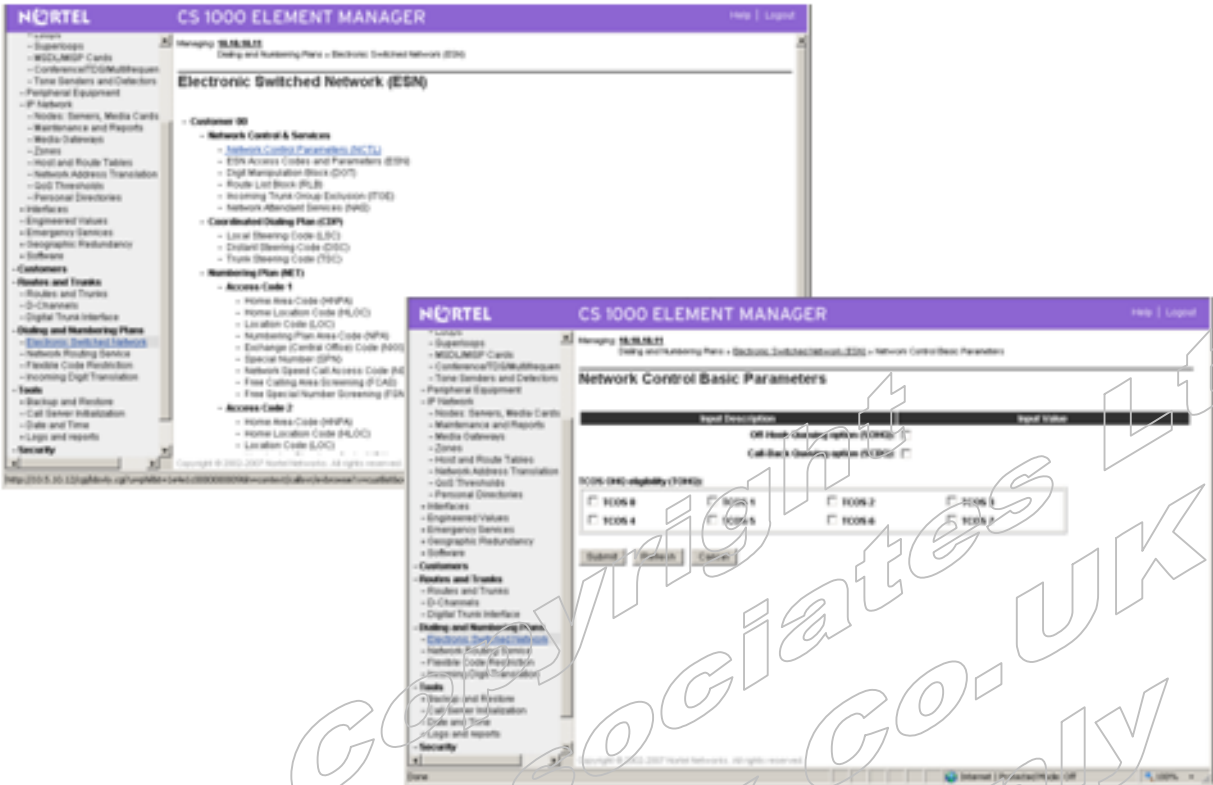
100

Next we create the VTRK route itself and the Trunks.

Note on the Virtual Trunks we must select the Protocol type we are using i.e SIP or H323. We also set the Mode of Operation (MODE) to ISLD and the Interface type for Route (IFC) to ISLD.

The Virtual Trunks will need Virtual TN's to configure them so ensure you have created a Virtual SUPERLOOP.

ESN



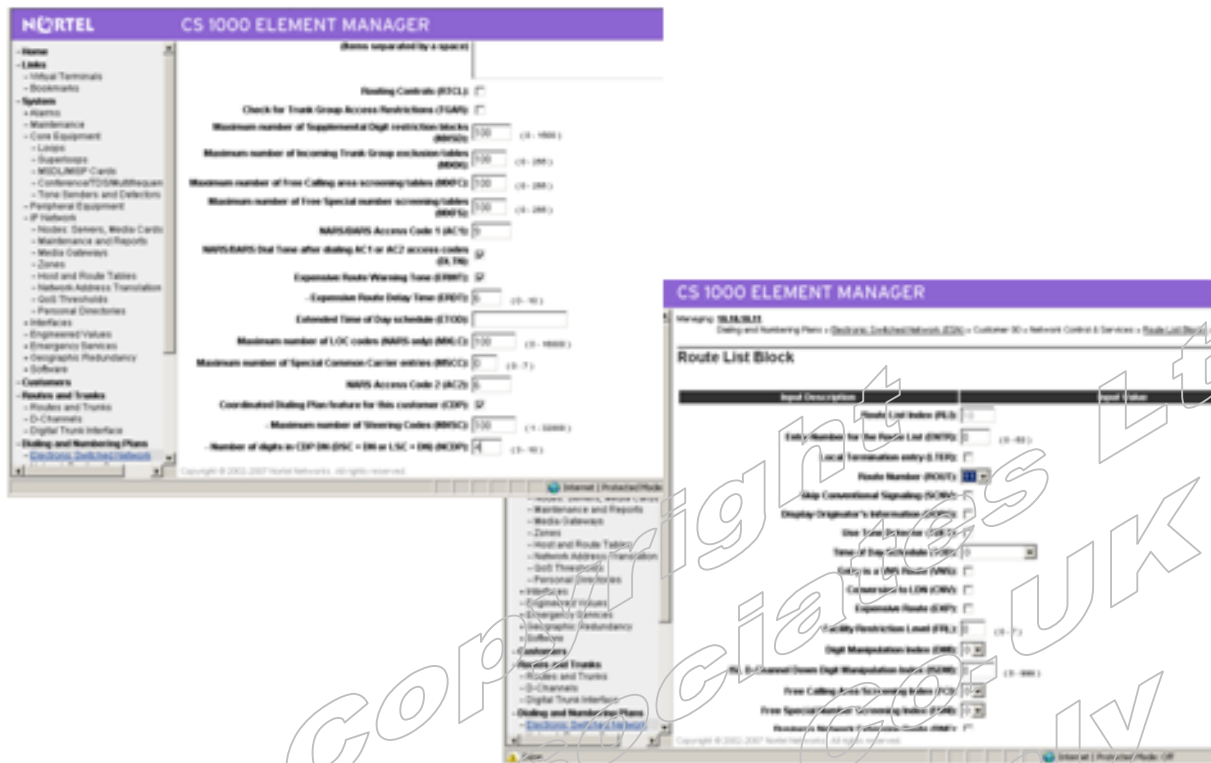
101

To allow us to programme Steering codes etc we need to create the default ESN tables.

Use the default values for Network Control Basic Parameters.



ESN Codes & RLB

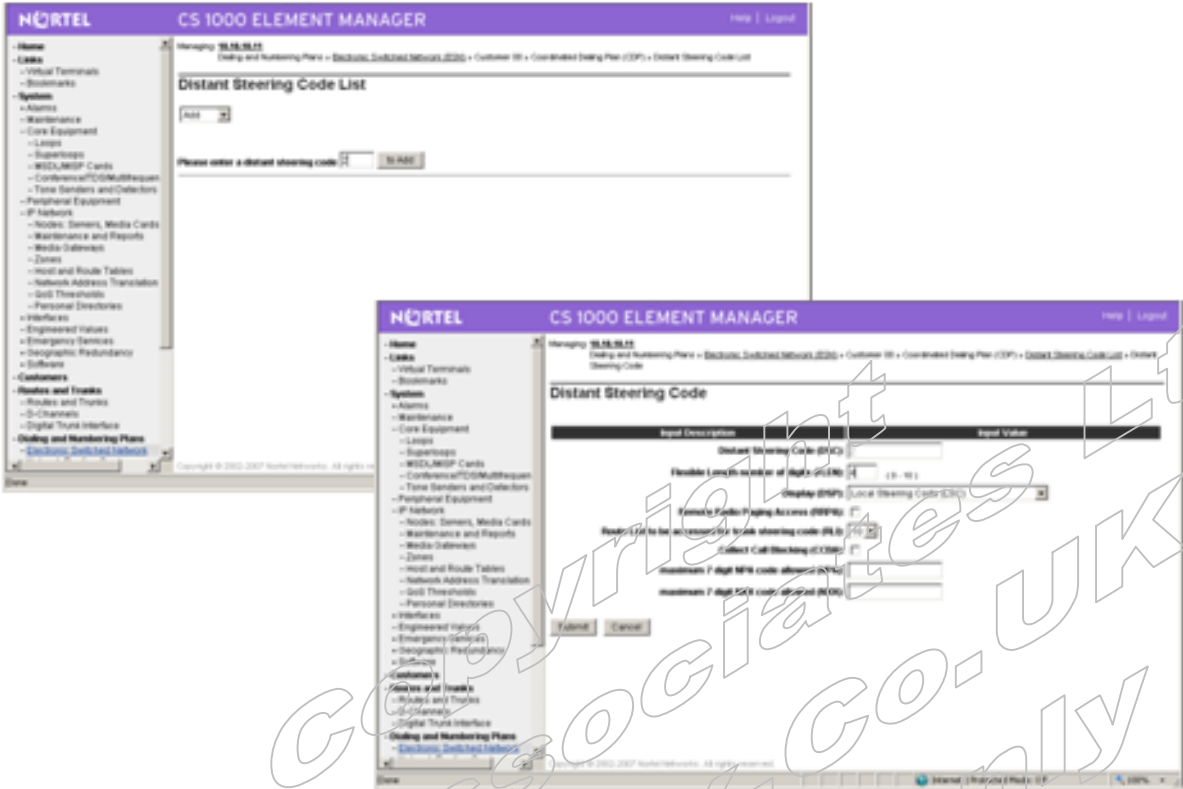


102

We need to setup the ESN Access Codes and Parameters, set all values that are "Maximum...." to 100 except Maximum Number of Common Carriers which should be set to 0.

Set AC1 to 9 and AC2 to 6.

Distance Steering Code



103

Steering codes are added to point the call to the correct route via the Route List Index.



IP Node – SIP G/W &URI Map



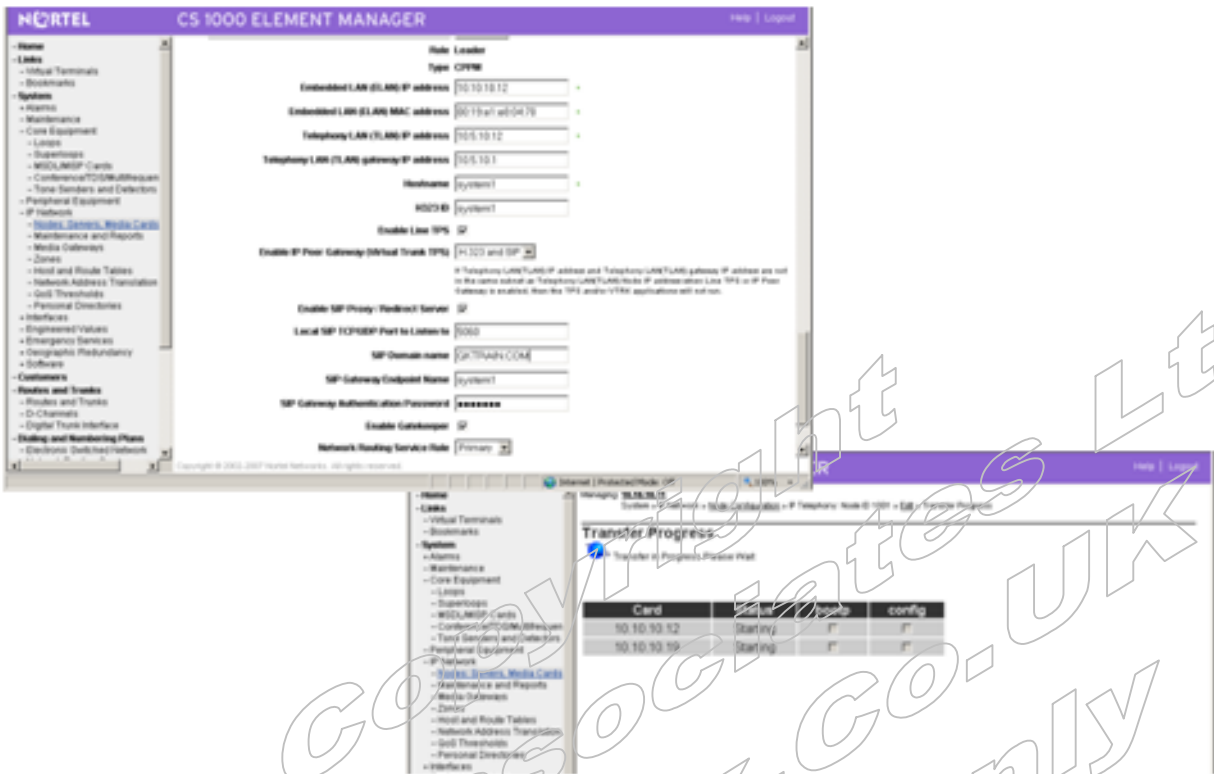
104

The Gateway information and Domains for SIP are entered into the IP Telephony Node.

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IP Node – Sig Server



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Network Routing Service



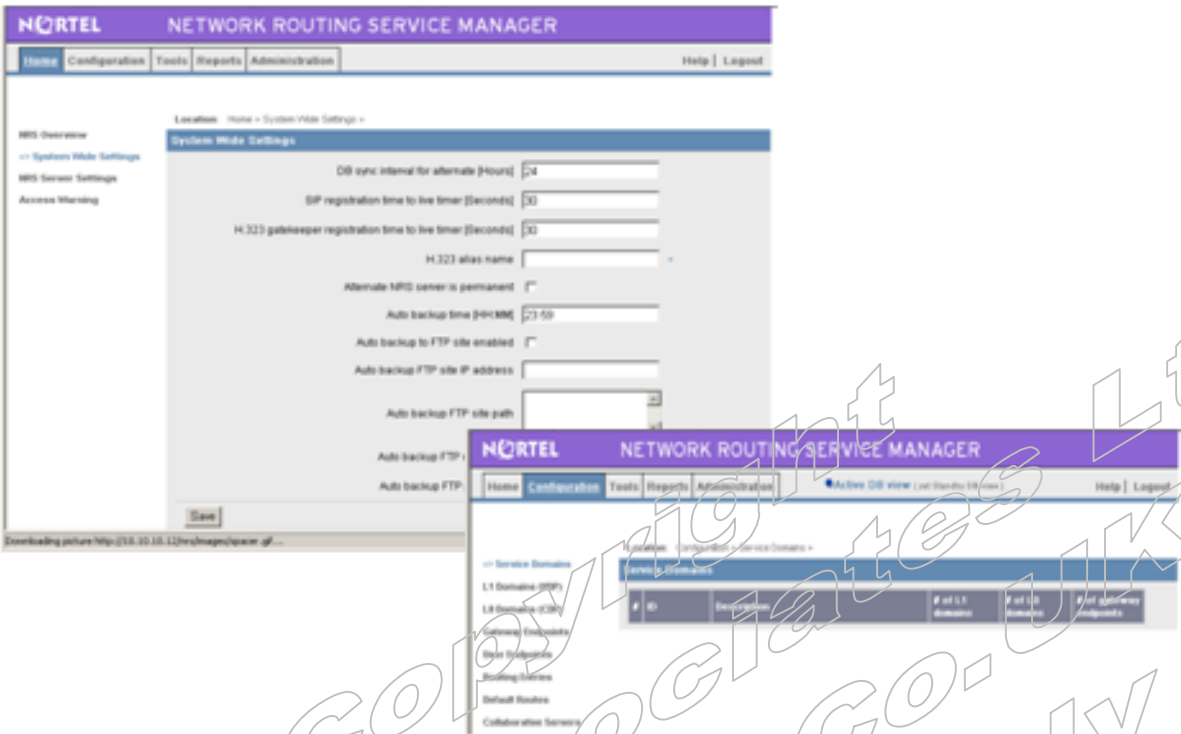
106

The NRS can be accessed from the Element Manager but it is possibly easier to access it directly by using the IP address of the server followed by "/nrs" e.g. 192.168.0.1/nrs

The Default login for the NRS is Username: Admin Password: Admin.

Once logged in you can add further users.

NRS



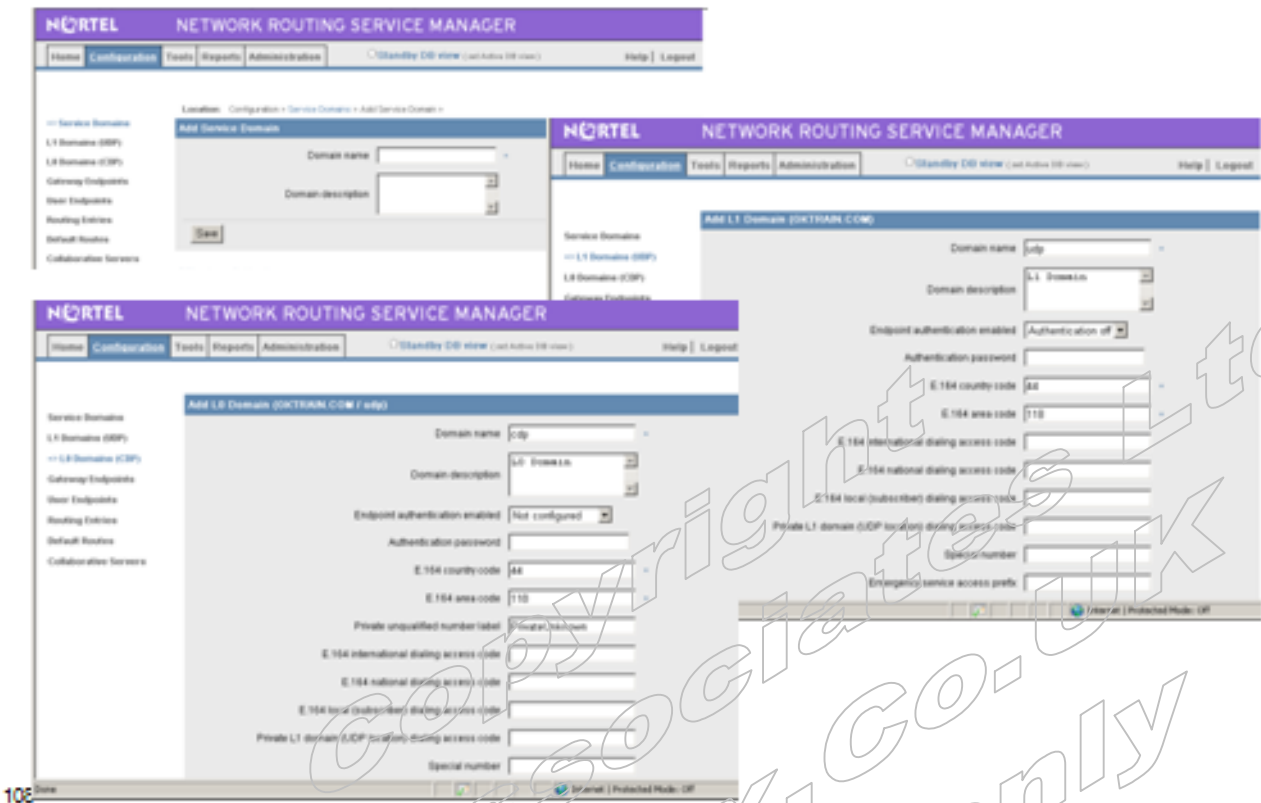
107

Check that the System Wide Settings are correct and adjust the DB Sync interval (Synchronisation of Primary, Alternate and Failsafe NRS) to a suitable setting.

Also ensure that the NRS Server settings point to the correct Primary and Alternate NRS.

To start configuration of the NRS click on the CONFIGURATION Tab, and then select the "Standby View" as configuration can only be made in Standby mode.

Domains



Once in Standby mode we can start to add the information such as the

- ❑ Service or SIP Domain
- ❑ L1 Domain (UDP)
- ❑ L0 Domain (CDP)



Endpoints

Service Domains

L1 Domains (SIP)

L1 Domains (CDP)

Gateway Endpoints

User Endpoints

Routing Entries

Default Routes

Add Gateway Endpoint (0KTRAIN.COM / udp / cdp)

Endpoint name

system1

Endpoint description

System1

Tandem gateway endpoint name

Endpoint authentication enabled

Not configured

Authentication password

E.164 country code

E.164 area code

4 international dialing access code

E.164 national dialing access code

al (subscriber) dialing access code

3 (CDP location) dialing access code

Private special number 1

Static endpoint address type

IP version 4

Static endpoint address

H.323 Support

H.323 not supported

SIP support

Dynamic SIP endpoint

SIP transport

TCP

SIP port

5060

Network Connection Server enabled

☒

Save

E.164 international dialing access code

E.164 national dialing access code

E.164 local (subscriber) dialing access code

Private L1 domain (UDP location) dialing access code

Private special number 1

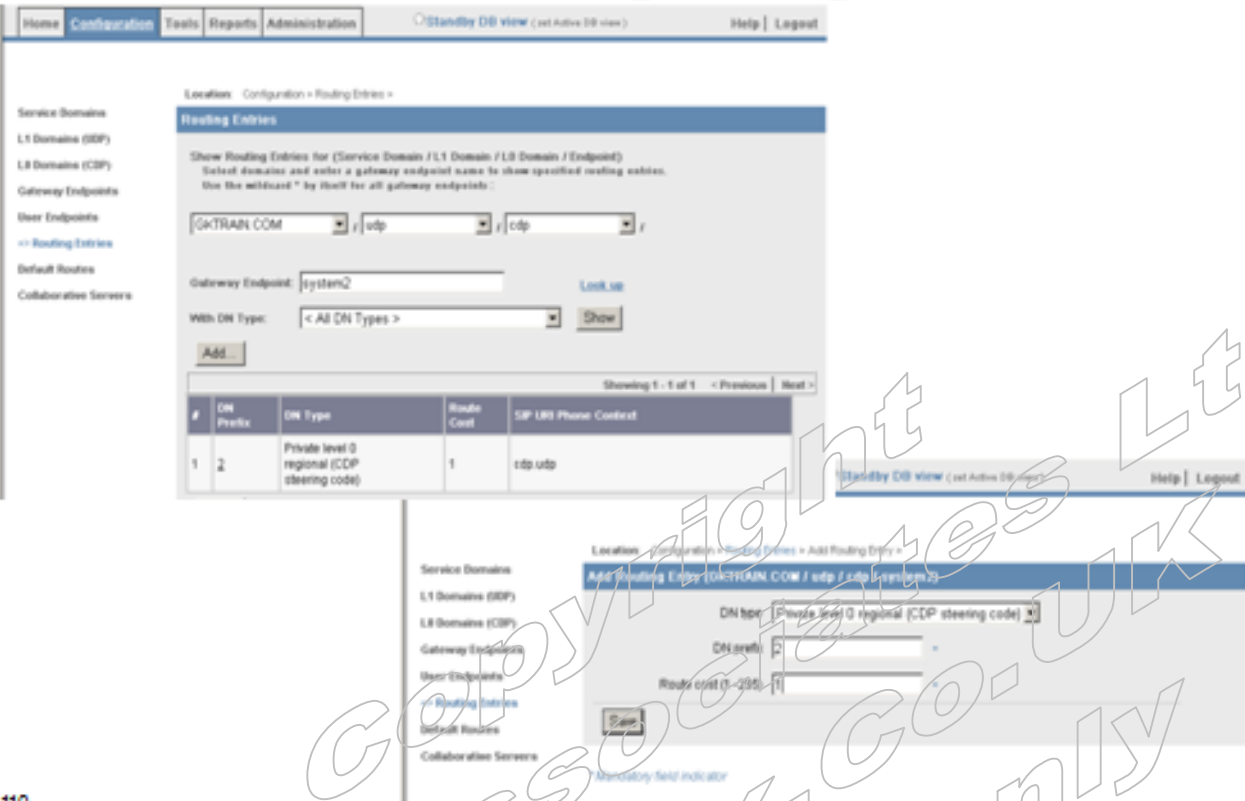
Private special number 2

With the Domains in place we can start to add Gateway Endpoints which define each of the systems being served by the NRS.

Each Endpoint is added into the correct Domain and then configured with the appropriate Protocol Support (SIP or H323).

The Network Connect Server can also be enabled here, this provides support for UniStim requests specifically for Network Virtual Office, Branch Office and Geographic Redundancy.

Routing Entry



110

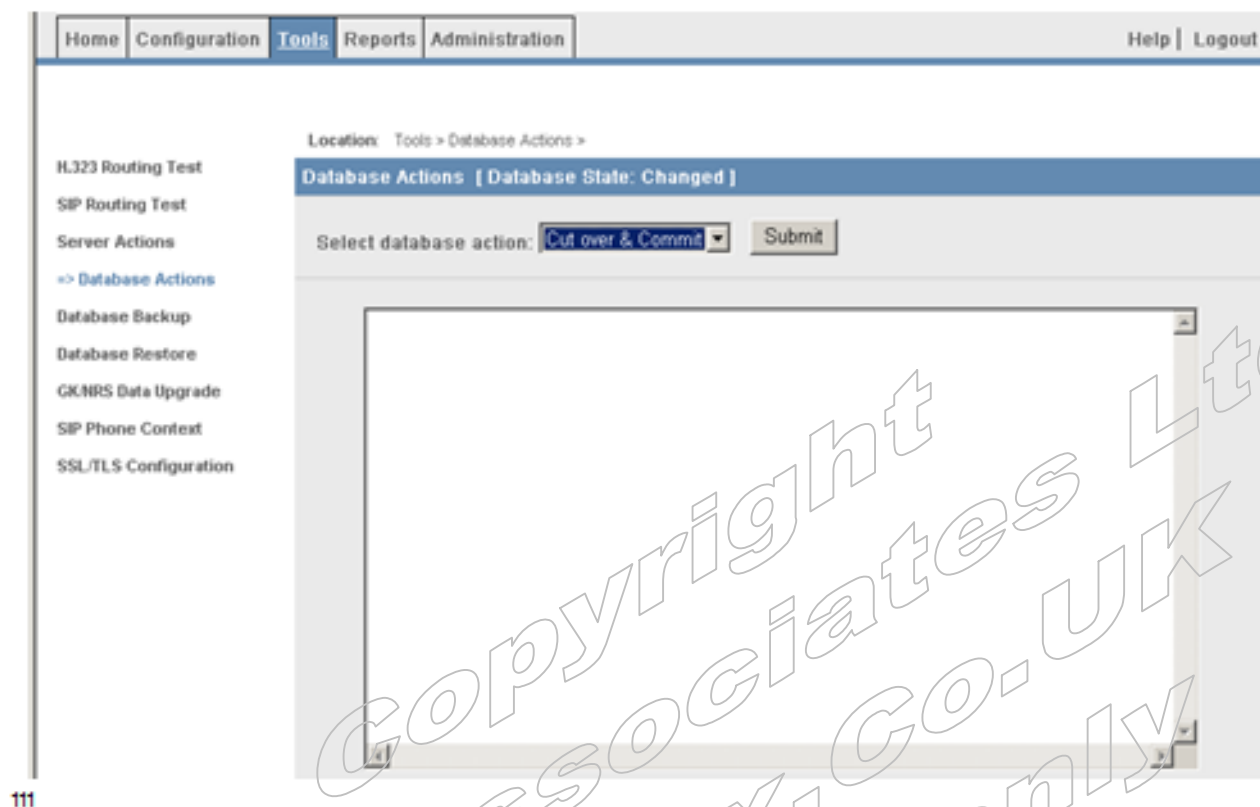
With the Endpoints in Place we can then add Routing entries to specific Endpoints.

Select the ROUTING ENTRIES menu item and select the Endpoint you wish to configure, note the LOOK UP link (In Blue) will allow you to browse the Endpoints.

Once the Endpoint is selected you can then add the specific Route you require selecting :-

- ☐ DN Type (CDP/UDP/SPN etc)
- ☐ DN Prefix (i.e. The starting number pattern to match to)
- ☐ Route Cost (This is used to determine which route to use when there is more than one option)

Cutover & Commit Db



111

Finally the configuration data must be moved to the Active side of the database

To do this select the TOOLS tab and DATABASE ACTIONS menu item. There are options to :-

- | | |
|---|--|
| ☐ CUTOVER | Moves Standby Config to Active for testing can be reversed |
| ☐ COMMIT | Commits current Active Config changes to Db |
| ☐ ROLLBACK/REVERT | Goes back to Previous Active Db |
| ☐ CUTOVER & COMMIT | Moves Standby to Active and Commits in one operation |

In the Lab we can use CUTOVER & COMMIT but in the field you should CUTOVER the Db first. Carry out testing and then COMMIT when you are satisfied with the changes made. If a CUTOVER is used, no further changes can be made until a COMMIT is done or the changes are reversed.

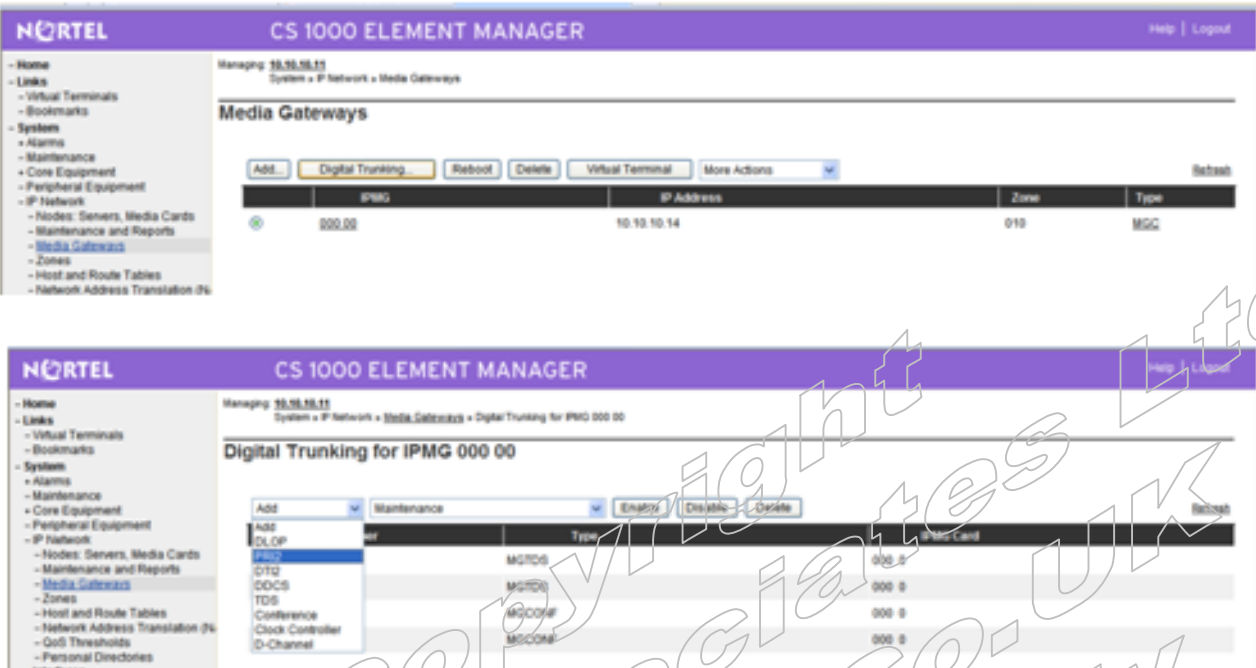
Exercise 9

1. What is the SIP URI map and what is its purpose ?
2. How does a Virtual Trunk locate the endpoint gateway to signal on call setup ?
3. What must you do before you can add any configuration to the NRS ?
4. Many SIP trunks does a Sig Server support ?
5. Which transport protocol does Nortel recommend for SIP ?
6. What sort of D channel is used for SIP trunks ?
7. How are Virtual Trunks addressed within the system ?
8. What is the default login for the NRS ?

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10. PRI Trunks



113

As we've already configured the Virtual Trunks ISDN is switched on for the customer so we don't need to do that again.

Due to Lab constraints we will be configuring MCDN trunks from one system to another so the setup will be different to that you would use if you were configuring to a carrier ISDN circuit. (Protocol etc.)

To configure the PRI LOOP number first select the Media Gateway it is installed in and click the DIGITAL TRUNKING button. Then select PRI" from the ADD drop down menu.

Assign LOOP to PRI Card

NORTEL CS 1000 ELEMENT MANAGER

Managing: 50.50.50.51
System: IP Network > Media Gateway > Digital Trunking for IPMG 000 00 > IPMG 000 00 PRI2

IPMG 000 00 PRI2

2.0 Mbit/s Primary Rate Interface Loop Number:

Media Gateway Card: (Suppl. PRR card)

NORTEL CS 1000 ELEMENT MANAGER

Managing: 50.50.50.51
System: IP Network > Media Gateway > Digital Trunking for IPMG 000 00

Digital Trunking for IPMG 000 00

	Number	Type	Status
☐	100	PRI2	000 0 01
☐	120	MGTRIS	000 0
☐	121	MGTRIS	000 0
☐	122	MGCONF	000 0
☐	123	MGCONF	000 0

Select the PRI Card location in the Media Gateway

Remember the LOOP you assign must not be in use for any other SUPERLOOP or Device.

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To configure the PRI LOOP number first select the Media Gateway it is installed in and click the DIGITAL TRUNKING button. Then select PRI" from the ADD drop down menu.

The system will prompt for a LOOP number to assign to the PRI. This must be an unused LOOP number and is not part of any existing SUPERLOOP. Here we have selected LOOP 100.

Create D Channel

After selecting the D-Channel number to use we are presented with the standard dialogue screen.

Note that in the D-Channel we are stating which DCH card is being used and as ours are daughter boards on the PRI itself the location (MG_CARD) is the same as the PRI e.g. 000 0 1 i.e. where the card is located in the Media Gateway.

As the trunks we are configuring are connecting together CS1K systems we have selected User(USR) as PRI and the Interface type for D-channel (IFC) as SL1. If you were configuring this to a different type of system or to the PSTN this would need to be selected appropriately.

Again as we are working "Back to Back" with another system we must define one end as NET as shown here and the other as USR. In a PSTN scenario the carrier end would always be NET so you would select USR.

Add a Route

Home

Links

Virtual Terminals

Bookmarks

System

Alarms

Maintenance

Core Equipment

Peripheral Equipment

IP Network

Nodes: Servers, Media Cards

Maintenance and Reports

Media Gateways

Zones

Host and Route Tables

Network Address Translation (NAT)

QoS Thresholds

Personal Directories

Interfaces

Engineered Values

Emergency Services

Software

Customers

Routes and Trunks

Routes and Trunks

D-Channels

Digital Trunk Interface

Dialing and Numbering Plans

Electronic Switched Network

Network Routing Service

Flexible Code Restriction

Incoming Digit Translation

Tools

Backup and Restore

Call Server Initialization

Date and Time

Logs and reports

Security

Passwords

Login Options

Managing 10.10.10.10

Routes and Trunks > Routes and Trunks > Customer 0, New Route Configuration

Customer 0, New Route Configuration

Basic Configuration

Input Description	Input Value
Route Data Block (RDB) (TYPE)	ROB
Customer number (CUST)	0
Route Number (ROUT)	5
Designator field for trunk (DLS)	PR2 Route
Trunk Type (TKTP)	TIE trunk data block (TIE)
Incoming and Outgoing trunk (ICOG)	Incoming and Outgoing (IAO)
Access Code for the trunk route (ACOD)	7005
Trunk type M911P (M911P)	☐
The route is for a virtual trunk route (VTRK)	☐
Digital Trunk Route (DTRK)	☒
ISDN BR Packet handler route (BRP)	☐
Digital Trunk Type (DGTP)	ISDN 30E + D (PR2)
Integrated Services Digital Network option (ISDN)	☒
Mode of operation (MODE)	ISDN/PRA route, DTRK must be YES (PRA)
Interface type for route (IFC)	Midian M1 (SL1)
Private Network Identifier (PNI)	0
Network Calling Name Allowed (NCNA)	☒
Network Call Redirection (NCRD)	☐
Call Type for outgoing direct dial (CTD)	Unrestricted Outgoing Plan (OCG)
Insert ESN Access Code (ESAC)	☐
Integrated Service Access Route (ISAR)	☐
Display of Access Profile on CLID (DAPC)	☐
Mobile Extension Route (MEROR)	☐

Basic Route Options

Network Options

116

Once the D-Channel is complete we can configure a Route for the PRI.

Note the following basic settings :-

- ☒Trunk Type (TKPT)

☒Incoming and Outgoing (ICOG)

☒Digital Trunk Route(DTRK)

☒Digital Trunk Type (DGTP)

☒ISDN

☒Mode of Operation (MODE)

☒Interface type for Route (IFC)
- TIE

IAO

Tick the Box

PR12

Tick the Box

PRA

SL1

Add Trunks to Route

NORTEL CS 1000 ELEMENT MANAGER

Manage: 15.15.15.11
Routes and Trunks > Routes and Trunks > Customer 0, Route 5, New Trunk Configuration

Customer 0, Route 5, New Trunk Configuration

- Basic Configuration

Input Description	Input Value
Multiple trunk input number (RTINPUT)	30
Trunk data block (TYPE)	THE trunk data block (TIE)
Terminal Number (TN)	100 1
Designator field for trunk (DE S)	PRI_TRK
Extended Trunk (XTTRK)	
Route number, Member number (RTMB)	5 1
Level 3 Signaling (SGL)	
Card Density (CDEN)	
Start arrangement Incoming (STR)	Immediate (IM)
Start arrangement Outgoing (STR)	Immediate (IM)
Trunk Group Access Restriction (TGAR)	1
Channel ID for this trunk (CSID)	
Network Music (NMUS)	
Increase or decrease the member numbers (INC)	Increase channel and member number (YES)
Class of Service (CLS)	Std

- Advanced Trunk Configurations

Save Cancel

117

Once the Route is configured we can add the Trunks to it.

Note that the TN used is the LOOP number assigned to the PRI card and that unit number starts at 1 rather than 0 as it is reserved for synchronisation..

The Route Number, Member Number (RTMB) is as it says "Route Number" " The first Member Number (1)" and as we are adding 30 channels in total the system will increment this for us automatically.

Adding a Clock Controller

```
File Edit Setup Control Window Help
OVL000
>
OVL000
>
OVL000
>
OVL000
>ld 73
DDB000
MEM AVAIL: (U/P): 98984362    USED U P: 5241769 43690    TOT: 104269821
DISK SPACE NEEDED: 36 KBYTES
REQ chg
TYPE pri2
FEAT syti
MGCLK 0 0 1
PREF 1
SREF
MGCLK
CCGD
CCAR
EFCS

MEM AVAIL: (U/P): 98984362    USED U P: 5241769 43690    TOT: 104269821
DISK SPACE NEEDED: 36 KBYTES
REQ
```

118

The Clock Controller is best added in LD 73

The Clock Type is MGCLK and it should be noted that every Media Gateway with a PRI card in it will need a separate clock controller.

The PREF & SREF prompts are the Primary and Secondary References.

Enabling the MSDL Card

```
File Edit Setup Control Window Help
DCH000
-
DCH000
.****
OUL000
>ld 96
DCH000
-
DCH000
.stat dch
DCH 005 : DSBL      RST      AUTO      DES : pp
DCH 010 : OPER      EST      ACTU     AUTO      DES : UDCH
.stat msdl
MSDL 000 0 1 MAN DSBL
.enl msdl 0 0 1 fdl
OUL021 IDLE
```

119

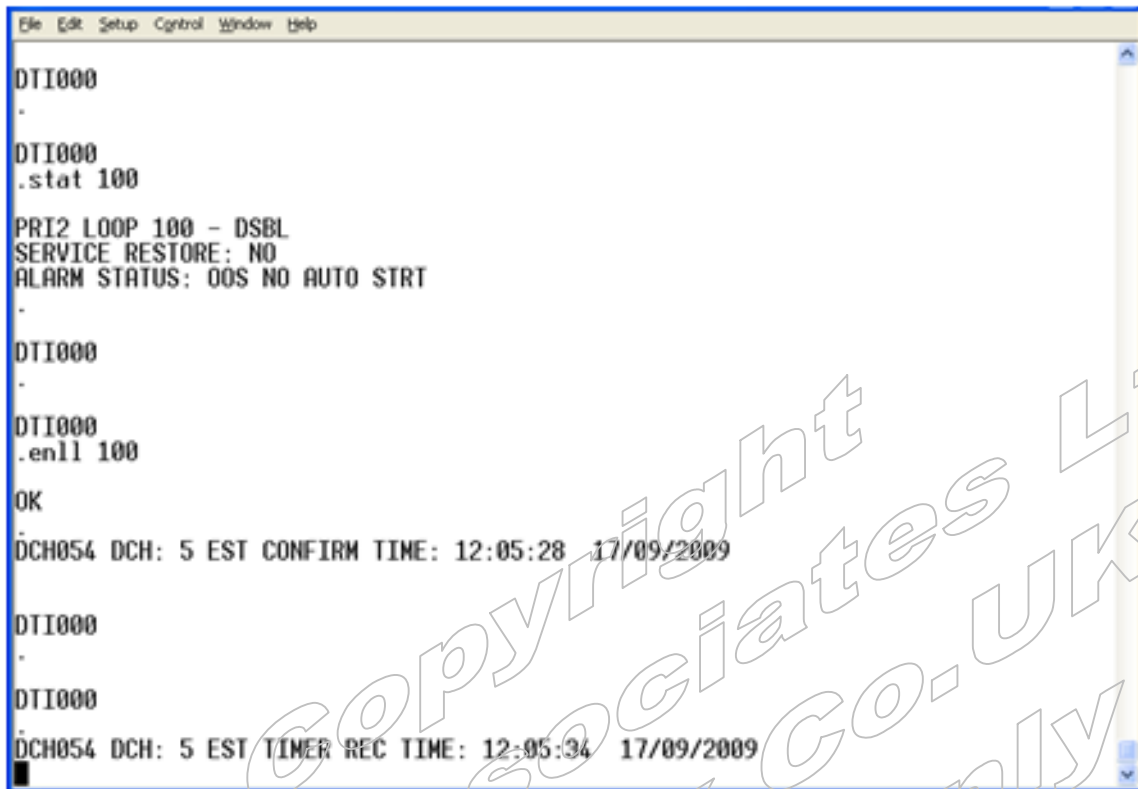
The MSDL D-Channel card now needs to be enabled and as this will be the first time its been used in this configuration we will also carry out a Force Download (FDL) at the same time.

>LD 96

```
.enlmsdl(TN of card) fdl
```

As the download occurs you should see the “Dots” march across the screen as data is sent to the card. On completion you should get an OK message.

Enable PRI LOOP



```
File Edit Setup Control Window Help
DTI000
.
DTI000
.stat 100
PRI2 LOOP 100 - DSBL
SERVICE RESTORE: NO
ALARM STATUS: OOS NO AUTO STRT
.
DTI000
.
DTI000
.enll 100
OK
DCH054 DCH: 5 EST CONFIRM TIME: 12:05:28 17/09/2009
DTI000
.
DTI000
DCH054 DCH: 5 EST TIMER REC TIME: 12:05:34 17/09/2009
```

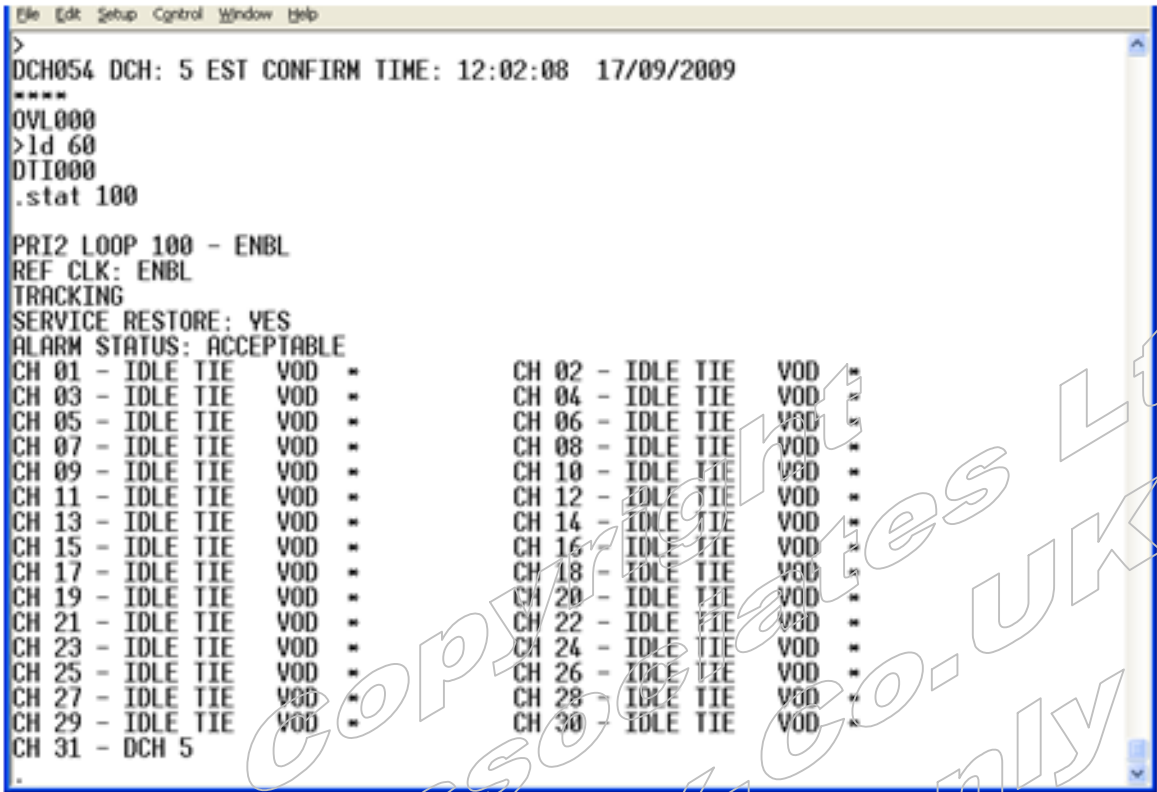
120

Once the D-Channel card is enabled we can try to establish the link.

In LD 60 we can use the ENLL (Loop Number) to bring the LOOP into service. This needs to be done on both systems i.e. both ends of the link before the service will correctly establish.

If necessary the LOOP can be disabled using the DISL (Loop Number) command and the counters listed (LCNT) and reset (RCNT) before re-enabling the LOOP to clear any issues.

STAT the LOOP



121

Once the card is enabled correctly you should see messages similar to those above confirming the D-Channel is established and the PRI channels IDLE and available.

You will also note the ALARM STATUS: ACCEPTABLE message which highlights any issues. Further configuration of the Clock Controller may be necessary to avoid timing issues in this configuration.

Appendix

Setting A law & UK Tones

LD 17	LD 56	Changing essential tones & cadences
REQ chg	Req New	
Type atrn	Type fcad	
Code 2 (0)	Wcad 32	
	Cndc 80 40 80 400	
	End rept	
	Cybs 1 2	
LD 17	REQ chg	LD 56
REQ chg	TYPE ftc	
Type parm	TABL 0	
Pcmi a (mu)	RING	
	HCCT yes	
	DIAL	
LD 97	XTON	129
Req Chg	Xcad	0
Type xctp	Busy	
Dtnf 138 (14)	XTON	130
	Xcad	30
	RGBK	
	XTON	132
	Xcad	32
	OVFL	
	XTON	130
	Xcad	0
LD 97		
Req Chg		
Type syp		
Intr yes		

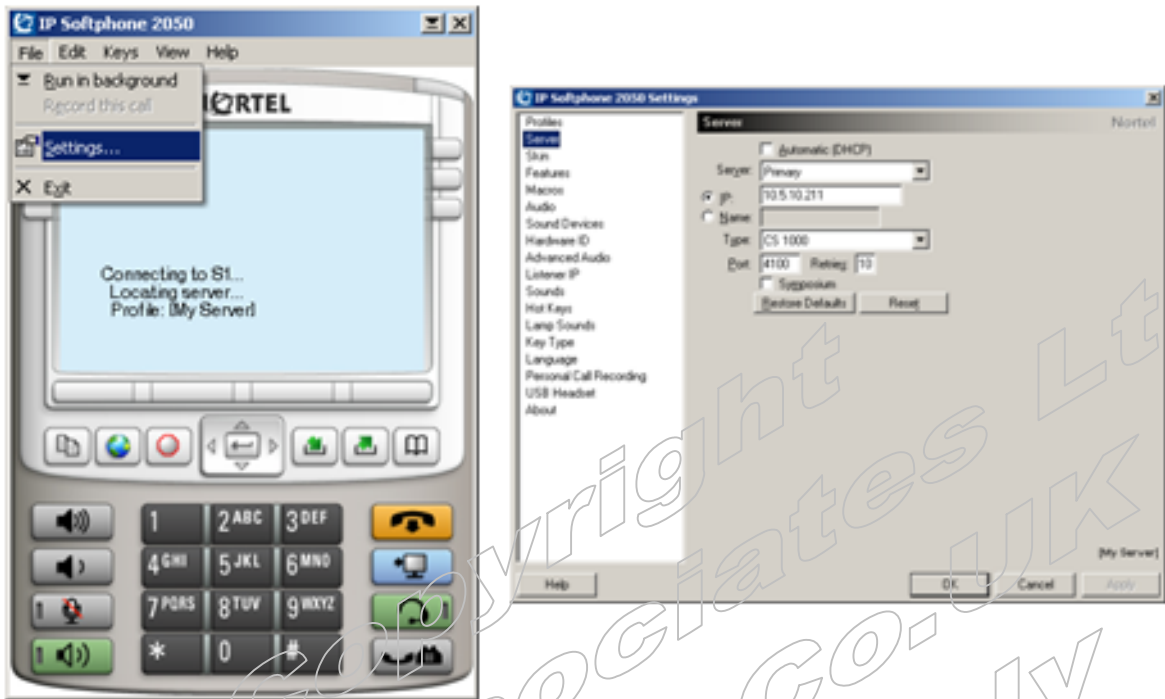
122

Note some prompts have been omitted in the listing above

Need to reboot for tones and law changes to take affect.

Note when building PRI trunks set PCML to A to match switch law else crackling voice quality.

Configuring SoftPhone



123

Select the Settings option from the FILE Menu and set the S1 Address by disabling the DHCP Option and selecting the IP Radio button.

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VGMC Media Card

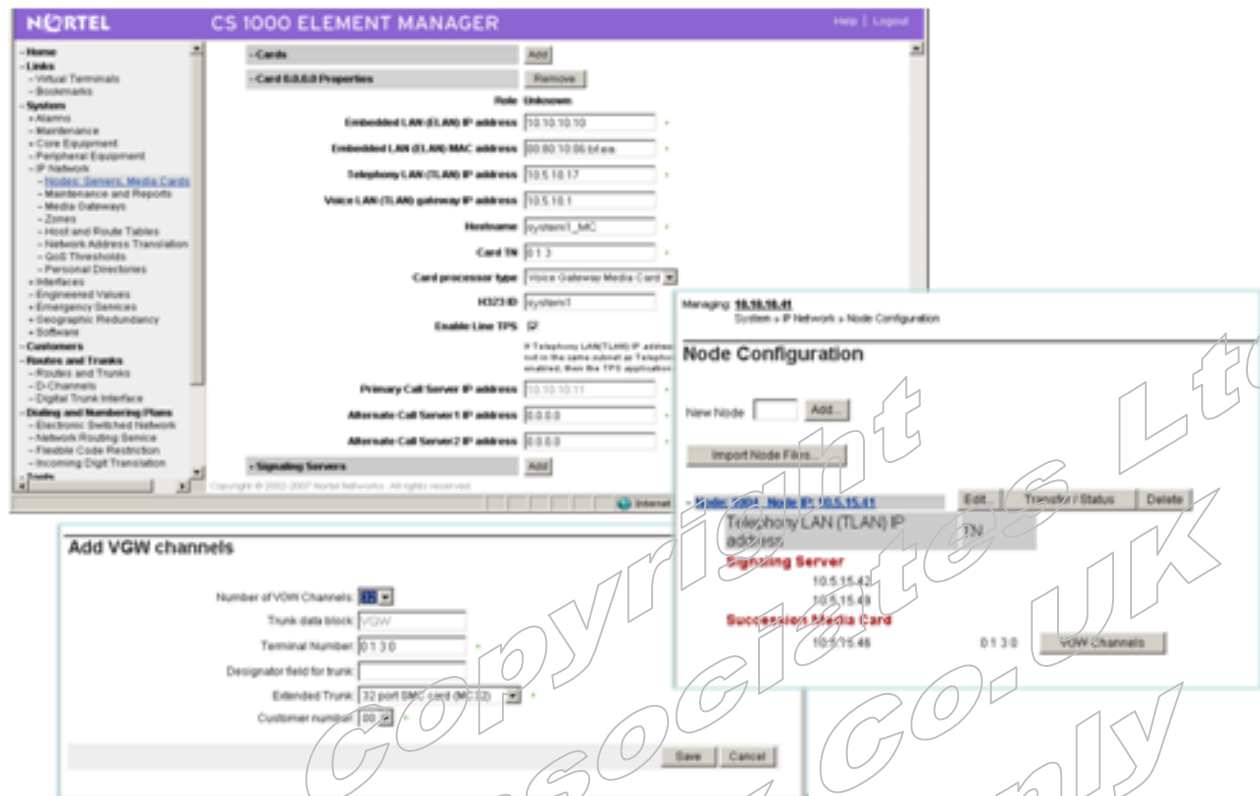
- VGMC Media Card
 - No SRTP
 - Supports TPS
- MDF Adaptor
 - Supports 2 x RJ45
 - ELAN & TLAN
 - 9 Pin d-Type serial
 - Needs Filter on SG & MG systems



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Media Card Configuration



The older VGMC and the new MC32S IPE style Media cards are configured in a very similar fashion. As they both support TPS they are configured under the IP Telephony Node. Both of these cards are similar to the Follower Sig Server in that they obtain their IP configuration using the BOOTP protocol from the Leader Sig Server.

After opening the IP Node click to ADD the card, you will need to select the card type and add the relevant IP addresses. The system will also want a unique Hostname for the card as well as its ELAN MAC address.

Once configuration is complete the Node information is Saved & Transferred. At this point it will add the Media Card to the node but the transfer will fail.

Now restart the card so it can BOOTP its IP information. When it has done this and the IP addresses are available Save & Transfer the Node information to it.

The Card should be ready to work but it's a good idea to check the Loadware on VGMC cards and on MC32S cards you should always download the Media Card Loadware at this point.

The final thing is to create the VGW channels by opening the Node as shown in the second image and clicking on the VGW CHANNELS button.

PAD Table Settings

- Pad Table Settings
 - Required for Media Cards
 - Sets levels for the card

CS 1000S DTU/PRI Prompt	Norway		Sweden		Switzerland		UK	
	Rx Code	Tx Code	Rx Code	Tx Code	Rx Code	Tx Code	Rx Code	Tx Code
ONP	5	6	14	3	3	3	6	5
DSET	4	7	7	7	7	4	3	4
OPX*	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
DTT	0	0	0	0	0	0	0	0
SDTT	0	0	0	0	0	0	0	0
DCO*	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
DTO	3	19	3	19	3	19	3	19
VNL	0	0	0	0	0	0	0	0
SATT	3	19	3	19	3	19	3	19
ACO	0	14	18	18	17	15	2	16
ATO	0	19	3	19	3	19	3	19
PRN	0	0	0	0	0	0	0	0
PRS	0	0	0	0	0	0	0	0
XUT	15	2	19	0	18	3	1	2
XEM	16	14	10	1	19	1	2	16
BRIL	0	0	0	0	0	0	0	0
BNT	0	0	0	0	0	0	0	0
WRLS	3	19	3	19	3	19	3	19
Note: *OPX and DCO do not apply for these countries. Press <cr> for these prompts.								
Note: The DASS/DPNSS interface to MO 1000S loss is adjusted by changing the PRI2 entry.								



VTRK Troubleshooting

Signaling Server - vtrkShow h323

Shows information about the h323 virtual trunks.

Signaling Server - vtrkShow sip

Show information about the sip virtual trunks

Call Server - LD 96

Enable monitoring for multiple D-Channels for incoming and outgoing messages:

enl mon tty

enl msgo <v dch#>

enl msgi <v dch#>

Call Server - LD 80

Trace sets and trunks:

trac <TN>

trac <customer no.> <DN>.

Synchronising NRS

On the Primary NRS, in OAM, enter:-

nrsDBSyncForce Alternate

nrsDBSyncForce Failsafe

Signaling Server - H323CallTrace ch on

Trace H323 incoming and outgoing call setup messages for selected channels or called/calling numbers from 1 to 32 digits.

Signaling Server - SIPCallTrace on

Trace SIP incoming and outgoing call setup messages for selected channels and numbers.

Signaling Server - SIPTraceLevel

Set the SIPCallTrace output to Summary or Detailed format.

Useful Commands

PDT Access

Call Server

To access PDT on the Call Server (Ctrl pdt) you must now enter a Username i.e. PDT2 before the PDT2 password. (Default U: pdt2 P: 2tdp22ler).

Signaling Server

To access PDT on the SIG Server you must now be logged into a suitable account such as PDT2 (see above)

The Default ADMIN2 account will not allow you access PDT. However you can create a Level 1 or Level 2 account with PDT2 access which you can use for PDT access.

CPPM – Clearing & Resetting Cards

To reset the CPPM boards restart the card from the installer compact Flash. To do this reset the system and type F when prompted. This will be twice on a configured system.

Call server - Answer Y to first 2 questions then select TOOLS menu

Select option b to initialise the Fix Media Device

Enter the password :- letron , when prompted

Select option a to complete the format

Sig Server – o/r to install menu then select Tools

Select option b to Initialise Fix Media device

Enter option a to complete format

Useful Commands

MGC – Clearing & Resetting

The Media Gateway Controller once configured will not respond to a c/r.

To login there are two modes ldb & oam, Local Database Mode or Operations and Maintenance

These are accessed by typing <ctrl> ldb or <ctrl> oam

To login to ldb mode you will need a pdt2 level password.

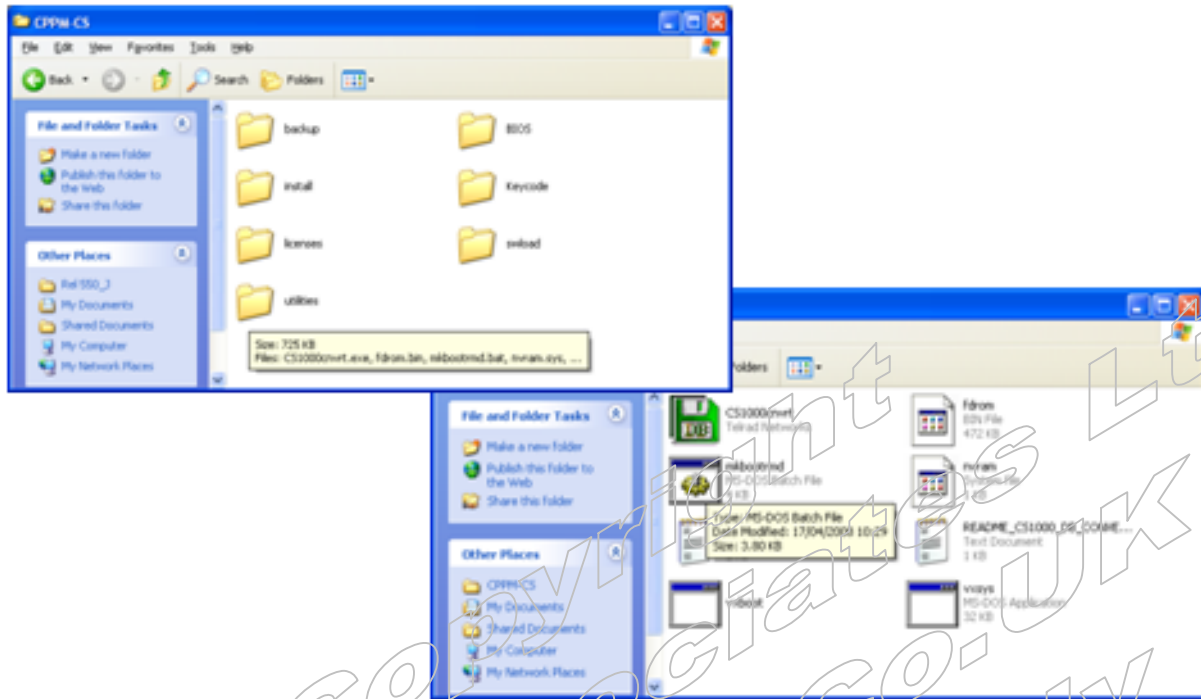
Useful MGC commands

mgcsetup – runs the configuration programme to setup the IP addresses for the card. If the card is cleared or new this runs automatically.

mgcIPClear – Clears the IP addresses from the non-volatile RAM on the card.

diskformat – Formats the Compact Flash on the MGC card. This removes any software from it downloaded from the Call Server.

Creating an Installer CF



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A bootable compact flash installer is required to install both the CPPM call server and Sig server as well as the Pentium IV call server.

To create the installer disk first locate a 512Mb compact flash card.

Locate the "Utilities" Folder in the call server software or "mkboot" folder for the Sig server install software. Once in the correct folder double click the file "mkbootind" to start the format process.

Format Bootable CF

```

C:\WINDOWS\system32\cmd.exe
WARNING!
=====
* THIS UTILITY FORMATS THE RMD
* THE DATA ON THE CARD WILL BE ERASED....!
=====
* This utility creates Bootable RMD for CS 1000M and CS 1000E,
  which can be used to boot a system with CPPIU or CPFM processors.
* This utility assumes that the drive entered is correct.
  So, please enter the correct RMD drive.
* For more information please read README_BOOTABLE_RMD.txt
=====
Please insert a RMD (Compact Flash) in drive now.
Press any key to continue . . .
Please enter the Drive letter of your RMD:e
Insert new disk for drive E:
and press ENTER when ready...

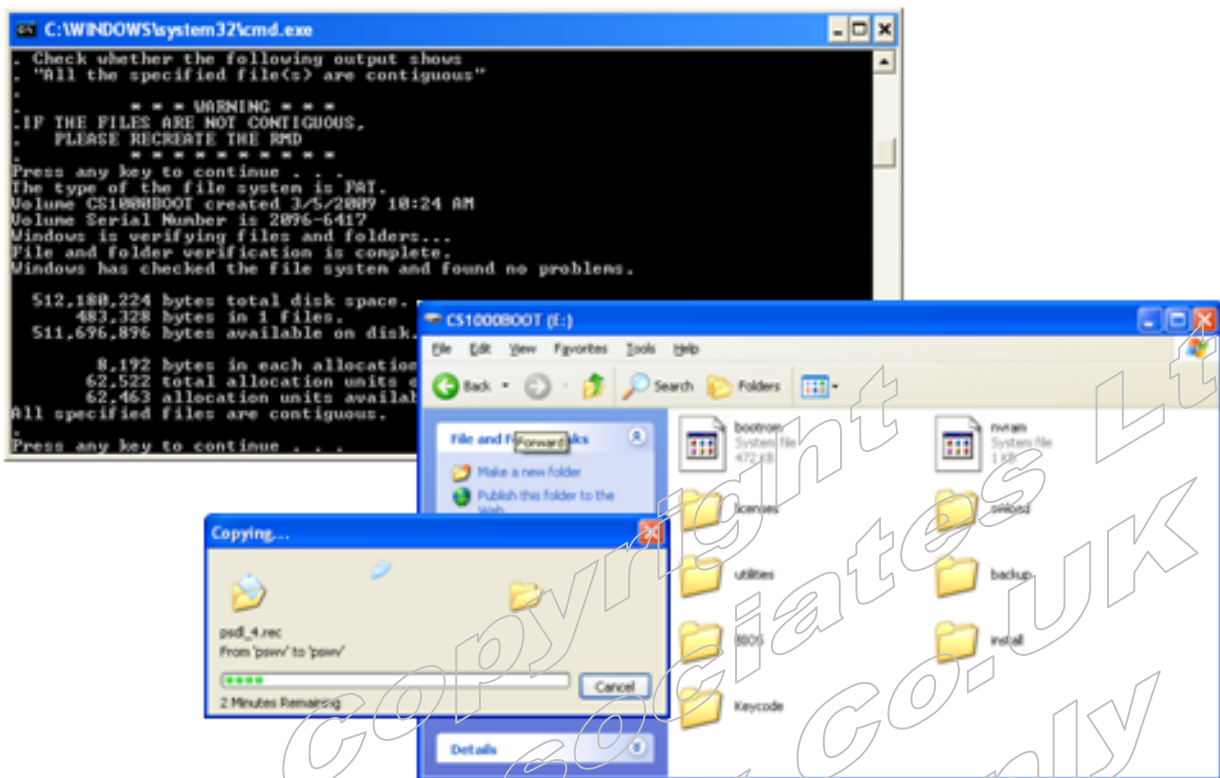
Volume Serial Number is 2896-6417
. RMD format Successful ...
. Installing Boot sector ...
. Copying files ...
  bootron.sys copied OK.
. Check whether the following output shows
  "All the specified file(s) are contiguous"
  * * * WARNING * * *
  IF THE FILES ARE NOT CONTIGUOUS,
  PLEASE RECREATE THE RMD
  * * * * *
Press any key to continue . . .
  
```

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Using the appropriate format tool for Call Server or Sig server "mkbootmd" the DOS windows above will open and you will be prompted through the formatting process.

1. Enter the letter of the Compact Flash drive.
2. Hit Enter to start the format process
3. The process will halt and ask you to check all files are contiguous.
4. Hit any key to continue

Copy Files to CF



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If all files are contiguous the Compact flash is ready to receive the installer files.

Return to the install software and copy all the folders to the Compact Flash card as shown.

A Sig server installer is then complete, however a Call Server will need a keycode file to enable installation.

Locate the appropriate Keycode file and copy it into the Keycode folder on the Compact Flash card. The card is now ready for installation of the Call Server.