EMWIS / SEMIDE International Network

Internet Fast Connection

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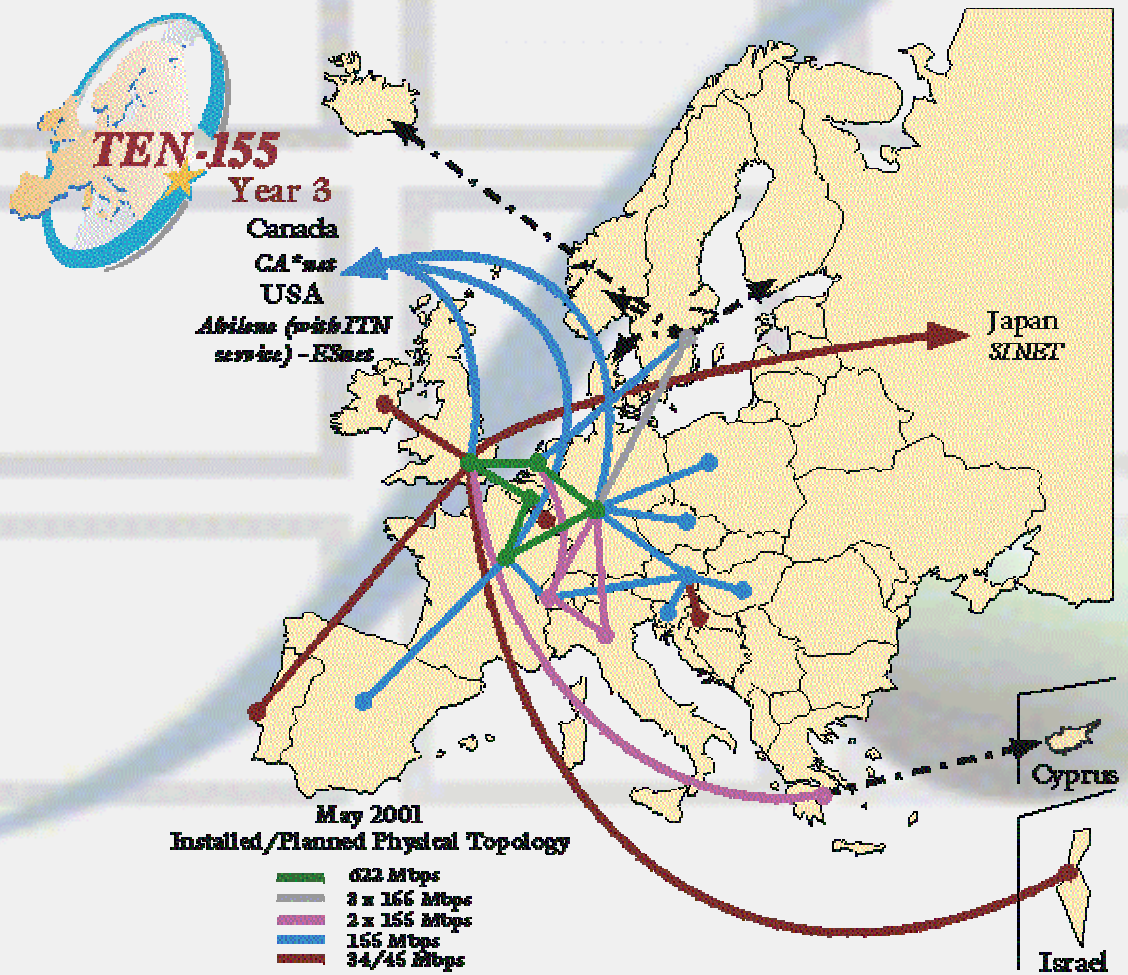
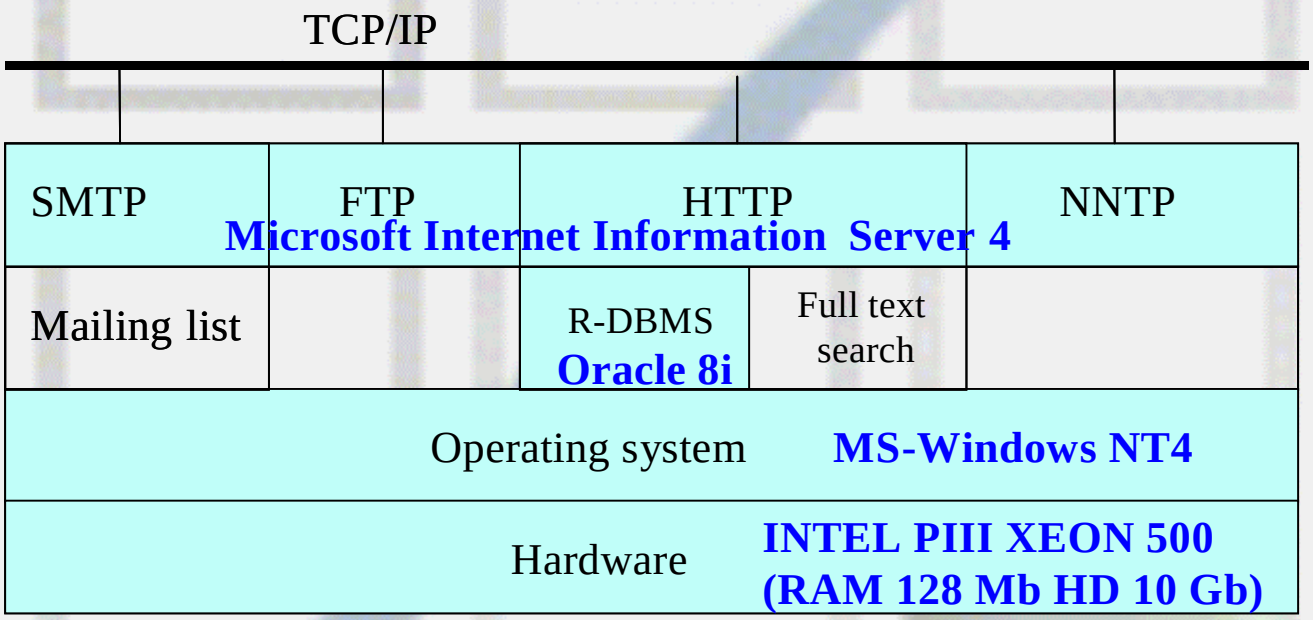
Introduction

- ✓ The reason of the presentation is to suggest a strategy of internet connection for 10 National Focal Point not having a fast connection to the European network TEN 155
- ✓ This connection will allow fast and secure information exchange with Emwis International Central Unit and other National Focal Point
- ✓ The countries needing this network connection are Algeria, Egypt, Lebanon, Morocco, Palestinian Authority, Syria, Tunisia, Jordan, Malta e Turkey (the last three countries have a lower connection priority)

Current NET 155 Connection Links



T.U. has suggest to use some products to adapt all NPF to the necessary network



Products selected by the Technical Unit and recommended to the NFP

T.U. has suggest to the NFP not directly connected to TEN-155 network to select an ISP providing ‘good’ connections (minimum 128 kbps) with the TU server

1

Sat Solution

2

Cable Connectivity Solution

Sat Solution

- ✓ Compared with today requirements of a worldwide and flexible communication and the existing telecommunications solutions, the advantages of satellite-based communication are obvious

- ✓ Currently, two thirds of telephone lines world-wide are installed in industrialized countries. These lines are available to approximately 15 per cent of world population. Consequently, it would take several decades to provide for complete world-wide coverage by terrestrial networks

- ✓ However satellite-based services may be installed everywhere in the world at short notice Thus it is possible to offer quick and reliable telecommunications solutions irrespective of existing infrastructure.

Characteristics of Satellite Communication

- ✓ **Worldwide availability** of the service: All applications are provided by one partner. No matter where a customer's business is: Antennas can be installed quickly and one operator coordinates the whole network - world-wide

- ✓ Satellite networks have a **very high flexibility**. A satellite-based hardware platform is fully scalable and the satellite network can easily be adapted to allow changes in transmission parameters. The existing technology can be developed according to the customer's individual demand

- ✓ **Rooftop-to-rooftop-connection** via satellite, which means that the antenna can be installed on-site no matter where the customer is situated. Shortly after the installation the customer can communicate world-wide, a terrestrial network is no longer needed

- ✓ The integration of **data, images, voice, fax or video** is possible. This means that all modern telecommunication solutions can be used and linked

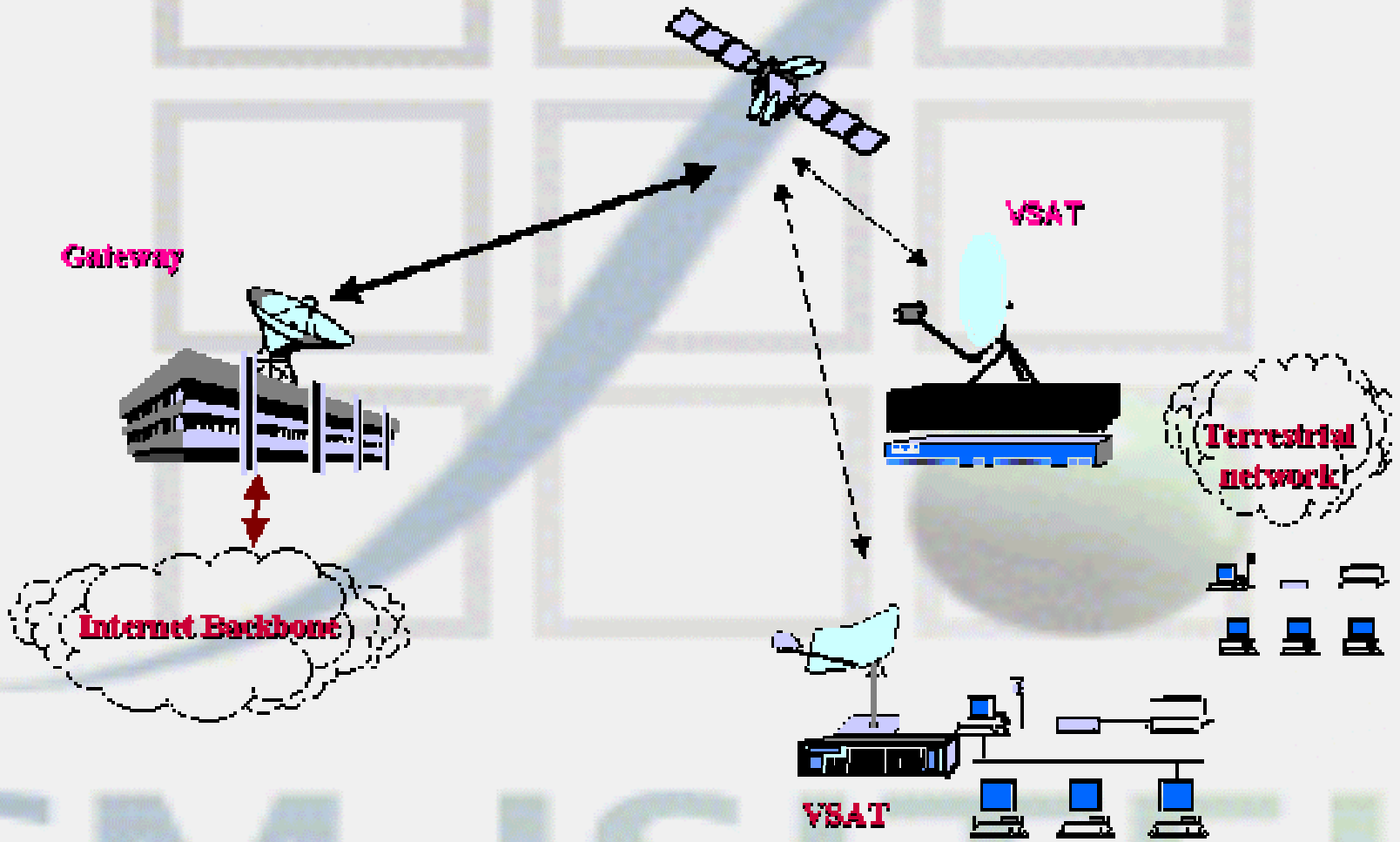
- ✓ A **24h hotline** and an **active network management** guarantee every customer a quality control regarding data transmission, a quick discovery of bottlenecks and possible defects, and a prompt field service to remove defects at short notice

- ✓ The **high (measured) availability** of satellite connections is an important advantage of satellite-based communication: 99,8% (in comparison to some terrestrial networks which show a measured availability of approximately 70%)

- ✓ The **Bit Error Rate** is **$<10^{-7}$**, which means that one bit error is possible during the transfer of 10.000.000 bits

- ✓ The **delay** is **ca. 520msec** (round trip delay)
- ✓ For companies with special requirements regarding **security in computer internetworking** and **reliability of data transfer**, satellite links constitute a useful back-up for terrestrial networks. In case of defects or outages of terrestrial links, the data is transmitted via satellite
- ✓ Last but not least: Variable bandwidth (according to the customer's needs) and a flexible bandwidth use help to **minimize the costs**

Sat General Architecture



Countries in which the system can provide turn-key service with full agreement with local government about licences for satellite transmission and VSAT installation

All costs for licences as well as local taxes will be included in local provider's contract

On site field service providers - also included in the contract - provide system installation and maintenance

The logistic & control center will provide the necessary support to customers and on site service providers:

- ✓ networkmanagement
- ✓ satellite monitoring
- ✓ on site service coordination

On demand Statistics providing Central warehouse.

The proposed service is based on a dedicated satellite slot on Eutelsat W3 located at 7°E, providing a high power coverage to both european and mediterranean basin sites.

Service including :

✓In Paris

- A central Hub based on Comstream technology, with RF station for the direct transmission on the satellite

✓In remote sites

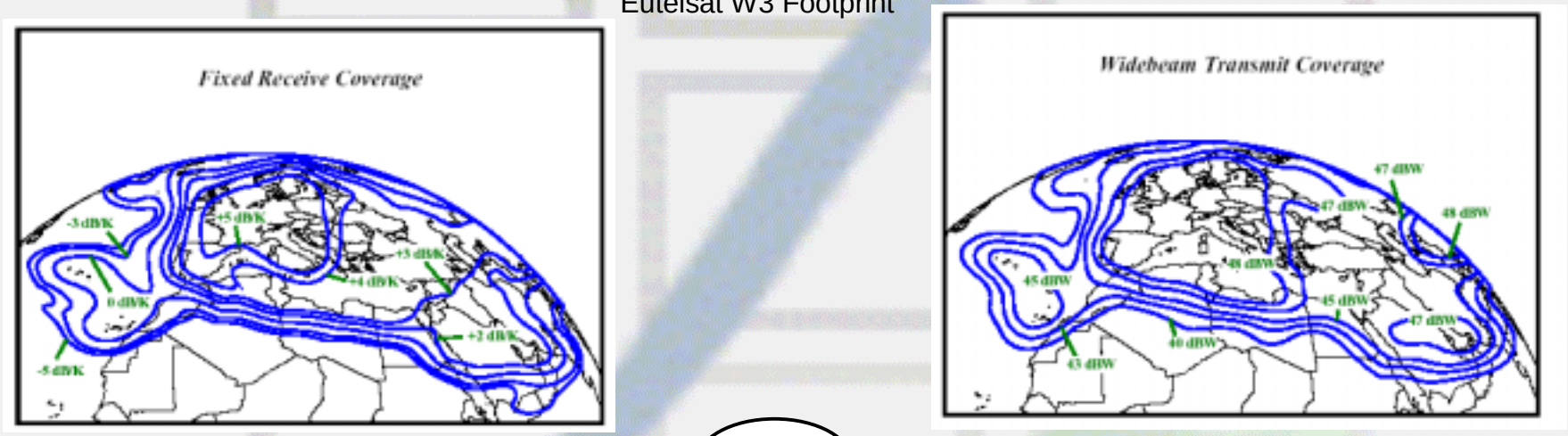
- VSAT remote stations / IP sat remote terminals
- Modem, Antenna and transmitter 2 watt

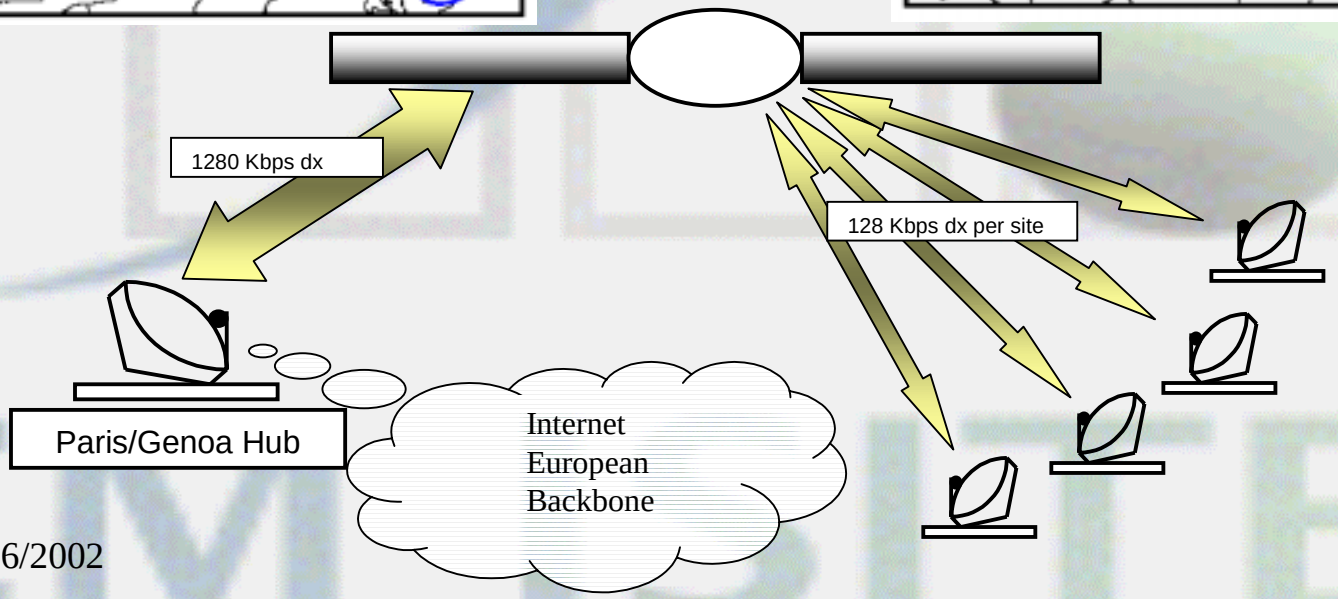
✓Space segment on Euteksat W3 for bidirectional 128 Kbps for each station (total 3.3 Mhz allocated)

✓Installation in Paris and all other sites, on site maintenance

General Scheme of the connectivity

Eutelsat W3 Footprint





The project proposes delivery and deployment of a two-way satellite network; designed to carry Internet Protocol (IP) based traffic between a central hub site and remote sites using Radyne ComStream IPSat™ terminals. The system is designed for open network standard in full compliance with all applicable industry standards from the IEC, DVB, IEEE, and MPEG technical communities. Radyne ComStream engineers have given special attention to allow scaleability of the network from ten to thousands of remote sites as network requirements grow and to provide seamless interoperability with customer applications.

Radyne ComStream recognizes that each customer has special network requirements and takes pride in system customization and on-site integration and installation services for a wide variety of applications. As part of our turnkey offering, we can provide IPTV Content Distribution products from Cisco Systems, Protocol Optimization, MPEG Encoding equipment from multiple vendors, Proxy or Caching servers from Microsoft or Cobalt Networks as examples of key applications currently supported in Radyne ComStream networks.

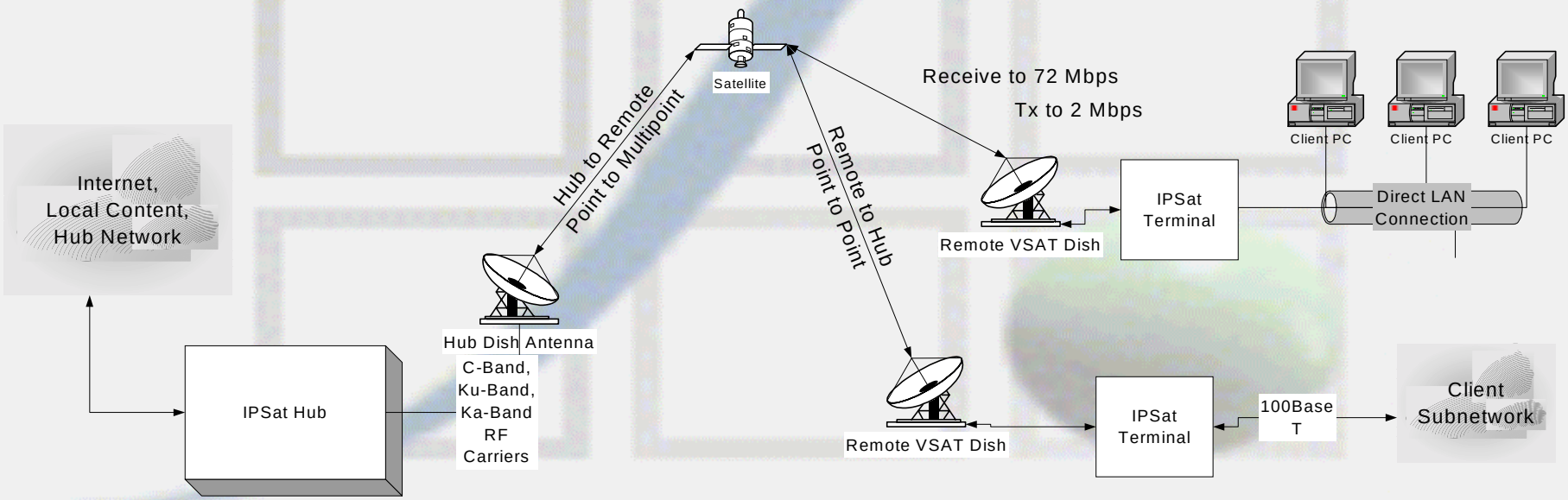
This proposal provides detailed discussions of both the hub and remote terminal designs, and specific Pricing and Delivery information. Customization of the network design around your application is available as well as on-site installation and commissioning.

System Overview

- ✓ The proposed system consists of a network hub with a single very high-speed (up to 72 Mbps) uplink feeding many remote stations, each of which includes an IPSat terminal. The IPSat provides full two-way connectivity to the hub over the satellite channel and to a local Ethernet network through a standard 10/100BaseT interface. The hub receives inbound SCPC satellite carriers from the IPSat remote terminals through a Multiple Receive Terminal (MERT), offering 12 demodulators in only 9 RU of space.

- ✓ The hub system is scalable from 1 to 72 Mbps outbound and can support virtually any number of satellite return channels. Any combination of Internet Protocol data streams, both TCP and UDP, unicast and multicast, may be carried between the hub and remote stations. This proposal includes the most basic hub configuration. Radyne ComStream can also integrate additional networking equipment and applications based on customer requirements.

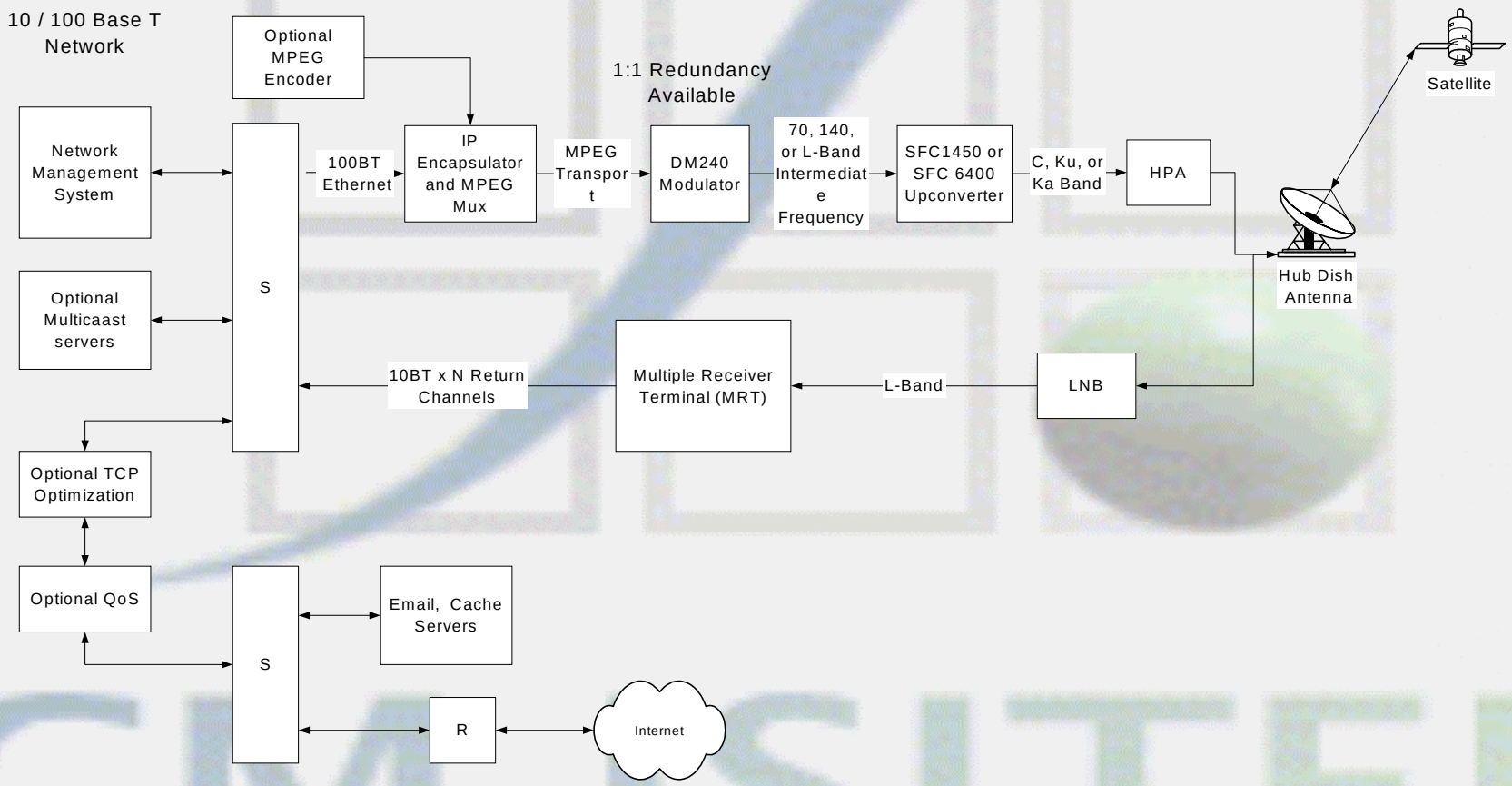
Figure 1 shows the basic system topology



Basic Network Topology

Hub System

A detailed block diagram of the Hub follows in Figure



Basic Hub Equipment

While the networking equipment used in the hub will vary greatly with the particular application of the network, the basic core of the system remains the same and includes the following:

Internet Protocol Encapsulator (IPE)

The IPE receives data from the hub IP network and encapsulates the data into a MPEG Transport stream according to the DVB Data Broadcast Specification, EN 301 192. The IPE may have up to 1000 unicast and multicast routes programmed, with subnets counting as only one route. IPE monitor and control may be through built-in Monitor and Control GUI for basic, single thread configuration. A separate monitor and control computer may be used for more complex applications, if desired.

1:1 redundancy is available using an external MPEG Multiplexer; IPE units may be configured as slaves for automatic configuration updates in redundant pairs. IPEs are sold with software controlled speed grades at 30Mbps, 80Mbps, and 155 Mbps. Users may upgrade lower rate IPEs to higher rate through software control.

The input interface to the IPE is a standard 10 BaseT / 100BaseTX Ethernet on RJ-45 connector, output interfaces include DVB SPI, ASI, M2P, RS-422, and others. Radyne ComStream sales engineers can help select the proper interface for your application, based on link speed and whether the IPE is interfaced directly to the Satellite Modulator or interfaced through a terrestrial link.

Satellite Modulator, DM-240

The DM-240 is Radyne ComStream's standard DVB compliant satellite modulator. As with the IPE the input interfaces include DVB SPI, ASI, M2P, RS-422, or others and may be directly interfaced to the IPE or through a terrestrial link. The modulator accepts the input MPEG transport stream and provides scrambling, FEC encoding, and modulation of the satellite carrier channel in accordance with the DVB specification, EN 300 421. Output interface may be 70 MHz, 140 MHz, or L-Band based on the desired RF uplink equipment. 1:1 redundancy is available using Radyne ComStream's RCS-11 switch.

C-Band or Ku-Band Upconverters, SFC-6400 or SFC-1450

The SFC line is Radyne ComStream's standard satellite upconverters suitable to interface the DM-240 output to the uplink High Power Amplifier (HPA) equipment. 1:1 redundancy is available using Radyne ComStream's RCU-101 switch.

Multiple Receiver Terminal (MRT)

The MRT is a 9 rack-unit chassis housing redundant, hot swappable AC power supplies, L-Band amplifiers and distribution, and up to 12 Single Channel per Carrier (SCPC) demodulators. The chassis includes integrated cooling fans and front panel LED display showing status of all demodulators installed. The demodulator cards are hot-swappable and will operate between 19.2kbps to 8.448Mbps, meeting the same performance specifications as our standard DBR-2000 receiver. Each demodulator includes an integrated router which provides a standard 10 BaseT Ethernet interface to the hub Ethernet network for return channel traffic from remote stations.

Optional Equipment

Based on the particular application, a network may require some additional equipment including:

1. MPEG video and audio Program Encoders, Divicom MV-20 or equivalent. IPEs may be set for “opportunistic data injection” to add data in null packets output from the Program Encoders to most efficiently use the full satellite channel bandwidth MPEG video and audio Program Encoders, Divicom MV-20 or equivalent. IPEs may be set for “opportunistic data injection” to add data in null packets output from the Program Encoders to most efficiently use the full satellite channel bandwidth.
2. TCP acceleration hardware, Mentat XH-45 or equivalent. Terminates TCP traffic on either end of the satellite link to speed TCP acknowledgements, allowing a single TCP session to consume the entire satellite channel bandwidth, if desired

3. Quality of Service (QoS) or Traffic Shaping hardware, Packeteer model 4500 or equivalent, provides control and statistics gathering of IP traffic at network, transport, or application layers. Very useful for guaranteeing Committed Information Rate (CIR) or Burst Information Rate (BIR) for service providers. Protects the network from any one user consuming inordinate amounts of channel bandwidth at the expense of other users. Also provides prioritization of Real Time Protocols (RTP) like voice over IP, streaming video or audio, etc over non-time critical applications like Email or FTP transfers
4. Basic networking equipment (routers, hubs, switches, etc.) as required
5. Application servers including Cisco Content Distribution, IPTV or equivalent multicast servers, distance learning application servers, E-Mail servers, file transfer applications, MS Exchange Server, Email servers, Web Caching applications, VoIP servers, and others

Radyne ComStream offers network design assistance for your particular application as required

Network Management

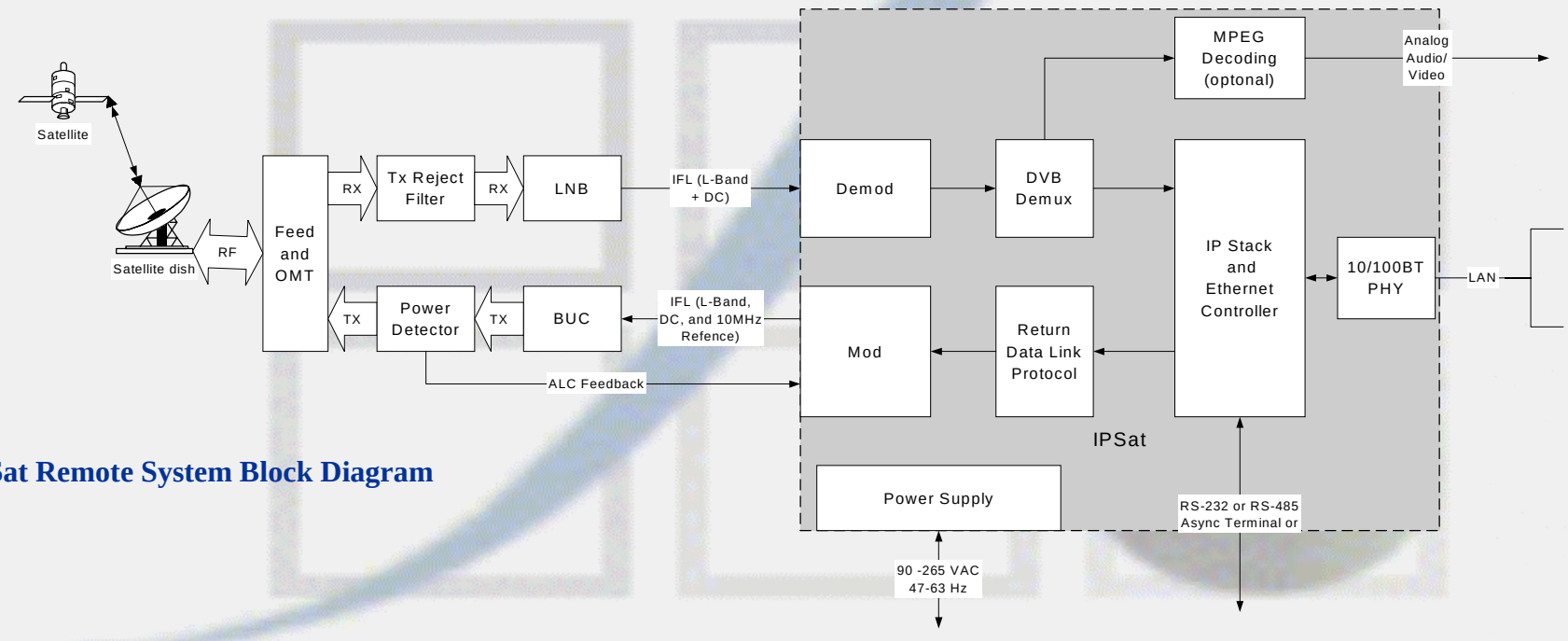
The IP Network Management System (IP NMS) is a Windows NT application that monitors and controls all Radyne ComStream hub equipment and remote stations. Hub equipment is controlled through RS-232 or RS-485 async interfaces, while remote stations are controlled through TCP/IP packets sent through the IPE to the network.

Security of the network is assured through the use of Radyne ComStream proprietary Monitor and Control protocols and dedicated Monitor and Control PIDs in the IPE. Functions the NMS can control in the remote station include:

- ✓ statistics gathering of received Eb/No, number of MPEG or IP packet sent or received in a given time period
- ✓ Satellite channel changes (frequency, data rates, etc.)
- ✓ PID filter changes to control user services at each remote station
- ✓ IP routing changes

IPSat Remote Terminal

The IPSat terminal is a combined high-speed IP Router and commercial-grade Satellite Earth Station, designed specifically for scalability and easy configuration. A block diagram of the IPSat remote system follows figure



IPSat Remote System Block Diagram

The IPSat terminal consists of Indoor and Outdoor units connected through 2 coaxial cables. A third cable for closed loop power control may be added as an option for Eutelsat or other applications requiring extremely accurate closed-loop power control

Outdoor Unit

The outdoor unit uses a standard DRO-type Low Noise Block Downconverter (LNB) to convert the received C-Band, Ku-Band, or Ka-Band carrier from the hub to an L-Band Intermediate Frequency (IF). The LNB output passes to the IPSat indoor unit through a receive (Rx) Interfacility Link (IFL) coaxial cable, usually RG-11 or equivalent, based upon the cable length of the particular installation. The IPSat also supplies power to the LNB through the Rx coaxial cable.

The IPSat transmit (Tx) IFL cable carries the L-Band transmit carrier and a high-stability 10MHz reference.The outdoor units are designed for high-performance in the most extreme environmental conditions, including arctic cold, desert heat, sand, sun, rain, hail, wind, and salt spray. Radyne ComStream also offers remote design, installation, and commissioning services if desired.

Indoor Unit

The IPSat indoor unit is a 2 rack unit chassis including DVB compliant demodulator, MPEG transport demux, IP stack processor, and Ethernet Controller functions. Innovative design of the receive path allows up to the full satellite channel bandwidth to output to the Ethernet port.

When used in conjunction with the optional MPEG program encoder or transport stream playback device at the hub, the IPSat will decode MPEG audio and video programs with high-quality digital television resolution in both PAL and NTSC output formats. The composite video is output along with two audio channels, a left and right stereo pair, for interface to a standard monitor or Audio/Video distribution system.

IP data passed to the IPSat Ethernet port is accepted and processed based on internal static routing tables, framed in HDLC packets, and passed to the satellite modulator. The modulator scrambles, FEC encodes, and modulates the data on an L-Band IF carrier for transmission to the satellite. Up to 1000 static routes may be defined in the IPSat to prevent unnecessary traffic from using precious satellite bandwidth.

Other IP level applications are supported through the use of external computers or other equipment. These applications include:

- ✓ Video conferencing
- ✓ Interactive games
- ✓ Distance Education
- ✓ Video on Demand
- ✓ Internet Access
- ✓ Standard ISP services
- ✓ Caching

CABLE CONNECTIVITY SOLUTION

At first, the greater part of companies needed an exclusive geographic network in order to interconnect two or more operative centres; today, the wide internet diffusion is replacing these geographic networks

Internet connection occurs through composite structures obtained by different technologies; some of these are standard while others are characteristic. To join these different technologies it is necessary to involve some technological aspects:

- Transmission's devices
- Communication's hardware
- Directive's schemes
- Directive's protocols

That, in their turn, present different options to consider in the planning phase because they will influence both the final performances of the connection and the relative costs.

The transmission's devices can be different in dimensions (bandwidth) between 9,6 Kbps and 44,736 Mbps and more. These transmission's devices can be developed on different structures, such as the telephone cable or optical fibres. Moreover, they differ one another in the way of providing connections. The main kind of devices are: circuit switching and packet switching. The first create a specific path between two terminals. A typical example is the telephone system. The telephones are directly and permanently connected to the telephone exchange and through this last, each telephone can establish a connection with the others. Typical examples are the leased lines, ISDN lines and S56.

The leased line is the sturdiest and most flexible system of the circuit switching devices. One of these, the 'T-Carrier' system, has different subspecies. The subspecies T-1 channels off the bandwidth of 1,544 Mbps in 24 transmission's channels; each one has a bandwidth of 64 kbps. The subspecies T-3, with a 44,736 Mbps bandwidth, can be divided into 672 different channels; each one has a bandwidth of 64 Kbps.

The ISDN (Integrated Services Digital Network) line can simultaneously transport voice and data on the same line. The ISDN line can be BRI (Basic Rate Interface) or PRI (Primari Rate Interface). The BRI – ISDN offers 144 Kbps and it is called “2B+D”. The “B” refers to the two channels (64 Kbps each) which can be unified to create a logical connection (128 Kbps). The “D” is a 16 Kbps channel used to check and activate call, closing and other service function. The PRI – ISDN is provided on a T-1 device at a theoretical transmission speed of 1,544 Mbps, usually distributed in 23 B channels (64 Kbps) and one D channel (64 Kbps). Instead of B and/or D channels it is possible to use the faster H channel (384, 1536, 1920 Kbps).

The S56 (Switched 56) line is an out-of-date technology and it is not considered in this study.

In order to encapsulate the data, that will be transported, the packet switching devices use an internal package's structure

They don't use a leased connection between two points; the local access device is not interconnected with the telecommunication manager's commutation's infrastructure

The packages are forwarded without a connection through the commercial packet switching network. Because of the absence of a easy defined path between two points, it's used a cloud to indicate this kind of network

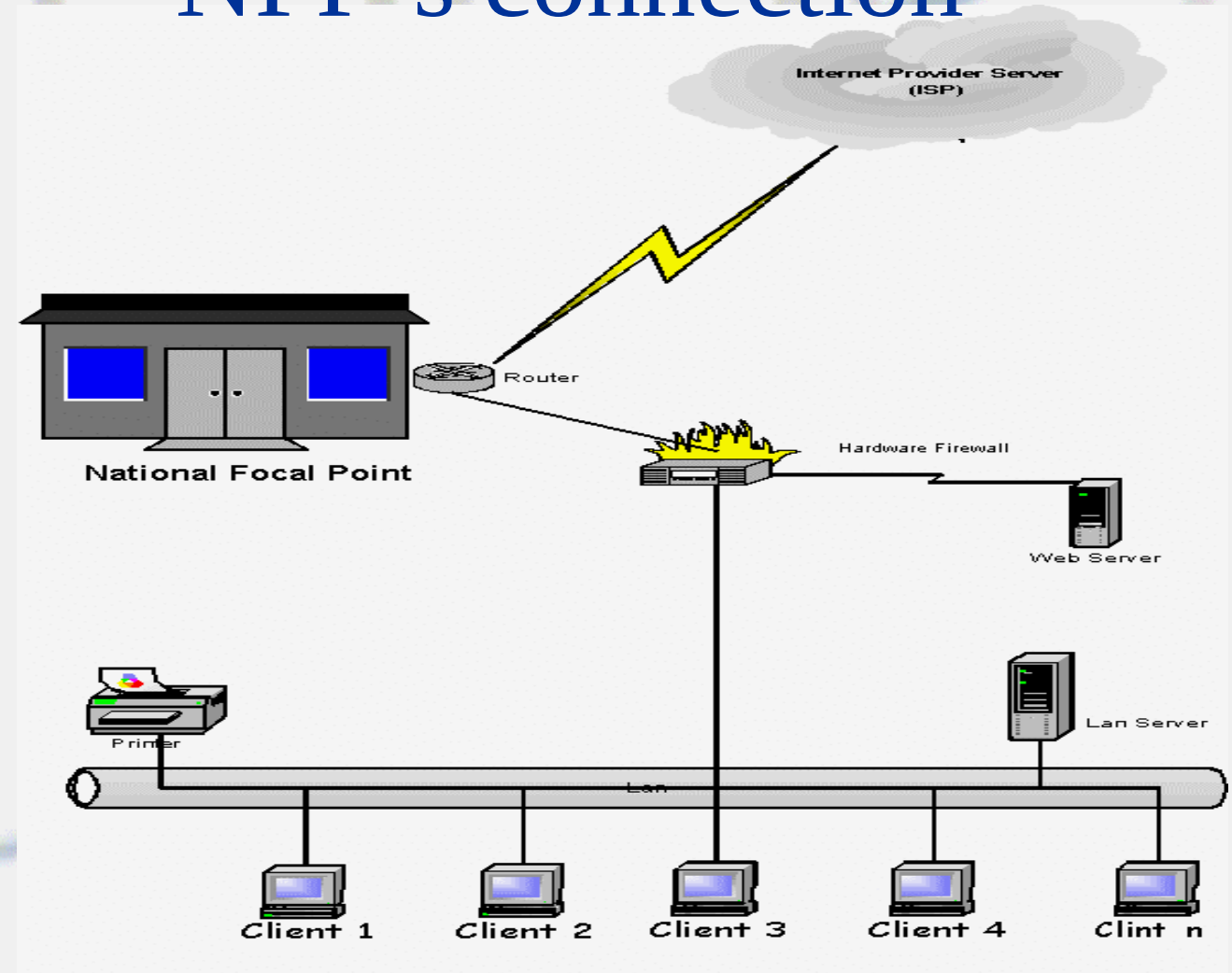
This solution has the advantage of a major flexibility because the packages can be channelled off in order to avoid damaged equipment but the commutation is more slowly than in the circuit commutation network because the path must be calculated for every single package.

An example of a packet switching network is the X.25, but as its highest speed is 56 Kbps, other technologies are becoming successful such as Frame Relay and ATM. The X.25 protocol defines the interface between the ‘point’ of a network, as a router (DTE, Dat Terminal Equipment), and a packet switching network (DCE, Data Comunications Equipment)

The network has the responsibility for transporting data to the final provider that will use the most efficient method to forward the information to the final client

Internet is a network like the X.25. It is the greatest world network, accessible by heterogeneous and independent platform. Its main characteristics are the right technological answer to allow the connection between the NFP’s considered in this study. Every single NFP can use Internet through the services offered by the local providers (ISP), such as in the following picture.

NFP's connection



The model above is made to satisfy a generic NFP's needs. It is composed by a LAN infrastructure, based on Windows 2000 or NT 4, on the star network Fast Ethernet and the TCP/IP protocol.

The following equipment is placed in a proper EDP centre where there are the power and RJ45 outlets from which the network ramifies. Particularly:

Leased Line

With 128 Kbps bandwidth provided by a local ISP, that will be accessible by means of a connection jack

Router

Connected below the leased line. It is provided by the local ISP

Firewall

Connected below the Router, it is the first protection level against undesired accesses. An appropriate model has got three gates 10Base-T Ethernet (trust, untrust and DMZ), it can be configured as a DHCP Server and it allows up to 4.000 concurrent TCP/IP sessions

Web Server

Connected to the DMZ firewall's line, it hosts the HTTP and FTP's services made available by the NFP. Its main technical characteristics are:

- Xeon 800 MHz Dual processor
- 1 GB RAM
- Controller RAID 5 on swap
- 6 HD on swap of 20 GB
- 2 lan interfaces
- DAT DRV 20/40 GB
- Sk video 8 Mb
- 2 RS232 ports, 2 LPT ports, 2 USB
- Monitor SVGA
- External uninterruptible power supply (UPS)

HUB Switch

Connected to the firewall's intranet line, it allows to link the different network cable's branches by means of the RJ45 100Base-TX port

LAN Server

Connected below the firewall, it centralizes all the network's services. Its main technical characteristics are:

- Pentium IV 1.6 GHz Processor
- 1 GB RAM
- Controller RAID 5 on swap
- 6 HD on swap of 20 GB
- 2 lan interfaces
- CD ROM reader and writer
- DAT DRV 20/40 GB
- Sk video 32 Mb
- 2 RS232 ports, 2 LPT ports, 2 USB
- Monitor SVGA
- External uninterruptible power supply (UPS) (suggested)

The work stations are characterized by:

PC Client

With the following technical characteristics:

- Pentium III 1 GHz Processor
- 256 MB RAM
- 1 HD 20 GB
- 1 lan interface
- Sk video 32 Mb
- 1 RS232 port, 1 LPT port, 2 USB
- Monitor SVGA

END

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