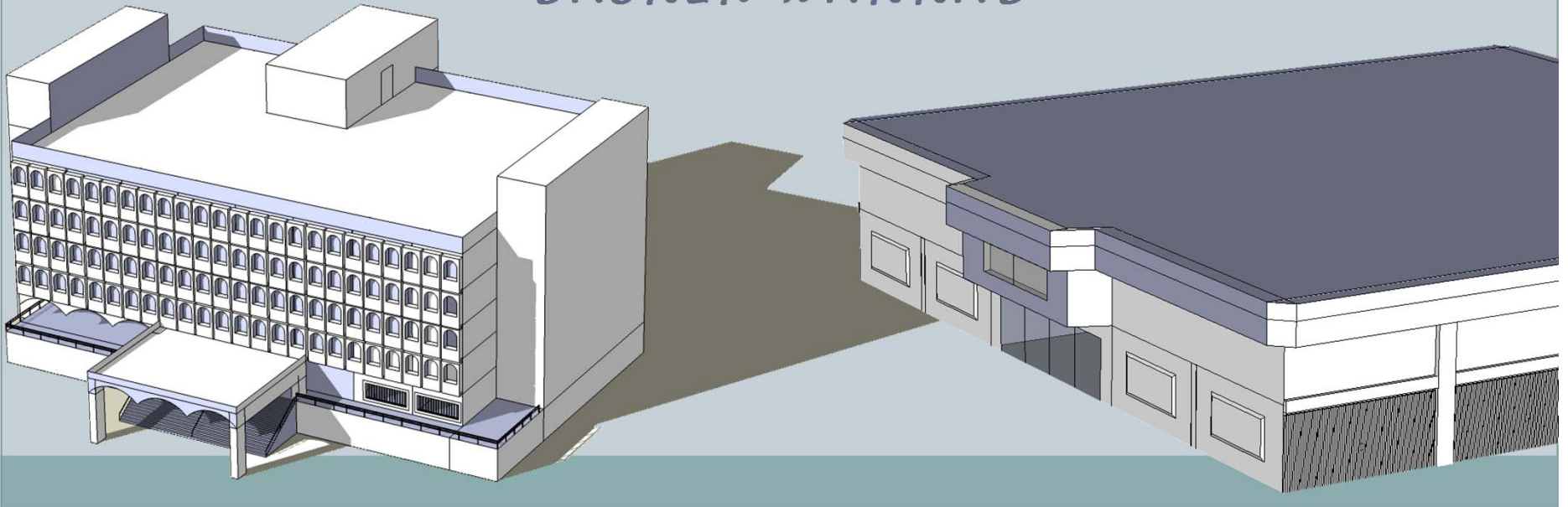# ITI Network Infrastructure
&
ITI to Dekouene Wireless Bridge

ABDULLAH ABDULLAH

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ITI NETWORK INFRASTRUCTURE

- ❖ **TOPOLOGIES &CABLING**

- ❖ **NETWORK TECHNOLOGIES AND DEVICES**

- ❖ **ONSITE INFRASTRUCTURE PLANNING**

- ❖ **LOGICAL NETWORK DESIGN**

- ❖ **SERVERS**

- ❖ **NETWORK SECURITY PLANNING**

Topologies & Cables

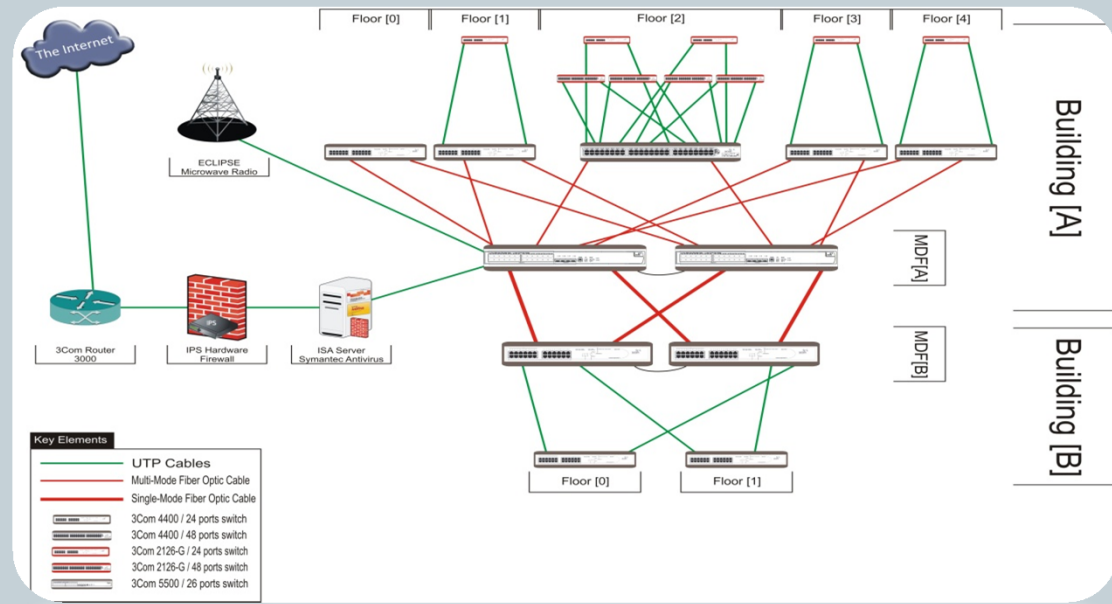**Topologies:**

- Bus
- Star
- Tree
- Mesh
- Ring

Cables:

- Twisted pair cables: UTP,STP
- Coaxial cable
- Optical fiber cables: multi-mode fiber, single-mode fiber

Topology used *PARTIAL MESH*

So what is partial mesh??

Partial mesh is a topology consists of two parts one of them is a full mesh scheme and the other part is a different topology, In our project we choose the star topology.
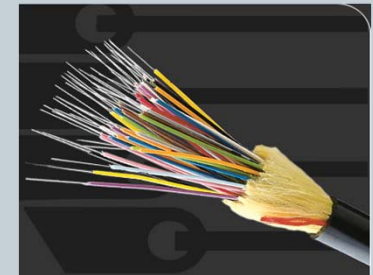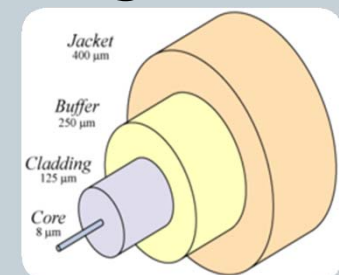
What about cabling??

- *Cabling used in the **Backbone** layer:*

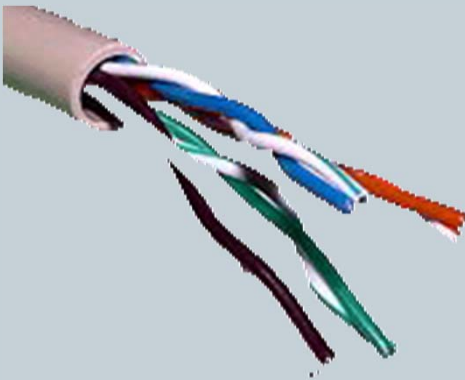 ➤ **Multimode Fiber** 62.5/125 micron code/cladding, enhanced grade, graded index glass fiber.

  ➤ **Single Mode Fiber** 8.3/125 micron code/cladding, enhanced grade, graded index glass fiber.

What about cabling??

- ### *Cabling used in the Horizontal layer:*
  - **Unshielded Twisted Pair (UTP)** cable – 100**Ohms** (+ - 15% at 1MHz to 100Mhz)
  - **Shielded Twisted Pair (STP)** cable – 100**Ohms** (+ - 15% at 1MHz to 100MHz)

What about the cabling standards??

- **Horizontal Cabling Standards:** Horizontal cabling must apply a certain length standards that were based upon the capabilities of the cables and their positions as shown in the following figure.and since our network shall be based on a **Star** topology.

.
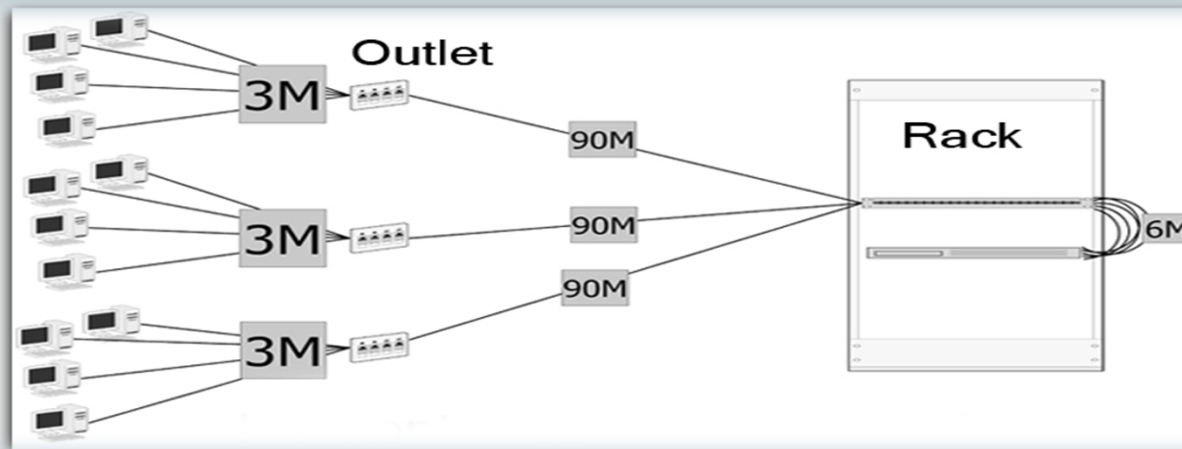
Network Technologies used

- **Link aggregation**: link aggregation is bonding together 2 or more data channels, in order to appear as a single, higher-bandwidth logical link; they provide redundancy and fault tolerance and it is also used to improve access to public networks by aggregation links or digital lines.
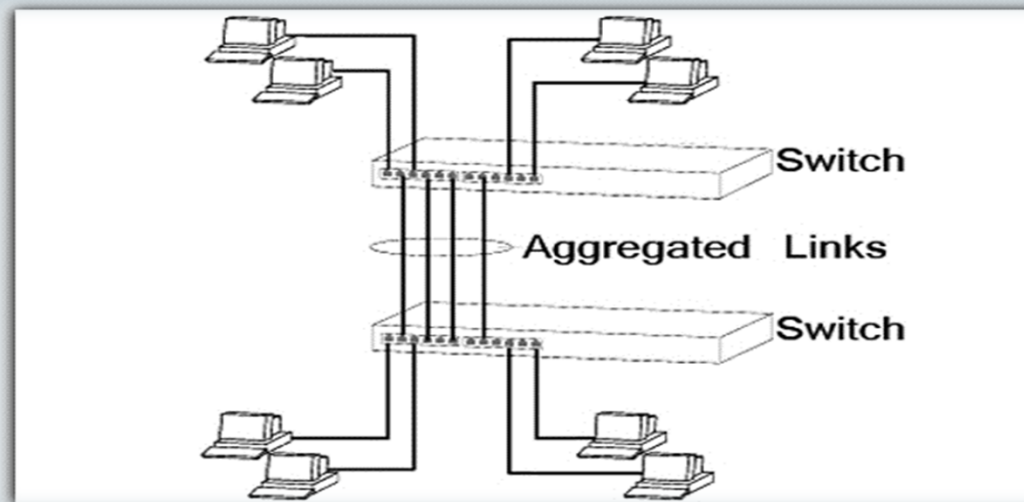
3com provide us XRN stacking technology

- **XRN stacking:** 3com provided us with *xrn stacking* technology, which beside link aggregation, it also enables multiple interconnected gigabit switches to behave as a single management switching entity, across layer 2 and 3 acting together to form a distributed fabric, and it consists of 4 main functions:

- ✓ *Distributed Device Management (DDM)*
- ✓ *Distributed Link Aggregations (DLA)*
- ✓ *Distributed Resilient Routing (DRR)*
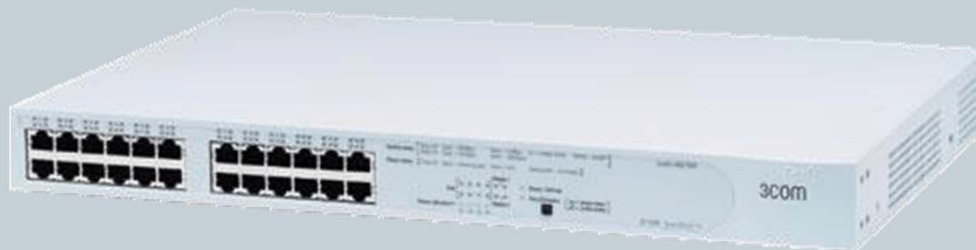
Network devices used

- **Core layer:**

  3com switch 5500-EI (premium stackable switches):

- **Distribution layer:**

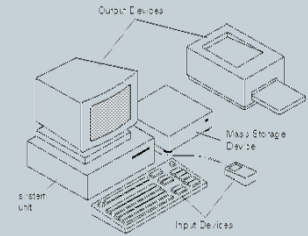 *3com super-stack 3 switch 4400*

Network devices used

- **Access layer:**

All the pc's are considered as access

Layer and switches used in the labs like

3Com Baseline Switch 2126-G 24-Port

- **Internet connection hardware:**

since we're using a HDSL, which is equivalent to 1024 kbit/sec of download and 512 kbit/sec of upload, we used a *3com router 3000 for DSl and Ethernet*

Network devices used

- **Server rooms:**

- ✓ Linked to the MDF by a
  > *3com gigabit switch 8*

- ✓ *Enables connection t 1000Mbps, 100 Mbps and Mbps*
- ✓ *3com gigabit switch 8 finds the fastest connection speed and automatically adjust to speed of the networking devices*

Telecommunication rooms

- **IDF –Intermediate Distribution Frame:**

  ✓ A frame that cross-connects the user cable media to individual user line circuits.

  ✓ Are placed in the midway of each floor.

  ✓ *3com superstack 3 switch 4400.*

- **MDF-main Distribuation Frame:**

  ✓ Is a distribution frame is connected to the external trunk cables from one side a and to the subscriber line from the other side.

  ✓ Are placed in the base floor of each building.

  ✓ *3com switch 5500-EI (premium stackable switches).*

Onsite Infrastructure planning

- ***Onsite Infra-structure planning:*** is the way the PC's , switches , cables and their lengths, racks (wall mounted and tower), outlets, raceways, and power supplies USB (650 VA,750 VA, 1000 VA) are distributed according to the rooms in both facilities .
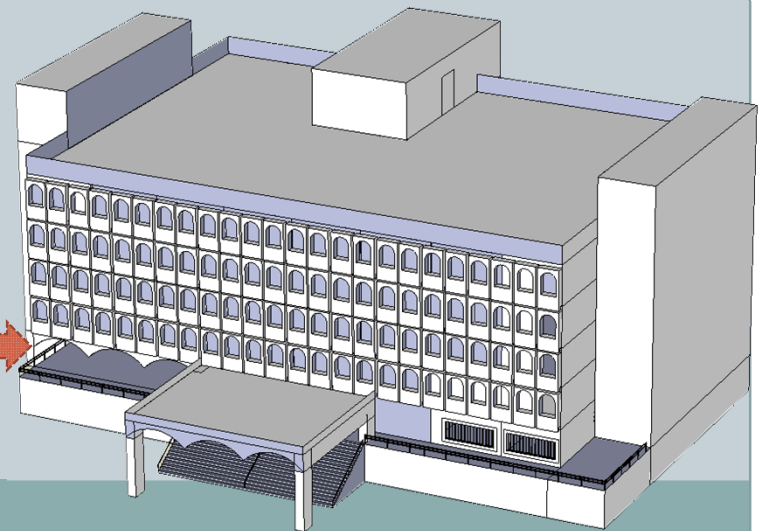
Onsite Infrastructure planning

- # Building [A] academic:
  - ## Floor 0:
    - ✓ 3Com® Wireless 8760 Dual-Radio 11a/b/g PoE Access Point
    - ✓ 3Com® 8dBi Dual-Band Omni Antenna
    - ✓ **17** PC spread over **10 rooms**
    - ✓ **584** m UTP cable
    - ✓ **1** super-stack 4400 24 ports
    - ✓ **2** 5500 switches
    - ✓ **2** UTP patch panel
    - ✓ **1** Fiber optic **8** ports
    - ✓ **1** Fiber optic **24** ports
    - ✓ **1** 650VA power supply
    - ✓ **2** 750VA power supply
    - ✓ **5** 1000VA power supply
    - ✓ **2** tower racks
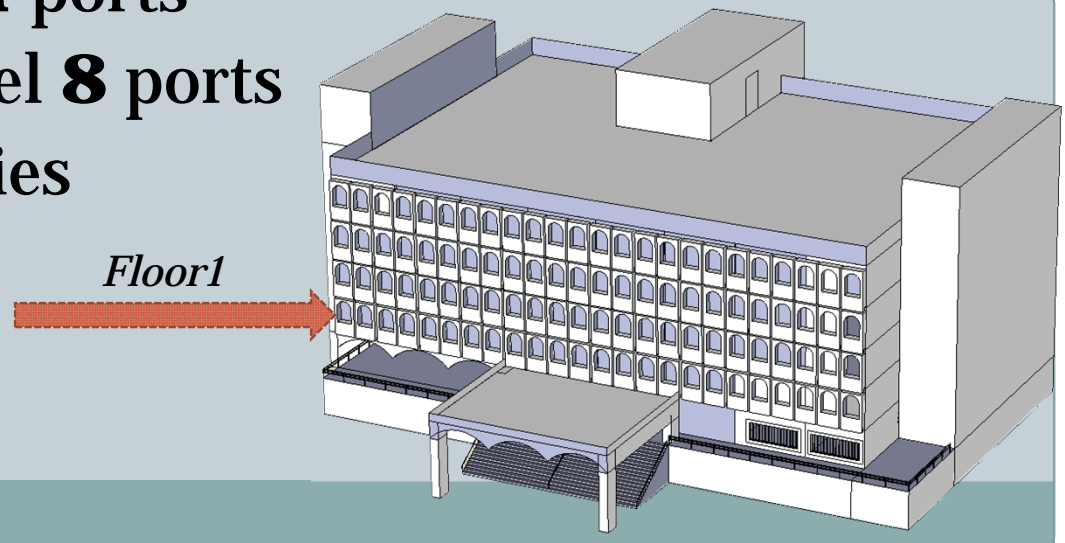   - ✓ **1** wall mounted rack

Floor 0

Onsite Infrastructure planning

- **Building [A] academic:**
- **Floor 1:**
- ✓ **31** PC spread over **13 rooms** and **1 lab**
- ✓ **616** m UTP cable
- ✓ **2** super-stack 4400 **24** ports
- ✓ **2** UTP patch panels **24** ports
- ✓ **1** fiber optic patch panel **8** ports
- ✓ **2** 650 VA power supplies
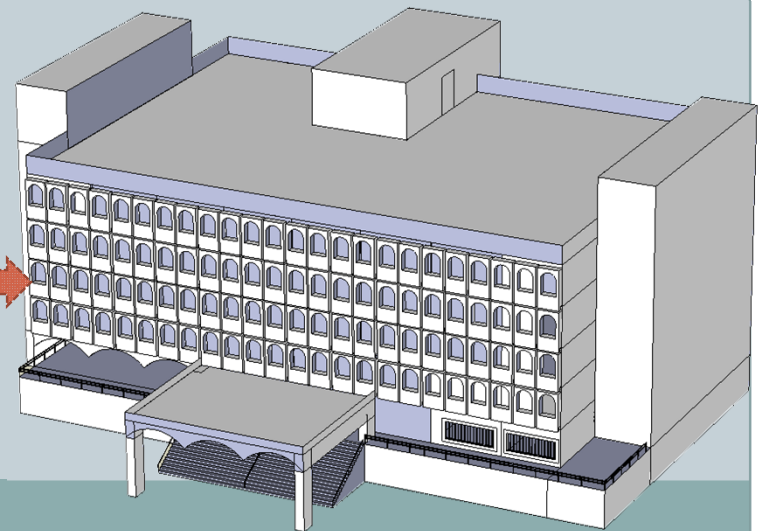- ✓ **1** tower racks
- ✓ **1** wall mounted racks

Floor1

Onsite Infrastructure planning

- **Building [A] academic:**
- **Floor 2:**
- ✓ **134** PC spread over **9 rooms** and **6 labs**
- ✓ **1708** m UTP cable
- ✓ **2** Switch 4400 24 ports
- ✓ **6** switch 4400 48 ports
- ✓ **2** UTP patch panel 24 ports
- ✓ **5** UTP patch panel 48 ports
- ✓ **1** Fiber optic patch panel
- ✓ **8** 650VA power supply
- ✓ **1** tower rack
- ✓ **6** wall mounted racks

Floor2
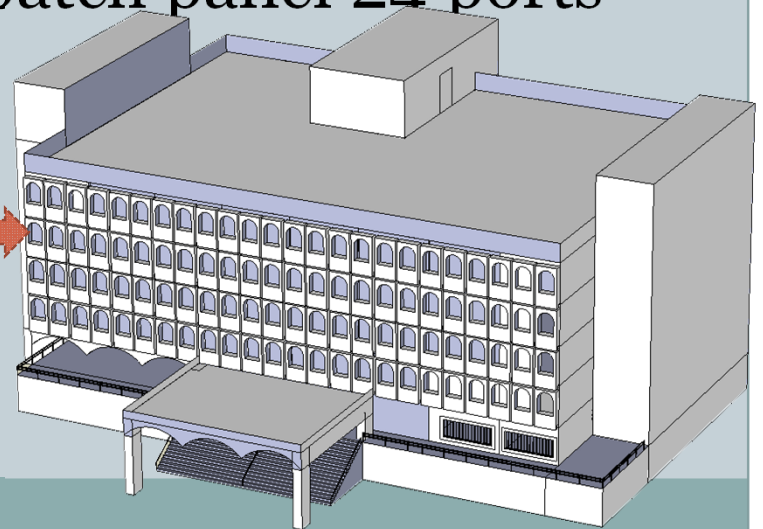
Onsite Infrastructure planning

- **Building [A] academic:**
- **Floor 3:**
  - ✓ **19** PC spread over **12 rooms**
  - ✓ **414** m UTP cable
  - ✓ **2** switch 4400 24 ports
  - ✓ **2** UTP patch panels1 fiber optic patch panel 24 ports
  - ✓ **1** fiber optic patch panel 8 ports
  - ✓ **2** 650 VA power supply
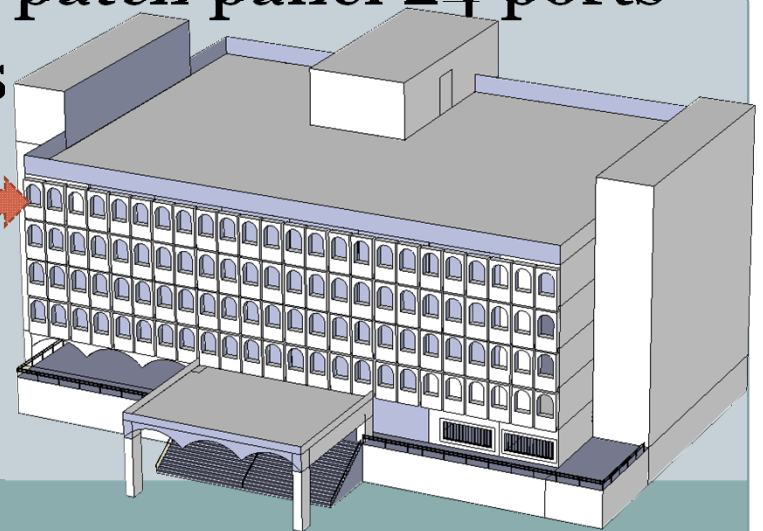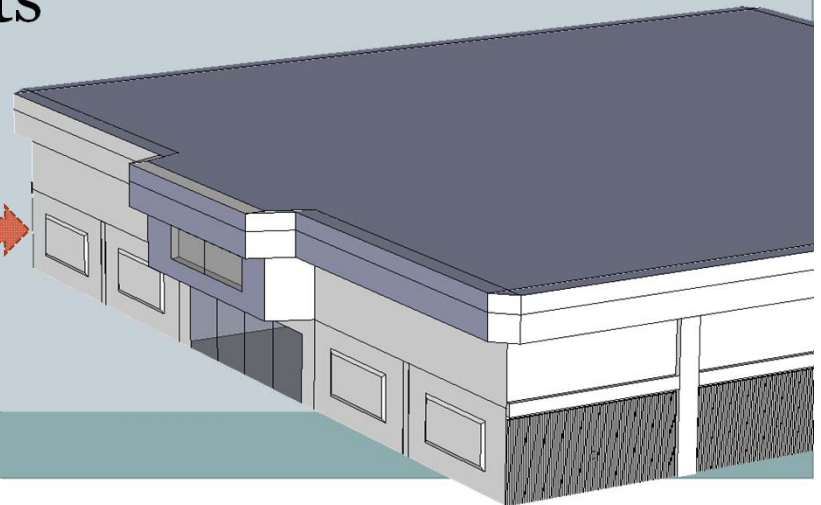 - ✓ **1** tower rack
  - ✓ **1** wall mounted rack

Floor3

Onsite Infrastructure planning

- **Building [A] academic:**
- **Floor 4:**
- ✓ **34** PC spread over **14 rooms** and **1 lab**
- ✓ **563** m UTP cable
- ✓ **2** switch 4400 24 ports
- ✓ **2** UTP patch panels1 fiber optic patch panel 24 ports
- ✓ **1** fiber optic patch panel 8 ports
- ✓ **2** 650 VA power supply
- ✓ **1** tower rack
- ✓ **1** wall mounted rack

Floor4

Onsite Infrastructure planning

- **Building [B] industrial:**
- **Floor 0:**
  - ✓ **20** PC spread over **10 rooms**
  - ✓ **344** m STP cable
  - ✓ **2** super-stack 4400 24 ports
  - ✓ **2** UTP patch panels 24 ports
  - ✓ **2** fiber optic patch panel 8 ports
  - ✓ **1** 650 VA power supplies
  - ✓ **1** 750 VA power supply
  - ✓ **2** tower racks

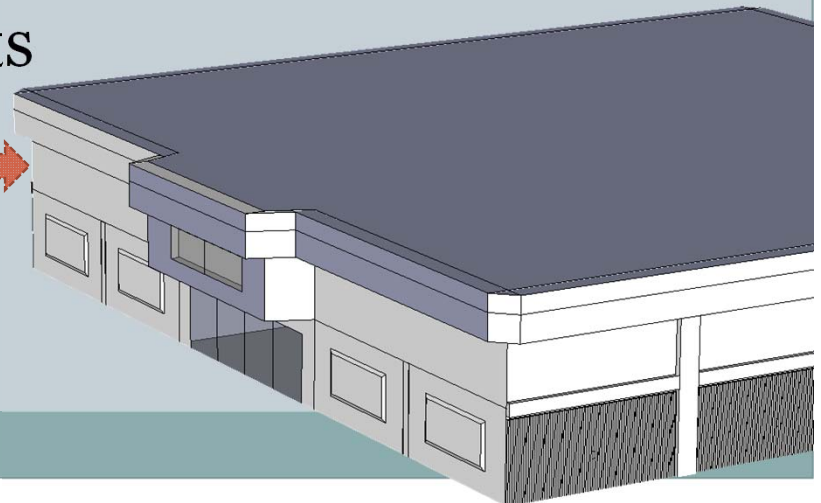*Floor 0*

Onsite Infrastructure planning

- **Building [B] industrial:**
- **Floor 1:**
- ✓ **11** PC spread over **11 rooms**
- ✓ **229** m UTP cable
- ✓ **1** switch 4400 24 ports
- ✓ **1** UTP patch panels1 fiber optic patch panel 24 ports
- ✓ **1** fiber optic patch panel 8 ports
- ✓ **1** 650 VA power supply
- ✓ **1** tower rack

Floor1

Onsite Infrastructure planning

- **_Overall measurements:_**
- Single-mode fiber cable: **139** m
- Multi-mode fiber cable:**74** m
- Wireless to MDF: **130** m UTP cable
- Outlet to PC's:
- ✓ **377** m UTP cable
- ✓ **30** m STP cable
- Patch panels to switches:
- ✓ **251** m UTP cable
- ✓ **20** m STP cable
- Raceyways:
- ✓ **680** m for UTP cables
- ✓ **140** m for fiber optics cable

Total:

- UTP cables:
- ❖ **4551.5** m + 10%= approximately **5000** m

- STP cables:
- ❖ **394 m** + 10%= approximately **430** m

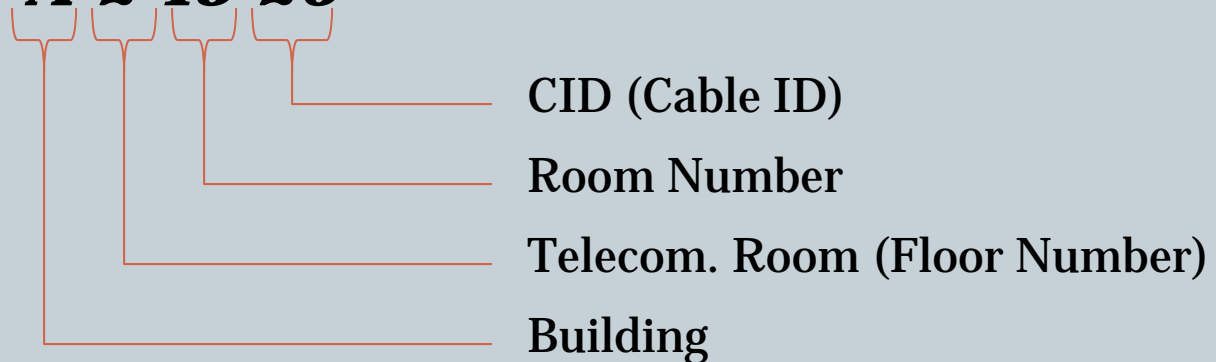# Onsite Infrastructure planning

Labeling: the labeling must be in a 6-9 inches far from the ends of the cable, and must be machines printed, and the labeling will be in the following form:

Building name-floor number-room number-cable ID

Example: **A-2-13-26**

CID (Cable ID)

Room Number

Telecom. Room (Floor Number)

Building

Logical network design

- IP Addressing : our IP addressing is based on class B since we have 271 nodes, Using 3 subnets the IP are configured to the nodes as shown in the table below:

Device	IP
DSL Router	172.16.32.2
ISA Server	172.16.32.1
Other Servers	*From* 172.16.64.1 *to* 172.16.64.10
Wireless Radio	172.16.64.11
Others	*From* 172.16.95.1 *to* 172.16.127.254

Servers

- Servers are placed in the base floor of the academic building [A] , and it consists of 5 servers, each server is a primary server for one task and a secondary server for another task...in that way if a server is down secondary will be activated, KVM switch is connected to all the servers, thus only one keyboard, mouse, and monitor is used by switching the button specified for each server.

Servers

- **Server [1]:**
  - Domain Controller – **Primary**
  - DNS (Domain Name System) Server – **Secondary**
- **Server [2]:**
  - Dynamic Host Configuration Protocol (DHCP) – **Primary**
- **Server [3]:**
  - Internet Security and Acceleration Server (ISA) – **Primary**
- **Server [4]:**
  - Data Server - **Primary**
  - Domain Controller – **Bridgehead Server**
- **Server [5]:**
  - Local Web-Server – **Primary**
  - Data Server Backup – **Secondary**

Servers

- *Windows Server 2008*: Windows Server 2008 is the most advanced Windows Server operating system yet, designed to power the next-generation of networks, applications, and Web services. With Windows Server 2008 you can develop, deliver, and manage

  rich user experiences and applications,

  provide a highly secure network

  infrastructure, and increase

  technological efficiency and value

  within your organization.

Network Security Planning

- Our Internet security plan is a scheme consists of three levels:

1. **Hardware Firewall:** 3com TippingPoint intrusion prevention system IPS
2. **Software Firewall:** ISA - Internet Security & Acceleration Server 2006
3. **Antivirus:** Symantec Antivirus Corporate Edition version 10.2
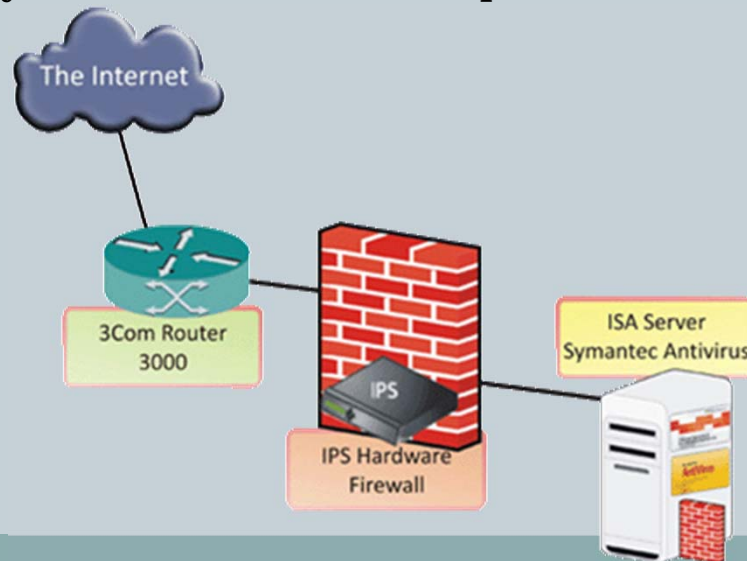
With the **TippingPoint Intrusion Prevention System** operating in-line in the network, malicious and unwanted traffic is blocked, while good traffic passes unimpeded.

Internet security & acceleration server 2006

- ISA Server provides the two basic services of an enterprise firewall and a Web proxy/cache server.
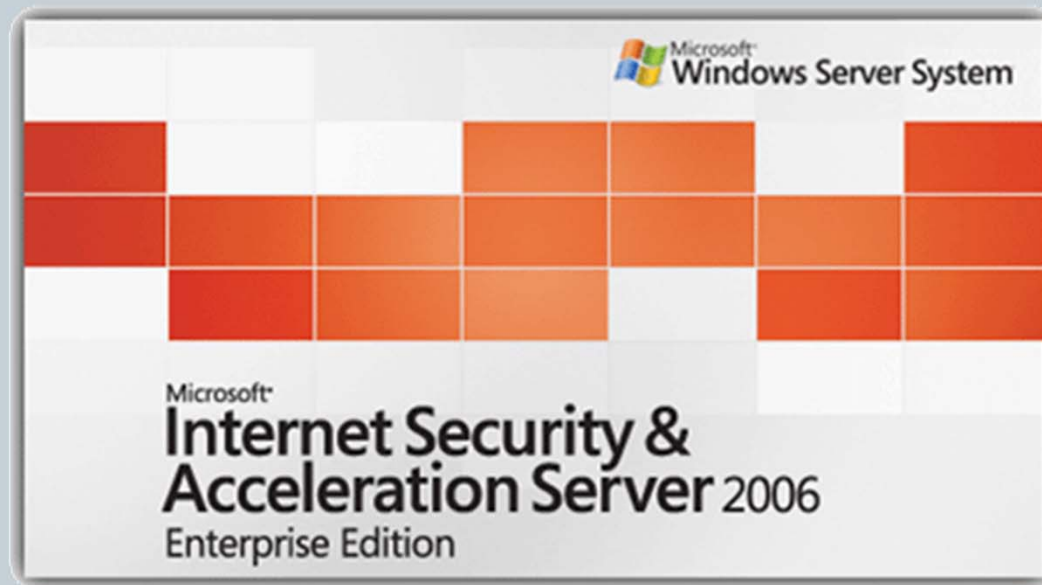
Symantec antivirus corporate edition 10.2

- Provides real-time virus and spyware protection for workstations and network servers to enable enterprise-wide system uptime.

WIRELESS BRIDGING

- ❖ **WHY WIRELESS BRIDGING??**
- ❖ **PROGRAMS USED FOR LINK PLANNING**
- ❖ **MICROWAVE LINK MIRROR**
- ❖ **HARDWARE USED FOR WIRELESS BRIDGING**
- ❖ **RADIO CONFIGURATIONS**
- ❖ **ANTENNAS USED**
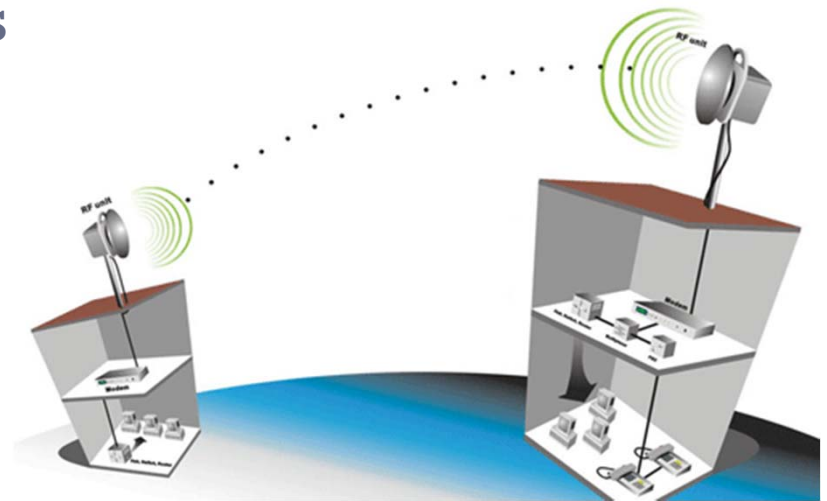
WHY WIRELESS BRIDGING??

- Fast exchange of data between I.T.I. Bir Hasan, and the General Administration of Technical Education.

- Information access at **any** desired moment.

- Best available way to **link** the two sites.

- Reliability and availability control.

Programs used for link planning

- Wireless bridge link calculations and planning was supported by 3 main program helped us retrieve almost exactly calculations of availability and reliability of the link.

1. Google Earth.
2. Harris StartLink 3.0
3. ICS Telecom.

Programs used for link planning

- As a first step, the two sites were implemented on maps using the coordinates retrieved from Google Earth software.
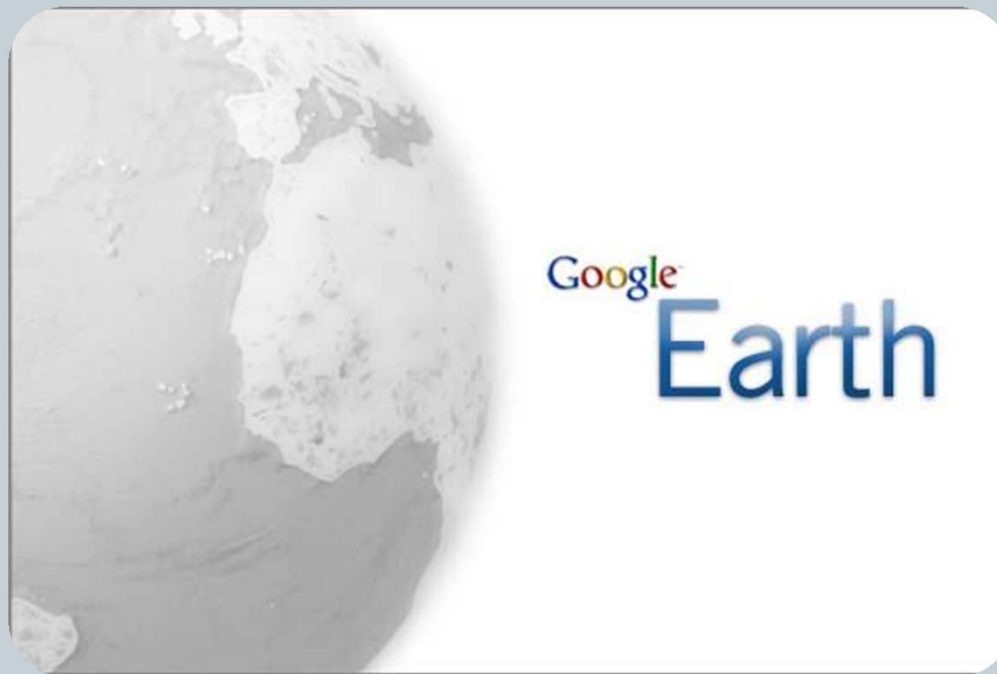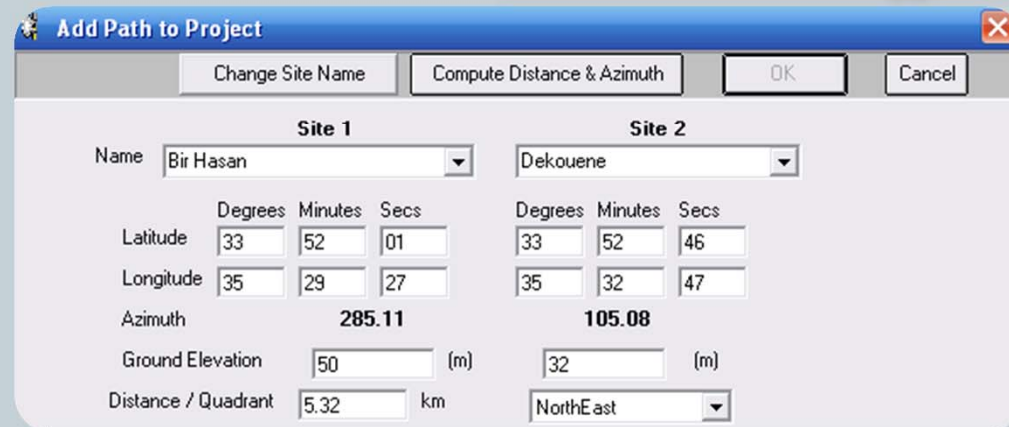
Programs used for link planning

- ***STARLINK 3.0***

❑ StarLink determines the distance and between the two sites upon giving it dimensions of the sites and Chooses the best way.

Programs used for link planning

- **Star link 3.0** – After providing it with our link parameters such as radio, antenna, frequency, feeder and climate related data, it calculates the gains and losses in addition to the path reliability and availability per year.
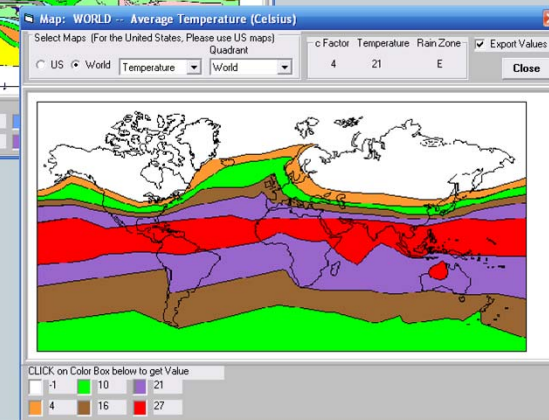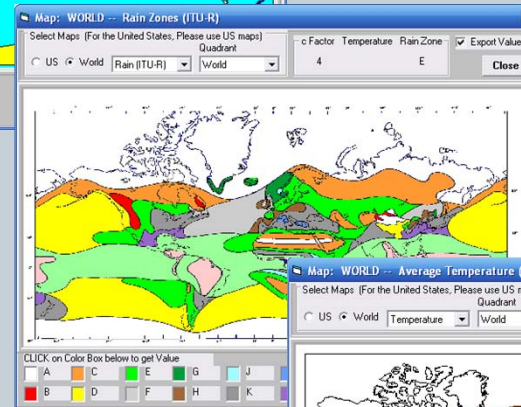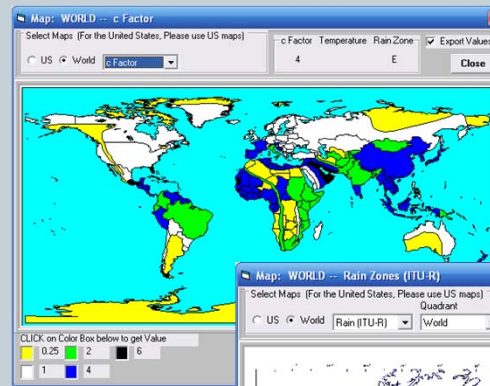
Programs used for link planning

- And also it calculates the climate factors like:

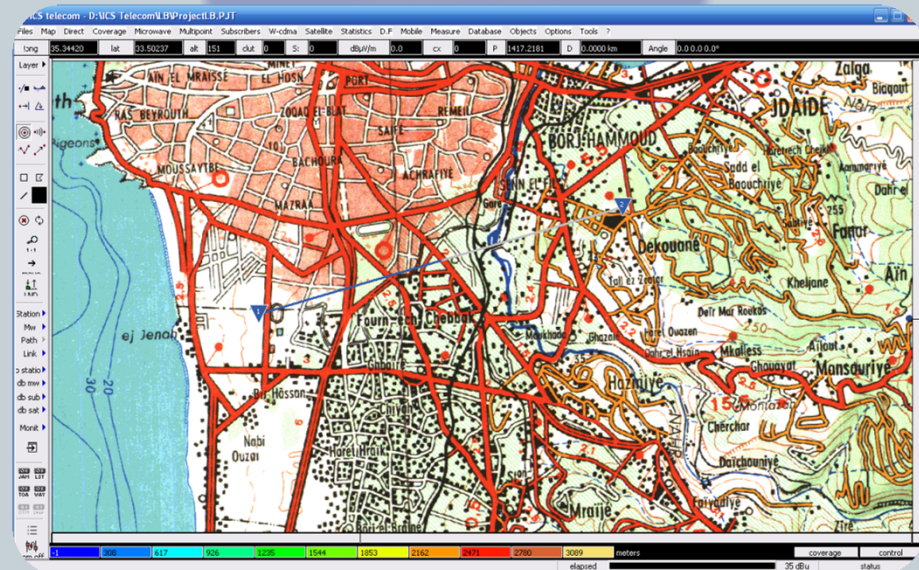➤ c-factor

➤ Rain zone

➤ Temperature

# Programs used for link planning

- ICS Telecom provide us the real physical path of our microwave link
- It also determines the coordinates for wireless mirror, if needed , to achieve a 100% line of sight link

Problem encountered!!!

- Since that Dekouene is lower altitude than Bir Hassan, implementing a line of sight was impossible
- Back-to-Back antenna Microwave Mirror was the solution.
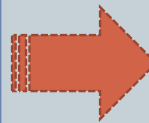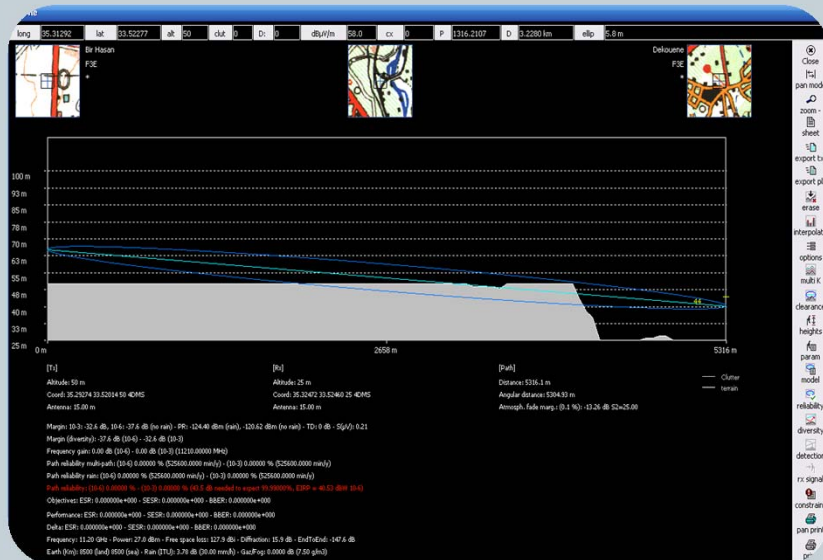
What is a Microwave link mirror??

- Mirror was placed on coordinates x(33/52/35.43) y(35/32/13.49) in SinnEl-Feel.

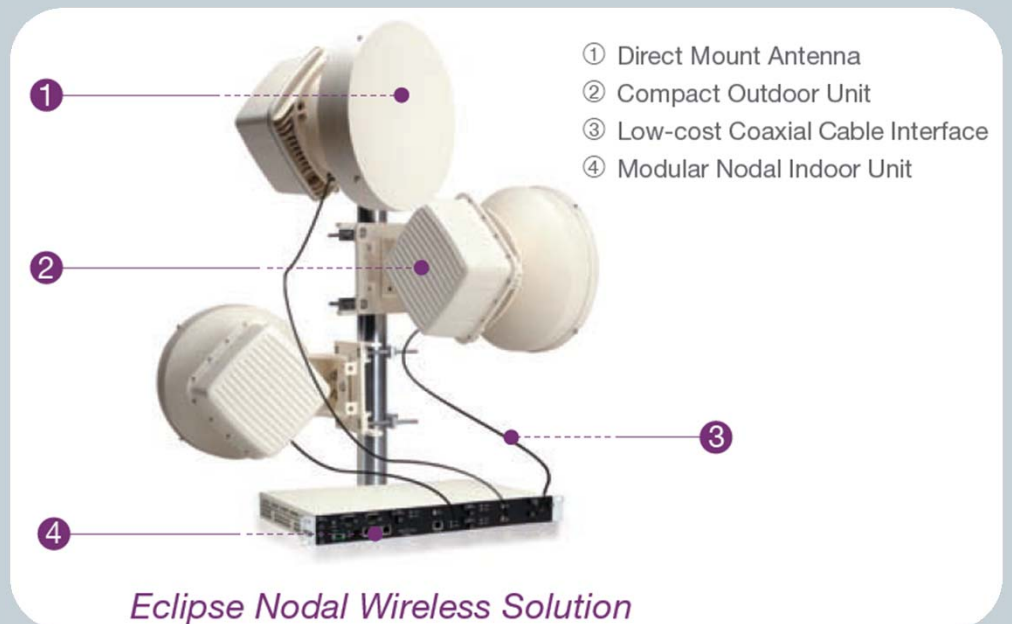- Radio choosen for mirror is a small radio from Harris Systems called: TRuePoint.

Hardware used for the wireless bridging

- After contacting *Harris startex* (Malbourne, Florida), microwave radio that complied our requirements was **Eclipse ETSI**.

① Direct Mount Antenna
② Compact Outdoor Unit
③ Low-cost Coaxial Cable Interface
④ Modular Nodal Indoor Unit

Eclipse Nodal Wireless Solution

Radio configuration

- Configuring the Eclipse ETSI radio was done by its Harris software called **Eclipse Portal**.

Configurations:
- SSID: IPNET-Link
- Frequency: 11.200 GHz
- Signal Protection: Frequency Diversity 10 MHz
- Signal Encryption: WEP
- Data Encryption: 128bits
- WEP Mode: HEX
- WEP Key: A105FC4A7B
- Power: Standard
- **Console Configuration:**
- Console Password: 1pN3t*!
- Telnet Password: t0k3nr1NG^
- HTTP Access: Yes
- HTTP Username: controller
- HTTP Password: 1Pn3T*!
- MAC Address Control: 00 E1 EF 74 4B 3F

Antenna Used

- *ValuLine VHP Series from Andrew company* gives standard performance unshielded antennas that provides a cost-effective solution for all terrestrial microwave systems operating at frequencies between 7 GHz and 60 GHz. These antennas are available in both single and dual polarized configurations and sized from 1 ft (0.3 m) to 6 ft (1.8 m) in diameter.

- Cable used in connection from the antenna to the radio was foam coaxial cable