

HIGHER TECHNICAL INSTITUTE

ELECTRICAL ENGINEERING COURSE

DIPLOMA PROJECT

"HTI NETWORK DESIGN USING
1GB OVER COPPER CABLING"

E/1253

BY: THOMAS HADJIKYRIACOU

JUNE 2001

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SUBMITTED BY:
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SUMMARY

AUTHOR: THOMAS HADJIKYRIACOU

TITLE: HTI NETWORK DESIGN USING 1GB OVER COPPER CABLING.

THIS REPORT EXAMINES THE STEPS THAT MUST BE FOLLOWED FOR THE HTI NETWORK DESIGN USING 1GBPS (1 GIGABIT PER SECOND) OVER COPPER CABLING.

GIGABIT ETHERNET HAS BEEN STANDARDIZED FOR FIBER OPTIC CABLE SINCE 1998, BUT UNTIL RECENTLY IS STANDARDIZED FOR CATEGORY 5 (CAT – 5) COPPER CABLE, THE MOST WIDELY USED CABLING MEDIUM WITHIN BUILDINGS. IN THE PAST, NETWORK MANAGERS WANTING TO GO TO GIGABIT SPEEDS WERE OFTEN FACED WITH RE – WIRING THEIR BUILDINGS WITH FIBER CABLE.

TODAY, WITH APPROVAL OF THE 1000BASE – T STANDARD FOR GIGABIT ETHERNET OVER COPPER, GIGABIT SPEEDS CAN BE WIDELY DEPLOYED AT LESS EXPENCE USING STANDARD CAT – 5 CABLING.

THERE IS A BIG MOVE TOWARD GIGABIT LANS (LOCAL AREA NETWORKS), ORGANIZATIONS ARE USED LANS TO SHARE APPLICATIONS AND EQUIPMENT ACROSS WORKGROUPS. ETHERNET THE NETWORKING STANDARD PIONEERED BY INTEL, DIGITAL, AND XEROX, HAS BECOME THE MOST COMMONLY USED LAN TECHNOLOGY WORLDWIDE. MORE THAN 85 PERCENT OF ALL INSTALLED NETWORK CONNECTIONS ARE ETHERNET, ACCORDING TO INTERNATIONAL DATA CORPORATION (IDC).

IN THE PAST FEW YEARS, HIGH – BANDWIDTH APPLICATIONS AND HIGH – SPEED COMMUNICATIONS BETWEEN NETWORKED USERS HAVE DRIVEN MAJOR INCREASES IN DESKTOP COMPUTING POWER, FIRST TO FAST ETHERNET (100MBPS) AND NOW TO GIGABIT ETHERNET (1000MBPS).

THE IEEE 802.3 ETHERNET STANDARD FOR GIGABIT ETHERNET ON CATEGORY 5 COPPER IS THE 1000BASE – T RATIFICATED IN JUNE 1999. MOST OF THE CABLING INSTALLED TODAY INSIDE BUILDINGS IS CATEGORY 5. THE IEEE HAS WRITTEN THE 1000BASE – T STANDARD FOR GIGABIT ETHERNET OPERATION OVER THE CATEGORY 5 CABLING SYSTEMS INSTALLED ACCORDING TO THE SPECIFICATIONS OF ANSI/TIA/EIA – 568A (1995). THERE SHOULD BE NO NEED TO REPLACE EXISTING CATEGORY 5 CABLING TO USE 1000BASE – T.

GIGABIT ETHERNET IS ETHERNET THAT PROVIDES SPEEDS OF 1000MBPS – ONE BILLION BITS PER SECOND. IT USES THE SAME FRAME FOR-MAT AND MEDIA ACCESS CONTROL TECHNOLOGY AS ALL OTHER 802.3 ETHERNET TECHNOLOGIES. IT ALSO USES THE SAME 802.3 FULL – DUPLEX ETHERNET TECHNOLOGY AND 802.3 FLOW CONTROL.

ALSO THE THREE IMPORTANT REASONS TO DEPLOY GIGABIT ETHERNET FOR GREATER BANDWIDTH AT THE BACKBONE ARE:

- **GIGABIT ETHERNET DELIVERS THE SCALABLE PERFORMANCE OF ETHERNET TECHNOLOGY.**
- **GIGABIT ETHERNET LEVERAGES THE INSTALLED BASE OF ETHERNET EQUIPMENT.**
- **GIGABIT ETHERNET LEVERAGES THE HISTORICAL COST DRIVERS OF ETHERNET SWITCHING EQUIPMENT.**

SO WE SEE THE GREAT ADVANTAGES OF GIGABIT ETHERNET WHEN USING THE 1000BASE – T STANDARD, WHICH IS A STANDARD FOR THE CATEGORY 5 CABLE USAGE INSTEAD OF FIBER WHICH IS MORE EXPENSIVE.

BY USING 1000BASE – T STANDARD WE HAVE HIGHER SPEEDS (1000MBPS), BIGGER BANDWIDTH AND MAYBE THE MOST IMPORTANT OF ALL THE PRICE. COPPER CABLE IS MUCH LESS EXPENSIVE THAN FIBER.

WE CAN APPLY THE STANDARDS TALLED ABOVE FOR THE HTI NETWORK DESIGN BY LOOKING CAREFULLY THE STEPS THAT SHOULD BE FOLLOWED FOR NETWORK DESIGN USING 1GBPS OVER COPPER CABLING, THE MOST IMPORTANT STANDARDS THAT SHOULD BE USED, BY FINDING THE RIGHT EQUIPMENT (CABLES, CONNECTORS, SWITCHES ETC.) AND FOLLOW THE RIGHT INSTALLATION METHODS.

INTRODUCTION

THE AIM OF THIS PROJECT IS TO INVESTIGATE THE PATH THAT WE SHOULD FOLLOW FOR THE CONSTRUCTION OF THE HTI NETWORK DESIGN USING 1GBPS (1 GIGABIT PER SECOND) OVER COPPER CABLING.

FIRST WE HAVE TO FIND THE TRUNKING THAT WE SHOULD USE FOR THE DISTRIBUTION OF POWER, DATA AND COMMUNICATION SERVICES IN BUILDINGS. WE MUST FIND THE APPROPRIATE COMPANIES THAT THEY CAN SUPPLY US WITH THE RIGHT EQUIPMENT WE WANT. THERE ARE MANY TYPES OF TRUNKINGS SO WE MUST CONCENTRATE TO THE RIGHT TYPE WE WANT WHICH SATISFIES OUR NEEDS WITH AN AESTHETIC APPEARANCE IF IS POSSIBLE AND WITH ATTRACTIVE PRICES.

THEN CABLES ARE FOLLOWED. VERY BIG ATTENTION SHOULD BE GIVEN TO CABLES BECAUSE CABLES ARE RESPONSIBLE FOR THE TRANSMISSION AND RECEPTION OF SIGNALS. THEY ARE THE WAY THE INFORMATIONS ARE TRAVELING BETWEEN USERS. THERE ARE TWO IMPORTANT WAYS THAT WE CAN ARRANGE THE CABLES, THE HORIZONTAL WIRING WHICH IS THE CABLING WHICH GOES FROM THE TELECOMMUNICATION CLOSETS TO THE OUTLETS (ACCESS POINTS) IN THE WORK AREA AND THE BACKBONE WIRING WHICH PROVIDES INTERCONNECTIONS BETWEEN USERS IN THE NETWORK. THERE ARE TWO TYPES OF BACKBONE: THE BUILDING BACKBONE AND THE CAMPUS BACKBONE. FIBER CABLES SHOULD BE USED FOR BACKBONE WIRING AND COPPER CABLES FOR HORIZONTAL WIRING.

CABLES COMING FROM TELECOMMUNICATION CLOSETS WILL CONNECT TO THE OUTLETS ON THE WALL AND THEN TO COMPUTERS. FOR THAT CONNECTIONS WE NEED THE APPROPRIATE CONNECTORS. CONNECTIONS WITH THE RJ11 CONNECTORS WE USE NOW FOR OUR PHONES AND ALSO FOR OUR MODEMS CAN'T BE USED FOR THE GIGABIT SYSTEM. THE RJ – 45 CONNECTORS ARE THE MOST WIDELY USED FOR THE GIGABIT SYSTEM. THE MAIN REASON IS THAT THE RJ – 11 CONNECTORS CAN'T ACCEPT THE 4 PAIR CABLES (CATEGORY 5) THAT SHOULD BE USED FOR GIGABIT SYSTEM INSTEAD WITH RJ – 45 CONNECTORS.

PATCH PANELS ARE FOLLOWED. PATCH PANELS ARE INTENDED TO PROVIDE AN EASY WAY FOR CONNECTING, DISCONNECTING OR ASSIGNING ONE GIVEN SOCKET TO A PARTICULAR SERVICE DURING OPERATION. A COMBINATION OF PATCH PANELS IS CALLED PATCHING BLOCK.

THE ABOVE COMPONENTS WE TALK ABOVE (TRUNKINGS, CABLES, CONNECTORS, PATCH PANELS) ARE MOSTLY PARTS FOR THE HTI STRUCTURED CABLING. THE STRUCTURED CABLING SYSTEM PROVIDES A UNIVERSAL PLATFORM UPON WHICH AN OVERALL INFORMATION SYSTEM STRATEGY IS BUILT. A STRUCTURED CABLING SYSTEM CAN SUPPORT MULTIPLE VOICE, DATA, VIDEO AND MULTIMEDIA SYSTEMS.

IN ORDER TO ACHIEVE THE HTI NETWORK DESIGN WE NEED A DEVICE WHICH CONNECTS TWO OR MORE SEPARATE NETWORK SEGMENTS AND ALLOWS TRAFFIC TO BE PASSED BETWEEN THEM WHEN NECESSARY. A SWITCH IS BEST SUITED FOR THAT JOB AND CAN ALSO DETERMINE IF A PACKET SHOULD BE BLOCKED OR TRANSMITTED BASED ON THE DESTINATION ADDRESS CONTAINED IN THAT PACKET. SWITCHES NOWDAYS ARE TEND TO REPLACE HUBS DUE TO THEIR GREATER FUNCTIONALITIES COMPARED WITH HUBS. OF COURSE ARE MORE EXPENSIVE BUT IF WE HAVE THE ECONOMIC CONVENIENCE BUYING SWITCHES INSTEAD OF HUBS IS THE BEST CHOICE.

FINALLY I HAVE TO SAY THAT NETWORK DESIGNS USING 1GBPS OVER COPPER CABLING ARE GETTING POPULAR AROUND THE WORLD WHERE THEY NEEDED, LIKE COMPANIES, SCHOOLS ETC. BECAUSE OF THEIR LOW COST OF INSTALLATION BY USING COPPER CABLE AND THEIR HIGH SPEEDS IF WE COMPARE THEM WITH OTHER NETWORKS THAT CAN SUPPORT GIGABIT SPEEDS BUT WITH THE USE OF EXPENSIVE FIBERS.