# Analysis of UTPA Network Topology

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- **Introduction**

  Many components are needed to create a complex network of a university, yet the key to its reliability and efficiently lies in the hands of whoever designs and manages these network components. In the case of UTPA it is the Telecommunications department, which takes care of the network administration as well as other services including telephony and video transmission. Steve Coupuld stands as the director and manages a group of approximately twenty people.

  Besides the Telecommunication department, another key entity involved in the networking arena is the UT-system (to which UTPA belongs to). It provides facilities for autonomous UT campuses so that they can add to their infrastructure. For instance, external circuits in UTPA are almost always bought through the UT-system office of Telecommunication (it is not required), due to the price for these circuits which is much lower than if UTPA were to buy as an independent organization; this is possible since UT-system buys for everyone (bulk). To have an overall view on how our campus fits in the UT scheme it is convenient to see the budget for some of these entities; for example, in the year 2004 the budget for UTPA was 188 million dlls (salaries, buildings, etc), compared to the UT Austin which was 1.6 billion dlls of the total 9.6 billion dlls that was assigned to the UT-system.

  It is important to mention that even tough UTPA is a relatively small campus when compared to others; it has benchmarks in sectors such as video transmission, due to its heavy use in the area. This is accomplished through T1 lines and includes 400 hours of instructional video that is streamed to twenty different high schools across the valley (for students enrolled in classes), this makes students complete advanced placement courses, and helps the university recruit top students.

  In the following sections I will cover basic information on equipment that conforms the network at UTPA, how it is configured, and what features are available to students an faculty as users of this network, I will talk about the overall layout of the equipment and how everything is connected, and finally touch on some of the current and future work that is taking place in the Telecommunications Department.

- **Equipment**

  The main items that make the network operate are three routers, one gateway, several switches, and of course miles of Ethernet cable and fiber. As for the routers, these are Cisco Catalyst 6509 routers/switches, each with 9 slots chassis (used for upgrading), that are capable of supporting transmission of 400 million packets per second.[3] The reason this model was chose is due to the scalability features it possesses, and the ease by which it can be upgraded; for instance, some of these systems are four to five years old, yet they have undergone modification in CPUs and memory. Still, on average, the routers activity range in the one to two percent, and traffic could be easily managed with a single one of these Cisco routers.

  In the following graph we can see the traffic for the Library handled by one of the 6509 routers (located in the Computer Center), over a 1 GB connection. The green area is incoming traffic and blue is outgoing traffic. This shows the load that one host generates on the router.

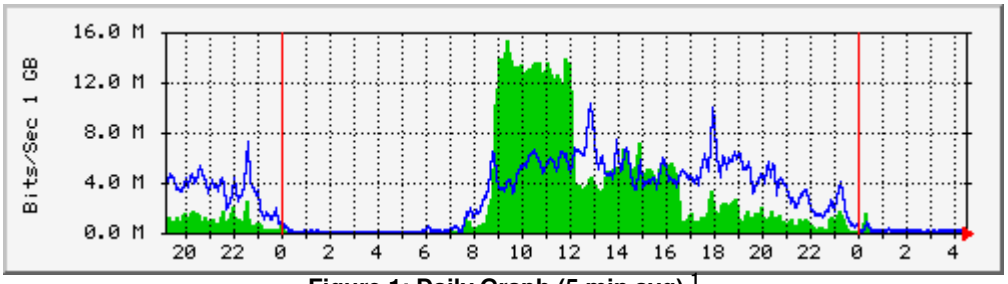


**Figure 1: Daily Graph (5 min avg)** [1]

The gateway by which all packets enter and leave campus to reach their destination is a Cisco 7204 router which uses the BGP protocol to communicate to other routers in campus. It runs at 700 MHz and has 256 MB DRAM memory (expandable to 1 GB); it can process up to one million packets per second, and supports the ATM and LAN port-adapters just to mention some.[2]

As for the switches there are many located throughout campus and in their majority are from the HP manufacturer, including models such as the 2524 and the 4108gl. The ProCurve Networking 2524 switch has 24 RJ-45 ports and has a throughput of 6.6 Mbps with 64-byte packets. In addition to the routers and switches there is the cabling (of both Ethernet and fiber optic) that interconnects these devices.

Although not directly related to the computing field I would like to mention that UTPA has it's own PBX switch to handle the calls within the campus, and it currently supports 2400 ports (combination of digital and analog), I will expand on this later in the document and relate it to VoIP efforts in the university.

- **Addresses and features**

The way UTPA is designed is through use of subnets to allocate all of the workstations throughout campus, and then each department might also apply a subnet mask to their machines. More specifically, UTPA has a class B IP address scheme which allows up to 65 534 addresses, but then there are subnets created into C type addresses (a 24-bit mask is applied to create these subnets).

Furthermore, one interesting feature that UTPA has recently incorporated into their network is Internet 2 which allows the deployment of advanced network applications and technologies (IPv6, IP multicasting, etc), only about 206 universities are part of this project.[4] The reason why it was adopted was because of research, and faculty who wanted grants, but needed internet 2 as a requirement.

- **Layout**

The design that a UT campus implements is not determined by the UT-system, each campus determines their own configuration. In the case of the UTPA, it consists mainly of routers and switches connected following two configurations: ring and star. All buildings (colleges) are connected to one of the three Cisco routers mentioned above through fiber that runs mainly underground. Similarly one of the routers is connected to the gateway (fiber) and once packets reach the gateway, they follow a link to Harlingen, and then get redirected to another router in San Antonio and will eventually reach their destination.

It is important to mention that the Telecommunications department only provides the networking service, and in some cases also manages the network, but it is not the case for the College of Business Adm. and the library, they manage their own network, but do eventually connect to the backbone provided by UTPA.

Getting the number of switches, routers and workstations of all the campus is not a trivial task since there is an heterogeneous configuration for each department in the university, instead we could easily obtain it through third party software like netdisco. This is an open source program for Linux which uses routers ARP tables and L2 switch MAC forwarding tables to locate nodes on physical ports and track them by their IP addresses.[5] On a big scope there are at least ten 4108 switches directly connected to the 6509s and about ten HP-2524 connected to HP-4000MS. As for the buildings, each one has several switches branched off from a main uplink switch.

- **Future work**

There are many projects which are currently taking place in the Telecommunications department, one which is receiving big effort is the wireless internet access across campus, this will encompass all colleges, and eventually the library which currently manages it's own wireless access through the use of several access points and is restricted to users through MAC filtering. Thus, setting uniform configuration and access for all students (this eliminates the hassle of students requesting access to each individual building).

Another interesting project currently undergoing work is the implementation of VoIP for the campus. This is a time consuming task, given the number of departments, faculty, and administrative offices; but we can see a start with the new building (Medical Institution) where VoIP telephony will be used in its entirety. Mainly, because running cooper cables to the building is too expensive, and would involve getting cables under the road, and doing the wiring in the building; running fiber is much more cost efficient. In addition to running fiber to this building, a new upgrade is scheduled that will enable a "Universal licensing scheme" allowing 3000 ports (compared to the 2400 currently available); and it is expected over time that there will be a 90% use of IP telephony.

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