Georgian Technical University

Networking at Georgian Technical University

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- GTU Computer Network Overview (8 min.)
  - Network Architecture, 1 GIG Core Upgrade, Internet Edge
- Network Virtualization (3 min.)
  - New Concepts, New Functionality,
- Discussion (3 min.)

Part 1

- **GTU Network Overview**

Network Architecture, 1 GIG Core Upgrade

- GTU has several buildings spread over the different campuses.
- To aid scalability, GTU has adopted a standard campus network architecture.
- A typical large building is shown here.

GTU Has 409 Ethernet Switches Installed

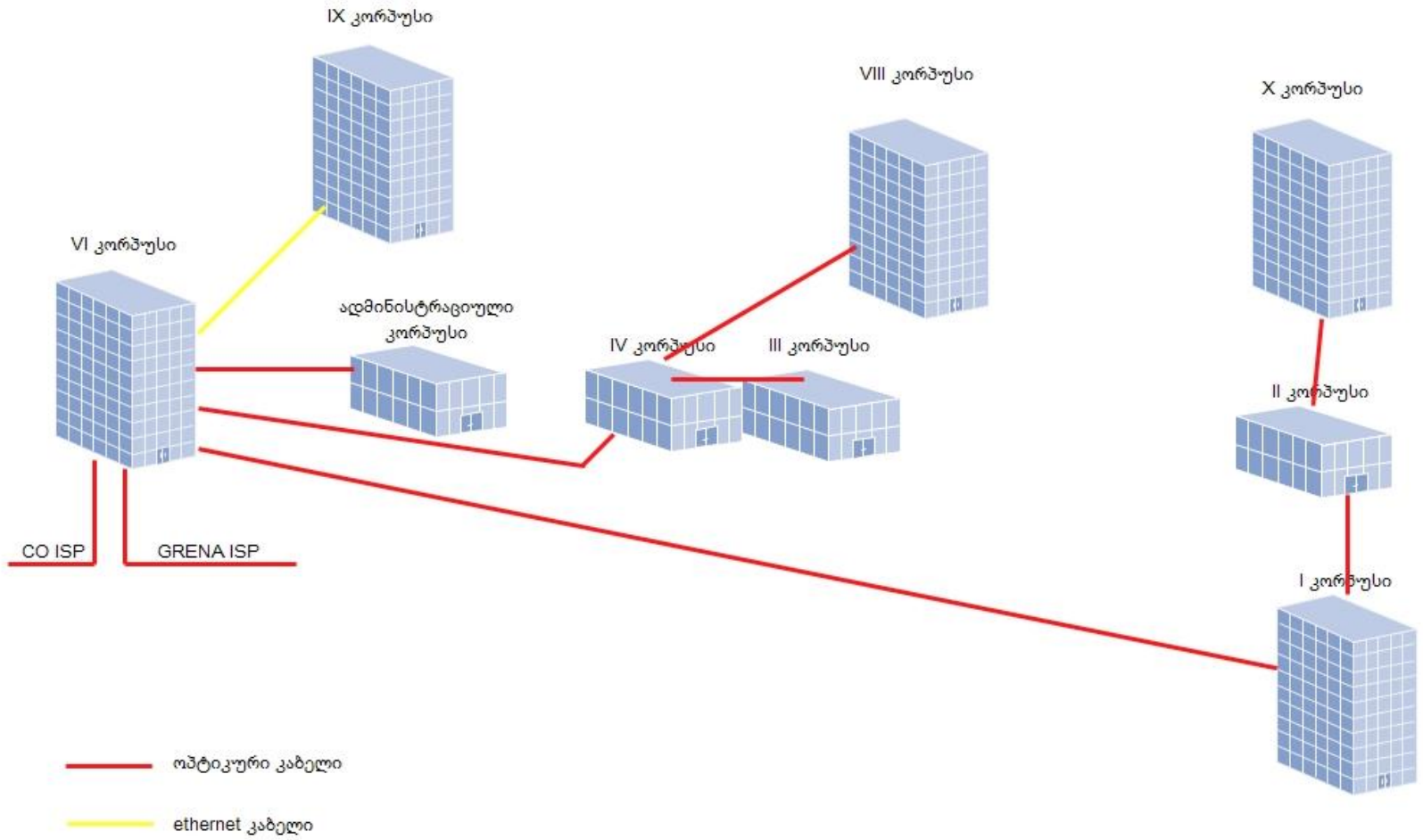
Wireless Connected Devices

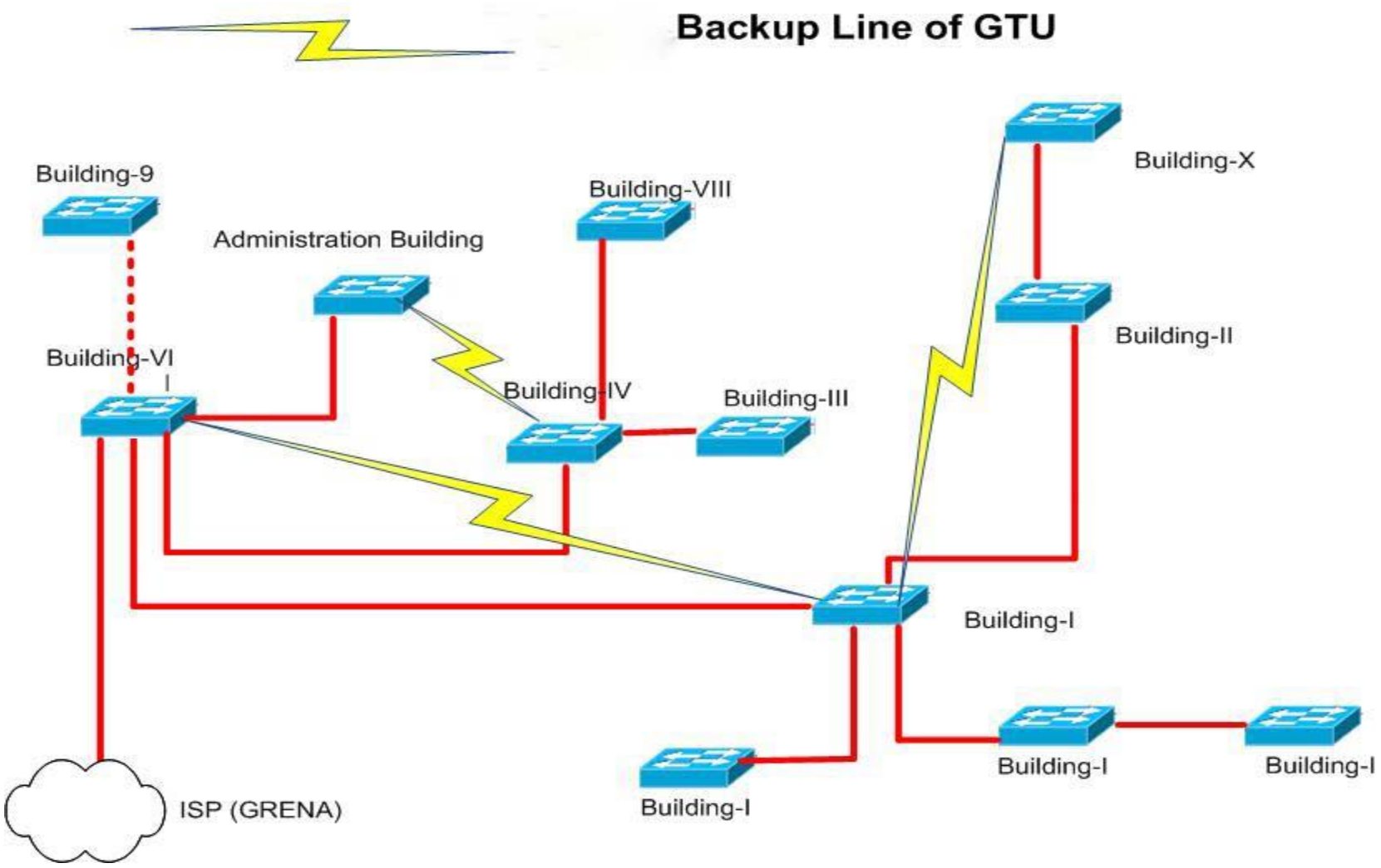
Users … Wired and Wireless –

- GTU users utilize many diverse devices and operating systems.
- All new access switches are 10/100/1000 and POE..
- GTU deploys close to 100 APs, providing wireless coverage within buildings on campus.
- An outdoor wireless mesh deployment is underway.

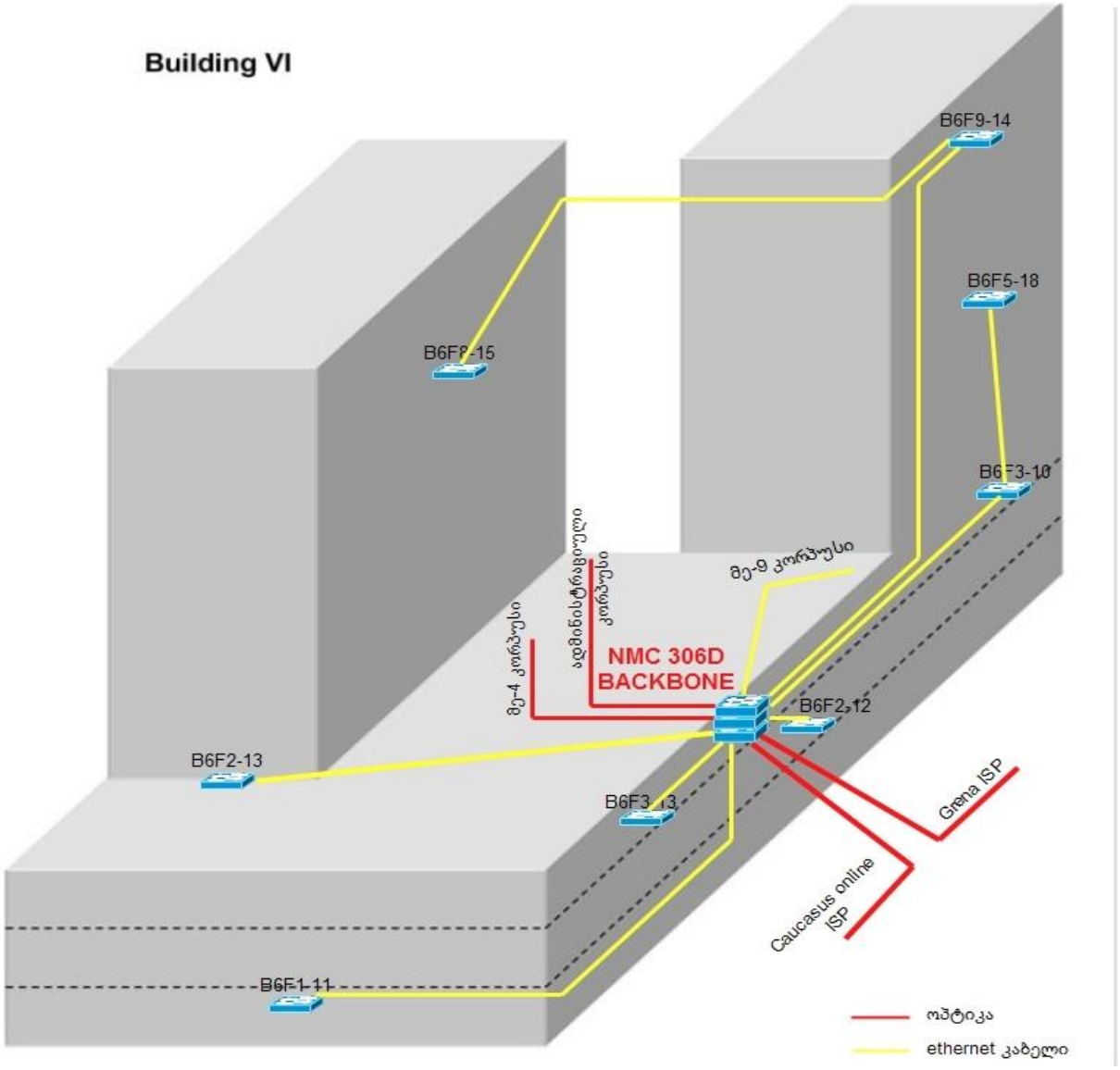
GTU Has 130 Wireless Access Points Installed

Fiber-optical Backbone of GTU Computer Network

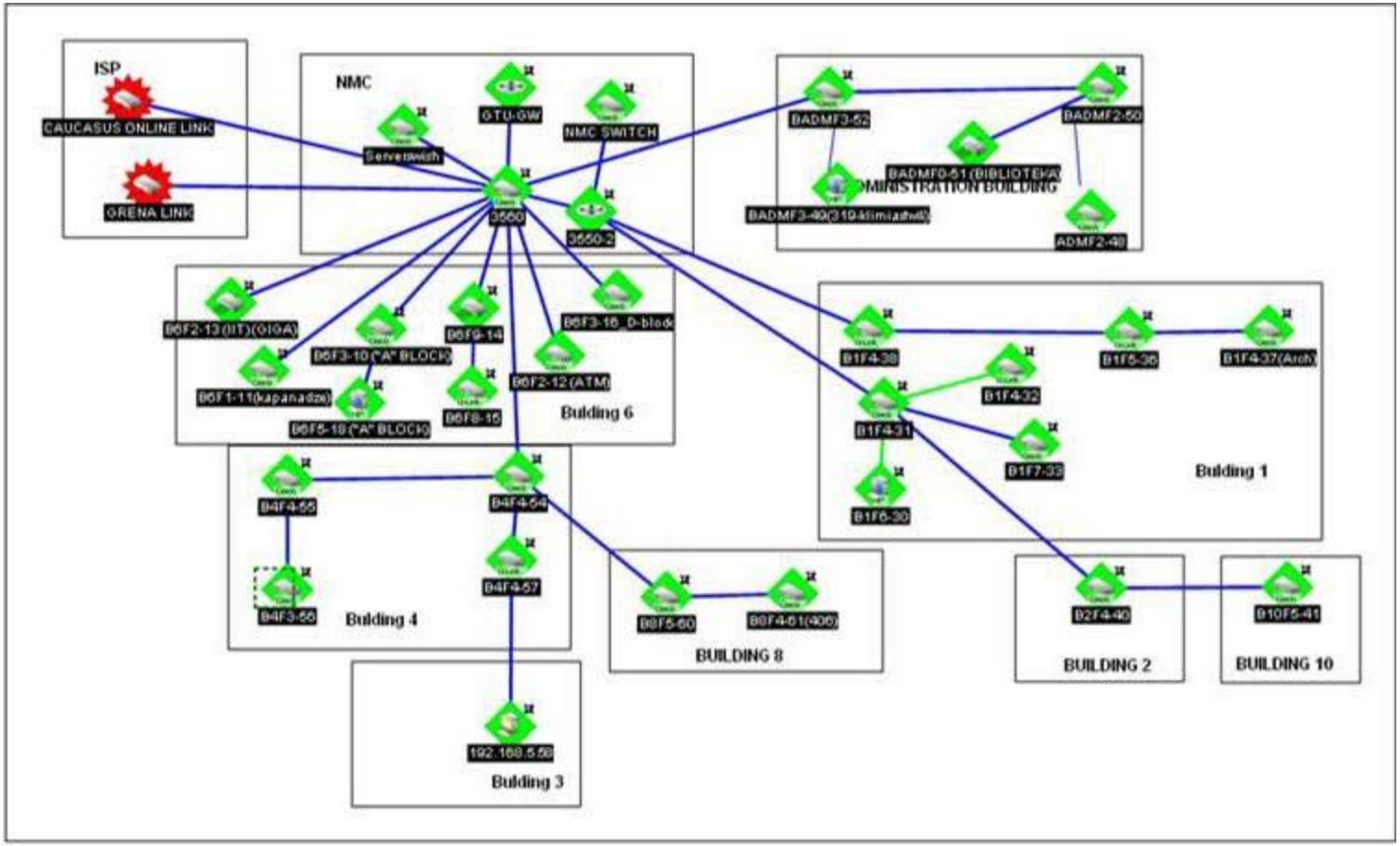


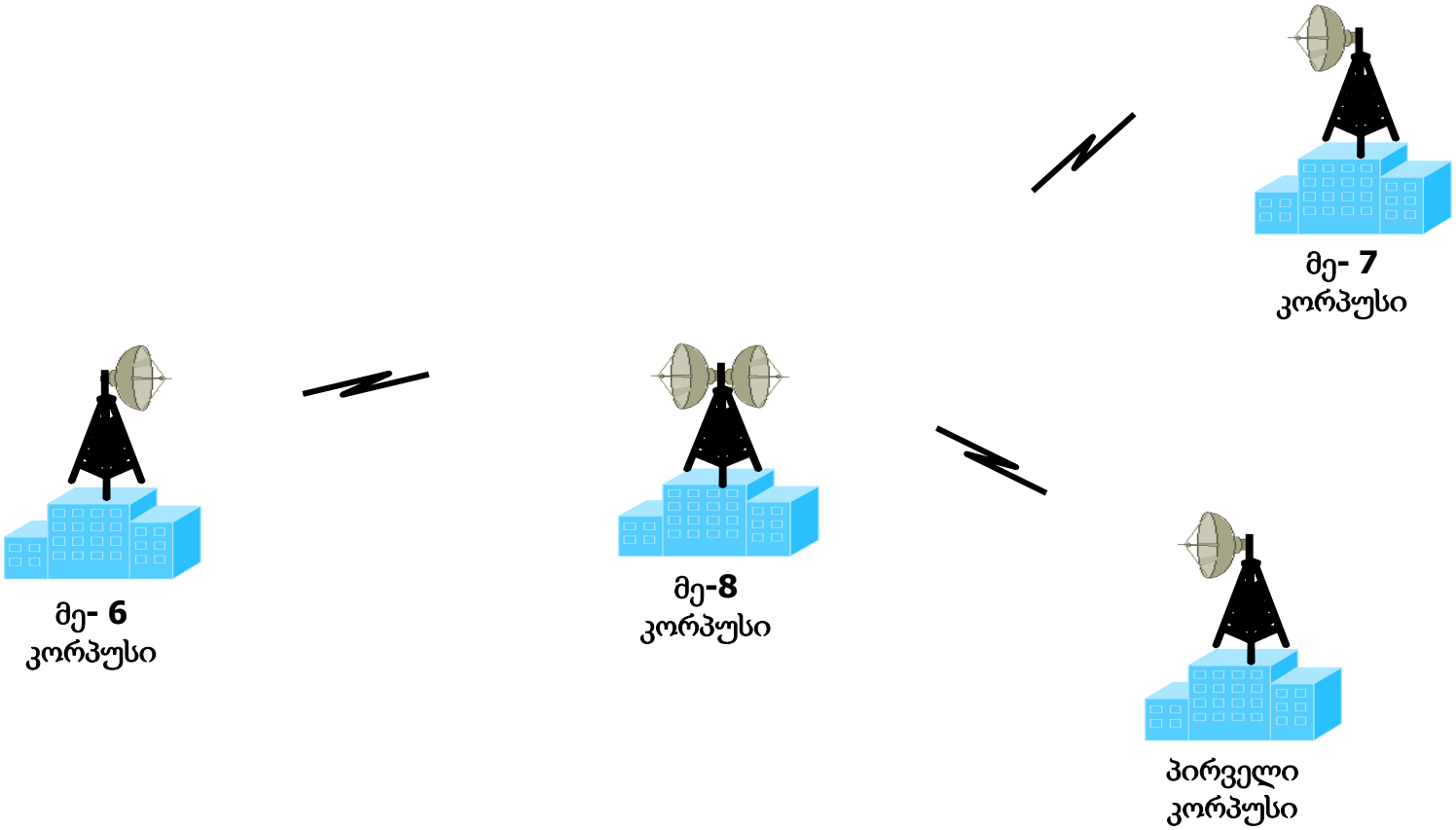


All Interfaces in the Core are 1GIGABIT


Building VI
B6F9-14
B6F5-18
B6F8-15
B6F3-10
მე-9 კორპუსი
ადმინისტრაციული კორპუსი
მე-4 კორპუსი
NMC 306D
BACKBONE
B6F2-12
B6F2-13
B6F3-13
Grena ISP
Caucasus online ISP
B6F1-11
ოპტიკა
ethernet კაბელი

GTU –Network Monitoring System




მე- 7
კორპუსი
მე- 6
კორპუსი
მე-8
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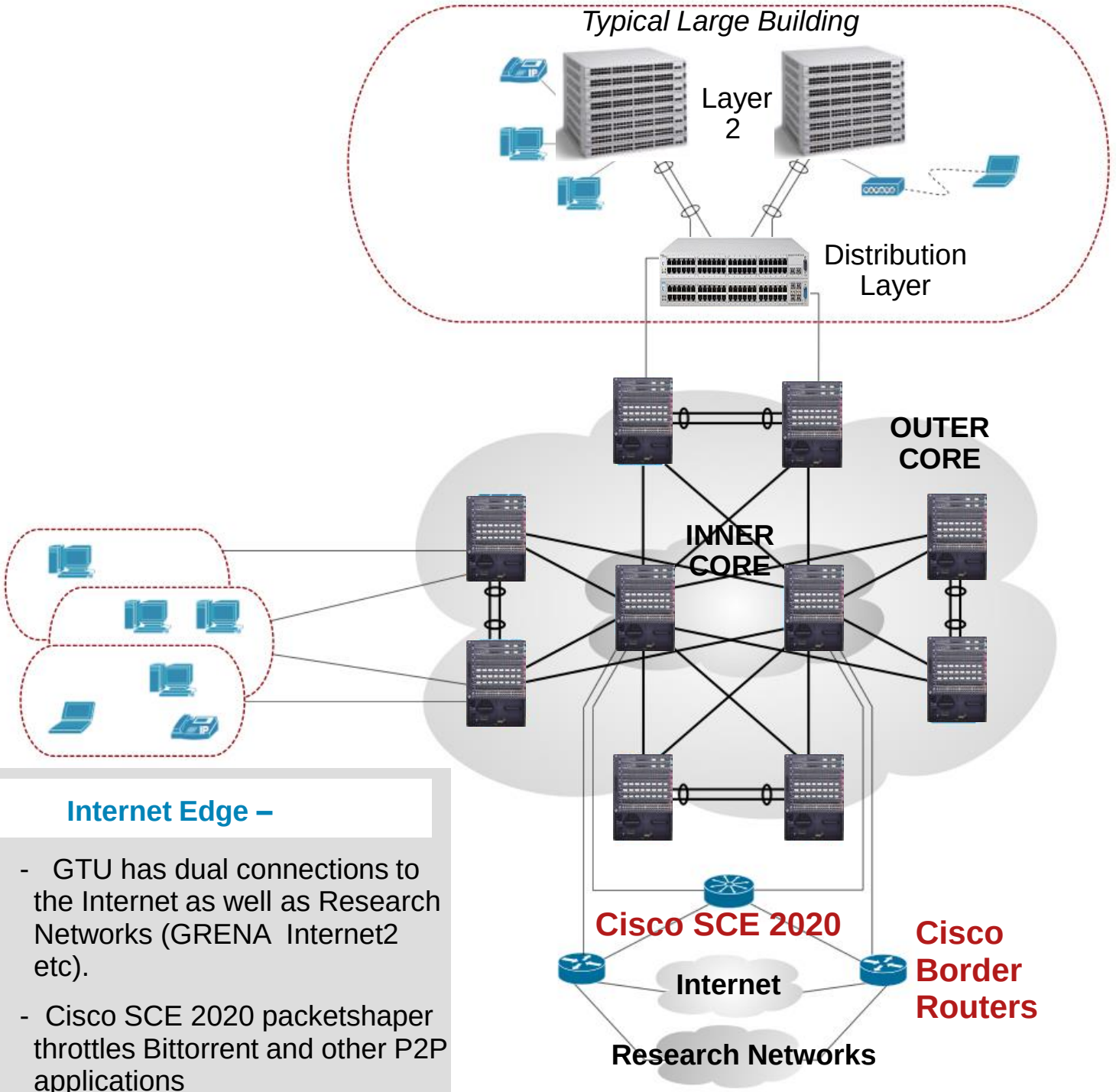
კორპუსი



Internet Edge –

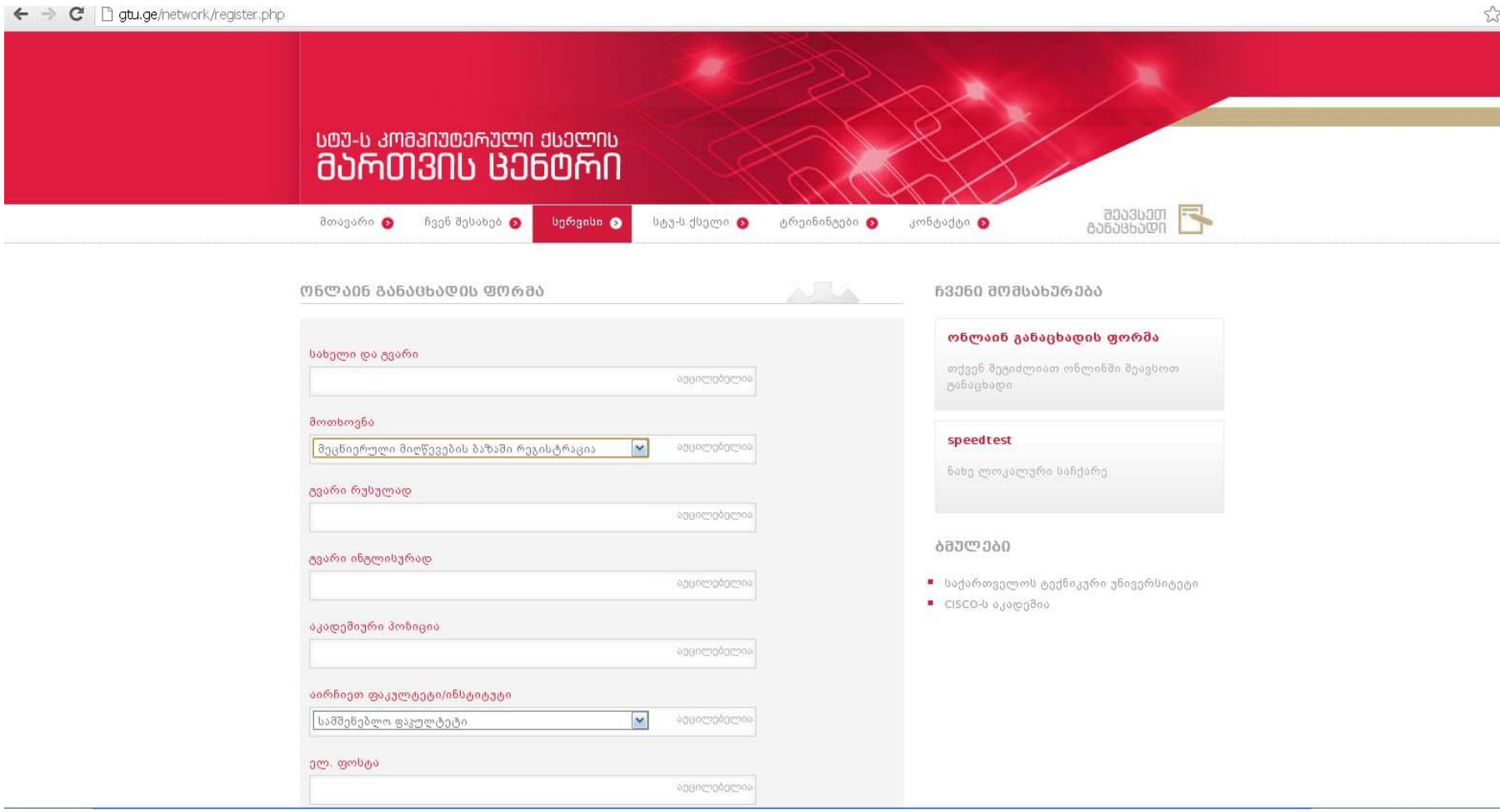
- GTU has dual connections to the Internet as well as Research Networks (GRENA Internet2 etc).
- Cisco SCE 2020 packetshaper throttles Bittorrent and other P2P applications

Commodity Internet Typical Day…

Interesting GTU Network Metrics

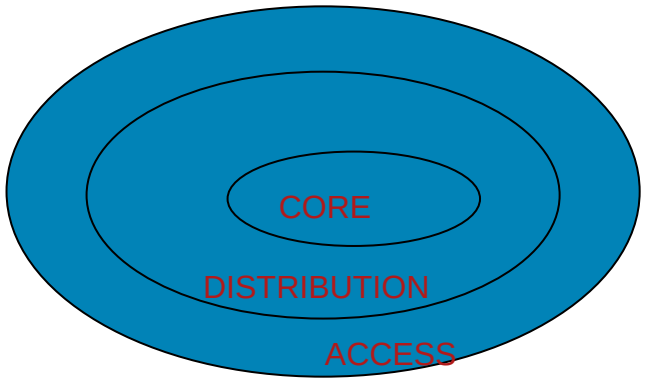
- Number of VLANs Allocated = 68
- Number of Subnets Allocated = 238
- Number of Wired Ports Used = 3,287
- Maximum Simultaneously Connected Wireless Users = 1,500+
- Number of Wireless Access Points = 130
- Internet Bandwidth for Main GTU Network = 200 Mbps
- Internet Bandwidth with Local Geo ISP = 1000 Mbps

New Site of GTU Network Management Center



Backbone Network Design: Principles & Architecture

- **Based on Modular Design**
  - Simplifies Management
- **Hierarchical Network Design**
  - Enhance Security
- **Three Tier Model**
  - Core layer
  - Distribution layer
  - Access layer



The Hierarchical Network Design Model Separates the Network into Three Functions

Core Layer Functions

The core layer provides a high-speed backbone. Functions and attributes of the core layer include the following:

- Providing high-speed, low-latency links and devices for quick transport of data across the backbone.
- Providing a highly reliable and available backbone. This is accomplished by implementing redundancy in both devices and links so that no single points of failure exist.
- Adapting to network changes quickly by implementing a quick-converging routing protocol. The routing protocol can also be configured to load-balance over redundant links so that the extra capacity can be used when no failures exist.

Filtering is not performed at this layer, because it would slow processing. Filtering is done at the distribution layer.

Distribution/Aggregation Layer Functions

The distribution layer interfaces between the core and access layers, and between access layer workgroups. Functions include:

- Implementing policies by filtering, and prioritizing and queuing traffic.
- Routing between the access and core layers
- Performing route summarization
- Providing redundant connections, both to access devices and to core devices.
- Aggregating multiple lower-speed access connections into higher-speed core connections

Access Layer Functions

- The access layer is where users access the network. Users can be local or remote.
- Local users typically access the network through connections to a switch.
- Remote users might access the network through the Internet, RAS using VPN connections
- The access layer must also ensure that only users who are authorized to access the network are admitted (Security-NAS).

Network Virtualization - Concept - VLANs

- **VLANs – Virtualization at Layer 2**

  Network Virtualization isn't new. VLANs are a type of network virtualization. Everyone is familiar with VLANs. We have deployed over 60 unique VLANs at GTU

- **VLANs provide Privacy, Security, Reliability**

  Some buildings have over a 10 VLANs.

  Departments use VLANs to segregate servers, students, faculty & staff, and admin office computers.

  If a large building has multiple departments, each department can have their own VLANs.

  Ports are assigned to VLANs.

Network Virtualization - New Concept - VRFs

- **What is a VRF?**

  A VRF is completely private campus-wide network. It is as if you had your own private routers.

  Any Subnets in any buildings campus-wide can be assigned to a particular VRF. A Subnet can be in only one VRF.

  A Subnet does not have to be in a VRF. In that case it is in the global routing table.

  A department can have as many VRFs as they require to implement their security policies.

  Routing between Subnets within a VRF is direct. No firewall is involved. It is wire speed (1Gbps).

  To connect to a Subnet outside of a VRF you have to go through a firewall. Usually this is a virtual firewall.

  VRFs are visible in the Transmogrifier.

Network Virtualization - New Concept - Virtual Networks

- **Introducing "Virtual Networks"**

  Previously departments could construct private networks within buildings using VLANs. Now departments can construct private networks across campus using combinations of VLANs and VRFs.

  A Virtual Network is the set of all VLANs, Subnets, and VRFs belonging to a particular faculty or department, including the virtual firewall that ties all of the VRFs together.

  Virtual Networks are visible in the Transmogrifier.

- **Real Life Example**

  Business Operations Virtual network. A picture is worth 1000 words.

GTU –
Network Virtualization - Advantages

- **Advantages of Virtual Networks**

  Departments can have offices in any buildings campus-wide, and can have a single firewall controlling access.

  Departments can centralize security policies.

  For the first time, network security is an integral part of network provisioning.

- **Virtual Networks are a new layer of security**

Network Virtualization FAQs

- **Is Virtual Networking mandatory?**

  No, it's not mandatory. In fact, it's completely optional. If you don't want to take advantage of virtual networking then you don't have to. It will be business as usual. All of your Subnets will continue to be in the global routing table.

- **If I decide to use Virtual Networking, does it impact my existing VLANs and Subnets?**

  The only impact is that you have to let the NMC know what VRF each subnet should be assigned to. Other than that, it's business as usual. No VLANs or IP addresses change. The Transmogrifier works as normal.

- **How many VRFs can a department have?**

  A department can have as many VRFs as they want. One for every subnet if necessary. Although in practice most departments will only need a small number (~6) to implement their security policies.

Thank You