CSCI 5160 Introduction to Enterprise Networks

Spring 2025

Midterm Practical Exam

There are four teams of Elon Musk's companies: **SpaceX, Tesla, Neuralink and X.com.** They are planning to open new offices in space between Mars and Earth. To do this, they will use all available types of communication and technology to communicate with Elon Musk's office.

For main communication for companies, they will use three types of satellites, **Low Earth Orbit (LEO), Medium Earth Orbit (MEO), and Geostationary Transfer Orbit (GTO)**. Additionally, inside the blue zone, they will use Boring, Solarcity, Starlink, and Pipal communication branches.

There are a total of employees: 510 x.com, 8195 SpaceX, 2047 Tesla, and 255 Neuralink users. For this purpose, X.com will collect their EmployeeCards from NASA, SpaceX from Starlink, Tesla and Neuralink from GTO.

To connect with Elon Musk's Office (6.6.6.6) through the EarthSwitch

- SpaceX is always going to meet at LEO before leaving the Mars Area, If not possible they can exit via GTO, lastly MEO
- Same for X.com, the primary exit is MEO, and the second LEO, the last exit will be GTO.
- For Tesla the primary exit is GTO and the secondary exit will be MEO.
- Finally, Neurolink is MEO, then GTO, the third place should act as backup.

Starlink has 2 Wireless connections. One for SpaceX and the second for Tesla.
Wireless SpaceX staying at Starlink should be able to communicate to Wired SpaceX. It's WPA2 is secured and encrypted with a wep128 bit key.
Also, Wireless Tesla staying at Starlink should be able to communicate with Wired Tesla. It's an open network.
Note SpaceX and Tesla can't communicate wirelessly.

All the employees should be able to get **ELON** name resolution from the ISS.

There are various LINKS for reaching Earth, But each of them has some sort of specialty.
LEO <-> SolarCity is an open-source IEEE protocol connection that is initiated from the LEO side.
Pipal <-> SolarCity utilized a proprietary protocol to communicate which is initiated by Pipal and has a Max speed of 1200Mbps.
Pipal <-> GTO Rock has a max speed of 512 Mbps with an open-source view.

LEO | MEO | GTO has only allowed 4 types of company employees and the rest are not allowed at all. It's made up of proprietary protocols. Only Pipal and GTO have very specific connectivity for one COMPANY only as an additional channel!

At Boring (on any one port) if any unknown employees try to access, that entry will be blocked for one minute and again open.

STP Paths: (First One is the Root Bridge, second is the Backup)
SpaceX: Boring - Starlink - Pipal - GTO
Tesla: Pipal - Starlink - Solarcity - Boring - LEO
X.com GTO - Pipal - Starlink - Boring - LEO
Neurolink MEO - Solarcity - Pipal - Starlink - Boring - LEO

Special Conditions for Earth Area Zone:
In Earth's Space zone, many countries and organizations rely on satellite communication. With limited bandwidth available, operating connections is a challenge. To solve this, four companies have formed two groups, each responsible for its communication system.
Since they share the same network, only one group can use direct communication at a time. The other group must rely on GalaxNet VRF, which allows different networks to work separately at the same connection.

Group 1 knows which path to follow based on the Link-state protocol which uses the SPF algorithm.
GEO/MEO/GTO > Moon - ONEWEB - Apollo is preferable, NASA less preferable.

Group 2 knows which path to follow based on a proprietary protocol which is an advanced distance-vector and uses the DUAL algorithm.
GEO/MEO/GTO > ISS > ONEWEB > NASA is preferable and Apollo less preferable
Each Group controls its own data travel paths

However, if Group1 wants to communicate with Group2 then they have to first reach OneWeb otherwise they can't.

Once Group 1 or Group 2 reaches Apollo or NASA, they have to use other Cards(Earth Cards) since they can't use the same cards because of RFC 1918 rules. But keep in mind APOLLO and NASA know which old Cards have information and represent newer ones. If either Apollo or NASA gets affected by solar storms, then the other one should be able to keep business running as usual.

! Each student is assigned a pool to represent their new IP addresses. You have to use only these. If you don't use your Pool, you cannot ping ElonMusk Office

Extra Credit:
Elon should be able to ssh any Router/switch on particular Ports/IPs using EarthCard information.

HW Specifications:
- LEO, MEO and GTO are Multilayer switches.
- Boring, Pipal and Solarcity are regular L2 switches.
- Starlink is Cisco 1800 Wireless Router.
- MarsSpaceZone is represented in Red.
- EarthSpaceZone is represented in Blue.
- OneWeb has two serial links connected with the Moon and ISS .

You will already find Earth Switch and Elon Musk Office Setup by TA.

Name	NAT	Pool EarthSwitch Facing ports (/24 mask)
Atul Anand	10.0.0.0 /29	100.0.0.1 & 100.0.0.2
Abey Biju Abraham	20.0.0.0 /29	100.0.0.3 & 100.0.0.4
Logan Chayet	30.0.0.0 /29	100.0.0.5 & 100.0.0.6
Pranav Pranav Deepak	40.0.0.0 /29	100.0.0.7 & 100.0.0.8
Thomas Fox	50.0.0.0 /29	100.0.0.9 & 100.0.0.10
Zeqian Han	60.0.0.0 /29	100.0.0.11 & 100.0.0.12
Sarang Kalantre	70.0.0.0 /29	100.0.0.13 & 100.0.0.14
Aravindh Goutham Mahendran	80.0.0.0 /29	100.0.0.15 & 100.0.0.16
Naveen Vinayaga Murthy	90.0.0.0 /29	100.0.0.17 & 100.0.0.18
Zhongze Zhang	100.0.0.0/29	100.0.0.19 & 100.0.0.20

MarsArea Space

Earth Area Space

Boring

Low Earth Orbit (LEO)

Apollo

Moon

Solarcity

Medium Earth Orbit (MEO)

Starlink

OneWeb

ELON-MUSK Office

EarthSwitch

International Space Station
ISS

access VLAN2

PiPal

Geostationary Transfer Orbit (GTO)

NASA