End of the Experiment

Pasadena is a calm city of science enthusiasts, where every now and then a rival group from a nearby campus tries to hack into their systems and steal confidential research data. One day a group of five friends from Caltech decided to properly secure all the networks in Pasadena and build a strong communication topology among themselves and the residents of their apartment building, so they can coordinate and defend against any future attacks.

Among the five friends, Sheldon works in the Theoretical Physics Lab, Leonard in the Experimental Physics Lab, Penny manages the back-office system of the Cheesecake Factory, Howard works at JPL Engineering Bay, and Raj works at the Particle Astrophysics Center. Furthermore, each of them has a certain number of active devices/agents (PCs, laptops, lab machines, terminals) in their respective network zones, and they want to include all of these in the overall communication topology to strengthen security for Pasadena.

The number of active devices/agents in each zone is listed below (do not forget to include the "main" character for that zone when calculating host requirements):

- Theoretical Physics Lab (Sheldon) (812 hosts)
- Experimental Physics Lab (Leonard) (360 hosts)
- Cheesecake Factory Back Office (Penny) (58 hosts)
- JPL Engineering Bay (Howard) (190 hosts)
- Particle Astrophysics Center (Raj) (275 hosts)

Moreover, the residents of the Pasadena apartment building formed a committee of 21 members to stay in touch with all these labs and workplaces.

Requirements:

While creating the network infrastructure, you are provided with certain restrictions and rules that you must follow:

1. Choose an appropriate **network address** and create **subnets using VLSM** so that each branch (lab/zone/apartment) is assigned a subnet with the least possible waste of addresses.

2. The Pasadena apartment network will have its own **web server** and a **DNS server**. The apartment committee members will have access to a dedicated server named `CaltechSupport`. Upon successful connection , it must display the message:

   ```
   "Bazinga!  We've got your back!"
   ```

3. As the apartment network is the most important and sensitive zone, all end devices in the apartment committee network must use **static IP addressing**. In contrast, all of the character work zones (Sheldon, Leonard, Penny, Howard, Raj) must use **DHCP** for IP assignment, handled by a DHCP server within each respective network.

4. Because Sheldon (Theoretical Physics Lab) and Raj (Particle Astrophysics Center) frequently exchange large simulation data and research plots, they require **email servers** to be set up in their zones so that they can send and receive mail between these two networks. Make sure that the basic email configurations (such as SMTP and POP/IMAP within Packet Tracer capabilities) are properly set up.

5. The following manual connections must be established, with the given restriction on router usage:

   - (Experimental Physics Lab - JPL Engineering Bay)
   - (Cheesecake Factory Back Office - Theoretical Physics Lab)

   Each pair in parentheses must be directly connected at the router level. Additionally, the two hyphened pairs **cannot use the same router**. For example, if the Experimental Physics Lab and JPL Engineering Bay use `Router-A` to connect their network zones, then the Cheesecake Factory Back Office and Theoretical Physics Lab must use some other router(s) instead of `Router-A`.

6. Establish connections among all network zones (the apartment network plus the five character zones) using the **minimum reasonable number of routers**, while still fulfilling all of the requirements above.

Routing and Connectivity Constraints:

When establishing routing and testing connectivity, keep the following points in mind:

1. There must exist at least **one floating static route** between the Pasadena apartment network and Raj's Particle Astrophysics Center **via Leonard's Experimental Physics Lab** with an **Administrative Distance (AD) of 25**. This floating route should act as a backup path.

2. Showing **2 end devices per network zone** (e.g., two PCs, or one PC and one laptop) is sufficient to represent all active hosts in that zone in Packet Tracer.

3. Configure at least **one network to be routed dynamically** and at least **two networks to be routed using standard static routes**. You must remember that the **default route cannot be used** while exchanging packets between zones. Data must be delivered using **explicit static routes** or **dynamic routes**.

4. At the end of your configuration, you must be able to **ping from any one network zone to another** (for example, from a PC in the apartment committee network to a PC in Raj's network) to demonstrate full end-to-end connectivity.

Deliverables:

The entire network described above should be implemented in **Cisco Packet Tracer** with appropriate devices (routers, switches, servers, PCs, etc.) and full configuration of addressing, routing, and services.

You must submit the following:

1. A **network topology diagram** (screenshot) with clear and proper labels for all routers, switches, servers, and end devices.
2. The **configuration commands of all the routers** you have implemented (for example, as text output from Packet Tracer's CLI or copied from the running configuration).
3. A complete **VLSM tree** showing how you subnetted the chosen network address to satisfy all host requirements with minimal address waste.
4. An **IP address table** summarizing:
    - Subnet addresses and masks
    - Default gateways for each network zone
    - Assigned IP addresses of servers and example end devices
    - Router interface IPs and their corresponding networks