

Sydney Train Network

Transport for New South Wales (TfNSW) has recently initiated a major digital modernization project across the Sydney Trains network. The goal is to improve operational coordination between stations, introduce high-speed and secure network connectivity, and deliver enhanced digital services through Internet/Wi-Fi for daily commuters throughout the metropolitan area.

Sydney Train operates several key rail corridors across the city, including the T1 North Shore & Western Line and T2 Inner West & Leppington Line. As part of Phase 1 of the modernization program, TfNSW has selected six of the busiest and most strategically important stations to establish an interconnected network infrastructure. These stations are:

Central Station – 3200 daily users

Town Hall – 2800 daily users

Wynyard – 2400 daily users

Redfern – 1500 daily users

Burwood – 1300 daily users

Parramatta – 2600 daily users

TfNSW has hired you as a Network engineer to design and configure a fully functional communication network among these stations. The network must support station operations, internal communication, digital displays, ticketing systems, staff devices, and public Wi-Fi access for commuters.

To complete this task, you must strictly adhere to the technical specifications and constraints provided by TfNSW.

NETWORK SPECIFICATIONS

- Central Station will serve as the temporary headquarters for the modernization project. It must act as the core hub, and all other stations should be logically connected to it.
- Because of the importance of the City Circle section of the rail network, Town Hall, Wynyard, and Central must be directly interconnected to ensure uninterrupted communication and failover capabilities.
- Redfern plays a critical interchange role, especially due to its proximity to universities and high commuter load during peak hours. Therefore, Redfern must also be directly connected to Central Station.
- Due to budget considerations related to trenching and optical fiber installation costs in inner-west Sydney, Burwood and Parramatta must not connect directly to Central. Instead, both stations must route their connectivity through Redfern, minimizing infrastructure cost.
- You must choose a suitable major network address and generate VLSM-based subnets for each station so that IP address wastage is minimal.
- Central Station and Wynyard Station will use static IP addressing for enhanced security, device tracking, and fixed-infrastructure services.

All other stations will receive IP addresses via a centralized DHCP Server located at Central.

- As part of the project, several backend services must be deployed:
 - ❖ A DHCP Server at Central
 - ❖ A DNS Server at Central
 - ❖ A Web Server at Central
 - ❖ An Email Server at Parramatta
- When any user in the network types the URL `www.sydneyrail.net`, they must be directed to a webpage hosted at Central Station displaying:
"Welcome to Sydney Trains!"
- All servers must be configured manually with static IP assignments.
- Routing Requirements:
 - Central, Town Hall, and Wynyard must use static routing.
 - Redfern, Burwood, and Parramatta must use dynamic routing, specifically RIP version 2.
 - A redundant backup link must be established between Wynyard and Central, ensuring connectivity even if the primary link fails.
 - Default routes are not allowed anywhere in the network. Only static and dynamic routes must be used for packet forwarding.
- You must represent each station using a router, and may use additional switches as needed to interconnect end devices.
- Use at least two PCs per station to represent local user networks, along with required servers and printers.
- The final network must achieve full end-to-end connectivity, meaning every station must be able to successfully ping every other station.

DELIVERABLES

At the end of the task, you must submit the following:

1. A fully configured Cisco Packet Tracer project file (.pkt).
2. A network topology diagram with correct labels for all interfaces, routers, servers, and inter-station links.
3. The complete set of configuration commands for each router.
4. A complete VLSM tree showing subnet calculations.
5. A detailed IP Addressing Table mapping networks, router interfaces, servers, and device roles.
6. A list of all assumptions made during network construction.

This project aims to replicate the technical challenges of designing real metropolitan rail communication networks. Your final design should emphasize routing accuracy, redundancy, subnetting efficiency, and service availability across the Sydney Trains system.