

1.3.1.3 Identifying Equipment to Meet Customer Requirements

Objectives

- Select the appropriate interface cards for the needs and budget of an organization.
- Compare the trade-off between cost and flexibility.
- Add new equipment to accommodate expansion and allow for future growth.

This activity will begin showing 100% completion. This is because the activity is designed to demonstrate the process used to design and plan a network upgrade. This activity is not designed to be graded.

Background / Preparation

An owner of a small Tier 3 ISP provides Internet access to small businesses in the area. Ten customers are starting e-commerce activities and have asked about co-locating their web servers in the NOC facilities to provide faster access to the Internet backbone via the upstream provider. Because of the growing trend toward e-commerce, the ISP owner has decided to add co-location services to the list of service offerings.

To connect customer web servers to the Internet, new routers must be purchased. The ISP owner is trying to decide between using several less-expensive Cisco 1841 routers or one or two of the larger Cisco 2811 routers. You have been asked to evaluate which router model best meets the needs of the proposed co-location service as well as how many routers and interface cards are needed. The following are requirements that must be met:

- The maximum budget for routers and interface cards is \$10,000 for the first year.
- The starting configuration must support 10 customer servers.
- At least 20% spare capacity must be available at all times. If the spare capacity falls below 20%, new equipment should be purchased.
- A 20% growth rate in the demand for co-location services is expected each quarter (every three months).
- The upstream connection is very important. Two serial ports need to be available to connect to the upstream ISP. To ensure that backup routes are available, each router needs to have its own connection to the upstream provider.

Your task is to recommend the solution that best meets the requirements for the first year of providing co-location services while staying within the maximum budget of \$10,000. For the purposes of this exercise, use the following equipment costs:

1841 router	\$1500
2811 router	\$2500
HWIC-4ESW 4-port Ethernet switch card	\$500
WIC-2T 2-port serial interface card	\$700
NM-ESW-161 16-port Ethernet switching network module	\$1500

Step 1: Evaluate the scalability of the Cisco 1841 router

(Begin this activity by opening the file, **Determining Business Needs.pka**.)

- a) Click the 1841 Router in the workspace area.
- b) Under the **Physical** tab, in the **Physical Device View** window, click the power switch to **0** to power off the router.
- c) Click each module in the **Modules** column to the left of the **Physical Device View** window and read the description for each module in the box below the router.
- d) Which module provides the most Ethernet ports? How many ports does it provide?

- e) Drag the module with the most Ethernet ports to an empty slot on the router shown in the **Physical Device View** window.
- f) Which module provides the most Serial ports? How many ports does it provide?

- g) Drag the module with the most Serial ports to an empty slot in the router shown in the **Physical Device View** window. Click the power switch to **1** to power on the router.
- h) The 1841 router has two Fast Ethernet ports in addition to the ports provided by the interface card. Assuming one Ethernet port is used per customer server, what is the maximum number of servers that an 1841 router can support with the added modules?

- i) A 20% growth needs to be provided. How many ports are set aside to accommodate this growth?

- j) Using the configuration from Step g, what would be the total cost to purchase this router?

- k) How many 1841 routers are needed to support the initial 10 customer servers? What is the total cost?

- l) How many spare ports does this equipment provide? Does this number meet the requirement for 20% growth?

- m) Fill out the expense sheet in Handout A with the necessary equipment and costs for each quarter of operation, assuming a 20% growth every quarter. (Hint: Round up to the nearest whole number. For example, if a 20% growth is 2.4 servers, plan to support 3 new servers.)
- n) Based on your expense sheet calculations, how soon will another 1841 router need to be purchased?

o) How much equipment can be purchased before the initial budget of \$10,000 is spent?

p) How many customer servers can be supported within the initial equipment budget?

Step 2: Evaluate the scalability of the Cisco 2811 router

(Return to the Packet Tracer Activity window.)

a) Click the 2811 Router in the workspace area.

b) Under the **Physical** tab, click the power switch to **0** to power off the router in the **Physical Device View** window.

c) Click each module in the **Modules** column and read the module description in the box below the router.

The modules with names that begin with "NM" are network modules. The modules with names that begin with "HWIC" or "WIC" are interface cards.

d) Which network module provides the most Ethernet ports? How many ports does it provide?

e) Drag the network module with the most Ethernet ports to the empty network module slot on the router in the **Physical Device View** window.

(The network module slot is the larger slot on the left-hand side of the router.)

f) How many empty interface card slots (smaller slots) are available?

g) Which interface card provides the most Ethernet ports? How many ports does it provide?

h) Drag the interface card with the most Ethernet ports to three of the four remaining slots on the router shown in the **Physical Device View** window.

i) Which interface card provides the most Serial ports? How many ports does it provide?

j) Drag the interface card with the most Serial ports to the empty slot on the router shown in the **Physical Device View** window. Click the power switch to **1** to power on the router.

The remaining questions in the handout for Step 2 will help you evaluate the scalability of the 2811 router. Write your answers in the handout.

- k) The 2811 router comes with two Fast Ethernet ports, in addition to the ports provided by the modules. Assuming one Ethernet port is used per customer server, what is the maximum number of servers that one 2811 router can support with the added modules?

- l) A 20% growth needs to be provided? How many ports are set aside to accommodate this growth?

- m) What is the total cost of this configuration?

- n) How many 2811 routers are needed to support the initial 10 customer servers? What is the total cost?

- o) How many spare ports does this initial equipment provide? Does this number meet the requirement for 20% growth?

- p) Fill out the expense sheet in Handout B with the necessary equipment and costs for each quarter of operation, assuming a 20% growth every quarter. (Hint: Round up to the nearest whole number. For example, if a 20% growth is 2.4 servers, plan to support 3 new servers.)

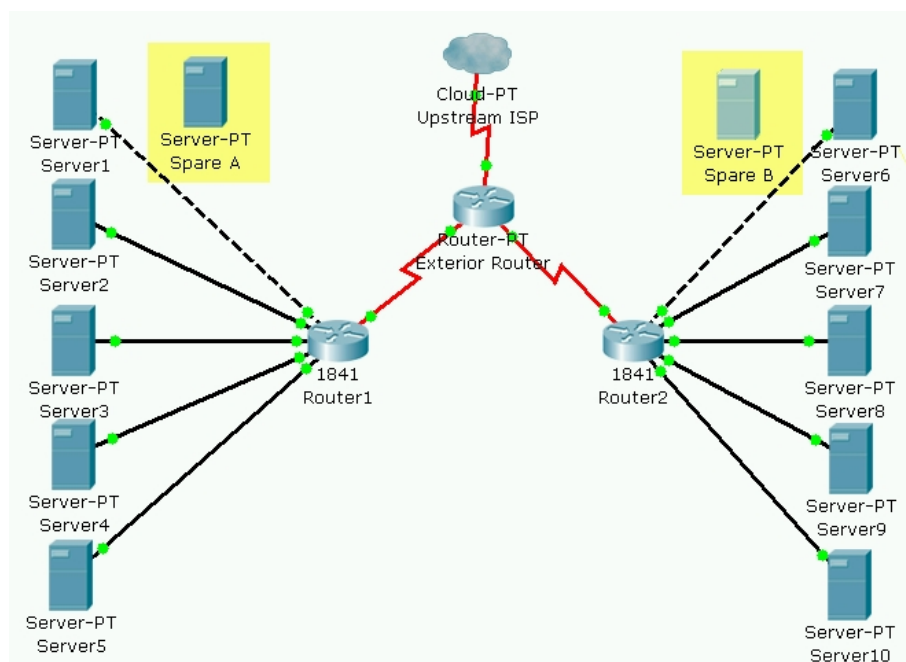
- q) Based on your expense sheet calculations, how soon will another 2811 router need to be purchased?

- r) How much equipment can be purchased before the initial budget of \$10,000 is spent?

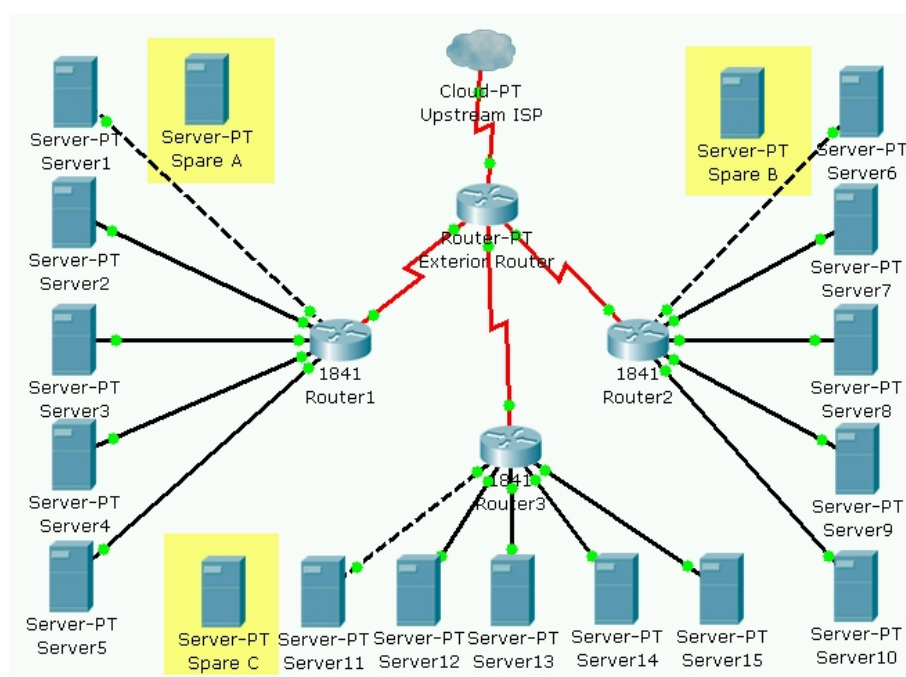
- s) How many customer servers can be supported within the initial equipment budget?

The following diagrams represent the initial and final network topologies for both the 1841 and 2811 routers. These topologies will help determine the best solution for meeting both the current and future needs while still remaining within budget.

Lab Topology Using 1841 Routers

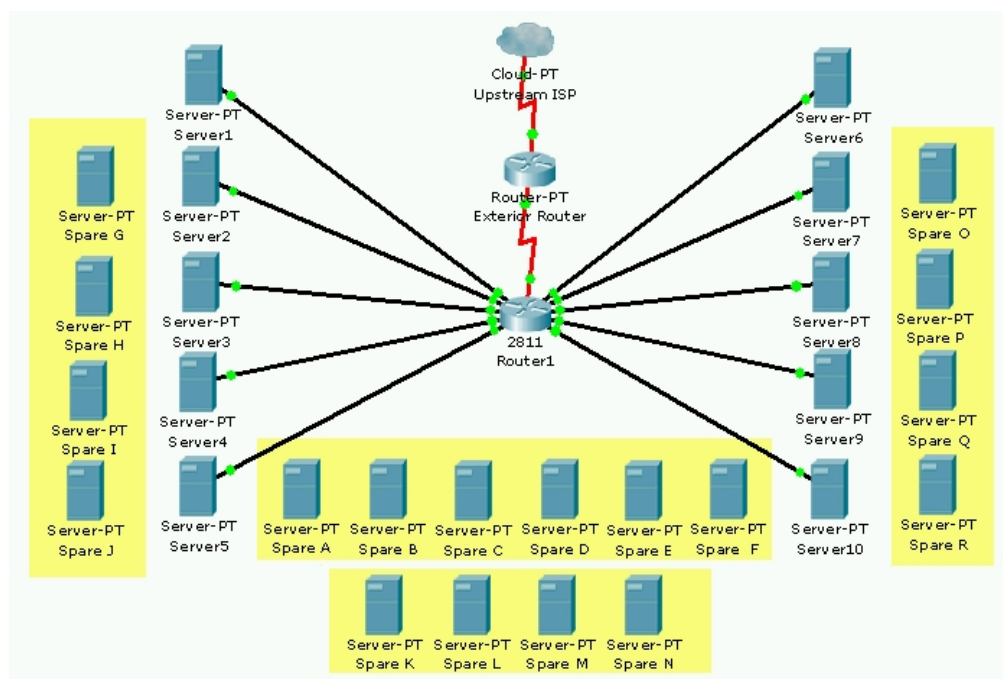


Topology A (Q1 startup) – Proposed initial co-location solution using Cisco 1841 routers

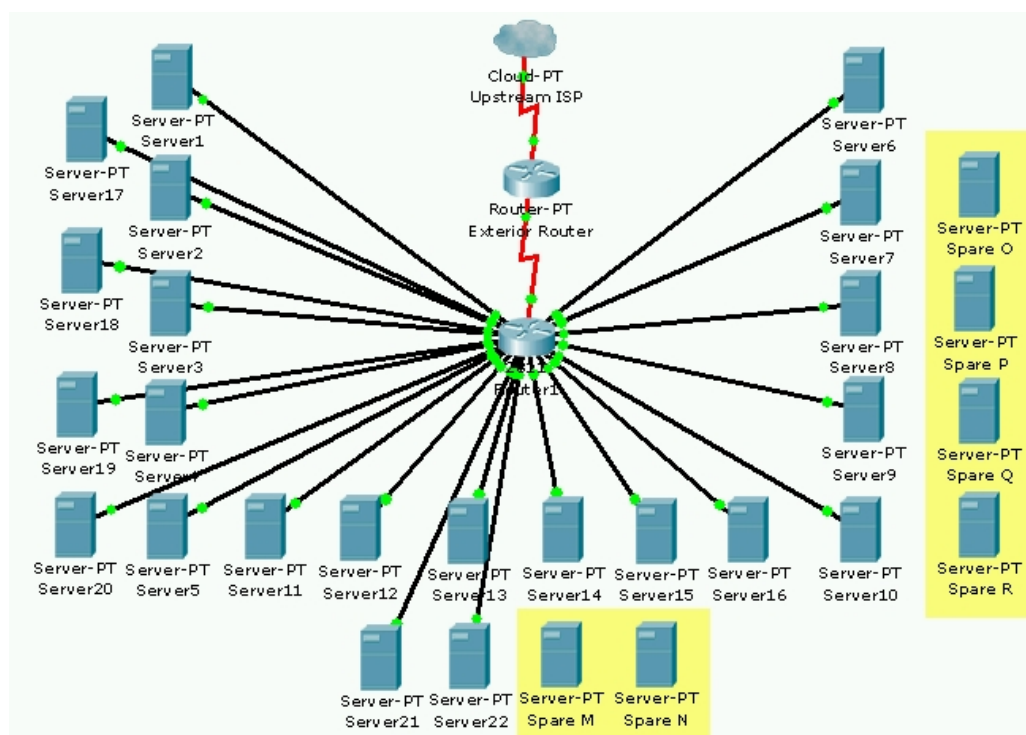


Topology A (end of Q4) – Expanded co-location design using Cisco 1841 routers

Lab Topology Using 2811 Routers



Topology B (Q1 startup) – Proposed initial co-location solution using a Cisco 2811 router



Topology B (end of Q4) – Expanded co-location solution using a Cisco 2811 router

Step 3: Recommend a co-location solution

- a) Based on your evaluations of the 1841 and 2811 router, which solution would you recommend to provide the best scalability while staying within the budget limitations? Explain the reasons for your choice?

- b) What other solutions could be considered?

Step 4: Reflection

- a) Whenever new equipment is added to a co-location rack, the rack must be powered down. This causes a loss of service to all the existing customers on that rack. If this happens too often, customers will switch to another provider. Based on your experiences with the 1841 and 2811 router configurations, which solution would minimize network downtime? Explain the reasons for your choice?

- b) Network availability and reliability is of great importance to e-commerce businesses. What would happen to the Internet access of the customer web servers if one of the routers in the co-location network failed? Which solution would negatively affect the most customers if a co-location router failed?

- c) What could be done to improve the reliability of the co-location network and to minimize downtime?

Handout A: Projected Year 1 Equipment Costs for Co-Location Solution A (Cisco 1841)

Timing (Q1, Q2, Q3 or Q4)	Number of Server Ports Required (including 20% spare)	Equipment Needed			
		Quantity	Description	Unit Cost	Total Cost (Quantity x Unit Cost)
TOTAL EQUIPMENT COST FOR YEAR 1					

Handout B: Projected Year 1 Equipment Costs for Co-Location Solution B (Cisco 2811)

Timing (Q1, Q2, Q3 or Q4)	Number of Server Ports Required (including 20% spare)	Equipment Needed			
		Quantity	Description	Unit Cost	Total Cost (Quantity x Unit Cost)
TOTAL EQUIPMENT COST FOR YEAR 1					