

Homework 10
1.264, Fall 2013
Communications, and software process
Due: Friday, December 6

A. Communications

Read the Qwest response to the Request for Information (RFI) on Carrier Ethernet, which is posted on course Web site. Assume that TacDoh is your aircraft parts distributor, rather than a purveyor of deep-fried delights. You operate in the same eight sites as TacDoh; see the map in Figure 1 on page 5 of the RFI. You have the same software applications as TacDoh, as listed on page 5: SAP is your ERP system, IBM/Lotus Notes is your email and document sharing system, the Web based customer order entry system is the one you have built this semester. Assume your desired deployment dates are in 2012, not in 2007, as on page 6. Qwest's proposed VPLS service (page 9) is an MPLS service, which we cover in lecture 36; you'll need to read about MPLS in the telecom book before we cover it in lecture. You should understand MPLS technology at a functional level: it delivers configurable bandwidth, quality of service guarantees, security and can seamlessly interface with Ethernet LANs.

You are involved in this RFI at the aircraft parts company because you are recommending much tighter integration with 10 key customers, whose facilities would be added to the aircraft parts company network, in addition to the 8 existing sites. While this is primarily a supply chain project, driven by supply chain efficiencies, you must determine an effective information system implementation, including the telecom components. The Qwest response must handle existing aircraft parts company traffic, but must also be capable of rapid extension to these 10 customers, and perhaps more. (Note the discussion on page 4 of the RFI about "growing into new areas".)

Frame relay, your existing network, is a pre-Internet protocol that is very similar to TCP/IP and has been used for several decades as a reliable, secure business network technology. Few if any new frame relay products are being developed today, and most frame relay users are migrating to carrier Ethernet or similar technologies, as is TacDoh. You don't need to read about frame relay in the telecom book.

IP PBXs (private branch exchanges) (page 7) are branch phone switches that handle voice over IP: voice calls go over the data network.

Please answer the following questions that your management has asked in a briefing about the RFI. Short answers, no more than a paragraph, are sufficient for each.

1. VPN
 - a. What bandwidth is provided over the IPsec VPN DSL links from Green Bay, WI and Chicago IL? Look up the typical DSL bandwidth in the telecom book. Then look at the bandwidth needed at these sites on page 24. Propose a way to use DSL to provide this amount of bandwidth. If DSL can't provide this bandwidth, describe strategies to meet the needs of these two offices.

- b. Does DSL connect Green Bay and Chicago with Syracuse, or is it an access technology? If DSL is an access technology, what wide area technology do you think it connects to? If DSL is a wide area technology, explain its distance limits, if any.
 - c. Is the VPN running over the open Internet?
 - d. Why would TacDoh use DSL links and a VPN for these offices instead of a T1, T3 or OC3 link?

- 2. Carrier Ethernet
 - a. Why would TacDoh explicitly prefer carrier Ethernet over other alternatives, such as a VPN for all sites, or T3 (OC1) or OC3 links running SONET?
 - b. Last mile: Qwest provides Ethernet local access via native Ethernet (MAN Carrier Ethernet) or SONET. Compare the configurability of MAN carrier Ethernet versus SONET: which one can provide more bandwidth options?
 - c. Does the Qwest VPLS (MPLS) service encrypt your traffic? If not, is this satisfactory?
 - d. Compare the redundancy of the Qwest proposal with your current network.

- 3. Cost. The Qwest proposal costs \$142,000 per month.
 - a. What is the cost of your current network, as shown in Figure 1? Typical monthly costs are \$45,000 for OC-3, \$15,000 for T-3, and \$1,000 for 7 Mbps business DSL.
 - b. Does the Qwest proposal offer a cost savings over your current network?
 - c. Your CEO asks what network changes can be made, and savings obtained, if video is eliminated. Provide a brief analysis.

- 4. Metro area network (MAN)
 - a. Which of your sites, if any, can be connected by a metropolitan area network (MAN)? Assume MANs are available in all the metro areas in which your company has facilities. Briefly explain your answer. If the MAN is feasible and it is inexpensive, briefly explain how the aircraft parts company might use it.

- 5. Bandwidth
 - a. How many phone conversations can be carried in 50 Mbps of bandwidth, as the headquarters sites require? Assume maximum utilization is 70% and that the average bandwidth used in a voice call is 32 kbps.
 - b. In Lotus Notes, how many 1MB documents can be shared (replicated) per minute with 20 Mbps of bandwidth? Assume 70% maximum utilization.

- 6. Bandwidth to external sites
 - a. Your biggest customer requires you to send all their documents in a single daily batch transmission that must start after 5pm and must be complete by 6pm. They are currently in Syracuse, NY, adjacent to your facility and connected via a shared LAN, but are moving to Atlanta, GA. The size of

the files to be sent daily is approximately 300 MB. Describe and briefly discuss at least 3 options you have.

- b. Your aircraft parts company has a manufacturing subsidiary in a remote area, connected only by a VSAT satellite link. You have a choice of 9.6kbps or 64kbps service. The site has the following traffic in a 10 hour day:
 - i. Lotus Notes documents: 500 messages per day, averaging 1MB
 - ii. Web/Internet access: 25 users, requiring general Web browsing capabilities as part of their jobs. Assume 2MB/hr/user.
 - iii. ERP (SAP) XML data: purchases, invoices, shipments, payroll, etc. 500 messages per day, averaging 250 KB per message
 - iv. Voice is handled via landline phones; it is not carried over the VSAT link, and there is no video.

Could you use 9.6kbps? Could you use 64kbps? Or is neither sufficient? What if you spread ERP and Notes traffic over 24 hours instead of 10?

7. Two railroads, UP and CSX, offer you the use of their fiber optic networks, which serve all your locations, as an incentive for you to sign a contract for using their intermodal services for inbound shipments to your distribution center. Assume that the transportation economics are favorable, that the railroad fiber network can handle your data traffic, and that the telecom cost is half of Qwest's bid. You would have to get to the railroad network point of presence. Assume a MAN is available in all cities in which you have facilities, and that the MAN costs would be \$20,000 per month for all 8 sites and would provide the same bandwidth as the Qwest proposal. Would you move your data traffic onto the railroad's private network? If so, what conditions would you require? Discuss briefly.

B. Review of Development Cycle 1

Take out your homework 2 solutions and revise them to reflect the knowledge gained from doing the first cycle of development. Don't rewrite the document; just make changes, additions or deletions to reflect what you've learned. They can be brief; they can refer to homework sets 3-9 as needed.

Please put in revised screen shots from your Web site to replace the initial Web pages in your homework 2 solution. Also, revise your estimate of the number and complexity of Web pages to implement your requirements.

Hand in the revised requirements narrative document. Keep it the same length and organization as your original document. Update the user interface, process descriptions, resource estimates, etc. Change the error bounds on the resource estimates to reflect the later stage of development. This will be the starting point for spiral 2.

While you would normally include the UML models, data model, sample database and prototype Web application in the revised requirements (and/or design documents), assume that they are available and will be delivered to the management as separate documents, to which you may refer. Thus, you should assume that homework sets 3-9

are being handed in to the management as well, and that they have been appropriately edited. Again, revise only homework 2.

Add one or two pages of comments at the beginning of your revised requirements, addressing the following questions:

- What do you believe the outcomes of development efforts would be in the following two cases:
 - Contracting development of your system to a vendor based on your original homework 2
 - Contracting development of your system to a vendor based on a package containing your homework sets 3-9 and revised homework 2
- Do you believe the error bounds? Do they reflect the uncertainty that has been removed by the first cycle of the spiral model?
- Do you feel the current requirements can be translated into a design and system with low risk, or are there still substantial elements of uncertainty? If so, identify some of the substantial elements of uncertainty.

Hand in

Hand in the communications question answer and the revised requirements document as two Word documents in a single zip file to the course Web site.

Extra credit (extra 50% credit on homework 10)

Assemble homework solutions 2-9, plus the first part of 10, into a single document that represents the entire first spiral of your system. Use screen shots to document the Web pages that you created in homework 6, 7 and 8. Create a table of contents for the document. Edit the document so that it's generally consistent in style. Hand this in instead of the revised requirement document to the course Web site.

This can be a useful project portfolio for you, and it may be a useful guide for future projects. This is completely optional; it is for extra credit only.

MIT OpenCourseWare
<http://ocw.mit.edu>

1.264J / ESD.264J Database, Internet, and Systems Integration Technologies
Fall 2013

For information about citing these materials or our Terms of Use, visit: <http://ocw.mit.edu/terms>.