CS144
An Introduction to Computer Networks

Unit 3: Packet Switching

Nick: In this unit you will learn a lot about packet switching – it is quite an intense unit and your head might be spinning with packets by the end of it. But that's why we have videos! You can cover the material at your own pace and review it several times.

Phil: We will start out with a leisurely look at why the Internet – and almost all modern networks – are built on a foundation of packet switching. Packet switching is *simple* in the sense that each packet is a self-contained unit of data that carries information necessary for it to reach

its destination. Packet switching is *efficient* in the sense that it keeps a link busy whenever there is work to be done, rather than have dedicated capacity reserved for each user or application.

Nick: After a leisurely introduction to packet switching, we will dive deeply into some of the consequences. We will take a journey that includes more math than you will see in any other unit of this course. The math might seem daunting at first, but it's actually quite simple. Once you learn the math, so many other details or complex questions become really easy to answer and understand. For example, you will learn why two packets traveling between the same two end hosts might encounter a different delay. While the time they spend traversing each link is the same, the packets might take different paths and experience different queueing delays in the router buffers.

Phil: Make sure you fully understand the three main components of packet delay: the packetization delay, the propagation delay, and the queueing delay; and that you understand the physical processes that cause them. By the end of this unit you will be able to answer questions like: "How long does it take for a

packet to get from here to London?" or "How many packets can I fit in space between the moon and Mars?". You'll understand why routers have buffers, and how queueing delay leads to uncertainty about when packets will arrive. For most applications, this isn't an issue. But for real time streaming applications, like Skype and YouTube, they need to playback smooth, hiccup-free audio and video to the user, and so they need to absorb the variation in delay across the Internet. You'll learn how playback buffers are designed.

Nick: Finally, you'll learn about how packet switches work in practice. At the end of the unit you'll also be able to answer the question: "How does an Internet router actually work?", and "How is it different from an Ethernet switch?". "How does a router arrange its lookup tables?" and so on. It's quite a whistle-stop tour of packet switching, and by the end of the unit you should have a good intuition for how packet switching works in the Internet.