CS144
An Introduction to Computer Networks

Unit 1: The Internet and IP

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| Network |
| Link |
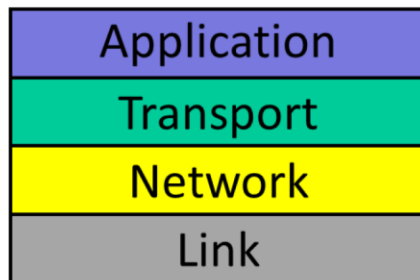
Phil: Welcome to the first unit! This is the unit where you get the "big picture," and a first few details.

Nick :You're going to learn the basics of how the Internet works. You might even figure out which one of us is Phil and which one is Nick. We hope to help you to understand *why* the Internet is designed the way it is. What are some of its strengths and weaknesses? We'll also teach you some of the commonly accepted network design principles, such as layering, encapsulation, and packet switching. At the end of this unit, you

should be able to answer questions such as "What is the Internet? What is an Internet Address?" and "How do applications such as the web, Skype, and BitTorrent work?" These principles will help you design better networks in the future.

Phil: At the end of the first unit, you should be familiar with something called the "4-layer model" of the Internet. It describes how the Internet is broken down into four distinct layers. You'll learn what layers are and why they're a basic principle of good network design. You'll learn what the Internet's four layers are and how they work together. You'll learn that most applications use a transport layer called the Transmission Control Protocol, or TCP, and how some applications use it.

You'll also learn that the Internet works by breaking data up into small units called packets. For example, when you request a web page, your computer sends some packets to the web server. The Internet decides how these packets of data arrive to the right destination.

Nick: This unit also examines one layer, called the

network layer, in a bit of detail. You might have heard of IP, the Internet Protocol. It's the protocol named after the Internet because it's the glue that lets the whole thing work. You can change all of the other layers, but to be using the Internet you need to be using the Internet Protocol at the network layer. You'll learn about what the Internet Protocol does and how it does it. You'll learn about Internet Protocol addresses and how they're assigned. You'll start to learn how the Internet decides the path a packet should take based on Internet addresses.

Phil: Finally, we'll show you a few software tools you can use to inspect how your computer is using the Internet. So you can apply what you've learned in this unit to the next time you browse the web!

What you will learn

How an application uses the Internet

The structure of the Internet: The 4 layer model

The Internet protocol (IP): What it is

Basic architectural ideas and principles

- Packet switching
- Layering
- Encapsulation

Nick

In this unit you will study four main topics

<click> 1. How an application uses the Internet. Phil will explain the common way in which a variety of different applications use the Internet, using Skype, BitTorrent and the Web as specific examples. You will learn that most applications want to communicate over a reliable, bi-directional byte-stream between two or more end points.

<click> 2. The structure of the Internet. As Phil just said, the internet is composed of four layers, each with a well-defined role in making the Internet work. I'll describe what the 4-layer model is, and the responsibility of each layer. You will learn why we use the Internet Protocol or "IP" every time we send packets across the Internet, and why we call IP the "thin waist" of the Internet.

<click> 3. The Internet protocol (IP). Because IP is so important, we'll spend several videos describing what IP does for us, and how it works. For now, we'll be focusing on IP version 4, because it's the most widely used version of IP today. You'll learn about IP addresses, how routers look up IP addresses and so on. Later in the course you'll learn about the newer version of IP, IPv6.

<click> 4. Basic architectural ideas and principles. You'll also be learning about four fundamental principles of networks, all of which are very relevant to our understanding of the Internet. The first is packet switching, which is the simple way in which data is broken down into self-contained packets of

information that are forwarded hop-by-hop based on the information in the packet header. The second is Layering, which we've already mentioned. And the third is encapsulation, which is the process of placing a packet processed at one layer inside the data of the packet below. This helps a clear separation of concerns between how data is processed at each layer in the hierarchy.

What this will help you with

At the end of the unit, you should have a good understanding of the basic structure of the Internet and three basic architectural ideas.

This information provides an intellectual structure for the rest of the course.

Phil

At the end of the unit, you should have a good understanding of the basic structure of the Internet and three basic architectural ideas. You'll understand how applications like your web browser works, and how the Internet delivers packets between two computers. You've probably heard the term TCP/IP used before: you'll learn what TCP is and what IP is, and why they're related. At first glance, these might seem like grungy, low-level details. But it turns out that they're the bedrock of what the Internet is. Every

year, new applications and uses of the Internet emerge. But all of them use these basic principles we'll talk about, and almost all of them use TCP/IP. By starting with these fundamentals that have remained amazingly constant, you'll learn the knowledge that will continue to be important even as we move on to 5G wireless networks, Web 3.0, and the Internet of Things.

And that's part of what's exciting. The Internet and what it can do is always expanding and changing. But there are some core ideas and principles which are constant through all of that evolution. By learning them, you'll not only know how the Internet and networks work today, but most likely how they will work in 20 years as well.