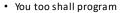
Course wrap	-un
Ben's wrap-up	
CSCI E 45a: The	Cyber World – part A
1	Copyright © Scott Bradner & Ben Gaucherin 2015
It's all bits, and	d inter-connected boxes
<u> </u>	• Bits = data = code
	Code is data, and data is code
	The same bits can be used/read
	differently depending on your goal/intent
A	 Small pieces, loosely joined
	A critical design principle at every
	level
2	Copyright © Scott Bradner & Ben Gaucherin 2015
Moore's law is	pretty powerful
	 Physical devices
	Smaller
	More powerful
	Inter-connected
	Increasing in number at a faster
	or devices being virtualized
	It's all bits!
	.cs an oics.
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The world is programmable

- All the inter-connected devices are programmable Your clothes and your toasters are next
- The network is indeed the computer
- Virtualized infrastructure is programmable "Infrastructure as code"





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Trust

- How do you know?
- The more complex the system the more opportunities to subvert



 Exploring and researching vulnerabilities is an important aspect of making technology safer, more secure, more trustworthy?
 The color of your hat matters

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The cyber infrastructure



- Locally structured but globally messy and redundant
 - "Two is one, and one is none"
 Topology as well as management
- Layered topology
 Core, Distribution, Access
- Management tools and frameworks
 Necessary but not sufficient

Not a replacement for thinking

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Г	1
Grounded in the cloud	
 Change from purchasing hardware to purchasing cycles 	
Right sizing resources	
A brave new world full of unknowns	
 Cycles Outsourcing, versus insourcing Centralized to distributed 	
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Г	1
Where we are, where we are going	
The "blessing and the curse" of a	
technology augmented life	_
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Scott's wra	p-up
CSCI E 45a: Th	ie Cyber World – part A
	,
1	Copyright © Scott Bradner & Ben Gaucherin 2015
History1 =	ackets & APDANET
гизтогут – ра	ackets & ARPANET
	• Deep in the "cold war"
	Sputnik caused ARPA Paul Baran developed datagram
	networks to survive a first strike
A	Named "packet" by Donald Davies
	Mesh network with cheap
	forwarders Reliability from redundant paths
	Larry Roberts built the
	ARPANET to share
	computers using the
	datagram (packet) concept
	ARPANET was an inter-site
	network
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History 2 - In	ternet
,	 Cerf & Kahn built on Baran's
	& Pouzin's work to define
	IPTCP
	Split into TCP/IP to support
A	Cohen's voice transport
	 IP is an end-to-end bearer service
	Using inter-network addresses
	ARPANET converted to TCP/IP
	January 1, 1983
	Became an inter-network network
	1 M hosts by January 1993
	171 M hosts by January 2003 963 M hosts by January 2013
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Internet services



- Services ride on the Internet
 Not provided by the net
 Reliability, flow control, congestion control, security are end-system-based functions
- Network just forwards packets to a destination as best it can - using routers
- Routers use routing protocols to know where to forward packets

Routing protocols run over the Internet

Routers use destination internetwork addresses to forward packets

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Internet plumbing

 Lots of other boxes in the net – mostly invisible to end hosts

NATs, firewalls, proxies, caches, load balancers, etc.

May maintain state, but state not required by end hosts

 Domain name system (DNS) used to translate userfriendly host names into inter-network addresses
 DNS uses the Internet, DNS is not provided by the Internet



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Security



- IT security is not easy
 Determining the actual risk is
 often the hard part
 People are not good at
 understanding risk
- Good design and operations can reduce risk

Good (exterior) walls not enough

Enterprise security policies do as well

Assuming they are clear and actionable

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Encryption



 Encryption makes the Internet safer and more secure

> Public key encryption is the foundation for Internet commerce and secure communication

Not currently breakable Standard symmetric encryption is top-secret strong

 But encryption runs counter to governments desire to know what is going on

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Regulation



- The Internet flourished in an era of little regulation At least in US & Europe
- Unlike the telephone world Services & tariffs are controlled
- Internet regulations becoming more common But still nowhere near what the telephone world has

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Standards



- All important Internet standards developed or maintained by multistakeholder SDOs E.g., IETF, W3C
- Old telephone standards developed or maintained by SDOs where governments have the final say E.g., ITU-T, ISO, ETSI
- Some people would like the first to change

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