Introduction to IA – Class Notes











Network Protocols & Vulnerabilities

≻ Standards allow interconnection □Otherwise we would suffer combinatorial explosion →



- Security implications of standards
 Inherent design of the standard itself
 - Degree to which security considerations are built into the standard (or not)
 - 3. Effectiveness of implementation of standards in vendor products

Standards

- > Core Layers
- Layered Standards Architectures
- Single-Network Standards
- Internetworking Standards



Core 1	Layers
Super Layer	Description
Application	Communication between application programs on different hosts attached to different networks on an internet.
Internetworking	Transmission of packets across a routed internet. Packets contain application layer messages.
Single Network	Transmission of frames across a single switched network. Frames contain packets.
1	
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Super Layer	TCP/IP	OSI	Hybrid TCP/IP-O:	
Application	Application	Application	Application	
		Presentation		
		Session		
Internet	Transport	Transport	Transport	
	Internet	Network	Internet	
Network	Subnet Access	Data Link	Data Link	
		Physical	Physical	





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NORWICH

Internet Protocol (IP)

> Basic functions of IP
 Organizes packets
 Determines how routers move packets
 > IPv4 main protocol of today's Internet
 Descriptive portion = header

 Consists of fields

 DPackets can be split into smaller fragments

 All have same identification field
 Assigned fragment offset value (sequence #)
 Reassembled on receiving side
 Source & destination addresses
 Running out of IPv4 address space!

I	Pv4 1	Packet St	ructu	re		NORWIC
Bit 0						Bit 31
Version (4 bits) Value is 4 (0100)	Header Length (4 bits)	Diff-Serv (8 bits)	Total Length (16 bits) length in octets			
ldentification (16 bits) Unique value in each original IP packet		Flags (3 bits)	Frag Octets fra	iment Offset (13 bits) from start of original IP agment's data field		
Time to L	ive (8 bits)	Protocol (8 bits) 1 = ICMP, 6 = TCP, 17 = UDP	Header Checksum (16 bits)			
		Source IP Ad	dress (32 bits)			
		Destination IP	Address (32 bits)			
Options (if any) Padd			Padding			
		Data	ı Field			
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Reliability	NORWICE	(тс	P Se
 Unreliable protocol Does not detect or correct errors TCP is <i>reliable</i> protocol TCP checksum field 			Bit 0 Sourc	ce Port Numb
□Recipient uses same algorithm to recompute checksum value □Discrepancy results in dropping p > Sender waits for ACK	packet		Header Length (4 bits) TCI	Reserved (6 bits) P Checksum (*
□After specified wait time, resends same packet		-		
Image Copyright Seriow, All rights reserved. URL: <u>http://tinyurl.com/3k86vkj</u> Permission received 2011-09-12 for use of copyrighted material. Copyright 22016 M. E. Kabay. All rights reserved.		2	ag fields are 1-bit	t fields. They ir

т	P Seg	ment			NORWI
Bit 0					Bit 31
Sou	rce Port Number (1	6 bits)	Destination Port N	lumber (16 bits)	
		Sequence Nu	mber (32 bits)		
		Acknowledgemer	nt Number (32 bits)		
Header Length (4 bits)	Reserved (6 bits)	Flag Fields (6 bits)	Window (16 bits)		
TCP Checksum (16 bits) Urgent Pointer (16 bits		r (16 bits)			
Options (if any)			Padding		
		Data	Field		
Flag fields are 1-b	it fields. They includ	le SYN, ACK, FIN, RS	T, PSH, and URG		



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NORWIC

TCP Security

- TCP originally designed without security and continues without it
- IPsec center of IETF efforts for Internet security But few users have moved to IPsec
 - □Therefore some pairs of users apply electronic signature
- > RFC 2385, "Protection of BGP Sessions via the TCP MD5 Signature Option"
 - Border Gateway Protocol used for exchange among administrative systems
 - Long-term relationships (like leased lines in old days)
 - □Viewed as relatively weak security
 - http://tools.ietf.org/html/rfc2385

NORWI **User Datagram Protocol** (UDP) > Some services do not require reliability □VoIP (Voice over IP) SNMP (Simple Network Management Protocol) > UDP: connectionless & unreliable – & simple > UDP & TCP both use port #s – but are different types of ports □So always specify which kind of port # □E.g., "TCP port 80" for HTTP > UDP even weaker than TCP Rit 0 Bit 31 Source Port Number (16 bits) Destination Port Number (16 bits) UDP Checksum (16 bits) UDP Length (16 bits Data Field









IPv4 Addres	s Report	
		This report generated at 12-Sep-2016 08:21 UTC.
IANA Unallocate	d Address Pool Exhaustion: 03-Feb-2011	
Projected RIR A	ddress Pool Exhaustion Date	5
RIR	Projected Exhaustion Date	Remaining Addresses in RIR Pool (/8s)
RIPE NCC	14-Sep-2012 (actual)	0.8479
LACNIC:	10-Jun-2014 (actual)	0.0490
ARIN:	24 Sep-2015 (actual)	
AFRINIC	25-Jun-2018	1 5219









JUNE 30, 2016 - Update							
World Regions	Population (2016 Est.)	Population % of World	Internet Users 30 June 2016	Penetration Rate (% Pop.)	Growth 2000-2016	Table % Users	
Asia	4,052,652,889	55.2 %	1,846,212,654	45.6 %	1,515.2%	50.2 %	
Europe	832,073,224	11.3 %	614,979,903	73.9 %	485.2%	16.7 %	
Latin America / Caribbean	626,119,788	8.5 %	384,751,302	61.5 %	2,029.4%	10.5 %	
Africa	1,185,529,578	16.2 %	340,783,342	28.7 %	7,448.8%	9.3 %	
North America	359,492,293	4.9 %	320,067,193	89.0 %	196.1%	8.7 %	
Middle East	246,700,900	3.4 %	141,489,765	57.4 %	4,207.4%	3.8 %	
Oceania / Australia	37,590,820	0.5 %	27,540,654	73.3 %	261.4%	0.8 %	
WORLD TOTAL	7,340,159,492	100.0 %	3,675,824,813	50.1 %	918.3%	100.0 %	
NOTES: (1) Internet Usage ann for detailed regional usage infor <u>Eurostats</u> and from local censu International Telecommunicatio disclaimers, navigation help an giving the due credit and placir	d World Population S rmation. (3) Demogr is agencies. (4) Inter <u>ns Union</u> , by <u>GfK</u> , b id methodology, plea ng a link to <u>www.inter</u>	Statistics update aphic (Population net usage inform y local ICT Regu se refer to the <u>S</u> metworldstats.com	d as of June 30, 20 on) numbers are ba nation comes from Jlators and other re <u>site Surfing Guide</u> . (om. Copyright © 20	 (2) CLICK on sed on data from data published by liable sources. (5) (5) Information in to 01 - 2016, Miniwa 	each world regic the <u>US Census</u> <u>Nielsen Online</u> , For definitions, his site may be tts Marketing Gr	on name Bureau, by the cited, roup. All	











