Presentation

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Exercise Other encodings are available. Find out the encodings used on various web pages from across the world

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Numbers

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An integer is typically represented using four bytes: but how those bytes are used varies

Some machines use *big endian* format: this stores the most significant byte of an integer (the *big end*) at the lowest machine address, less significant bytes at increasing addresses

Others use *little endian* format: the least significant byte (*little end*) is stored at the lowest machine address, more significant bytes at increasing addresses

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If a machine receives four bytes 00 00 00 2A, does that mean the integer 42 (hex 0000002A) or the integer 704643072 (hex 2A000000)?

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A typical solution so that everyone agrees on order is to pick a single order (*the network byte order*) and always transmit bytes in that order

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When a machine receives a value it converts it to its native order

The *de facto* order used on most networks is big endian

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This is simpler than having a protocol to negotiate endianness and having separate chunks of code for each combination

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The floating point endian is usually the same as the integer endian, but doesn’t have to be!

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For example: how to represent the end of a line in a text file?

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- Pre-MacOS X used a single CR

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If we are still fumbling an issue as simple as this, just think on the general case!

Presentation

The End of the Line

Exercise Read about XDR as an encoding system

Exercise Read about the Multipurpose Internet Mail Extension (MIME)

Applications

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There are very many applications that run over the IP from the well-known things like the Web and email, to the near-invisible (but very important) applications that do everyday things like serving files or controlling industrial devices

Applications

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Exercise Read up on your favourite applications and how they employ IP

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And early code left a lot to be desired in programming habits, giving us some fragile implementations

But fast development led to IP’s early acceptance and success

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Some are fairly benign, such as TTL being used as a hop count

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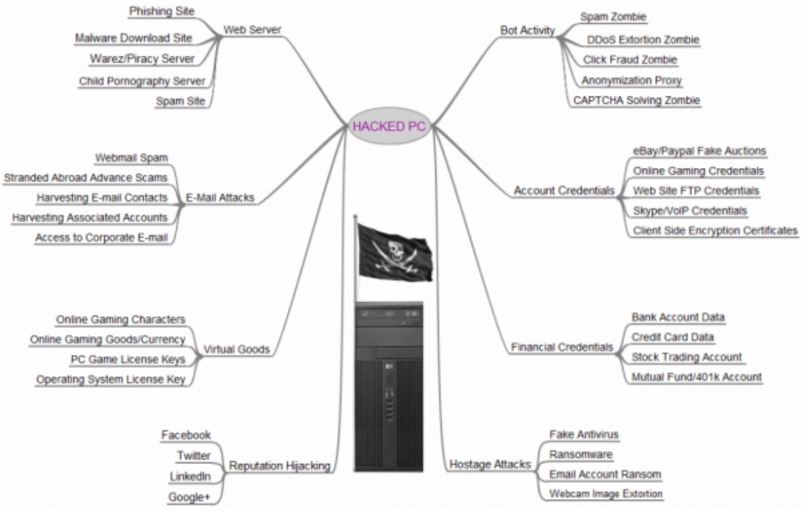
- crash the machine
- tie up the machine with so much bogus data that real traffic can't get through: called *denial of service*
- gain control over the machine, which can then be used attack a more important target or send spam

Security



Uses for a hacked PC

From: `krebsonsecurity.com`

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The point is that we all have things to hide from people who would use information to harm us, financially or otherwise

Remember not all those looking at your traffic have your benefit in mind

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Thus we must protect ourselves against these issues

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We shall return to this kind of attack, but shall start with some attacks on the technology

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Flooding Attacks

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SYN floods. A denial of service attack

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The server must save a chunk of information about the initial SYN so it can recognise the client ACK as part of the new connection; and the options, like SACK, MSS

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The individual hosts are sometimes called *zombies*

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Thus the server can run out of resources and not be able to respond to real connection requests

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A DDOS attack might be several GB/s of SYNs: attacks of TB/s are becoming more common

Security

> *Since the start of the [ransom DDoS] campaign, show-of-force attacks have grown from 200+ Gbps in August to 500+ Gbps by mid-September, then ballooned to 800+ Gbps by February 2021*

Akamai

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Thus flooding a secondary target or targets

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Real connections might get dropped, but since most of the SYNs are bogus, the probabilities are that attack connections are dropped

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This is good as it consumes no resources in the server until they are definitely needed

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The loss of SACK is no big deal when we have to cope with a SYN flood