

Internet Security

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General information

- Area:
 - Diplom (Informatik): BKS – Hauptstudium Vertiefer
 - Master (Informatik): Kommunikationsbasierte Systeme
 - Bachelor (Informatik): Kommunikationstechnik
 - Master (techn. Informatik): Techn. Anwendungen
 - Will be integrated into a Module system of SECT and INET
- Time
 - Wednesday: 10:00 – 12:00
- Room
 - TEL 1118/19
- Language
 - English (Questions can be asked in German!)
- Web site
 - http://www.net.t-labs.tu-berlin.de/teaching/ss09/is_ss09/

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General information

- ❑ Mailing list
 - Via ISIS, see Web page
- ❑ Exam
 - For those that need it ☺
 - Oral or written exam after semester end (depends on # of participants)
- ❑ Prerequisite: some knowledge of
 - How the Internet works
 - How operating systems work
 - Little bit of undergraduate math for cryptography
- ❑ Additional contact persons:
 - Jan Böttger (INET) and Collin Mulliner (SECT)

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What is this course about?

- ❑ Network security? Not quite!
- ❑ Focus:
 - Security of networked applications
 - Security of Web browsers
 - Protection of network infrastructure
 - Firewalls
 - Intrusion detection

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Topics

- ❑ **Basics of secure network protocol design**
 - Using cryptography (not a cryptography class!)
 - The role of correct software

- ❑ **Practical focus**
 - This is not a pure academic-style course
 - You'll see real security holes
 - A lot of (in)security is about doing the unexpected
 - „Think sideways“

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How to think about insecurity

- ❑ Bad guys don't follow rules
- ❑ Need to understand what sort of attacks are possible to compromise a system
 - Prerequisite to understand what to protect in a system!
- ❑ **This is not the same as actually launching them!**
 - Taking a security class is not an excuse for hacking
 - Hacking is any form of unauthorized access, including exceeding authorized permissions
 - The fact that a file or computer is not properly protected is no excuse for unauthorized access

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Reading

- Kaufman, Perlman, and Spencer.
Network Security: Private Communication in a Public World,
Second Edition, Prentice Hall, 2002
- Cheswick, Bellovin, and Rubin.
Firewalls and Internet Security: Repelling the Wily Hacker,
Second Edition, Addison-Wesley Professional 2003
- Garfinkel, Spafford, and Schwartz.
Practical Unix & Internet Security,
O'Reilly Media, Inc.
- Matt Bishop.
Computer Security: Art and Science,
Addison-Wesley Professional 2002
- ... (see Web)
- **Research papers** (see Web)

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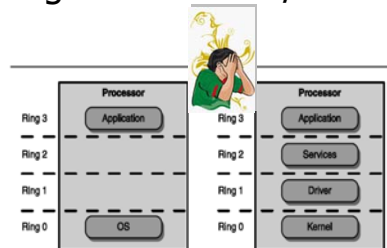
Network security

Overview

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Dichotomy: Hosts

- ❑ Is (or can be) well-controlled
- ❑ There are well-developed authentication and authorization models
- ❑ Strong notion
 - Of „privileged“ state
 - What programs can use/do



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Dichotomy: Networks

- ❑ None of the above
- ❑ Anyone can (and does) connect to the network
- ❑ Connectivity can only be controlled in very small, well-regulated environments, and maybe not even then
- ❑ Different OS have different – or no – notions of userIDs and privileges

=> notions of privilege is missing

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Networking

- ❑ Networks interconnect
- ❑ Networks always interconnect
- ❑ Interconnections happen everywhere 😊
but mainly at the edges

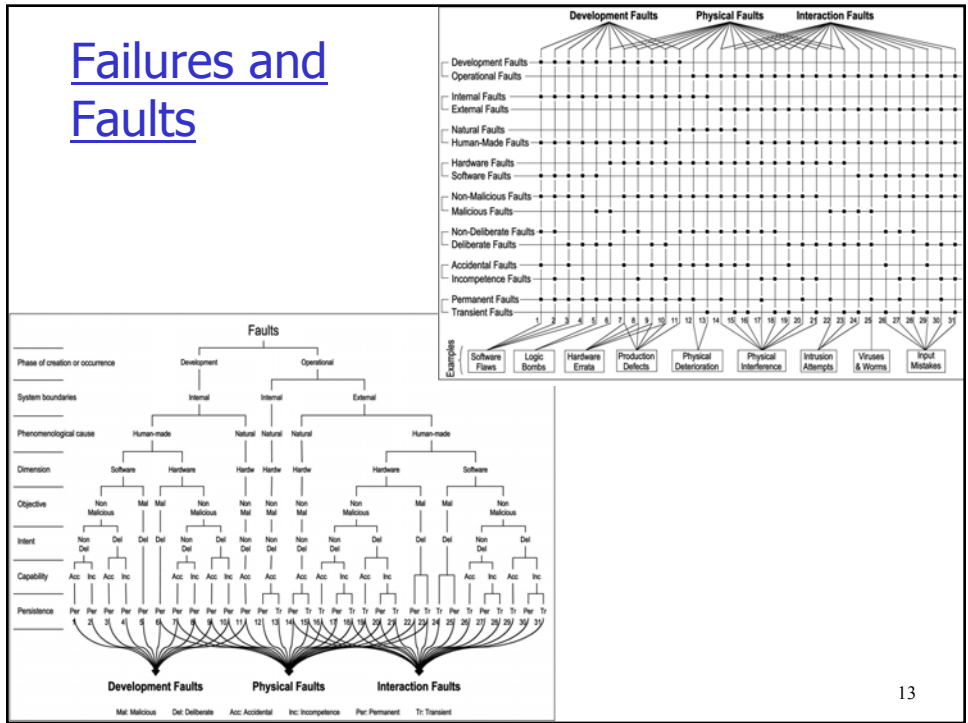
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Failures

- ❑ Benign failures
 - Most network failures are benign
 - The Internet allow for such failures
 - Data corruption
 - Timeouts
 - Dead hosts
 - Routing problems
 - ...
- ❑ Rule of thumb:
 - Anything that can happen by accident
can happen malicious
-> much more dangerous!

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Failures and Faults



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Principle: Trust nothing

- ❑ A host can/should trust **nothing** that comes over the wire!
- ❑ Any desired protections have to be explicitly supplied
- ❑ There may be help from lower layers that supply protection
 - Yet those layers have to be based on the same principle!
 - Research on such lower layer protection is a very hot topic and far from being solved!

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Attitude question

- ❑ Unproductive attitudes
 - „Why would anyone ever do that?“
 - „That attack is too complicated“
 - „No one knows how this system works, so they can't attack it“
- ❑ Better attitudes
 - „Programming Satan's Computer“ (Ross Anderson)
 - „Assume that serial number 1 of any device is delivered to the enemy“
 - „You hand your packets to the enemy to deliver; you receive all incoming packets from the enemy“

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Network security tools

- ❑ Cryptography
- ❑ Network-based access control (firewalls and more)
- ❑ Monitoring

- ❑ Protocol analysis by formal verification

- ❑ *Paranoid design!*

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Protocol design

- ❑ Heavy use of crypto and authentication
- ❑ Ensure that sensitive fields are protected
- ❑ Make authentication bilateral
- ❑ Figure out the proper authorization
- ❑ Defend against
 - Eavesdropping
 - Modification
 - Deletion
 - Replay
 - And combinations thereof

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Buggy software

- ❑ Most network security holes are due to **buggy code**
- ❑ A buggy network-connected program is an insecure one ☹️
- ❑ **Correct coding counts for a lot!**

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Course overview

- ❑ Introduction
 - Attacks and threats, cryptography overview
 - Authentication (Kerberos, SSL)
- ❑ Applications
 - Web, browser, email, ssh
- ❑ Lower layer network security
 - NAT, (IPsec), firewalls
- ❑ Monitoring / information gathering
 - Intrusion detection, network scans
- ❑ Availability
 - Worms, denial of service, network infrastructure

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