DATACOMM

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Datacomm Security

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Datacomm Security

- Data Integrity
- Sources of Error
- Controlling Errors
- Other Elements of Security

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Data Integrity

- Integrity refers to correctness and completeness
- Switched telephone system has variable quality
 - Some virtual circuits are silent
 - Others are noisy--contain random and nonrandom extraneous and transient signals
- Effects of noise
 - Obliterates differences between 0s and 1s
 - High-frequency transfers especially
 - susceptible to distortion of signal
 - Results in data loss
- Noise originates in electrical interference

– e.g., lightning storms, motors, transmitters

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Sources of Error

Options for handling errors

- Check nothing
- Error detection with flagging
- Error detection with request for retransmission
- Forward error correction (FEC) – intelligent receiver
 - detect and correct certain errors

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Controlling Errors

Echo Checking

- Send back all data to host (transmitter) for comparison with original message
- Echoplex data transmission on old terminals sent data to host and then back to display
- Expensive: at least doubles transmission time
- Effectiveness depends on how errors are detected solely on the host
- May introduce false positives where terminal received data OK but return to host had noise
- Used for critical applications



Controlling Errors

Cyclical Parity

- Two or more parity bits
- Permits detection of more types of error than simple parity check
- Can have each parity bit depend on specific bits in byte
 - E.g., parity bit #1 could check bits 1, 3 & 5 of a 6-bit sequence;
 - parity bit #2 could check bits 2, 4 & 6 of the 6-bit sequence

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Controlling Errors

Hamming Code

- FEC using 4 parity bits per byte
- Places parity bits in positions 1, 2, 4 & 8
- Data bits in positions 3, 5, 6, 7, 9, 10 & 11
- Each data bit is part of the parity calculation for two or three parity bits
- Can detect all single-bit errors and exactly correct the error
- High overhead (4 parity bits for 7 data bits) has kept applications rare

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Controlling Errors

Checksums

- Add up the data
- Append results to data
- After transmission, recalculate checksum
- · Compare new checksum with transmitted checksum

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Controlling Errors

- **Cyclical Redundancy Check**
- Similar to checksum
- Uses more complicated arithmetic; e.g., addition, multiplication, division, subtraction
- Generates a hash total
- · Can ensure that almost all errors, including multi-bit errors, will be caught
- Widely used
 - client account numbers
 - telephone and credit card numbers

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Other Elements of Security

NIST goals of datacomm: message should be

- sealed--unmodifiable without authorization
- sequenced--numbered to prevent loss or duplication
- secret--incomprehensible except to authorized recipient(s)
- signed--non-repudiable authentication
- stamped--non-repudiable receipt of message



Secure Transmission Facilities

Transmission media have different vulnerabilities

- Easiest to tap: wireless & cellular telecomm
- Easy: twisted pair, coax
- Possible: satellite and terrestrial microwave
- Hardest: fibre optic lines

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- Security uses I&A: identification and authentication
- · Identification depends on user ID
- Authentication can depend on
 - what you know; or
 - what you have; or both
 - what you are (or how you do stuff)
- Commonest form of authentication is password
- Other devices include one-time password
- generator
- Call-back devices limit access to known locations

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Historical and Statistical Logging

• Historical:

- record all data passing through device
- AKA audit trails
- Mainframe systems typically log
 - all login/logout
 - file opens/closes & which records changed
 - device requests (printers, tapes....)
- Statistical logging
 - How long user IDs access specific files
 - Does not keep record-level detail

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Closed User Groups

- Set of user IDs that can access information
- Can also define CUGs on VANs such as CompuServe

 ICSA has CUGs for clients taking on-line courses



- Firewall = data filter to examine all inbound and outbound data
- Firewall can prevent intruders from gaining access to certain parts (or any) of system
- Accept inbound connection only from trusted hosts
- Can set up internal firewalls to segregate certain systems from each other; e.g., research computers protected from sales users
- Application-level firewalls search data stream for e-mail, database access, file transfers
- Firewalls susceptible to IP address spoofing

























- Read Chapter 6 of your textbook in detail, adding to your workbook notes as appropriate.
- Review and be prepared to define or expand all the terms listed at the end of Chapter 6 of your textbook (no hand-in required)
- Answer all the exercises on pages 128 of the textbook using a computer word-processing program or absolutely legible handwriting (hand in after quiz tomorrow morning)