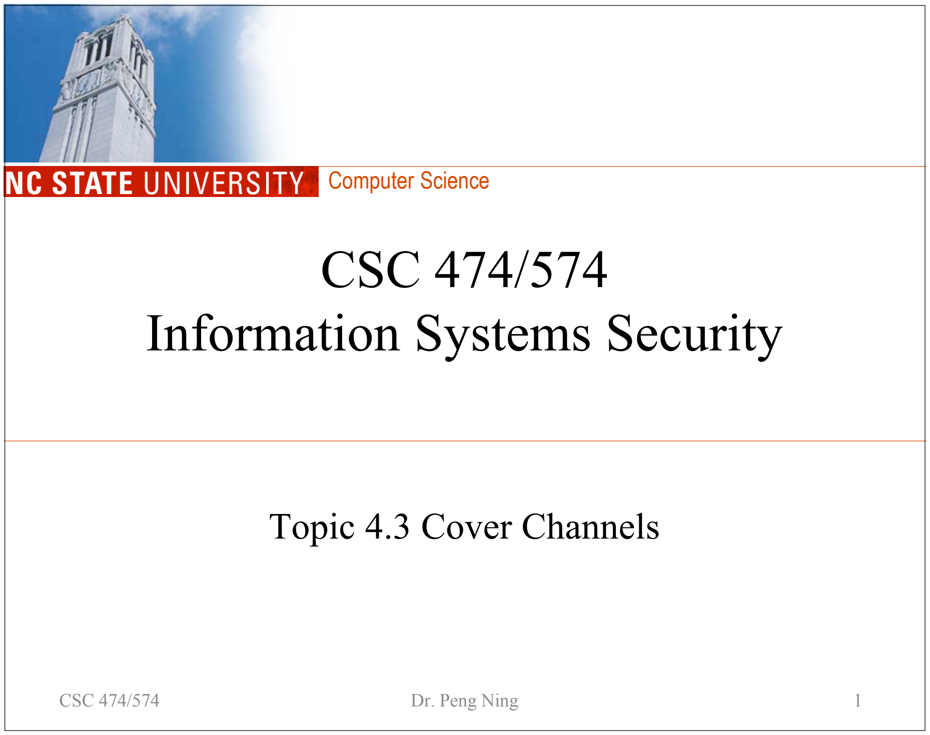
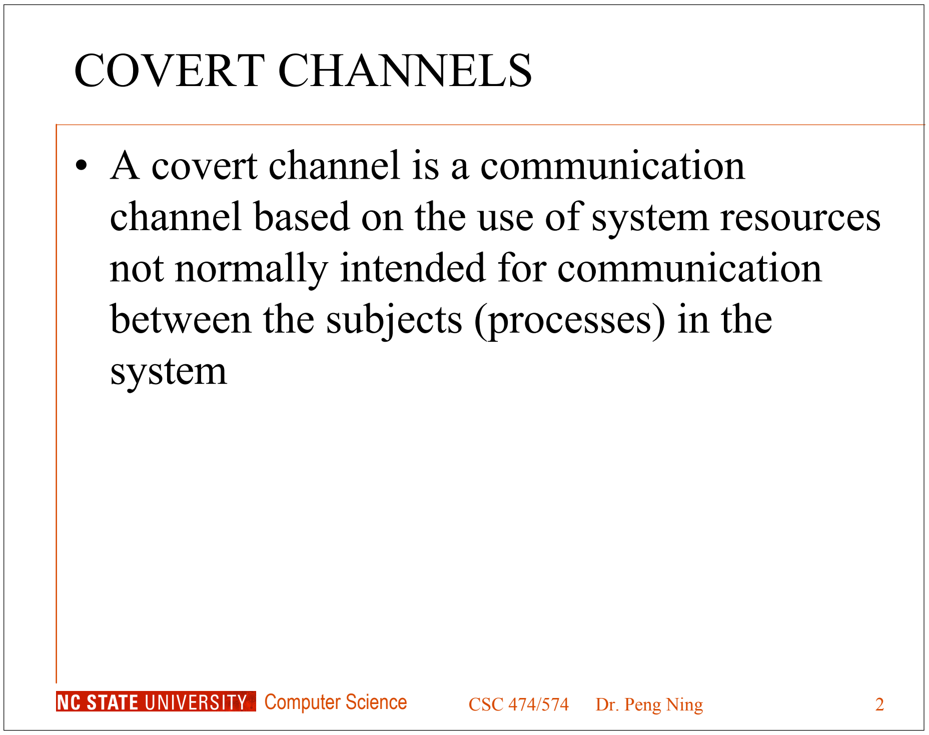


NC STATE UNIVERSITY Computer Science

CSC 474/574
Information Systems Security

Topic 4.3 Cover Channels



COVERT CHANNELS

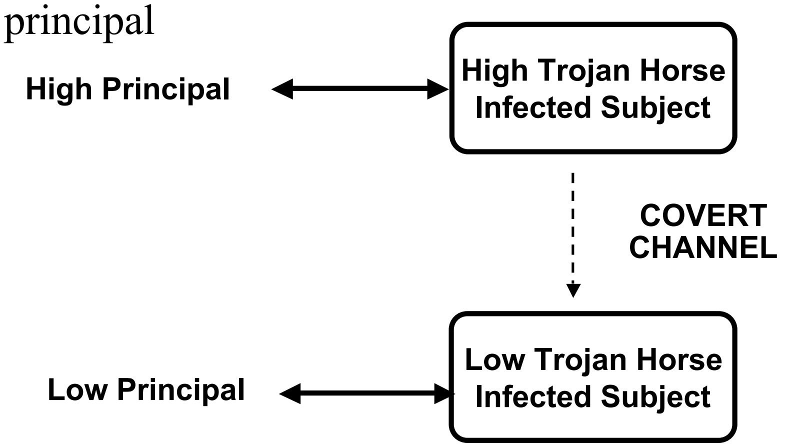
- A covert channel is a communication channel based on the use of system resources not normally intended for communication between the subjects (processes) in the system

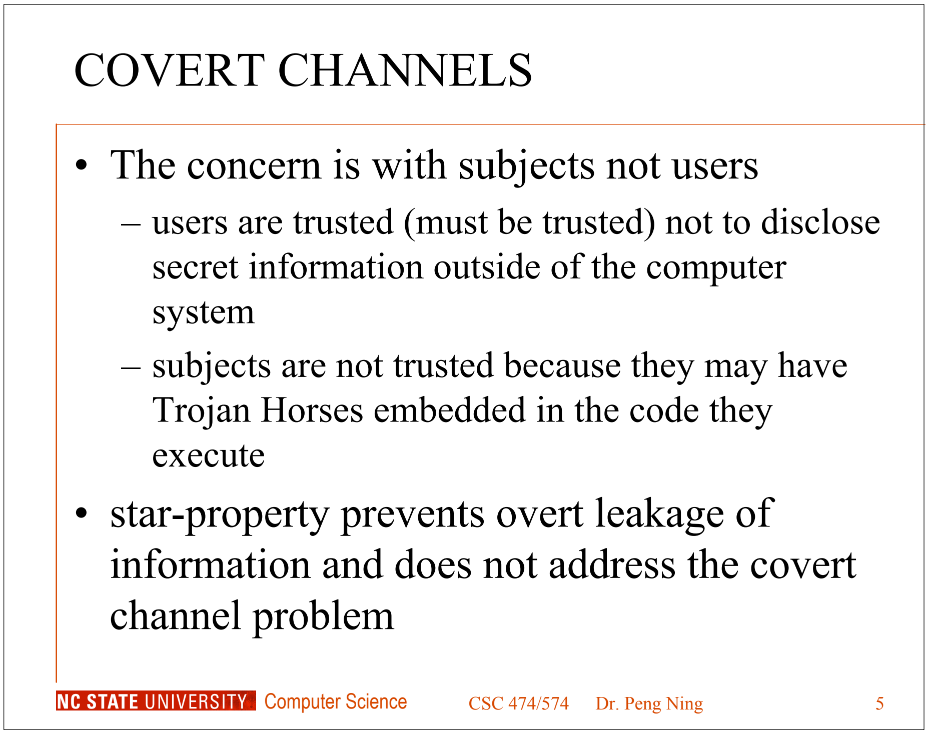
COVERT CHANNELS

- HARMLESS CASES
  - The channel parallels an overt channel (and is therefore legal)
  - The sender and receiver are the same process (mumbling channel)
- HARMFUL CASE
  - The sender and receiver are not permitted to communicate under the given security policy

COVERT CHANNELS

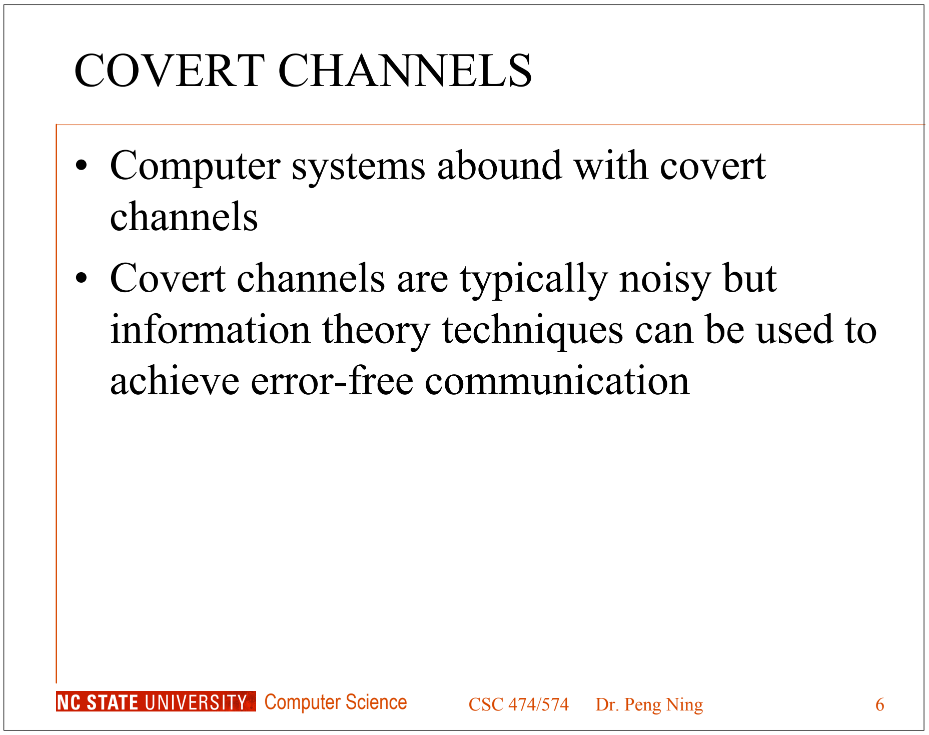
- Information is leaked unknown to the high principal


High Principal
High Trojan Horse Infected Subject
COVERT CHANNEL
Low Principal
Low Trojan Horse Infected Subject



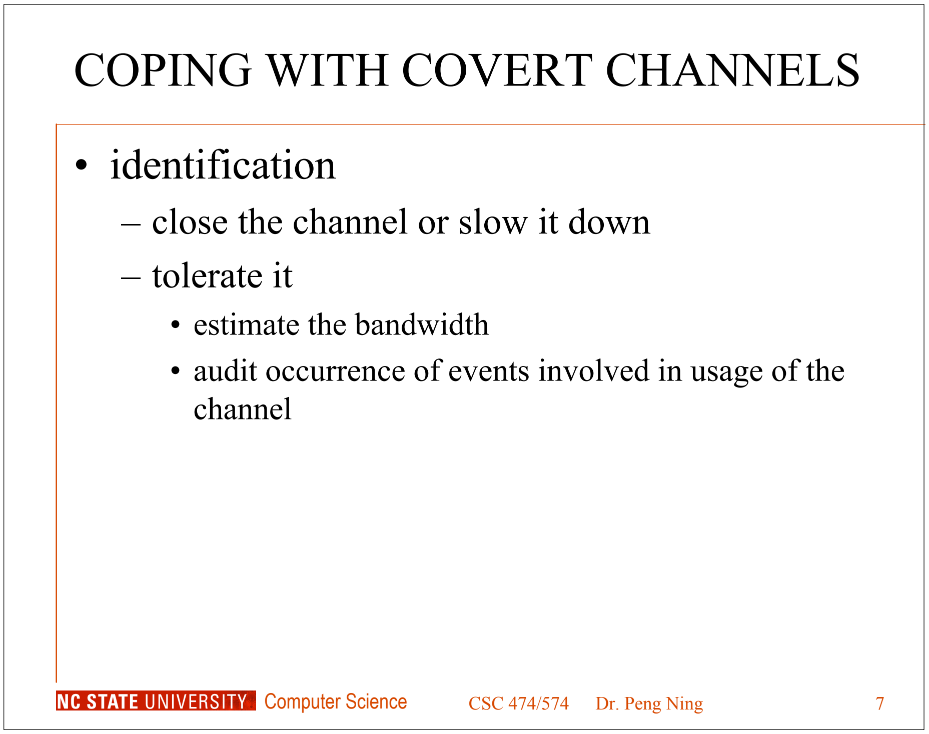
COVERT CHANNELS

- The concern is with subjects not users
  - users are trusted (must be trusted) not to disclose secret information outside of the computer system
  - subjects are not trusted because they may have Trojan Horses embedded in the code they execute
- star-property prevents overt leakage of information and does not address the covert channel problem



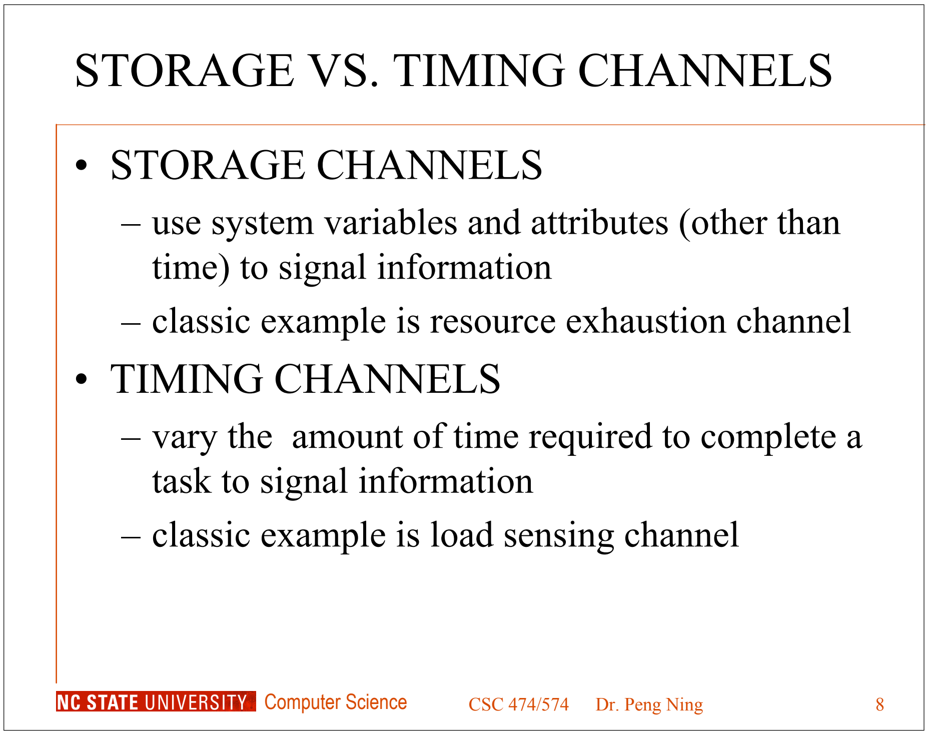
COVERT CHANNELS

- Computer systems abound with covert channels
- Covert channels are typically noisy but information theory techniques can be used to achieve error-free communication



COPING WITH COVERT CHANNELS

- identification
  - close the channel or slow it down
  - tolerate it
    - estimate the bandwidth
    - audit occurrence of events involved in usage of the channel



STORAGE VS. TIMING CHANNELS

- STORAGE CHANNELS
  - use system variables and attributes (other than time) to signal information
  - classic example is resource exhaustion channel
- TIMING CHANNELS
  - vary the amount of time required to complete a task to signal information
  - classic example is load sensing channel

RESOURCE EXHAUSTION CHANNEL

- Given 5MB pool of dynamically allocated memory
- HIGH PROCESS
  - bit = 1 → request 5MB of memory
  - bit = 0 → request 0MB of memory
- LOW PROCESS
  - request 5MB of memory
  - if allocated then bit = 0 otherwise bit = 1

LOAD SENSING CHANNEL

- HIGH PROCESS
  - bit = 1 → enter computation intensive loop
  - bit = 0 → go to sleep
- LOW PROCESS
  - perform a task with known computational requirements
  - if completed quickly then bit = 0 otherwise bit = 1

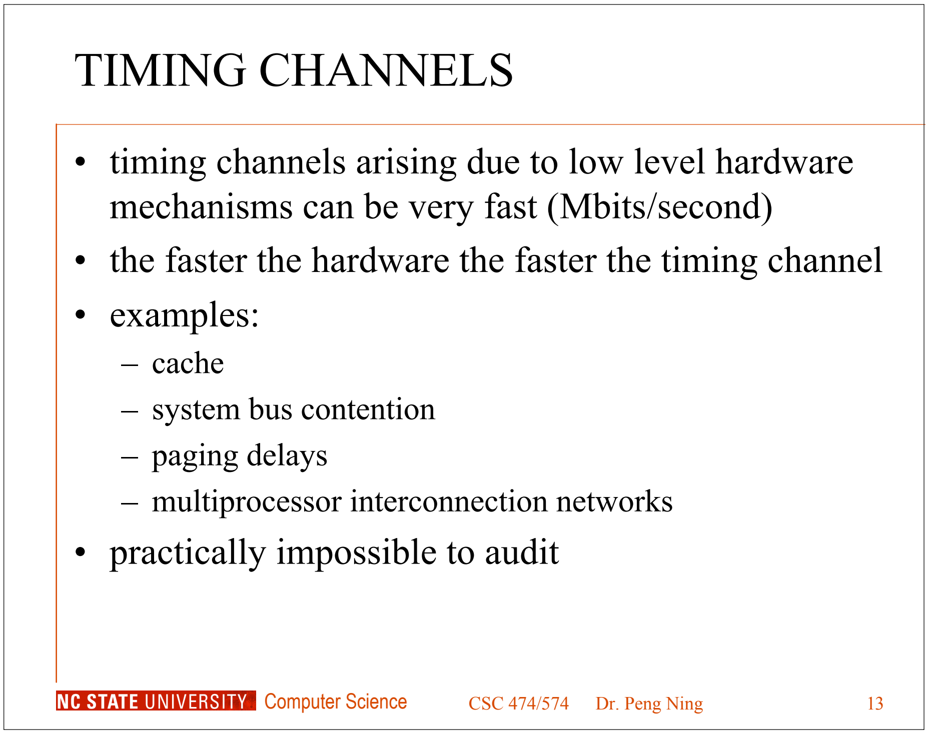
SOME SIMPLE STORAGE CHANNELS

- file names
- file attributes
  - size
  - date modified
  - protection bits
  - access control lists
- file status
  - open or closed
  - locked or unlocked
- file existence

once identified these are relatively easy to close (in principle)

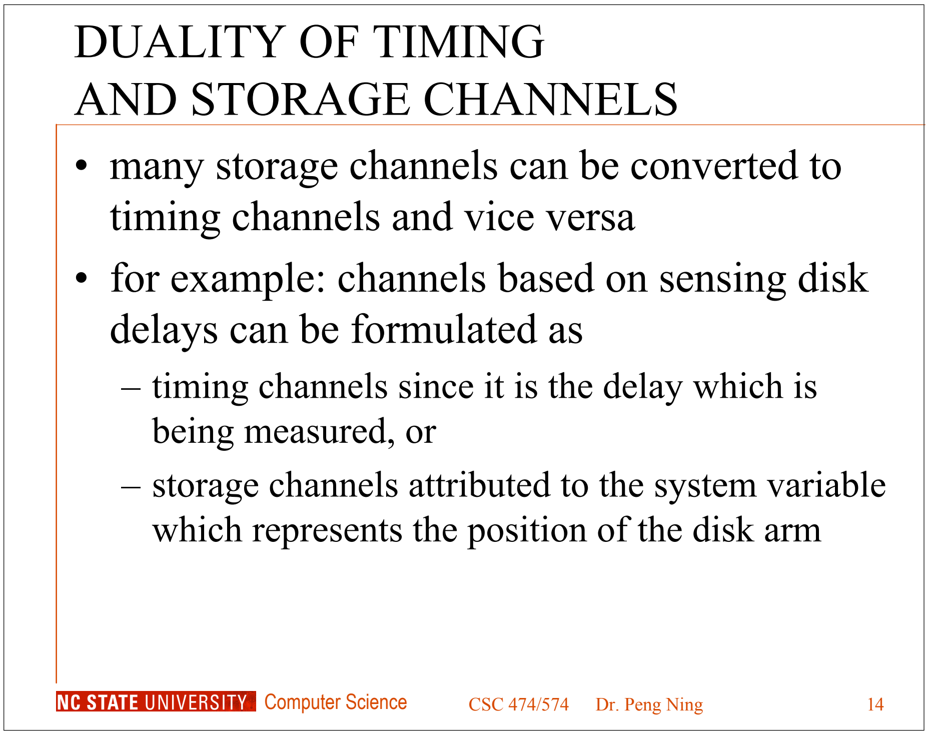
RESOURCE EXHAUSTION CHANNELS

- can be closed by static resource allocation across security classes at the cost of resource utilization
- can be audited to detect attempted usage



TIMING CHANNELS

- timing channels arising due to low level hardware mechanisms can be very fast (Mbits/second)
- the faster the hardware the faster the timing channel
- examples:
  - cache
  - system bus contention
  - paging delays
  - multiprocessor interconnection networks
- practically impossible to audit



DUALITY OF TIMING AND STORAGE CHANNELS

- many storage channels can be converted to timing channels and vice versa
- for example: channels based on sensing disk delays can be formulated as
  - timing channels since it is the delay which is being measured, or
  - storage channels attributed to the system variable which represents the position of the disk arm