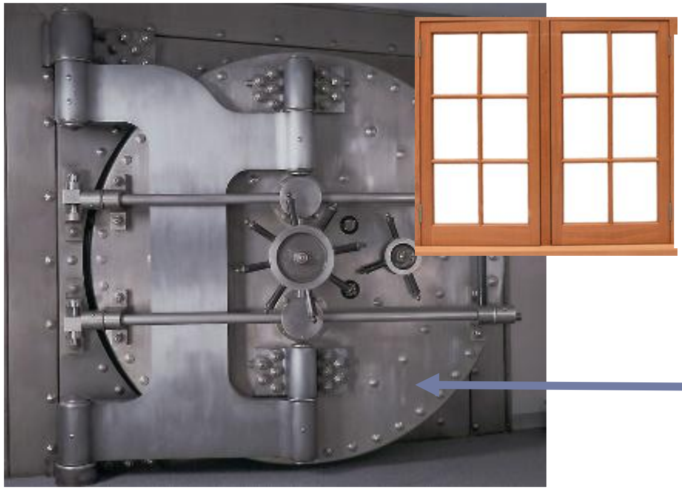
SC3010
Computer Security

Lecture 2: Software Security (I)

Basic Concepts in Software Security

Vulnerability: a *weakness* which allows an attacker to reduce a system's information assurance.



Exploit: a *technique* that takes advantage of a vulnerability, and used by the attacker to attack a system

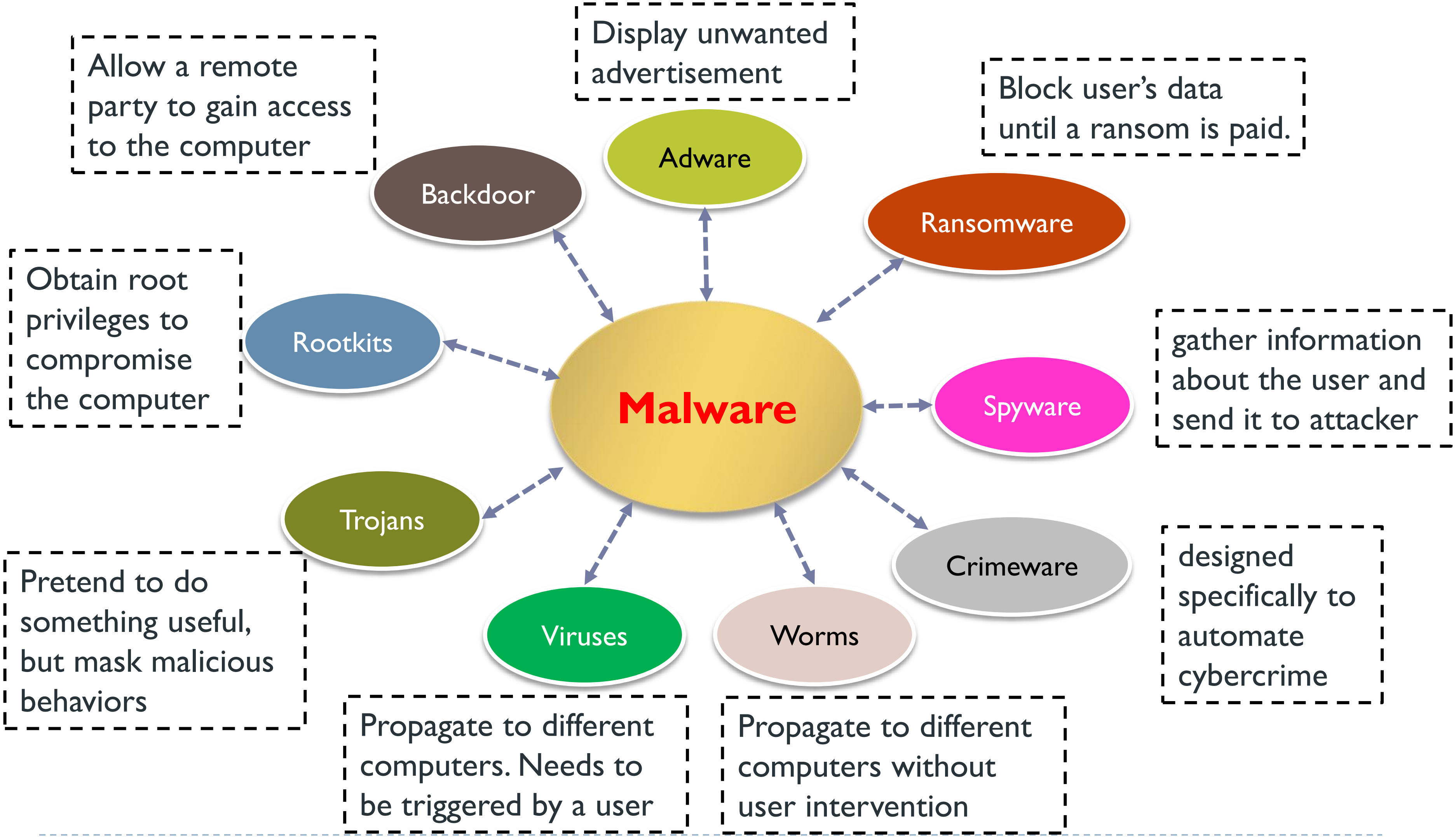
Payload: a *custom code* that the attacker wants the system to execute

Software system

Different Kinds of Vulnerabilities

Memory safety violations	• Buffer overflows and over-reads • Dangling pointers
Input validation errors	• Format string attacks • SQL injection • Code injection • Cross-site scripting in web applications
Race conditions	• Time-of-check-to-time-of-use bugs • Symlink races
Privilege-confusion bugs	• Cross-site request forgery in web applications • Clickjacking • FTP bounce attack
Privilege escalation	• Privilege escalation
Side-channel attack	• Timing attack

Different Kinds of Malware



Malware

Backdoor

Allow a remote party to gain access to the computer

Adware

Display unwanted advertisement

Ransomware

Block user's data until a ransom is paid.

Rootkits

Obtain root privileges to compromise the computer

Spyware

gather information about the user and send it to attacker

Trojans

Pretend to do something useful, but mask malicious behaviors

Viruses

Propagate to different computers. Needs to be triggered by a user

Worms

Propagate to different computers without user intervention

Crimeware

designed specifically to automate cybercrime

Why Does Software Have Vulnerabilities

Human factor

- Programs are developed by humans. Humans make mistakes
- Programmers are not security-aware
- Misconfigurations could lead to exploit of software vulnerabilities

Language factor

- Some programming languages are not designed well for security
  - Mainly due to more flexible handling of pointers/references.
  - Lack of strong typing.
  - Manual memory management. Easier for programmers to make mistakes.

Outline

- **Review: Memory Layout and Function Call Convention**

- **Buffer Overflow Vulnerability**

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