软件安全与漏洞分析

4.1 软件自我保护技术概述

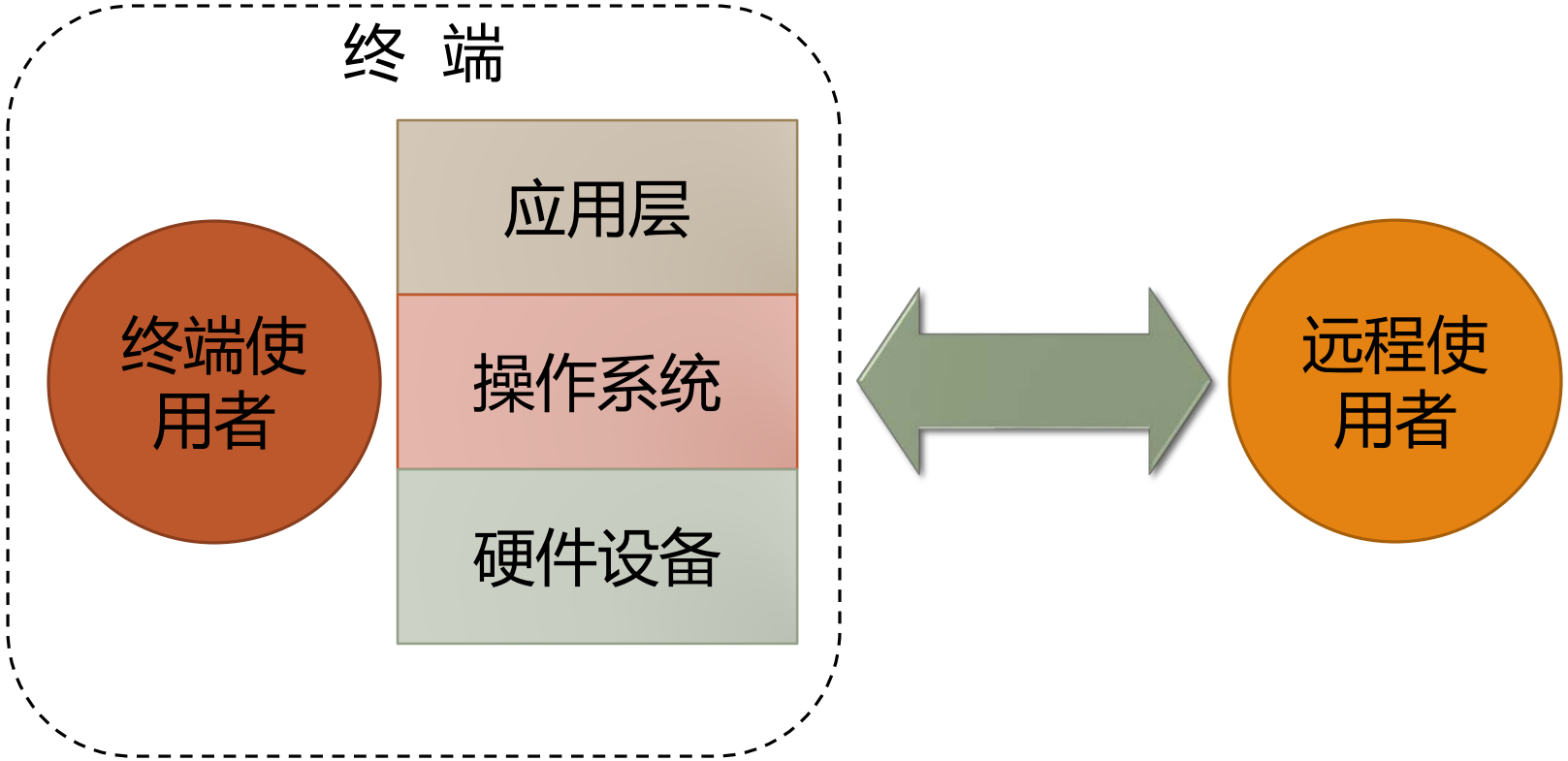
Previously in Software Security

- 其他软件与操作系统防护技术
  - 安全数据删除
  - 针对不可信操作系统的防护
- 软件验证和漏洞检测技术
  - 模糊测试
  - 具体/符号执行
  - 污点传播

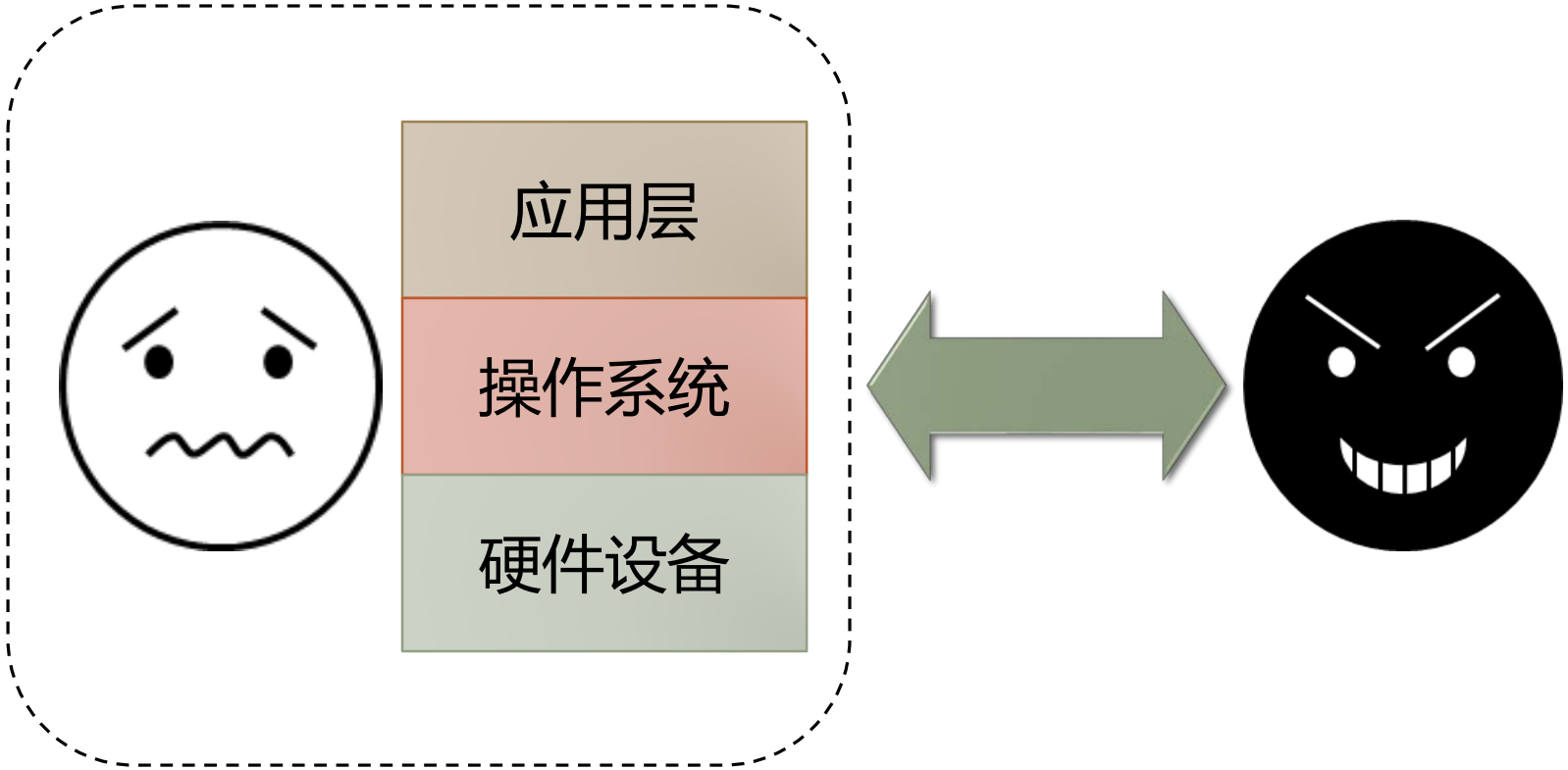
软件自我保护技术概述

- 本节主题 – 软件自我保护技术
  - Man-At-The-End攻击模型
  - 主要软件自我保护技术：代码混淆
  - 主要软件自我保护技术：软件防篡改
  - 主要软件自我保护技术：软件水印
  - 主要软件自我保护技术：软件胎记

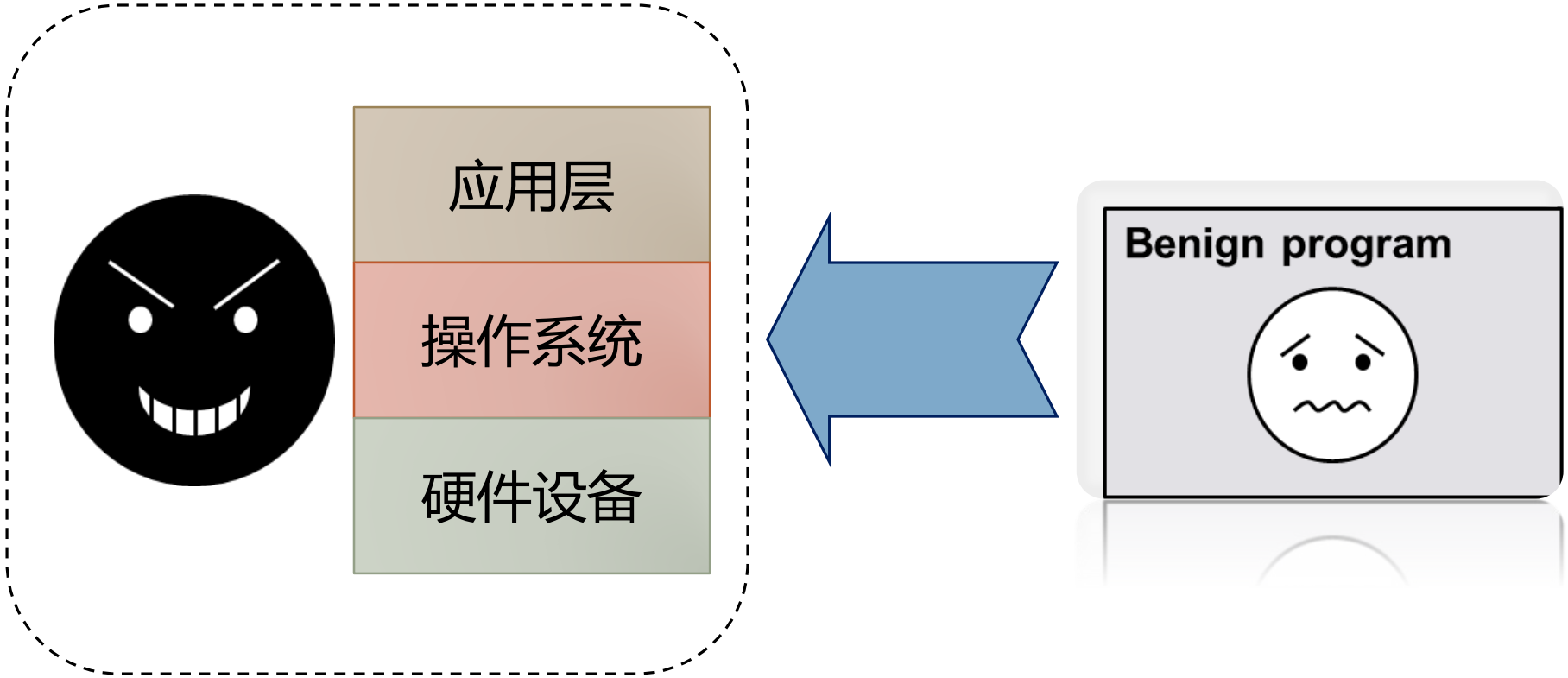
Man-At-The-End攻击



Man-At-The-End攻击

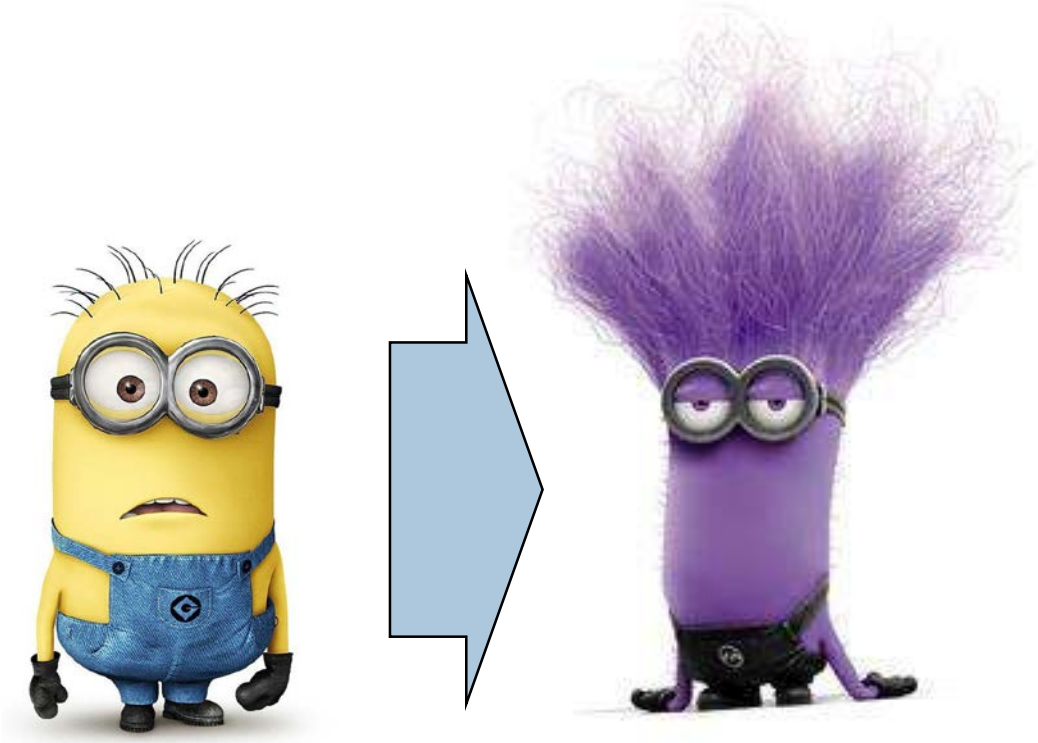


Man-At-The-End攻击



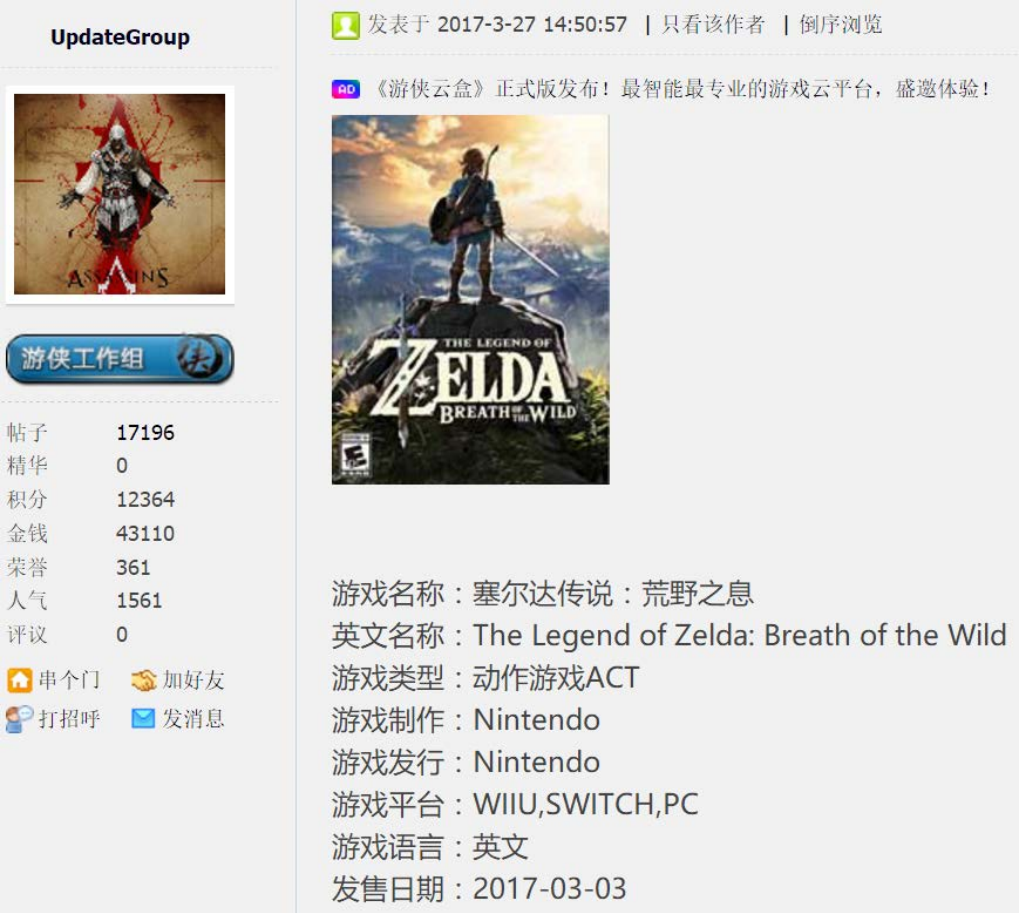
Man-At-The-End攻击

- 攻击者：**位于终端，**对终端计算资源有最高控制权限
- 攻击对象：安装在受控终端上的**软件程序**
- 攻击目的：**获悉、篡改**软件的**内部逻辑**



Man-At-The-End攻击

- 实际攻击场景1：**盗版/破解**



Man-At-The-End攻击

- 实际攻击场景2：**病毒/恶意代码分析**

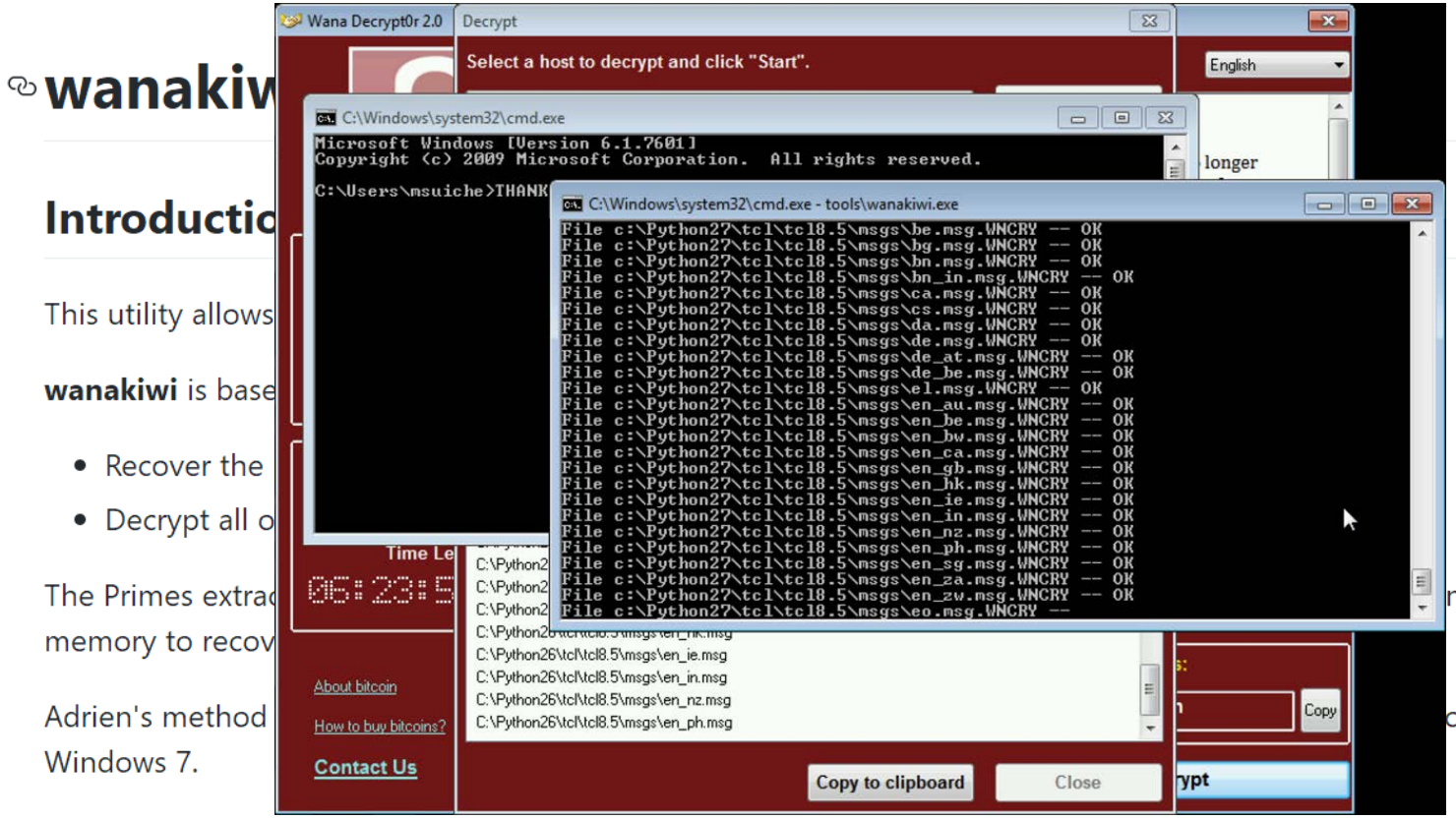
Man-At-The-End攻击

- 实际攻击场景2：**病毒/恶意代码分析**

```
qmemcpy(&szUrl, sinkholeddomain, 0x39u);      // previously unregistered domain, now sinkholed
v8 = 0;
v9 = 0;
v10 = 0;
v11 = 0;
v12 = 0;
v13 = 0;
v14 = 0;
v4 = InternetOpenA(0, 1u, 0, 0, 0);
v5 = InternetOpenUrlA(v4, &szUrl, 0, 0, 0x84000000, 0);// do HTTP request to previously unregistered domain
if ( v5 )                                     // if request successful quit
{
  InternetCloseHandle(v4);
  InternetCloseHandle(v5);
  result = 0;
}
else                                          // if request fails, execute payload
{
  InternetCloseHandle(v4);
  InternetCloseHandle(0);
  detonate();
  result = 0;
}
return result;
}
```

Man-At-The-End攻击

- 实际攻击场景2：**病毒/恶意代码分析**



Man-At-The-End攻击

- MATE攻击的动机之一：**信仰**
  - 互联网精神 -- **开放、分享**
  - 商业软件 -- **闭源、收费授权**

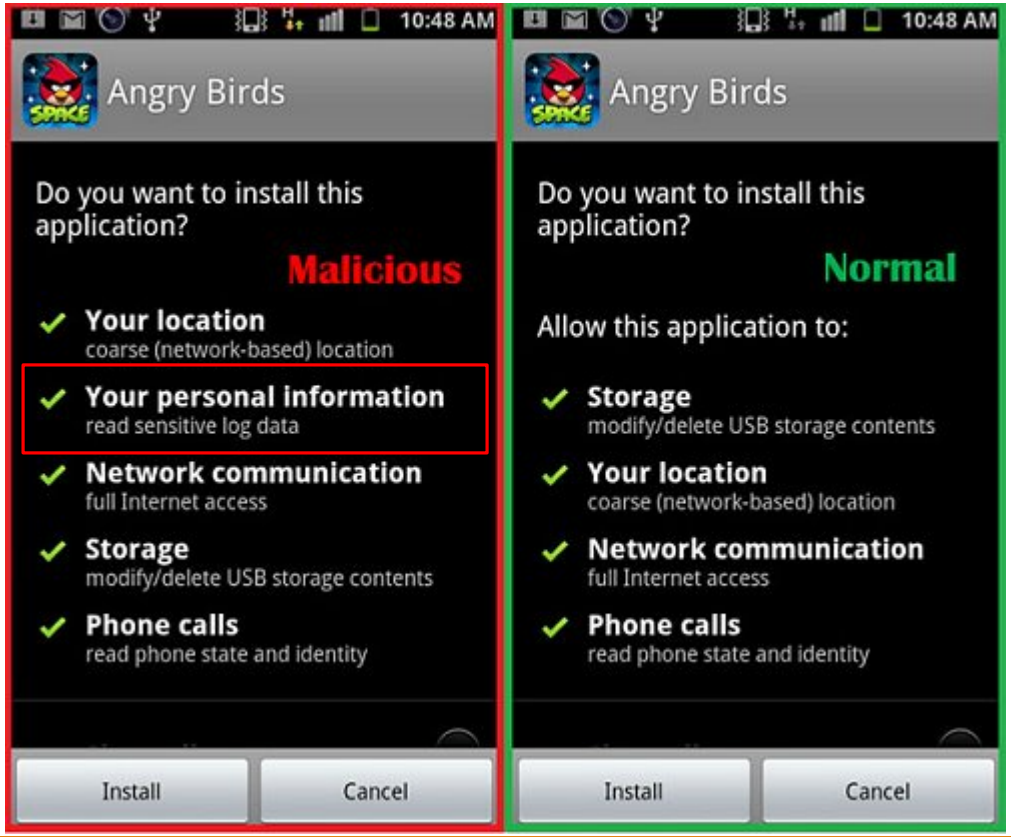
伟大领袖毛主席教导我们：哪里有压迫，哪里就有反抗

Man-At-The-End攻击

- MATE攻击的动机之二：利益

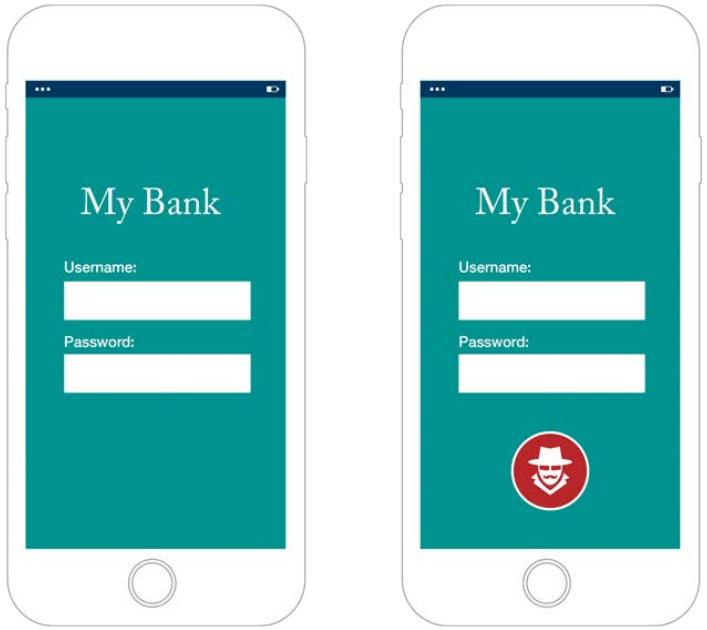
Man-At-The-End攻击

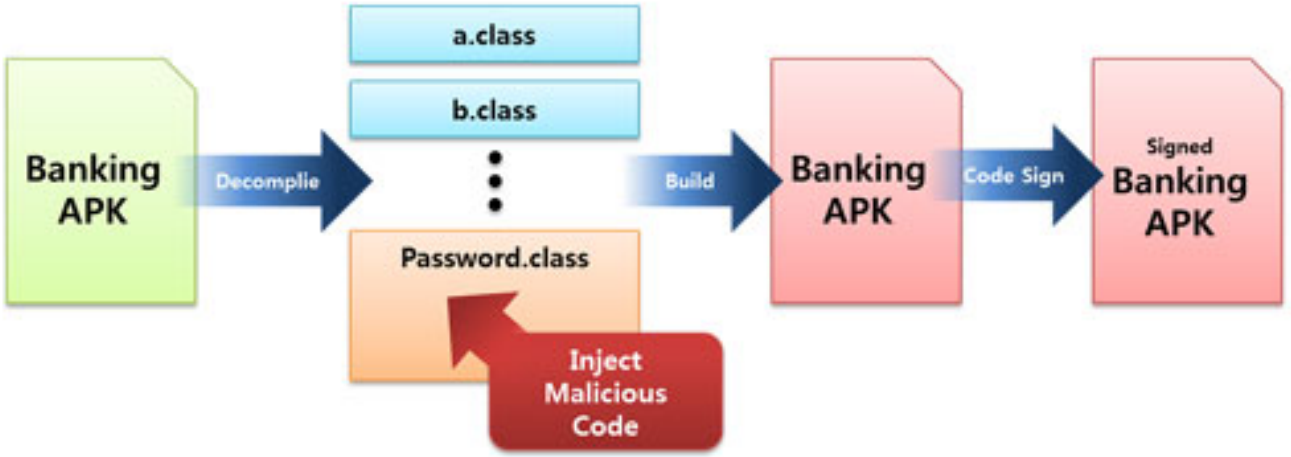
- MATE攻击的动机之二：利益



Man-At-The-End攻击

- MATE攻击的动机之二：利益





Man-At-The-End攻击

- MATE攻击的动机之二：利益

Man-At-The-End攻击

- 危害：合法收益的损失

Man-At-The-End攻击

- 危害：合法收益的损失

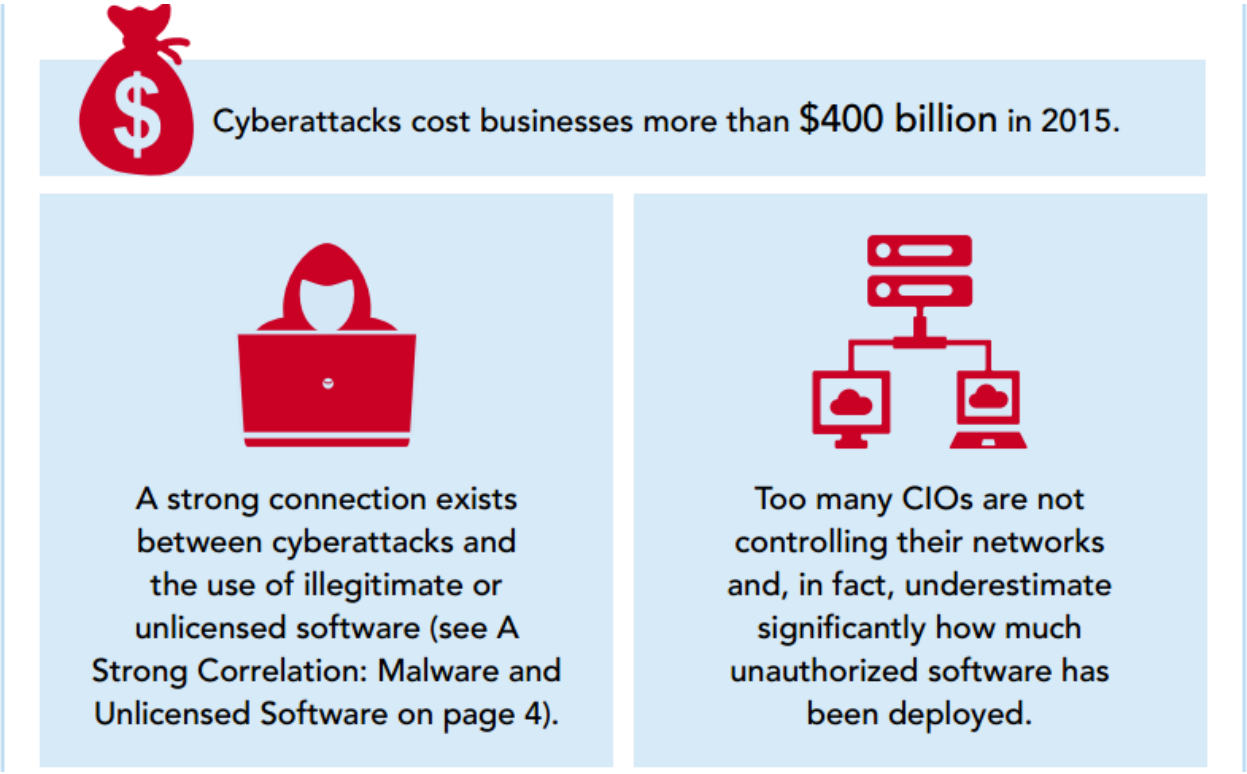
Cybersecurity has become a top concern for companies and other organizations around the world. These and other factors — including increased awareness of the importance of proper SAM, and years of education and enforcement — contributed to a modest decrease in unlicensed software use in more than a decade, from 43 percent to 39 percent.

Accompanying the global decline in the use of unlicensed software was a corresponding drop (4 percent in constant-dollar terms) in the commercial value of unlicensed software, to $52.2 billion.

Yet despite these positive developments, for 72 of the 116 markets covered in the study, more than half of the total PC software deployed in 2015 was unlicensed; in 37 markets, 75 percent or more was unlicensed. There is still much more to be done.

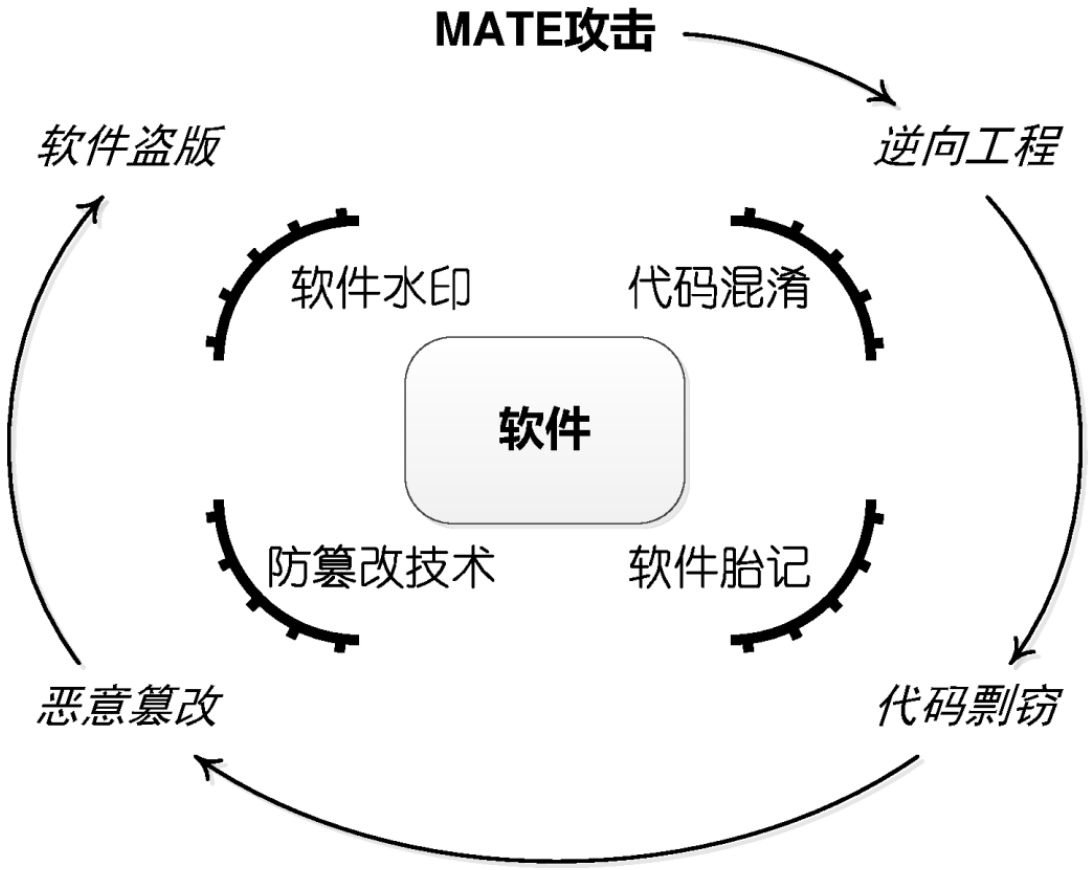
Man-At-The-End攻击

- 危害：与网络攻击高度关联



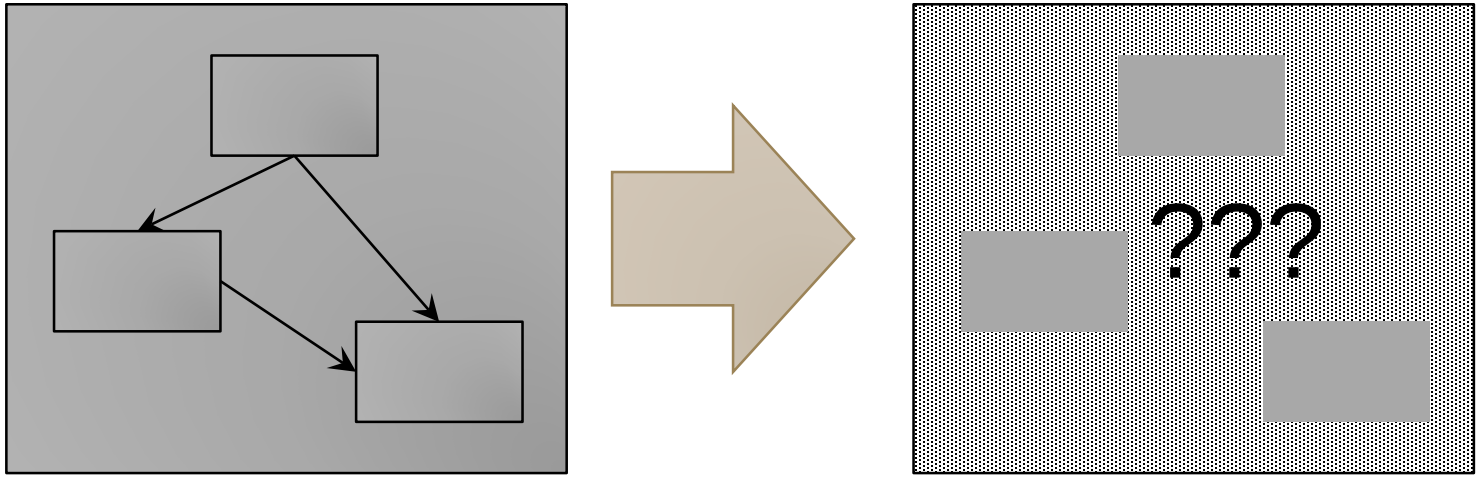
Man-At-The-End攻击

- 反制措施：



代码混淆

- 目标：阻止对软件实施非授权的逆向分析



- 核心方法：**语义保留的程序变换**

代码混淆

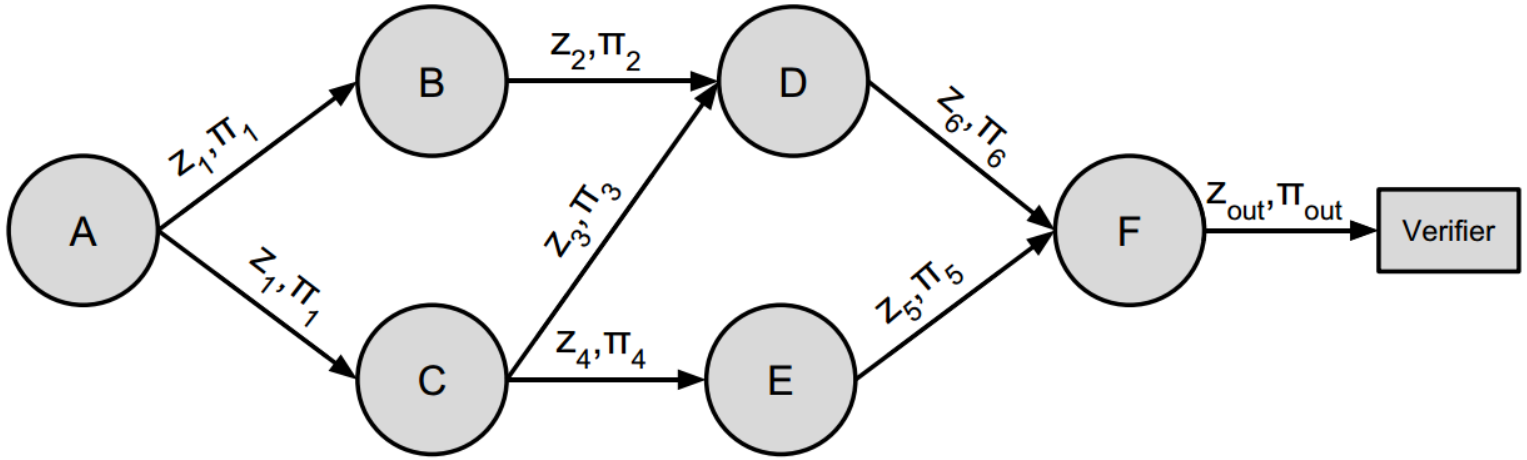
- 案例：

代码混淆

- 相关知识：
  - 安全性理论（安全目标及其可实现性）
  - 一些主要的代码混淆方法
  - 局限性

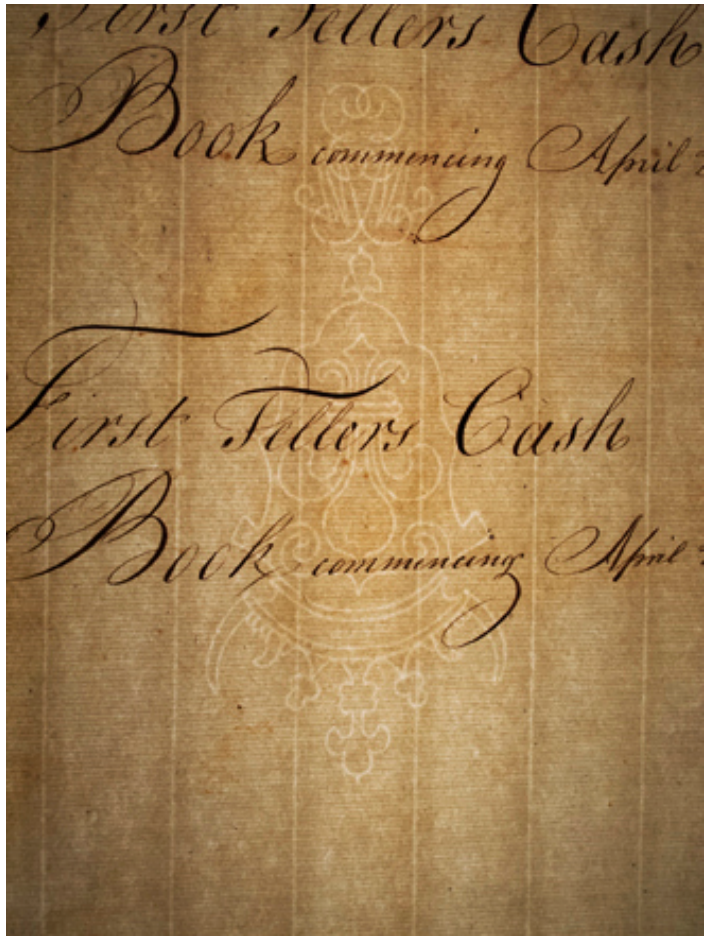
软件防篡改

- 目标：使软件能够自行发现（甚至阻止）对自身的恶意篡改
- 举例：Proof-Carrying Data



- 相关知识：现有的几种软件防篡改技术概览

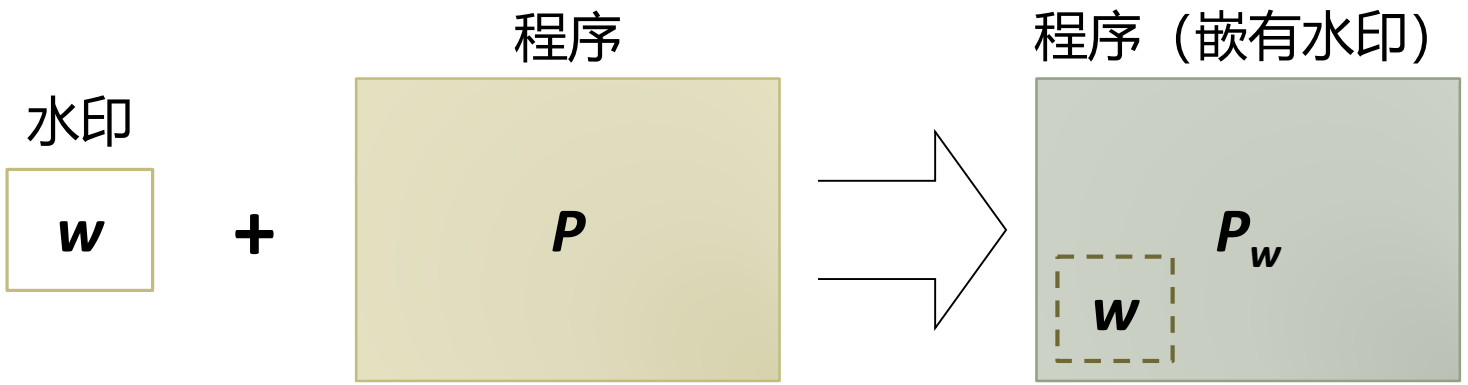
软件水印


First Tellers Cash
Book commencing April
First Tellers Cash
Book commencing April


中国人民银行
E71Q586943
100
100

软件水印

- 目标：在软件中嵌入用于标识其版权归属的秘密信息



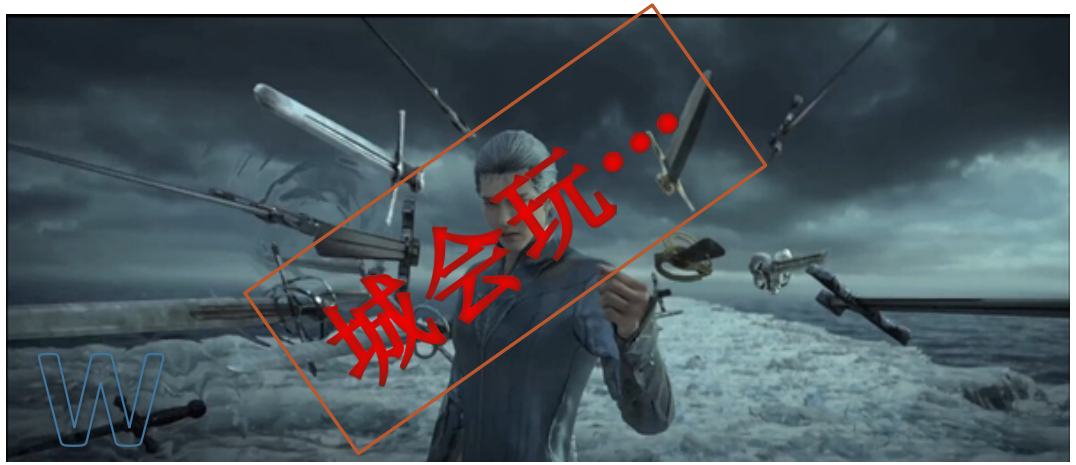
- 相关知识：
  - 几项关键的安全性指标
  - 主要方法及其不足等

软件胎记

照抄代码？

搞得定！

但是……



玩不会……

软件胎记

- 目标：对指定程序功能抽象出本质性的特征组合，作为该程序的唯一标识
- 与软件水印的区别：
  - 水印是人为嵌入的声明信息（**信息由嵌入者决定，与目标软件无关**）
  - 胎记是对软件的某种“侧写”（**信息完全取决于软件语义，不可控**）
- 相关知识：现有基于软件胎记的代码剽窃检测技术概览

What’s next?

- 代码混淆
  - 安全性理论（安全目标及其可实现性）
  - 一些主要的代码混淆方法
  - 局限性