Threat Modeling: The Art of Identifying, Assessing, and Mitigating security threats

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Winter School in Information Security,
Finse – May 3 – 8, 2015

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Agenda

- Introduction
  - Causes of Compromised Security
  - What is Threat Modeling?
  - Why Threat Modeling?
- Threat Modeling Process (Microsoft Security Development Lifecycle (SDL))
- Demo (SDL Threat Modeling Tool)
- Conclusion

Introduction

- Causes of Compromised Security
  - Technology weaknesses
  - Configuration weaknesses
  - Policy weaknesses
  - Human error and malice

Introduction

- What is Threat Modeling?
  - Threat modeling is a structured way to identify, understand, and mitigate threats
  - A road map for developer to write secure code
  - Threat modeling is all about finding problems

Introduction

- Why Threat Modeling?
  - The most reliable way to
    - ✓ Find security issues in system architecture and business processes
    - ✓ Identify threats and vulnerabilities relevant to your system
    - ✓ Identifies where more resources are required to reduce risk
  - Helps you to
    - ✓ Understand your organization/user weaknesses
    - ✓ Shape your system design to meet your business objectives
    - ✓ Increase awareness of threats
    - ✓ Improve the security of your system by implementing effective countermeasures

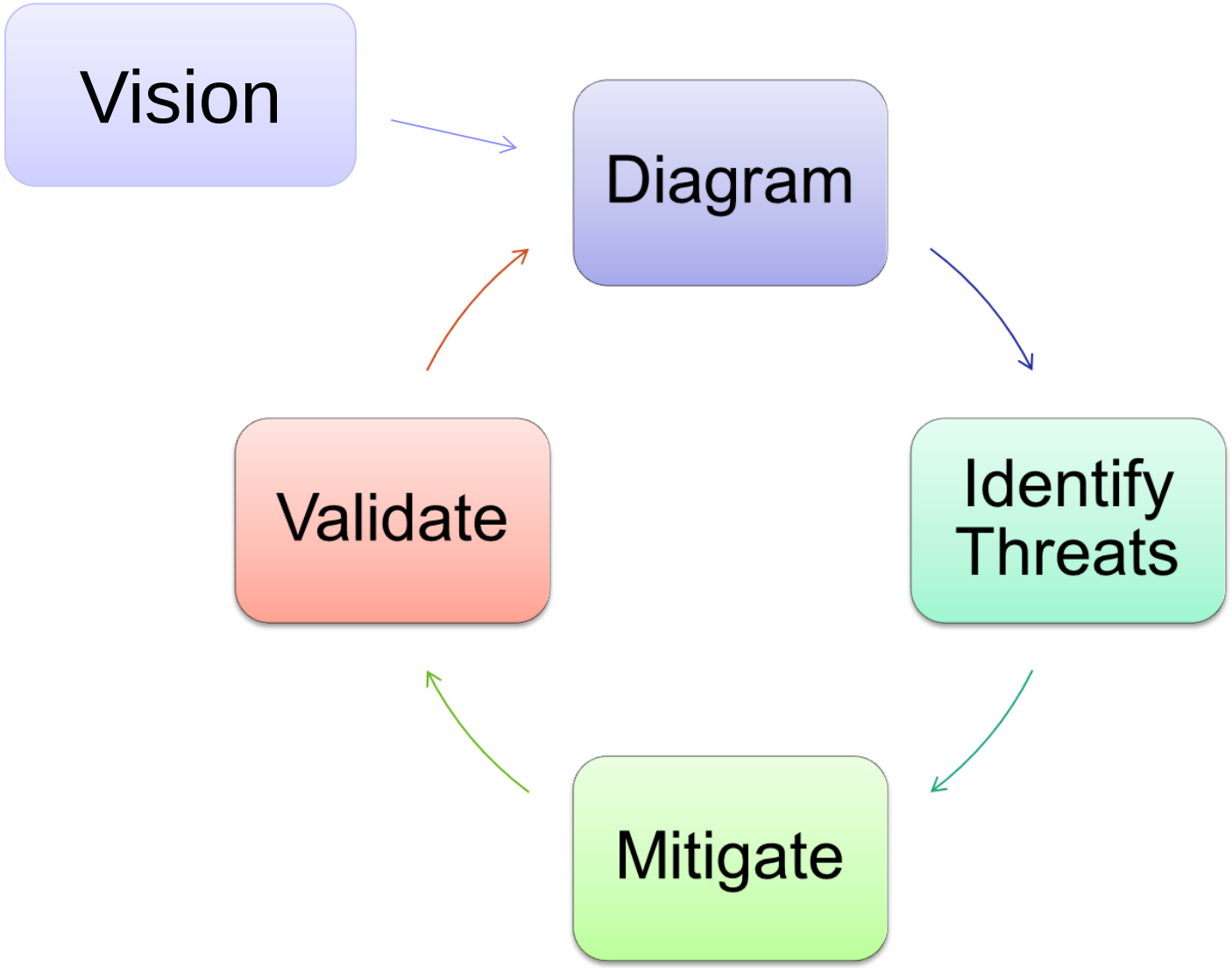
Threat Modeling Process

- Threat modeling Terminology
  - Role – The set of business process capabilities of human who interacts with the system
  - Asset – It is something of value (in threat modeling is called a threat target).
  - Action – Something a role can do to asset: Create, Read, Modify, Delete
  - Threat – Something that takes advantage of security weaknesses in a system and has a negative impact on it.
  - Attacks – Actions taken to harm a system or disrupt normal operations by exploiting vulnerabilities using various techniques and tools.
  - Vulnerability – Is a weakness in system design, implementation, or operation.
  - Risk – Is the probability that something bad could happen.

Threat Modeling Process

- Threat modeling Terminology
  - Actor – Threat agent
  - Data Flow Diagram (DFD) – A diagram which models the flow of data through the system.
  - Trust Boundary – A DFD annotation that indicates a connection crosses between trust levels
  - Trust – The level of trust placed on individuals in a specific role
  - Security Control – Product and/or processes employed to mitigate a specific threat(or a group of threats) to an acceptable level.

Threat Modeling Process (Microsoft Security Development Lifecycle (SDL)



Vision

- Build a list of assets and system objectives that require protection including:
- Things attackers want
  - System components (hardware and software)
  - Information such as ID number and credit card numbers
  - Anything else that, if compromised, would prevent correct operation of your system
- Scenarios
  - Use cases/Use Stories
  - Add security to scenarios, use cases

Diagram

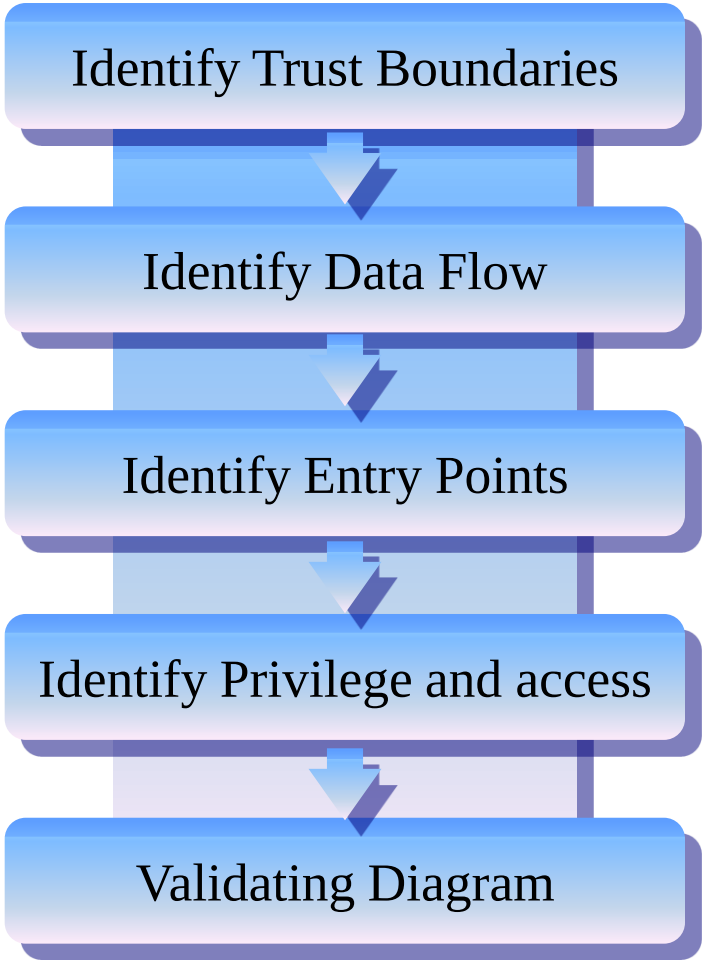
Describe System Architecture

- Create a system architecture
  - System components
  - Understand data and data classification
- Diagram the system
  - Show subsystems
  - Show data flow
- Focus on confidentiality, integrity, and availability
  - What can we prevent?
  - What do we care about most?
  - What is the worst thing that can happen?

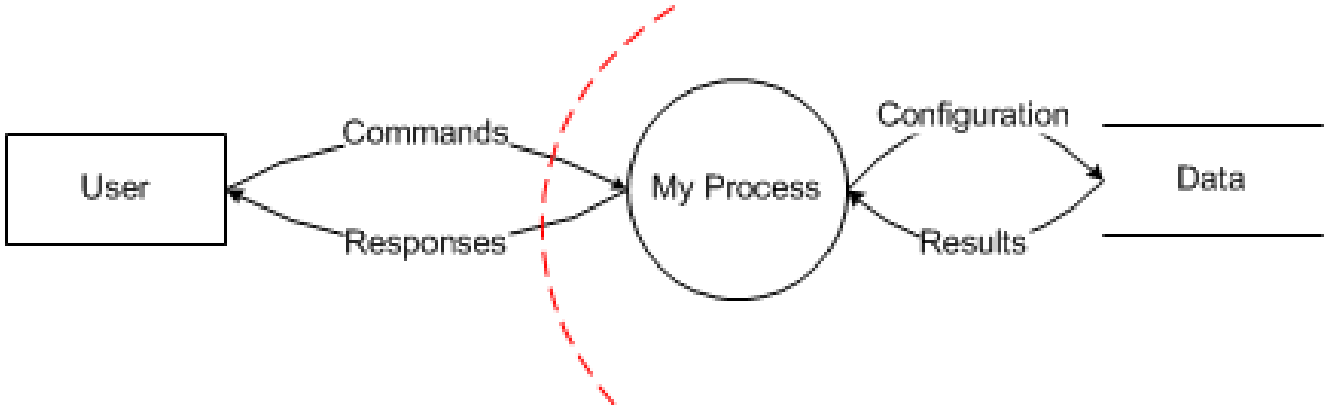
Decompose the system

- Break down the system
  - Show the events that drive the system
  - Show the processes that are driven
  - Identify entry points
  - Identify technologies
  - Diagram trust boundaries

- Begin to think like an attacker
  - Where are my vulnerabilities?
  - What am I going to do about them?



A Real Diagram



Identify Threats

S **Spoofing**
Can an attacker gain access using a false identity?

T **Tampering**
Can an attacker modify data as it flows through the application?

R **Repudiation**
If an attacker denies doing something, can we prove he did it?

I **Information disclosure**
Can an attacker gain access to private or potentially injurious data?

D **Denial of service**
Can an attacker crash or reduce the availability of the system?

E **Elevation of privilege**
Can an attacker assume the identity of a privileged user?

Mitigate

- Option 1: Accepting the risk
- Option 2: Transferring the risk
- Option 3 : Address the risk
  - ✓Four ways to address threats:
    - Redesign to eliminate
    - Apply standard mitigations
    - Invent new mitigations (Riskier)

Validate

- Validate the whole TM
  - Does diagram match final code?
  - Are threats enumerated?
  - Minimum: STRIDE per element that touches a trust boundary
  - Has Test reviewed the model?
    - ✓ Created appropriate test plans
    - ✓ Tester approach often finds issues with TM, or details
  - Is each threat mitigated?
    - ✓ Are mitigations done right

Demo

- Microsoft **Threat Modeling** Tool

Conclusion

- The security development process requires thorough understanding of a systems assets, followed by identifying different vulnerabilities and threats that can exist.
- Use threat modeling to develop security testing strategy.
- Know your enemy and know yourself.
  - What techniques and technologies will hackers use?
  - What techniques and technologies can testers use?

Without threat modelling, protecting yourself is like “shooting in the dark”

References

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THANK YOU!