Threat Modeling

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- Security Engineer @ Certus Cybersecurity
- Focused on application and cloud security
- Involved in penetration tests, threat modeling, virtual CISO engagements, etc.
- Topics to talk about: Scrubs, Beer & Gin, biking, and all the geeky stuff

Background of Threat Modeling

Basics of Threat Modeling

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Basics of Threat Modeling

Reduces the attack surface of the architecture in scope

Fixing vulnerabilities **costs 100x** more if app is in production[1]

Help the developers to think about attack vectors

Identifies **single point of failures** and bottlenecks

[1] Dawson, Maurice & Burrell, Darrell & Rahim, Emad & Brewster, Stephen. (2010). Integrating Software Assurance into the Software Development Life Cycle (SDLC). Journal of Information Systems Technology and Planning. 3. 49-53.

Basics of Threat Modeling

- Light weight process
- Shift security left within the SDLC
- Developers should be included
- The results should feed
  - Risk assessments
  - Source code review
  - Penetration testing
  - …

- Three different kind of threat models (base, differential, blueprint)

Base TM

- Starting from scratch
- Should be done for new or existing solutions

Differential TM

- Builds up on base TM
- Done for a new function or design change

Blueprint TM

- Done for reoccurring design patterns
- Harder to scope and execute

Framework & Standards

PASTA
Process for Attack Simulation and Threat Analysis

OCTAVE
Operationally Critical Threat, Asset, and Vulnerability Evaluation

DREAD
Damage Potential, Reproducibility, Exploitability, Affected User, Discoverability

VAST
Visual, Agile, and Simple Threat Modeling

STRIDE / LM
Spoofing, Tampering, Non-Repudiation, Information Disclosure, Denial of Service, Elevation of Privileges, (Lateral Movement)

Threat Modeling Process

Basics of Threat Modeling

Phase 1

- Understand the solution
- Research technologies
- Scope the exercise

Phase 2

- Identify trust zones
- Depict the architecture
- Document data connections

Phase 3

- Spot potential threat objects
- Illustrate possible attack vectors
- Define mitigations

Scoping

✓ **Identify your stakeholders**
  ○ Business Owner
  ○ Engineers / Architects
  ○ Security Contacts

✓ **Understand the solution**
  ○ Business context
  ○ Involved components
  ○ Data streams and classification
  ○ Dev/deployment processes

✓ **Scope things out**
  ○ Identify boundaries / authority limitations
  ○ Specifically outscope such systems out of their control

Architecture Depiction - Interviews

Conduct interviews with relevant stakeholders, covering at least

- Engineers / Architects
- Business Owner
- Security contacts (if available)

During the calls, make sure to

- Ask questions multiple times in a different way
- Ask open ended questions
- Never work with assumptions

Result

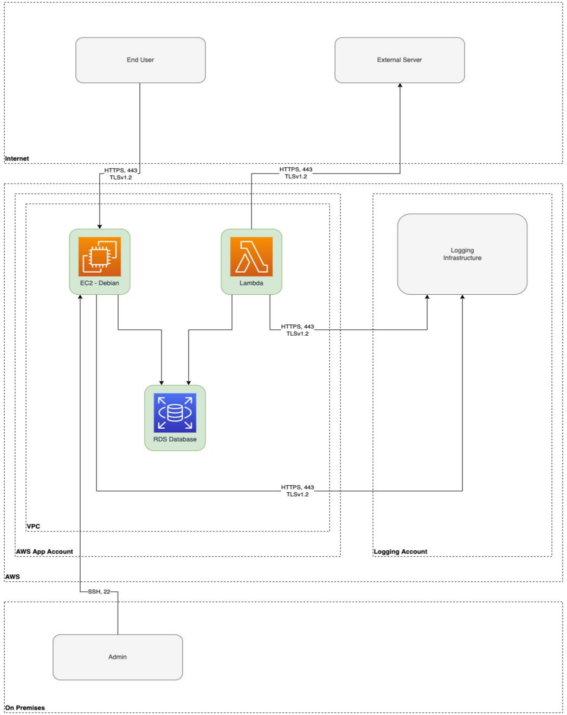
- Understanding all the components involved and their roles
- Have a clear picture of the controls in place

Architecture Depiction - Diagram

- ✓ Create the architecture, which should answer
  - ○ Trust Zones
  - ○ Components
  - ○ Upstream & downstream components / environments
  - ○ Any traffic flows
  - ○ Users & their devices

- ✓ System decomposition (https://c4model.com/#CoreDiagrams)

- ✓ Discuss architecture with the project team



Threat Identification

01 Threat Objects

Identify an adversary's potential motivations and outline threat objects

02 STRIDE / LM

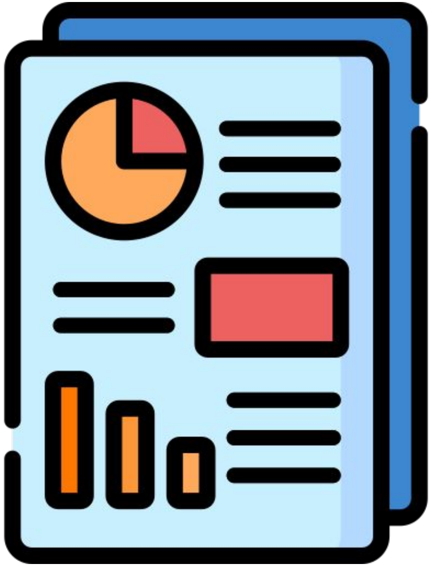
Walkthrough the diagram (each component and data stream) to identify threats related to:

- Spoofing
- Tampering
- Non-Repudiation
- Information Disclosure
- Denial of Service
- Elevation of Privileges
- Lateral Movement

03 Controls

Review existing controls to highlight any resolved threats as such

Threat Identification - Reporting



Executive Summary
Including a description of the solution, high-level overview of the threats, any assumptions that the threat model was executed with, and the scope.

Threat Model Diagram
Including all details outlined with the team and a description of in-scope and out-of-scope components.

Threat Scenarios
Including a title, detailed description of the impact, attack vectors and any missing controls / mitigation strategies.

Conclusion Thoughts

Limitations & Quality Gates

Limitations

- Timing, scoping and prioritization issues
- The quality of the results are dependent on the design's quality
- Security engineer may not have enough understanding or wrong level of details
- It does not replace a penetration test or source code review

Quality Gates

- Contains remediated threat scenarios
- Not overloaded with unnecessary details
- Threat scenarios are summarized
- A good threat scenario should at least answer the following questions
  - Who could execute the attack?
  - How is it executed?
  - What are the exploited components?
  - Why is it an issue? / What is the impact?

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