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Course: Security Analysis and Risk Management

Project: Cyber Security 4 ALL(CS4ALL)

Chapter 2

Threat Modeling and Vulnerability Assessment

Overview

- Introduction to threat modeling
- Threat Modeling Methodologies
  - STRIDE Model: Spoofing, Tampering, Repudiation, Information Disclosure, Denial of Service & Elevation of Privilege
  - PASTA Methodology: Process for Attack Simulation And Threat Analysis
- Techniques for vulnerability identification and assessment
- Tools and practices for vulnerability scanning

Introduction to Threat Modeling

- **Definition:**
  - Threat Modeling is a structured approach used in cybersecurity to identify, evaluate, and prioritize potential threats to a system or application.
- **Goal:**
  - To understand and mitigate security risks by analyzing how malicious entities could attack a system and what defenses can be put in place to prevent or reduce the damage from these attacks.

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Introduction to Threat Modeling

- **Purpose:**
  - Helps anticipate potential threats, understand security requirements, and design defenses.
- **Importance:**
  - Proactive Security
  - Efficient Resource Allocation
  - Improve Communication

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Steps in Threat Modeling

- **Asset Identification**
  - Identify critical components of the system (Asset may be Personally Identifiable Information (PII), Passwords, Secrets, Session IDs,) and understand their importance in the overall system functionality.
- **Threat Identification**
  - Identify potential threats using models like STRIDE, PASTA, VAST or OCTAVE.

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Steps in Threat Modeling

- **Vulnerability Identification**
  - Examine the system for possible weaknesses that could be exploited by threats.
- **Risk Assessment**
  - Evaluate the impact and likelihood of identified threats and vulnerabilities to prioritize remediation efforts.
- **Mitigation Strategy**
  - Design and implement security controls and countermeasures to reduce the risk from the identified threats.

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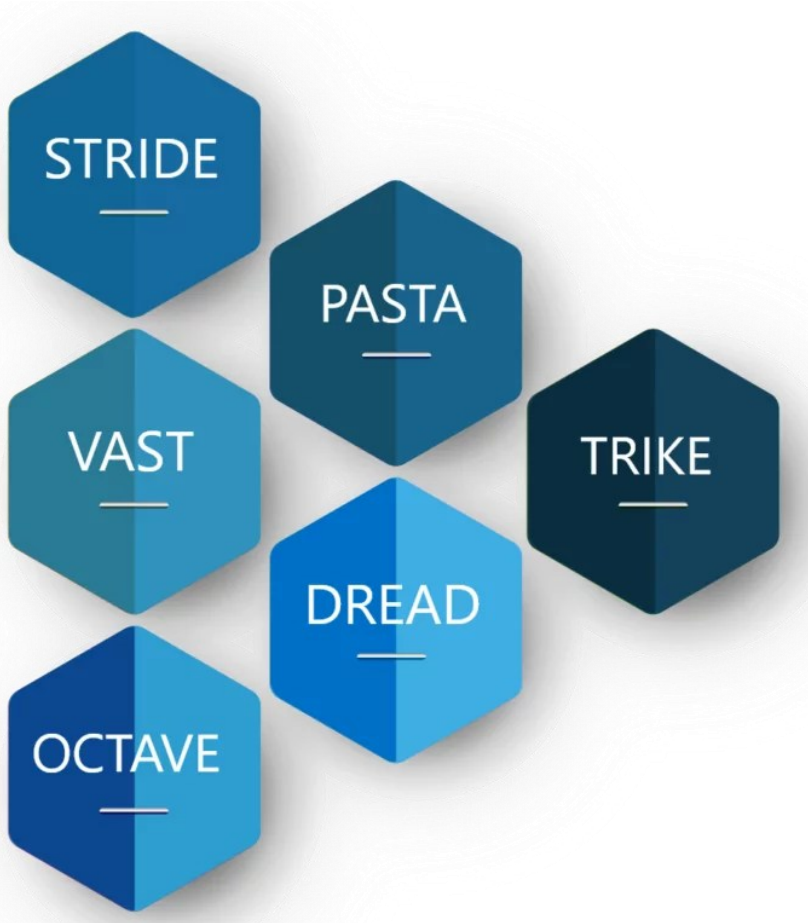
Threat Modeling Methodologies

- **STRIDE**
- **PASTA**
- VAST
- OCTAVE
- DREAD
- TRIKE



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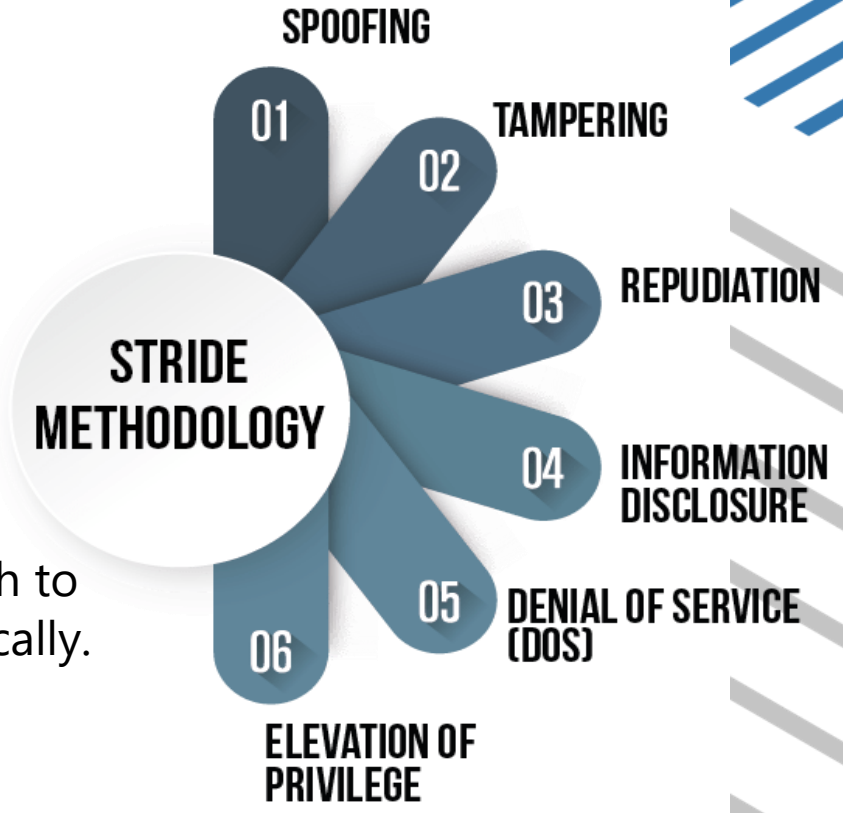
STRIDE

- It is an approach to threat modeling developed by Loren Kohnfelder and Praerit Garg at Microsoft in 1999.
  - S: Spoofing
  - T: Tampering
  - R: Repudiation
  - I: Information Disclosure
  - D: Denial of Service
  - E: Elevation of Privilege



- **Benefit:** Organized approach to categorize threats systematically.

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STRIDE

- **Spoofing:**
  - Impersonating another identity to access data or resources.
- **Tampering:**
  - Unauthorized alteration of data.
- **Repudiation:**
  - Denying an action, leading to lack of accountability.

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STRIDE

- **Information Disclosure:**
  - Unauthorized access to confidential information.
- **Denial of Service:**
  - Disrupting service availability.
- **Elevation of Privilege:**
  - Gaining higher access levels than authorized.

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STRIDE

	Type of Threat	What Was Violated	How Was It Violated?
S	Spoofing	Authentication	Impersonating something or someone known and trusted.
T	Tampering	Integrity	Modifying data on disk, memory, network, etc.,
R	Repudiation	Non-repudiation	Claim to not be responsible for an action
I	Information Disclosure	Confidentiality	Providing information to someone who is not authorized
D	Denial of Service (DoS)	Availability	Denying or obstructing access to resources required to provide service
E	Elevation of Privilege	Authorization	Allowing access to someone without proper authorization

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PASTA

- **Definition:**
    - **Process for Attack Simulation and Threat Analysis (PASTA)**
    - is a seven step methodology to create a process for simulating attacks to IT applications, analyzing the threats, their origin, the risks they pose to an organization and how to emigrate them.
- **Objective**:
    - to identify the threat, enumerate them and assign a score.

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PASTA

- **PASTA:**
  - **Focus:**
    - Attack simulation to identify possible attack paths.
  - **Phases:**
    - Seven phases, from defining objectives to modeling and risk analysis.
  - **Use Case:**
    - Ideal for complex systems needing detailed threat scenarios.

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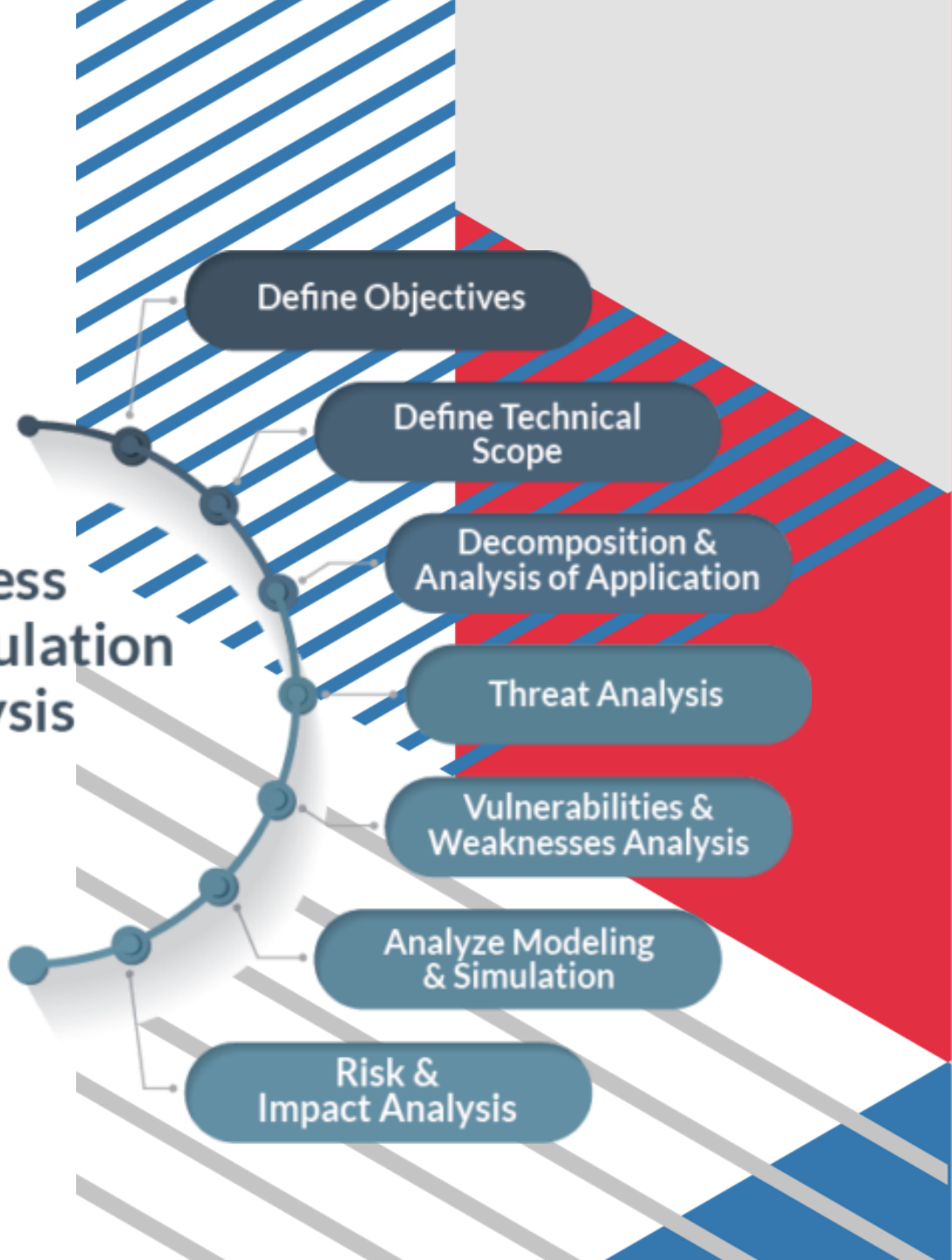
PASTA Phases

1. Define Business Objectives
2. Define Technical Scope
3. Decompose Application and Infrastructure
4. Analyze Threats
5. Enumerate Vulnerabilities
6. Analyze Exploits
7. Develop Mitigation Strategies



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Vulnerability Identification and Assessment

- **Vulnerability assessment** is the process of identifying, quantifying and prioritizing security vulnerabilities in an organization's IT infrastructure.

- It involves scanning systems, networks, and applications for known vulnerabilities, misconfigurations, and weaknesses that could be exploited by attackers to gain unauthorized access, steal data, or disrupt operations.

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Importance of Vulnerability Identification and Assessment

- **Proactive Risk Management**
  - helps organizations identify and mitigate security risks before they can be exploited by malicious actors.

- **Compliance Requirements**
  - Many regulatory frameworks and industry standards, such as PCI DSS, HIPAA, and GDPR, require regular vulnerability assessments to ensure compliance with security requirements.

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Importance of Vulnerability Assessment

- **Enhanced Security Posture**
  - By addressing vulnerabilities promptly, organizations can strengthen their overall security posture and reduce the likelihood of successful cyber attacks.

- **Cost Savings**
  - Identifying and remedying vulnerabilities early can help organizations avoid the financial costs associated with data breaches, regulatory fines, and reputational damage.

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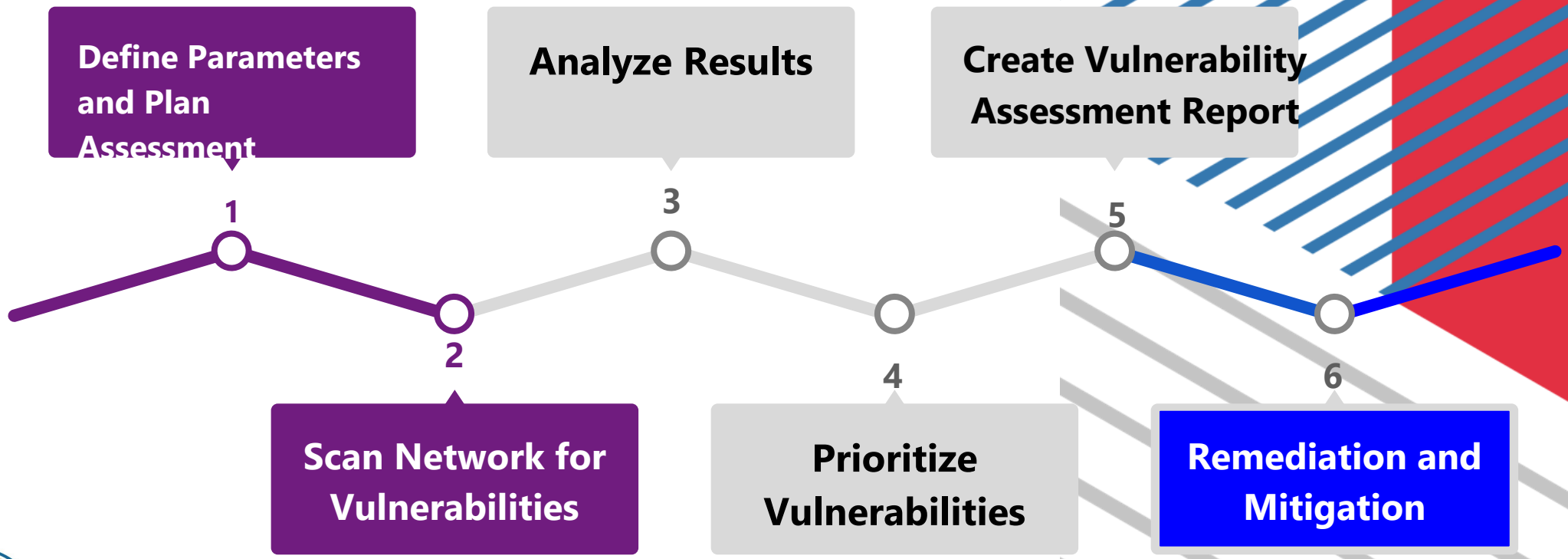
Vulnerability Assessment Process



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Techniques for Vulnerability Identification and Assessment

- Manual Code Review:
  - Reviewing code for common flaws and vulnerabilities.
- Automated Scanning:
  - Using tools to detect vulnerabilities automatically.

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Techniques for Vulnerability Identification and Assessment

- Penetration Testing:
  - Ethical hacking to exploit system weaknesses.
- Configuration Review:
  - Ensuring configurations meet security standards.

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Tools and Practices for Vulnerability Scanning

- **Tools:**
  - **Nessus**: Comprehensive vulnerability scanner for networks.
  - **OpenVAS**: Open-source tool for scanning network vulnerabilities.
  - **Burp Suite:** Web application scanner focusing on OWASP vulnerabilities.

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Tools and Practices for Vulnerability Scanning

- **Tools:**
  - **Nmap:** is used for host discovery, port scanning, service enumeration, and vulnerability detection.
  - **QualysGuard:** provides comprehensive scanning, reporting, and remediation capabilities for networks, hosts, and web applications.
  - **OWASP ZAP**: helps to identify security vulnerabilities in web applications, APIs, and websites.

Tools and Practices for Vulnerability Scanning

- **Best Practices:**
  - Regular scanning schedules.
  - Reviewing and validating scan results.
  - Prioritizing fixes based on risk assessment.

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Conclusion

- **Threat Modeling:** Helps preemptively identify threats.
- **Methodologies:** STRIDE and PASTA offer structured ways to categorize and assess threats.
- **Vulnerability Identification and Assessment:**
  - Techniques and tools are essential for discovering and managing risks.
  - helps organizations identify and mitigate security risks before they can be exploited by malicious actors.

Thank You

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Questions & answers

Invite questions from the audience.

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