



Understanding How They Attack Your Weaknesses: CAPEC



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The Long-established Principal of “Know Your Enemy”

- “One who knows the enemy and knows himself will not be endangered in a hundred engagements. One who does not know the enemy but knows himself will sometimes be victorious. Sometimes meet with defeat. One who knows neither the enemy nor himself will invariably be defeated in every engagement.”



- Chapter 3: “Planning the Attack”
 - The Art of War, Sun Tzu

The Importance of Knowing Your Enemy

- **An appropriate defense can only be established if you know how it will be attacked**

- **Remember!**
 - Software Assurance must assume motivated attackers and not simply passive quality issues
 - Attackers are very creative and have powerful tools at their disposal
 - Exploring the attacker's perspective helps to identify and qualify the risk profile of the software

What are Attack Patterns?

- **Blueprint for creating a specific type of attack**
- **Abstracted common attack approaches from the set of known exploits**
- **Capture the attacker's perspective to aid software developers, acquirers and operators in improving the assurance profile of their software**

Leveraging Attack Patterns Throughout the Software Lifecycle

- **Guide definition of appropriate policies**
- **Guide creation of appropriate security requirements (positive and negative)**
- **Provide context for architectural risk analysis**
- **Guide risk-driven secure code review**
- **Provide context for appropriate security testing**
- **Provide a bridge between secure development and secure operations**

Common Attack Pattern Enumeration and Classification (CAPEC)

- **Community effort targeted at:**
 - Standardizing the capture and description of attack patterns
 - Collecting known attack patterns into an integrated enumeration that can be consistently and effectively leveraged by the community
 - Gives you an attacker's perspective you may not have on your own

- **Excellent resource for many key activities**
 - Abuse Case development
 - Architecture attack resistance analysis
 - Risk-based security/Red team penetration testing
 - Whitebox and Blackbox testing correlation
 - Operational observation and correlation

- **Where is CAPEC today?**
 - <http://capec.mitre.org>
 - Currently 311 patterns, stubs, named attacks



CAPEC - Common Attack Pattern Enumeration and Classification (CAPEC)

Google


Common Attack Pattern Enumeration and Classification
A Community Knowledge Resource for Building Secure Software

CAPEC List

- Full CAPEC Dictionary
- Methods of Attack View

About CAPEC

- Documents
- Resources

Community

- Related Activities
- Collaboration List

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Building software with an adequate level of security assurance for its mission becomes more and more challenging every day as the size, complexity, and tempo of software creation increases and the number and the skill level of attackers continues to grow. These factors each exacerbate the issue that, to build secure software, builders must ensure that they have protected every relevant potential vulnerability; yet, to attack software, attackers often have to find and exploit only a single exposed vulnerability. To identify and mitigate relevant vulnerabilities in software, the development community needs more than just good software engineering and analytical practices, a solid grasp of software security features, and a powerful set of tools. All of these things are necessary but not sufficient. To be effective, the community needs to think outside of the box and to have a firm grasp of the attacker's perspective and the approaches used to exploit software.

Attack patterns are a powerful mechanism to capture and communicate the attacker's perspective. They are descriptions of common methods for exploiting software. They derive from the concept of design patterns applied in a destructive rather than constructive context and are generated from in-depth analysis of specific real-world exploit examples.

To assist in enhancing security throughout the software development lifecycle, and to support the needs of developers, testers and educators, the **Common Attack Pattern Enumeration and Classification (CAPEC)** is sponsored by the Department of Homeland Security as part of the Software Assurance strategic initiative of the National Cyber Security Division. The objective of this effort is to provide a publicly available catalog of attack patterns along with a comprehensive schema and classification taxonomy. This site now contains the initial set of content and will continue to evolve with public participation and contributions to form a standard mechanism for identifying, collecting, refining, and sharing attack patterns among the software community.

Release 1.4 Available

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Homeland Security

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What do Attack Patterns Look Like?

■ Primary Schema Elements

- Identifying Information
 - Attack Pattern ID
 - Attack Pattern Name
- Describing Information
 - Description
 - Related Weaknesses
 - Related Vulnerabilities
 - Method of Attack
 - Examples-Instances
 - References
- Prescribing Information
 - Solutions and Mitigations
- Scoping and Delimiting Information
 - Typical Severity
 - Typical Likelihood of Exploit
 - Attack Prerequisites
 - Attacker Skill or Knowledge Required
 - Resources Required
 - Attack Motivation-Consequences
 - Context Description

| Supporting Schema Elements

- Describing Information
 - Injection Vector
 - Payload
 - Activation Zone
 - Payload Activation Impact
- Diagnosing Information
 - Probing Techniques
 - Indicators-Warnings of Attack
 - Obfuscation Techniques
- Enhancing Information
 - Related Attack Patterns
 - Relevant Security Requirements
 - Relevant Design Patterns
 - Relevant Security Patterns

Attack Pattern Description Schema Formalization

Description

■ Summary

■ Attack_Execution_Flow

– Attack_Phase^{1..3} (Name(Explore, Experiment, Exploit))

■ Attack_Step^{1..*}

- Attack_Step_Title

- Attack_Step_Description

- Attack_Step_Technique^{0..*}

■ Attack_Step_Technique_Description

■ Leveraged_Attack_Patterns

■ Relevant_Attack_Surface_Elements

■ Observables^{0..*}

■ Environments

- Indicator^{0..*} (ID, Type(Positive, Failure, Inconclusive))

■ Indicator_Description

■ Relevant_Attack_Surface_Elements

■ Environments

- Outcome^{0..*} (ID, Type(Success, Failure, Inconclusive))

■ Outcome_Description

■ Relevant_Attack_Surface_Elements

■ Observables^{0..*}

■ Environments

- Security_Control^{0..*} (ID, Type(Detective, Corrective, Preventative))

■ Security_Control_Description

■ Relevant_Attack_Surface_Elements

■ Observables^{0..*}

■ Environments

■ Observables^{0..*}



Individual CAPEC Dictionary Definition (Release 1.2)

Blind SQL Injection



Attack Pattern ID 7

Pattern Abstraction: Detailed

Typical Severity High

Description Summary

Blind SQL Injection results from an insufficient mitigation for SQL Injection. Although suppressing database error messages are considered best practice, the suppression alone is not sufficient to prevent SQL Injection. Blind SQL Injection is a form of SQL Injection that overcomes the lack of error messages. Without the error messages that facilitate SQL Injection, the attacker constructs input strings that probe the target through simple Boolean SQL expressions. The attacker can determine if the syntax and structure of the injection was successful based on whether the query was executed or not. Applied iteratively, the attacker determines how and where the target is vulnerable to SQL Injection.

In order to achieve this using Blind SQL Injection, an attacker:

For example, an attacker may try entering something like "username' AND 1=1; --" in an input field. If the result is the same as when the attacker entered "username" in the field, then the attacker knows that the application is vulnerable to SQL Injection. The attacker can then ask yes/no questions from the database server to extract information from it. For example, the attacker can extract table names from a database using the following types of queries:

```
"username' AND ascii(lower(substring((SELECT TOP 1 name FROM sysobjects WHERE xtype='U'), 1, 1))) > 108".
```

If the above query executes properly, then the attacker knows that the first character in a table name in the database is a letter between m and z. If it doesn't, then the attacker knows that the character must be between a and l (assuming of course that table names only contain alphabetic characters). By performing a binary search on all character positions, the attacker can determine all table names in the database. Subsequently, the attacker may execute an actual attack and send something like:

```
"username'; DROP TABLE trades; --"
```

Complete CAPEC Entry Information

Complete CAPEC Definition (Release 1.2)
Stubs, Substubs

Stub: A stub is a CAPEC entry that is a placeholder for a complete CAPEC entry. It is used to represent a CAPEC entry that is not yet defined or is not yet complete. A stub is identified by the word "Stub" in the title of the entry. A stub is used to represent a CAPEC entry that is not yet defined or is not yet complete. A stub is identified by the word "Stub" in the title of the entry.

Substub: A substub is a CAPEC entry that is a placeholder for a complete CAPEC entry. It is used to represent a CAPEC entry that is not yet defined or is not yet complete. A substub is identified by the word "Substub" in the title of the entry. A substub is used to represent a CAPEC entry that is not yet defined or is not yet complete. A substub is identified by the word "Substub" in the title of the entry.

CAPEC Entry Information: Each CAPEC entry includes the following information:

- CAPEC ID:** A unique identifier for the CAPEC entry.
- Title:** A brief description of the CAPEC entry.
- Summary:** A brief description of the CAPEC entry.
- Impact:** A brief description of the CAPEC entry.
- References:** A list of references related to the CAPEC entry.
- Related CAPECs:** A list of related CAPEC entries.
- Related CVEs:** A list of related CVE entries.
- Related CWEs:** A list of related CWE entries.
- Related STIGs:** A list of related STIG entries.
- Related NIST SPs:** A list of related NIST SP entries.
- Related NVDs:** A list of related NVD entries.
- Related NUSs:** A list of related NUS entries.
- Related NUSs:** A list of related NUS entries.

Stub's Information: This section provides detailed information about the stub, including its title, summary, impact, and references. It also includes a list of related CAPECs, CVEs, CWEs, STIGs, NIST SPs, NVDs, and NUSs.

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A Few Key Use Cases for CAPEC in Support of SwA

- **Help developers understand weaknesses in their real-world context (how they will be attacked)**
- **Objectively identify specific attacks under which software must demonstrate resistance, tolerance and resilience for a given level of assurance**
- **Indirectly scope which weaknesses are relevant for a given threat environment**
- **Identify relevant mitigations that should be applied as part of policy, requirements, A&D, implementation, test, deployment and operations**
- **Identify and characterize patterns of attacks for security test case generation**
- **Identify and characterize threat TTPs for red teaming**
- **Identify relevant issues for automated tool selection**
- **Identify and characterize issues for automated tool results analysis**

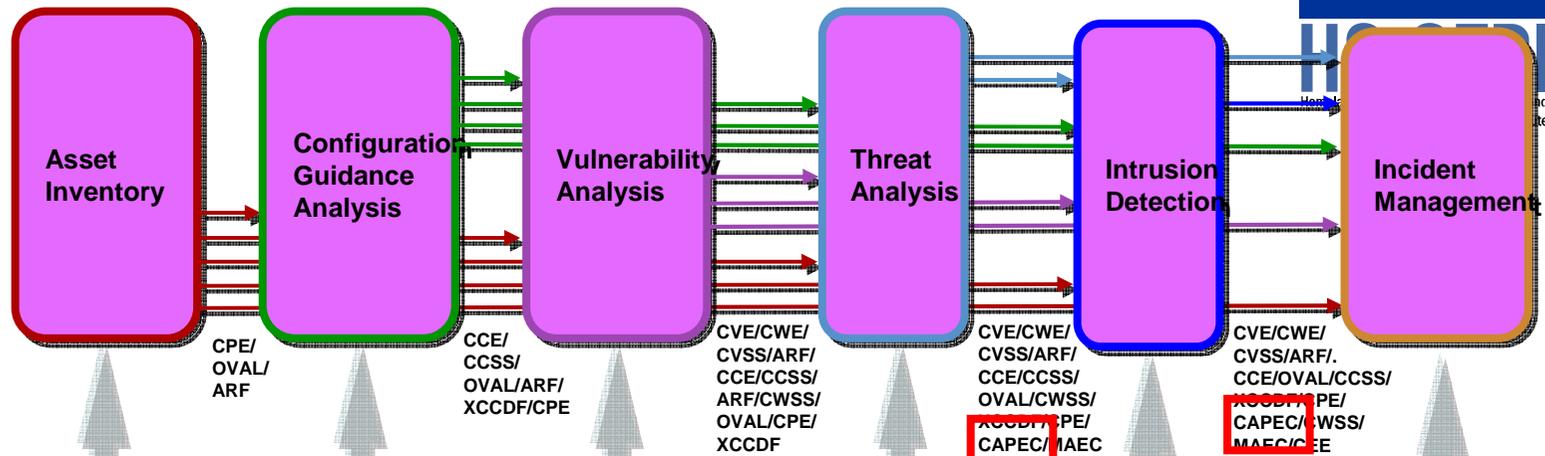
CAPEC and Security Measurement

■ CAPEC current non-automation value

- Measuring stick for evaluating and comparing penetration testing tools and application defense tools
 - Similar to CWE value to secure code analysis tools and CVE value to vulnerability scanners
- Measuring stick for attack resistance claims of assurance cases
 - It comes down to the proxies for measuring security (vulnerabilities, weaknesses and attack resistance)

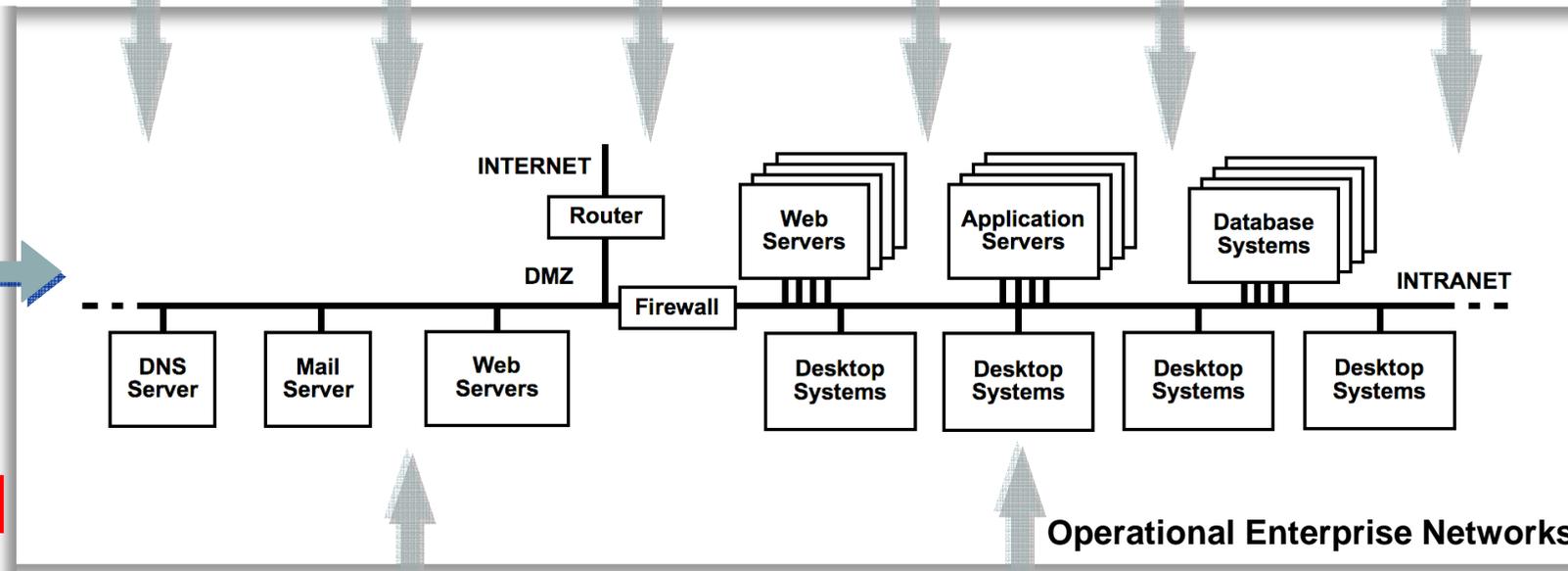
■ CAPEC developing automation value

- Characterizing the nature of software attack
 - Formalization of attack patterns to enable:
 - Recognition and mapping of attack instances from the operations realm
 - Refined ability to measure attack resistance in terms of resistance to individual sub-elements of attack with observables
 - Automated generation of penetration attack cases
 - Defining & mapping attack simulations in penetration testing tools
 - Alignment with malware characterization (MAEC)



Assessment of System Development, Integration, & Sustainment Activities and Certification & Accreditation

CWE/CAPEC/SBVR/CWSS/MAEC/OVAL/XCCDF/CCE/CPE/ARF



CVE/CWE/CVSS/CCE/CCSS/OVAL/XCCDF/CPE/CAPEC/MAEC/SBVR/CWSS/CEE/ARF

CVE/CWE/CVSS/CCE/CCSS/OVAL/XCCDF/CPE/CAPEC/MAEC/SBVR/CWSS/CEE/ARF

Enterprise IT Change Management

Centralized Reporting

CAPEC Status

Where is CAPEC today?

- **V1.4**

- Massive schema changes
- Some new content
- Added initial set of network attack patterns

- **V1.5**

- Added ~25 new network attack patterns
- Added enhanced material to ~35 patterns
- New View added for WASC Threat Taxonomy 2.0
- Added ~65 mappings to CWE and several within CAPEC

Currently 311 patterns, stubs, named attacks; 67 categories and 6 views

CAPEC Current Content (12 Major Categories)

1000 - Mechanism of Attack

- **Data Leakage Attacks - (118)**
- **Resource Depletion - (119)**
- **Injection (Injecting Control Plane content through the Data Plane) - (152)**
- **Spoofing - (156)**
- **Time and State Attacks - (172)**
- **Abuse of Functionality - (210)**
- **Exploitation of Authentication - (225)**
- **Probabilistic Techniques - (223)**
- **Exploitation of Privilege/Trust - (232)**
- **Data Structure Attacks - (255)**
- **Resource Manipulation - (262)**
- **Network Reconnaissance - (286)**

CAPEC Current Content (Which Expand to...)

1000 - Mechanism of Attack

- Data Leakage Attacks - (118)
 - Data Excavation Attacks - (116)
 - Data Interception Attacks - (117)
- Resource Depletion - (119)
 - Violating Implicit Assumptions Regarding XML Content (aka XML Denial of Service (XDoS)) - (82)
 - Resource Depletion through Flooding - (125)
 - Resource Depletion through Allocation - (130)
 - Resource Depletion through Leak - (131)
 - Denial of Service through Resource Depletion - (227)
- Injection (Injecting Control Plane content through the Data Plane) - (152)
 - Remote Code Inclusion - (253)
 - Analog In-band Switching Signals (aka Blue Boxing) - (5)
 - SQL Injection - (66)
 - Email Injection - (134)
 - Format String Injection - (135)
 - LDAP Injection - (136)
 - Parameter Injection - (137)
 - Reflection Injection - (138)
 - Code Inclusion - (175)
 - Resource Injection - (240)
 - Script Injection - (242)
 - Command Injection - (248)
 - Character Injection - (249)
 - XML Injection - (250)
 - DTD Injection in a SOAP Message - (254)
- Spoofing - (156)
 - Content Spoofing - (148)
 - Identity Spoofing (Impersonation) - (151)
 - Action Spoofing - (173)
- Time and State Attacks - (172)
 - Forced Deadlock - (25)
 - Leveraging Race Conditions - (26)
 - Leveraging Time-of-Check and Time-of-Use (TOCTOU) Race Conditions - (29)
 - Manipulating User State - (74)
- Abuse of Functionality - (210)
 - Functionality Misuse - (212)
 - Abuse of Communication Channels - (216)
 - Forceful Browsing - (87)
 - Passing Local Filenames to Functions That Expect a URL - (48)
 - Probing an Application Through Targeting its Error Reporting - (54)
 - WSDL Scanning - (95)
 - API Abuse/Misuse - (113)
 - Try All Common Application Switches and Options - (133)
 - Cache Poisoning - (141)
 - Software Integrity Attacks - (184)
 - Directory Traversal - (213)
 - Analytic Attacks - (281)
- Probabilistic Techniques - (223)
 - Fuzzing - (28)
 - Manipulating Opaque Client-based Data Tokens - (39)
 - Brute Force - (112)
 - Screen Temporary Files for Sensitive Information - (155)

- Exploitation of Authentication - (225)
 - Exploitation of Session Variables, Resource IDs and other Trusted Credentials - (21)
 - Authentication Abuse - (114)
 - Authentication Bypass - (115)
 - Exploitation of Privilege/Trust - (232)
 - Privilege Escalation - (233)
 - Exploiting Trust in Client (aka Make the Client Invisible) - (22)
 - Hijacking a Privileged Thread of Execution - (30)
 - Subvert Code-signing Facilities - (68)
 - Target Programs with Elevated Privileges - (69)
 - Exploitation of Authorization - (122)
 - Hijacking a privileged process - (234)
- Data Structure Attacks - (255)
 - Accessing/Intercepting/Modifying HTTP Cookies - (31)
 - Buffer Attacks - (123)
 - Attack through Shared Data - (124)
 - Integer Attacks - (128)
 - Pointer Attack - (129)
- Resource Manipulation - (262)
 - Accessing/Intercepting/Modifying HTTP Cookies - (31)
 - Input Data Manipulation - (153)
 - Resource Location Attacks - (154)
 - Infrastructure Manipulation - (161)
 - File Manipulation - (165)
 - Variable Manipulation - (171)
 - Configuration/Environment manipulation - (176)
 - Abuse of transaction data structure - (257)
 - Registry Manipulation - (269)
 - Schema Poisoning - (271)
 - Protocol Manipulation - (272)
- Network Reconnaissance - (286)
 - ICMP Echo Request Ping - (285)
 - TCP SYN Scan - (287)
 - ICMP Echo Request Ping - (288)
 - Infrastructure-based footprinting - (289)
 - Enumerate Mail Exchange (MX) Records - (290)
 - DNS Zone Transfers - (291)
 - Host Discovery - (292)
 - Traceroute Route Enumeration - (293)
 - ICMP Address Mask Request - (294)
 - ICMP Timestamp Request - (295)
 - ICMP Information Request - (296)
 - TCP ACK Ping - (297)
 - UDP Ping - (298)
 - TCP SYN Ping - (299)
 - Port Scanning - (300)
 - TCP Connect Scan - (301)
 - TCP FIN scan - (302)
 - TCP Xmas Scan - (303)
 - TCP Null Scan - (304)
 - TCP ACK Scan - (305)
 - TCP Window Scan - (306)
 - TCP RPC Scan - (307)
 - UDP Scan - (308)



CAPEC Current Content (311 Attacks...)



Current Maturation Paths

- **Extend coverage of CAPEC**
- **Improve quality of CAPEC**
- **Expand the scope of CAPEC**
- **Bridge secure development with secure operations**
- **Improve integration with other standards (MAEC, CEE, etc.)**
- **Expand use of CAPEC**

Expanding the Scope of CAPEC

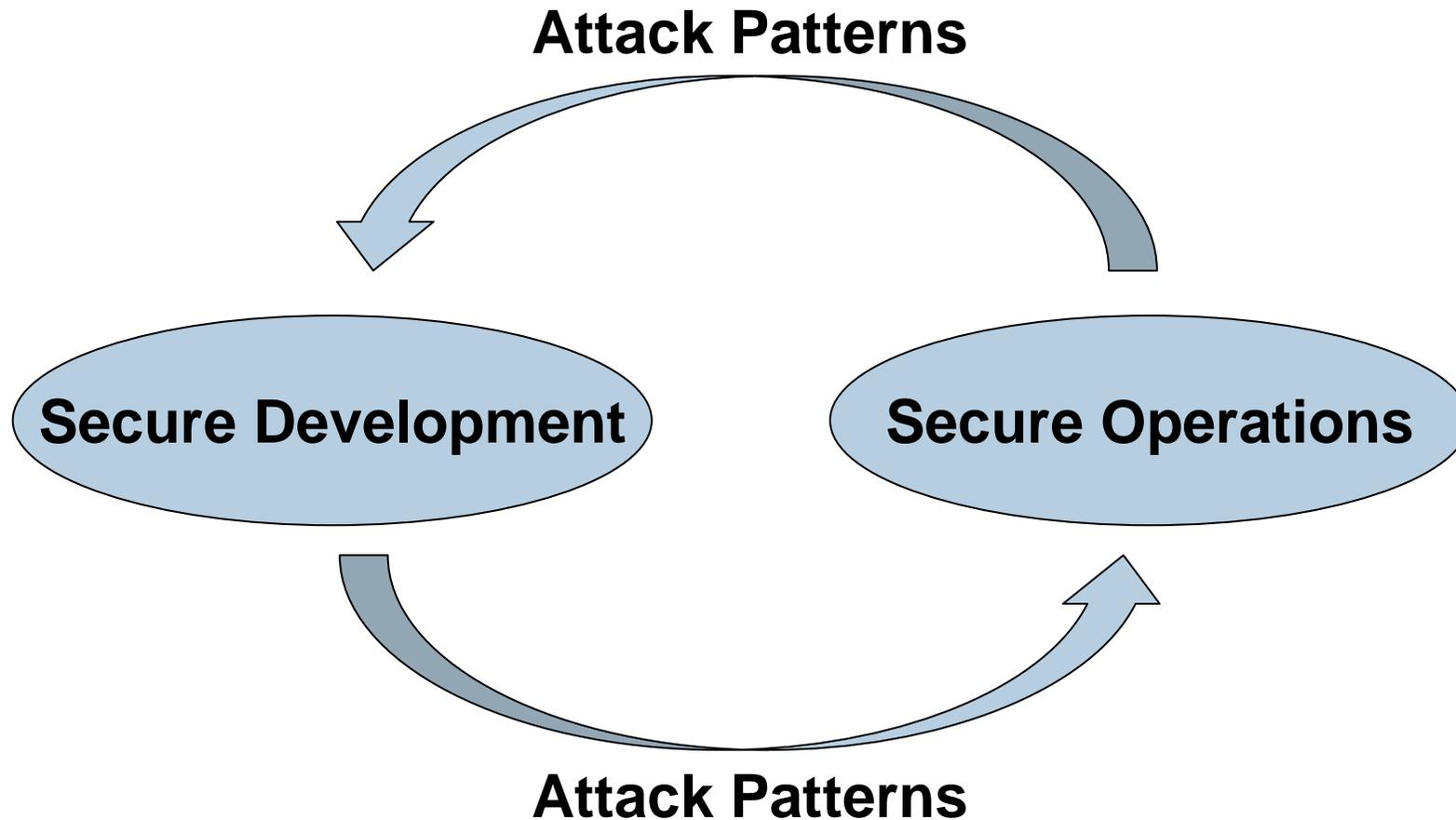
- **Originally focused solely on attacks against software systems**

- **CAPEC has begun to expand its scope to encompass the capture and characterization of attack patterns in domains outside of but relevant to software system attacks**

- **CAPEC v1.4**
 - Network attack patterns

- **CAPEC v1.6**
 - Social Engineering attack patterns
 - Supply chain attack patterns

Attack Patterns Bridge Secure Development and Secure Operations



Attack Patterns Help Answer Foundational Questions Regarding Secure Operations

Question	Role of Attack Patterns
Are we being attacked? (Were we attacked?)	Attack patterns offer structured descriptions of common attacker behaviors to help interpret observed operational data and determine its innocent or malicious intent.
How are we being attacked?	Attack patterns offer detailed structured descriptions of common attacker behavior to help interpret observed operational data and determine exactly what sort of attack is occurring.
What is the objective of the attack?	Elements of attack patterns outlining attacker motivation and potential attack effects can be leveraged to help map observed attack behaviors to potential attacker intent.
What is our exposure?	The structure detail and weakness mapping of attack patterns can provide guidance in where to look and what to look for when certain attack pattern behaviors are observed.
Who is attacking us?	Attack pattern threat characterization and detailed attack execution flow can provide a framework for organizing real-world attack data to assist in attribution.
What should we do to prevent against attacks in the future?	Attack patterns offer prescriptive guidance on solutions and mitigation approaches that can be effective in improving the resistance tolerance and/or resilience to instances of a given pattern of attack.

“Observables” are the Key Enabler for Bridging Secure Development and Secure Operations

- **The Observables construct is intended to capture and characterize events or properties that are observable in the operational domain.**
- **These observable events or properties can be used to adorn the appropriate portions of the attack patterns in order to tie the logical pattern constructs to real-world evidence of their occurrence or presence.**
- **It enables the alignment of the low-level aggregate mapping of observables that occurs in the operations domain to the higher-level abstractions of attacker methodology, motivation, and capability that exist in the development domain.**

Observables Intent

- **By capturing them in a structured fashion, the intent is to enable future potential for detailed automatable mapping and analysis heuristics.**
- **The current Observables draft schema adorns the Attack_Step, Attack_Step_Technique, Attack_Step Outcome, and Attack_Step Security_Control elements of the attack pattern schema. It focuses on characterizing specific observable measures, their value, their sensor context, and how accurate or easy to obfuscate they are.**
- **Future schema revisions should flesh out the construct to cover other relevant dimensions.**



Observables Structure

■ The imminent revision of the Observables schema will:

- Capture more complete descriptive information for the measure source
- Support for both Static “Stateful Measures” and Dynamic “Events”
- Enable Measure composition, chaining and logical combination through multiplicities and relationships
- Leverage flexible structures for Actions, Objects & Attributes to support description of both current and future “observables”
- Provide extensive relevant content for enumeration constraints on source, event, action, object & attribute types

A Few Use Cases for “Observables” in Bridging Secure Development (SD) and Secure Operations (SO)

- SO: Correlate observed events (realtime or from incident management) to detect that attack is occurring
- SO: Correlate observed events (realtime or from incident management) to identify what type of attack is occurring
- SO: Utilize info in relevant CAPEC patterns to focus where else to look for other indicators of attack
- SO: Utilize info in relevant CAPEC patterns to focus where else to look to determine severity of breach
- SO: Utilize info in relevant CAPEC patterns to characterize the attacker (including maybe someday supporting attribution)
- SD: Utilize real-world operations events to identify new attack patterns
- SD: Utilize real-world operations events to prioritize relevant attack patterns based on reality of what is being used
- SD: Utilize real-world operations events to determine if mitigations are effective

Integration With Other Standards

- **Continued deep integration with CWE & CVE**
- **Integration into Temporal factors of CWSS**
- **The Observables schema is a shared need and solution among CAPEC, the Malware Attribute Enumeration and Characterization (MAEC) & the Common Event Expression (CEE)**
- **Continuing to refine bidirectional linkages and integrations between CAPEC & MAEC**

Industry Uptake

Manually review code after security education

Manual code review, especially review of high-risk code, such as code that faces the Internet or parses data from the Internet, is critical, but only if the people performing the code review know what to look for and how to fix any code vulnerabilities they find. The best way to help understand classes of security bugs and remedies is education, which should minimally include the following areas:

- C and C++ vulnerabilities and remedies, most notably buffer overruns and integer arithmetic issues.
- Web-specific vulnerabilities and remedies, such as cross-site scripting (XSS).
- Database-specific vulnerabilities and remedies, such as SQL injection.
- Common cryptographic errors and remedies.

Many vulnerabilities are programming language (C, C++ etc) or domain-specific (web, database) and others can be categorized by vulnerability type, such as injection (XSS and SQL Injection) or cryptographic (poor random number generation and weak secret storage) so specific training in these areas is advised.

Resources

- A Process for Performing Security Code Reviews, Michael Howard, IEEE Security & Privacy July/August 2006.
<http://msdn.microsoft.com/en-us/library/aa302437.aspx>
- .NET Framework Security — Code Review;
<http://www.mscorlib.com/en-us/library/aa302437.aspx>
- **Common Weakness Enumeration, MITRE; <http://cwe.mitre.org/>**
- **Security Code Reviews;**
http://www.codesecurely.org/Wiki/view.aspx/Security_Code_Reviews
- Security Code Review — Use Visual Studio Bookmarks To Capture Security Findings; <http://blogs.msdn.com/alki/archive/2008/01/24/security-code-review-use-visual-studio-bookmarks-to-capture-security-findings.aspx>
- Security Code Review Guidelines, Adam Shostack;
<http://www.verber.com/mark/cs/security/code-review.html>
- OS WASP Top Ten; http://www.owasp.org/index.php/OWASP_Top_Ten_Project

**CWE
CAPEC**

Testing

Testing activities validate the secure implementation of a product, which reduces the likelihood of security bugs being released and discovered by customers and malicious users. The majority of SAFECode members have adopted the following software security testing practices in their software development lifecycle. This is not to “test in security,” but rather to validate the robustness and security of the software products prior to making the product available to customers. These testing methods do find security bugs, especially for products that may not have undergone critical secure development process changes.

Fuzz testing

Fuzz testing is a reliability and security testing technique that relies on providing intentionally malformed data and then having the software under test consume the malformed data to see how it responds. The science of fuzz testing is somewhat new but it is maturing rapidly. There is a small market for fuzz testing tools today, but in many cases software developers must build bespoke fuzz testers to suit specialized file and network data formats. Fuzz testing is an effective testing technique because it uncovers weaknesses in data handling code.

Resources

- Fuzz Testing of Application Reliability, University of Wisconsin;
<http://pages.cs.wisc.edu/~bart/fuzz/fuzz.html>
- Automated Whitebox Fuzz Testing, Michael Levin, Patrice Godefroid and Dave Molnar, Microsoft Research;
<ftp://ftp.research.microsoft.com/pub/tr/TR-2007-58.pdf>
- IANewsletter Spring 2007 “Look out! It’s the fuzzi!” Matt Warnock;
http://iac.dtic.mil/iatac/download/Vol10_No1.pdf
- Fuzzing: Brute Force Vulnerability Discovery, Sutton, Greene & Amini, Addison-Wesley.
- Open Source Security Testing Methodology Manual, ISECOM.
- **Common Attack Pattern Enumeration and Classification, MITRE;**
<http://capec.mitre.org/>



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Fundamental Practices for Secure Software Development A Guide to the Most Effective Secure Development Practices in Use Today

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Linkage with Fundamental Changes in Enterprise Security Initiatives

Twenty Critical Controls for Effective Cyber Defense Guidelines

What the 20 CSC Critics say...

20 Critical Security Controls - Version 2.0

- 20 Critical Security Controls - Introduction (Version 2.0)
- Critical Control 1: Inventory of Authorized and Unauthorized Devices
- Critical Control 2: Inventory of Authorized and Unauthorized Applications
- Critical Control 3: Secure Configurations for Hardware and Software
- Critical Control 4: Secure Configurations for Network Devices
- Critical Control 5: Boundary Defense
- Critical Control 6: Maintenance, Monitoring, and Analysis of Security Alerts
- **Critical Control 7: Application Software Security**
- Critical Control 8: Controlled Use of Administrative Privileges
- Critical Control 9: Controlled Access Based on Need to Know
- Critical Control 10: Security Incident Response and Reporting
- Critical Control 11: Data Protection
- Critical Control 12: Information Security Policies and Procedures
- Critical Control 13: Security Awareness and Training
- Critical Control 14: Vendor Risk Management
- Critical Control 15: Physical Security
- Critical Control 16: Penetration Testing
- Critical Control 17: Incident Response and Reporting
- Critical Control 18: Security Incident Response and Reporting
- Critical Control 19: Security Incident Response and Reporting
- Critical Control 20: Security Incident Response and Reporting

CAG: Critical Control 7: Application Software Security

<< previous control

Consensus Audit Guidelines

next control >>

How do attackers exploit the lack of this control?

Attacks against vulnerabilities in web-based and other application software have been a top priority for criminal organizations in recent years. Application software that does not properly check the size of user input, fails to sanitize user input by filtering out unneeded but potentially malicious character sequences, or does not initialize and clear variables properly could be vulnerable to remote compromise. Attackers can inject specific exploits, including buffer overflows, SQL injection attacks, and cross-site scripting code to gain control over vulnerable machines. In one attack in 2008, more than 1 million web servers were exploited and turned into infection engines for visitors to those sites using SQL injection. During that attack, trusted websites from state governments and other organizations compromised by attackers were used to infect hundreds of thousands of

CWE and CAPEC included in Control 7 of the “Twenty Critical Controls for Effective Cyber Defense: Consensus Audit Guidelines”

Procedures and tools for implementing this control

Source code testing tools, web application security scanning tools, and object code testing tools have proven useful in securing application software, along with manual application security penetration testing by testers who have extensive programming knowledge as well as application penetration testing expertise. The Common Weakness Enumeration (CWE) initiative is utilized by many such tools to identify the weaknesses that they find. Organizations can also use CWE to determine which types of weaknesses they are most interested in addressing and removing. A broad community effort to identify the “Top 25 Most Dangerous Programming Errors” is also available as a minimum set of important issues to investigate and address during the application development process. When evaluating the effectiveness of testing for these weaknesses, the Common Attack Pattern Enumeration and Classification (CAPEC) can be used to organize and record the breadth of the testing for the CWEs as well as a way for testers to think like attackers in their development of test cases.



Homeland Security



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 Information technology - Security techniques
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TITLE: National Body New Work Item Proposal on "Secure software development and evaluation under ISO/IEC 15406 and ISO/IEC 18405"

SOURCE: INCITSACS 1, National Body of (US)

DATE: 2006-09-30

PROJECT: 15406 and 18405

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DISTRIBUTION: P, D and L-Members
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Common Criteria v4 CCDB

- TOE to leverage CAPEC & CWE
- Also investigating how to leverage ISO/IEC 15026

NIAP Evaluation Scheme

- Above plus
- Also investigating how to leverage SCAP

New Work Item Proposal
 NP submitting

PROPOSAL FOR A NEW WORK ITEM

Date of presentation of proposal YYYY-MM-DD	Proposer: ISO/IEC JTC 1/SC27
Secretariat National Body	ISO/IEC JTC 1 N XXXX ISO/IEC JTC 1/SC 27 N

A proposal for a new work item shall be submitted to the secretariat of the ISO/IEC joint technical committee concerned with a copy to the ISO Central Secretariat.

Presentation of the proposal

Title: Secure software development and evaluation under ISO/IEC 15406 and ISO/IEC 18405

Scope

In the case where a target of evaluation (TOE) being evaluated under ISO/IEC 15406 and ISO/IEC 18405, includes specific software portions, the TOE developer may optionally present the developer's technical rationale for mitigating software common attack patterns and related weaknesses as described in the latest revision of the Common Attack Pattern Enumeration and Classification (CAPEC) model table from <http://csrc.nist.gov>. The developer's technical rationale is expected to include a range of mitigation techniques, from architectural properties to design features, coding techniques, use of tools or other means.

This Technical Report (TR) provides guidance for the developer and the evaluator on how to use the CAPEC as a technical reference point during the TOE development lifecycle and in an evaluation of the TOE secure software under ISO/IEC 15406 and 18405, by addressing:

- A refinement of the ISO 15406 Attack Potential evaluation table for software, taking into account the entries contained in the CAPEC and their characteristic.
- How the information for mitigating software common attack patterns and related weaknesses is used in an ISO 15406 evaluation, in particular providing guidance on how to determine which attack patterns and weaknesses are applicable to the TOE, taking into consideration of:
 - the TOE technology;
 - the TOE security problem definition;
 - the interfaces for TOE exports that can be used by potential attackers;
 - the Attack Potentials that the TOE needs to provide resistance for.
- How the technical rationale provided by the developer for mitigating software common attack patterns and related weaknesses is used in the evaluation of the TOE design and the development of test cases.
- How the CAPEC and related Common Weakness Enumeration (CWE) weaknesses are used by the evaluator, who needs to consider at the applicable attack patterns and be able to exploit specific related software weaknesses while performing the subsequent vulnerability analysis (AVA_VAN) activities on the TOE.
- How incomplete entries from the CAPEC are resolved during an ISO 15406 evaluation.
- How the evaluator's attack and weakness analysis of the TOE incorporates other attacks and weaknesses not yet documented in the CAPEC.

The TR also investigates specific elements from the ISO/IEC 15026 (and its revision) are applicable to the guidelines being developed in the TR within the context of BS 15406 and 18405.

ISO/IEC JTC 1/SC 27/WG 3, NWP

“Secure software development and evaluation under ISO/IEC 15408 and ISO/IEC 18045”



- The way how the CAPEC and related CWE taxonomies are to be used by the developer, which needs to consider and provide sufficient and effective mitigation to all applicable attacks and weaknesses.
- The way how the CAPEC and related CWE taxonomies are to be used by the evaluator, which needs to consider all the applicable attack patterns and be able to exploit all the related software weaknesses while performing the subsequent AVA_VAN activities.
- How incomplete entries from the CAPEC are to be addressed during an evaluation.
- How to incorporate to the evaluation attacks and weaknesses not included in the CAPEC.

CAPEC Future Plans

- **V1.6 (imminent)**
 - Will flesh out 15 stub patterns to full patterns
 - Will add ~10 new patterns around application framework attacks
 - Will add 5-10 new social engineering attack pattern stubs
 - Will add 5-10 new supply chain attack pattern stubs
 - Will incorporate extensively refined Observables schema
- Strategic focus for the near to mid-term will be on utilizing CAPEC as a bridge between secure development and secure operations
- Continue expanding and refining content
- Continue expanding outreach and supporting CAPEC use
- Establish initial compatibility program

Questions?

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Homeland
Security

Know Your Weaknesses

<http://cwe.mitre.org>

CWETM

CAPECTM

<http://capec.mitre.org>

Know Their Attacks