



OWASP Cornucopia

Ecommerce Website Edition

OWASP Cornucopia - Ecommerce Website Edition helps developers identify security requirements from the OWASP Secure Coding Practices - Quick Reference Guide

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SAFECode - Practical Security Stories and Security Tasks for Agile Development Environments



Practical Security Stories and Security Tasks for Agile Development Environments

JULY 17, 2012

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No.	Security-focused story	Backlog task(s)	SAFECode Fundamental Practice(s)	CWE-ID
18	As a(n) architect/developer, I want to ensure AND as QA, I want to verify that cross-site request forgery attacks are prevented	<p>[D] Use one of the many available libraries and frameworks that takes CSRF into account.</p> <p>[D] Defend against cross-site scripting (see Story 17).</p> <p>[A/D] Add business logic and workflow steps to critical processes in the system, and make them out-of-band: send an email in case of password change, send a text message when changing a critical value.</p> <p>[D/T] Log critical operations and the details of their initiation and arguments.</p> <p>[A/D] Do not use HTTP GET for any method that effects a change in system state.</p>	<ul style="list-style-type: none"> • Use Anti-Cross Site Scripting (XSS) Libraries • Validate Input and Output to Mitigate Common Vulnerabilities • Use Logging and Tracing 	CWE-352
19	As a(n) architect/developer, I want to ensure AND as QA, I want to verify proper neutralization of Special Elements used in an OS Command ('OS Command Injection')	<p>[D] Consider all input as malicious and filter according to the context.</p> <p>[D] Check all arguments to functions like exec() or system() for the expected format before executing.</p> <p>[D] Limit the use of external processes; prefer library calls.</p> <p>[D] Use static code analysis tools.</p> <p>[D] Consider the use of command shells [system()] as opposed to directly calling an executable [exec()] and its implications in command line arguments, like shell expansion.</p> <p>[A/D] Reduce the attack surface by adopting the backlog items of "Execution with Unnecessary Privileges."</p>	<ul style="list-style-type: none"> • Validate Input and Output to Mitigate Common Vulnerabilities • Use Static Analysis Tools • Use Least Privilege 	CWE-78

OWASP Secure Coding Practices – Quick Reference Guide



OWASP Secure Coding Practices – Quick Reference Guide

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Version 2.0

November 2010

November 2010

Authentication and Password Management:

- ☐ Require authentication for all pages and resources, except those specifically intended to be public
- ☐ All authentication controls must be enforced on a trusted system (e.g., The server)
- ☐ Establish and utilize standard, tested, authentication services whenever possible
- ☐ Use a centralized implementation for all authentication controls, including libraries that call external authentication services
- ☐ Segregate authentication logic from the resource being requested and use redirection to and from the centralized authentication control
- ☐ All authentication controls should fail securely
- ☐ All administrative and account management functions must be at least as secure as the primary authentication mechanism
- ☐ If your application manages a credential store, it should ensure that only cryptographically strong one-way salted hashes of passwords are stored and that the table/file that stores the passwords and keys is write-able only by the application. (Do not use the MD5 algorithm if it can be avoided)
- ☐ Password hashing must be implemented on a trusted system (e.g., The server).
- ☐ Validate the authentication data only on completion of all data input, especially for sequential authentication implementations
- ☐ Authentication failure responses should not indicate which part of the authentication data was incorrect. For example, instead of "Invalid username" or "Invalid password" just use "Invalid

Microsoft Elevation of Privilege (EoP) Card Game

Elevation of Privilege (EoP) Card Game



Elevation of Privilege (EoP) is the easy way to get started [threat modeling](#), which is a core component of the [design phase](#) in the Microsoft Security Development Lifecycle (SDL).

The EoP card game helps clarify the details of threat modeling and examines possible threats to software and computer systems.

The EoP game focuses on the following threats:

- Spoofing
- Tampering
- Repudiation
- Information Disclosure
- Denial of Service
- Elevation of Privilege



EoP uses a simple point system that allows you to challenge other developers and become your opponent's biggest threat.



Downloads for EoP



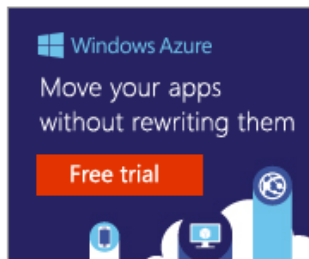
Elevation of Privilege (EoP) Threat Modeling Card Game



Quick links

[Overview](#)[System requirements](#)[Instructions](#)

Looking for support?

[Visit the Microsoft Support site now >](#)

Elevation of Privilege (EoP) is the easy way to get started threat modeling. It is a card game that developers, architects or security experts can play.

Quick details

Version:	1	Date published:	2/7/2013
Language:	English		

Files in this download

The links in this section correspond to files available for this download. Download the files appropriate for you.

File name	Size	
EoP_Card Game Images.pdf	6.0 MB	DOWNLOAD
EoP_Cards_Box_Native_files.zip	85.9 MB	DOWNLOAD
EoP_Instructions.pdf	565 KB	DOWNLOAD
EoP_Score Card.pdf	357 KB	DOWNLOAD
EoP_Whitepaper.pdf	271 KB	DOWNLOAD

Overview

Elevation of Privilege (EoP) is the easy way to get started threat modeling. It is designed to make threat modeling easy and accessible for developers and architects. Threat modeling is a core security practice during the design phase of the Microsoft Security Development Lifecycle (SDL). The EoP card game helps examine possible threats to software and computer system. This game is licensed under the Creative Commons Attribution 3.0 United States License. Native files of the game are made available to allow editing, localization, and printing of the game. To view the full content of this license, visit <http://creativecommons.org/licenses/by/3.0/us/>

[↑ Top of page](#)

System requirements

Supported operating systems: Windows 7, Windows Server 2003, Windows Server 2008, Windows Vista, Windows XP

More web application relevant



EoP examples

- An attacker could squat on the random port or socket that the server normally uses
- An attacker can confuse a client because there are too many ways to identify a server
- An attacker can make [your authentication system|client|server] unusable or unavailable [without ever authenticating] [but the problem goes away when the attacker stops|and the problem persists after the attacker goes away] (10 cards)
- An attacker can provide a pointer across a trust boundary, rather than data which can be validated

Cornucopia examples

- Gary can take over a user's session because there is a long or no inactivity timeout, or a long or no overall session time limit, or the same session can be used from more than one device/location
- Marce can forge requests because per-session, or per-request for more critical actions, strong random tokens or similar are not being used for actions that change state
- Eduardo can access data he does not have permission to, even though he has permission to the form/page/URL/entry point

More coverage of web security requirements



EoP suits = STRIDE

- **Spoofing**
Impersonating something or someone else
- **Tampering**
Modifying data or code
- **Repudiation**
Claiming to have not performed an action
- **Information Disclosure**
Exposing information to someone not authorized to see it
- **Denial of Service**
Deny or degrade service to users
Elevation of Privilege
Gain capabilities without proper authorization

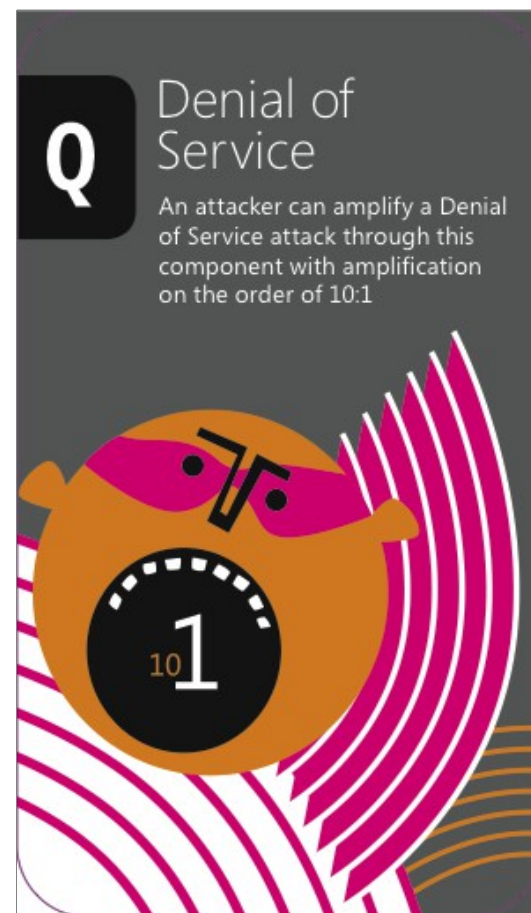
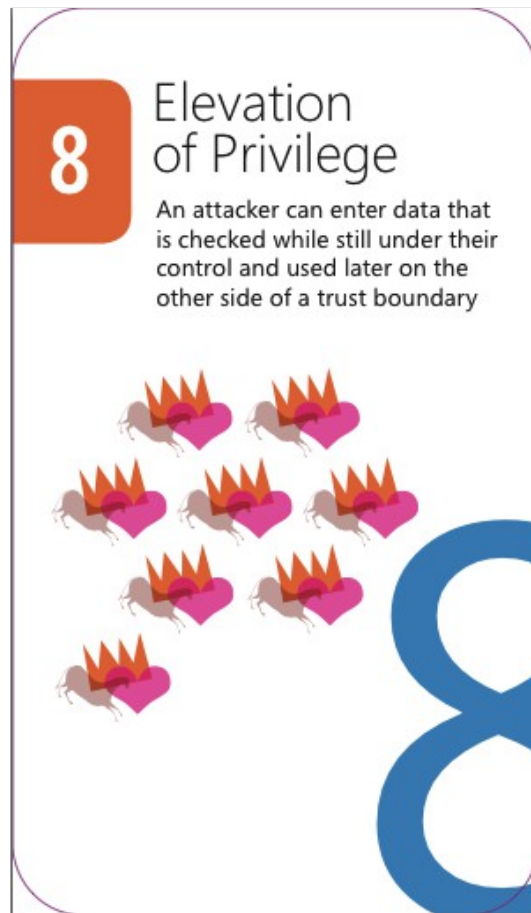
Cornucopia suits

- **Data validation and encoding**
Input and output data validation and escaping
- **Authentication**
Verification of identity claims and related processes
- **Session management**
Maintenance of user state
- **Authorization**
User/role permission controls
- **Cryptography**
Hashing, digital signatures, encryption and random number generation processes and their usage including key management
- **Cornucopia (everything else)**
Including information leakage, data loss, dependencies, abuse of trust, non-repudiation, configuration management, function misuse, denial of service

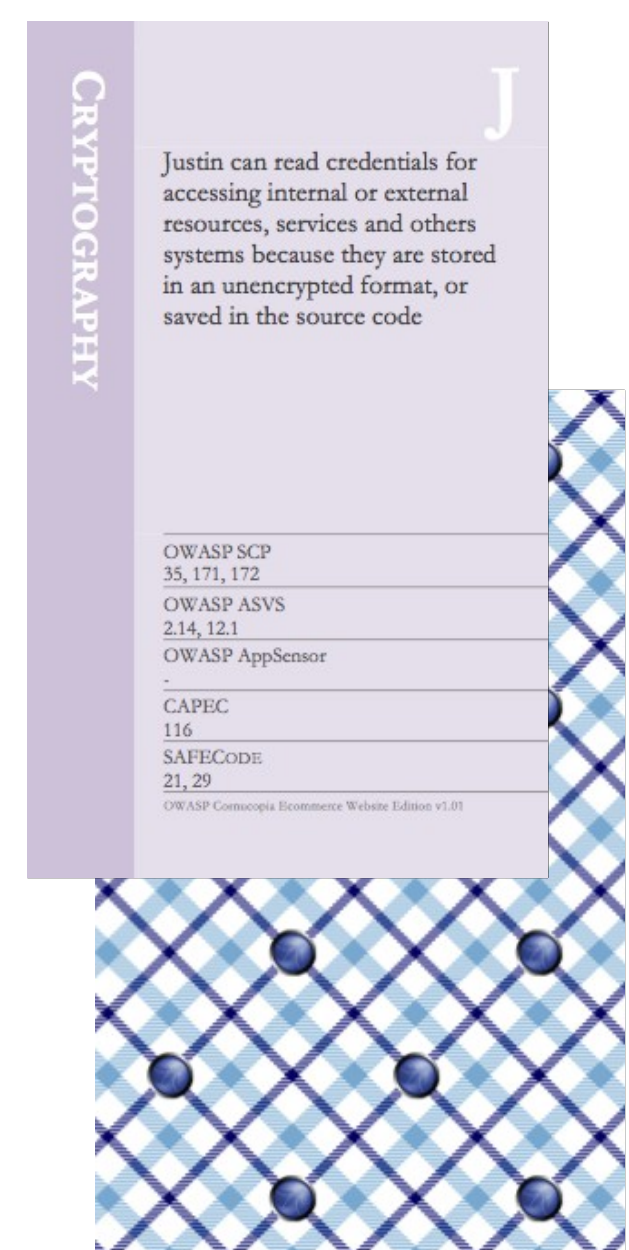
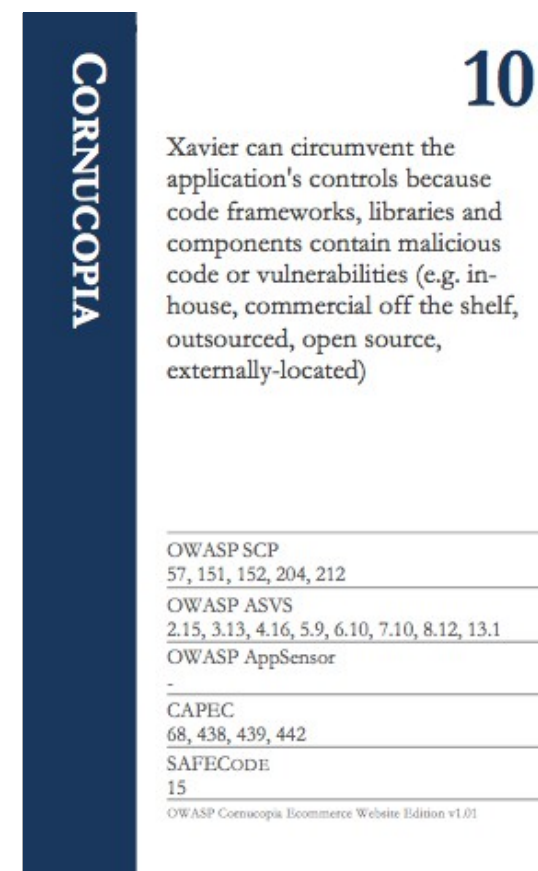
Less colourful and less pictorial



EoP playing cards



Cornucopia playing cards



Less vendor specific and **more** webapp/OWASP specific ✓

EoP examples

- An attacker could take advantage of .NET permissions you ask for, but don't use
- An attacker can alter information in a data store because it has weak ACLs or includes a group which is equivalent to everyone ("all Live ID holders")

Cornucopia examples

- Bob can influence, alter or affect the application so that it no longer complies with legal, regulatory, contractual or other organizational mandates
- You have invented a new attack of any type

Read more about application security in OWASP's free Guides on Requirements, Development, Code Review and Testing, the Cheat Sheet series, and the Open Software Assurance Maturity Model

- You have invented a new attack against Authorization

Read more about this topic in OWASP's Development and Testing Guides

More information rich



EoP

- Suit name (e.g. Denial of Service)
- Attack description
- Ranking (card number)

Cornucopia

- Suit name (e.g. Authentication)
- Attack description
- Ranking (card number)
- Cross-referencing
Security requirements, security verification checks, attack detection points, attack patterns and Agile user stories

OWASP SCP
10, 32, 93, 94, 189

OWASP ASVS
4.1, 4.2, 4.3, 4.4, 4.6, 4.12

OWASP AppSensor
ACE3

CAPEC
25, 39, 74, 162, 166, 207

SAFECode
8, 10, 11, 12

OWASP Cornucopia Ecommerce Website Edition v1.01

More individual



EoP

- An attacker could steal credentials stored on the server and reuse them (for example, a key is stored in a world readable file)
- An attacker can manipulate data because there's no integrity protection for data on the network
- An attacker can provide or control state information
- An attacker can say "I didn't do that," and you'd have no way to prove them wrong

Cornucopia

- Shamun can bypass input validation or output validation checks because validation failures are not rejected or sanitized
- Kyun can access data because it has been obfuscated rather than using an approved cryptographic function
- Keith can perform an action and it is not possible to attribute it to him

What's in a name?



The “names” can represent

- External or internal people
- Aliases for computer system components
 - The application itself
 - Other applications
 - Services
 - Operating systems
 - Infrastructure
- Jim can undertake malicious, non-normal, actions without real-time detection and response by the application

Identifying requirements with each card played

- Suit and value
- Attack description
- Cross-referencing

AUTHENTICATION

7

Cecilia can use brute force and dictionary attacks against one or many accounts without limit, or these attacks are simplified due to insufficient complexity, length, expiration and re-use requirements for passwords

OWASP SCP

33, 38, 39, 41, 50, 53

OWASP ASVS

2.3

OWASP AppSensor

AE2, AE3

CAPEC

2, 16

SAFECode

27

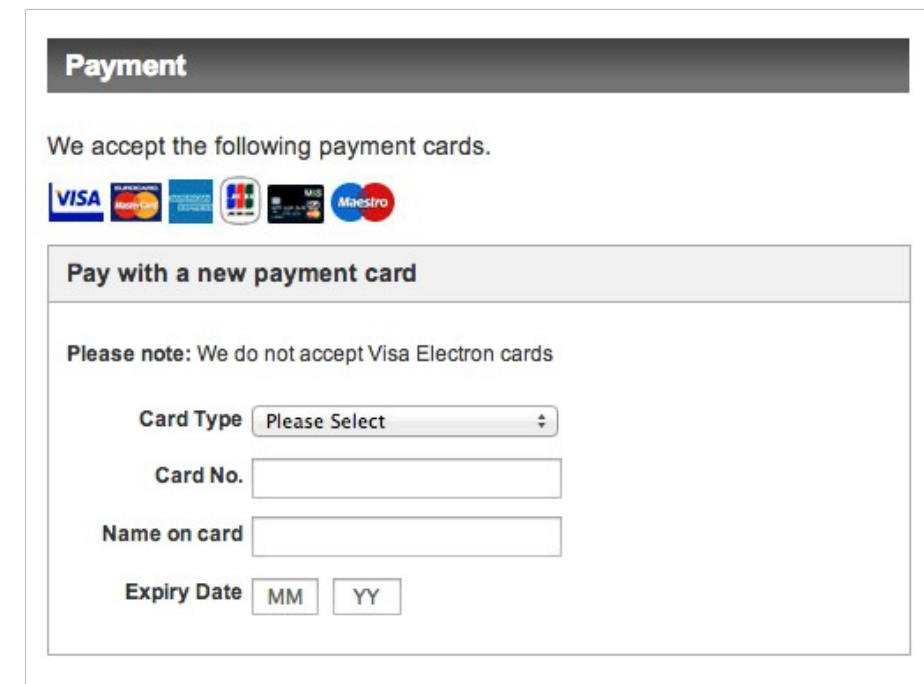
OWASP Cornucopia Ecommerce Website Edition v1.01

- Is this a viable attack for the function/system under consideration?
- Document the attack
- Subsequently use the cross-references to help create security requirements:
 - User stories
 - Unit tests
 - Configurations
 - etc

Example: Third party hosted payment form 1/3

Common e-commerce implementations

- Merchant-managed e-commerce implementations
 - Proprietary/custom developed shopping cart/payment application
 - Commercial shopping cart/payment application
- Shared-management e-commerce implementations
 - Third-party embedded application programming interfaces (APIs) with Direct Post
 - An inline frame (or “iFrame”) that allows a payment form hosted by a third party to be embedded within the merchant’s page(s)
 - Third-party hosted payment page which redirects the consumer to a page on an entirely different domain for payment entry
- Wholly outsourced e-commerce implementations



The screenshot shows a payment form with a dark header bar labeled "Payment". Below the header, it states "We accept the following payment cards." and displays logos for VISA, MasterCard, American Express, Discover, and Maestro. A section titled "Pay with a new payment card" contains a note: "Please note: We do not accept Visa Electron cards". The form includes input fields for "Card Type" (a dropdown menu showing "Please Select"), "Card No.", "Name on card", and "Expiry Date" (split into "MM" and "YY" boxes).

Example: Third party hosted payment form 2/3

CORNUCOPIA

9

Michael can bypass the application to gain access to data because administrative tools or administrative interfaces are not secured adequately

OWASP SCP

OWASP ASVS

OWASP AppSensor

CAPEC
225, 122

SAFECODE

OWASP Cornucopia Ecommerce Website Edition v1.01

- The template used at the third party could be modified by an attacker

Example: Third party hosted payment form 3/3

DATA VALIDATION & ENCODING

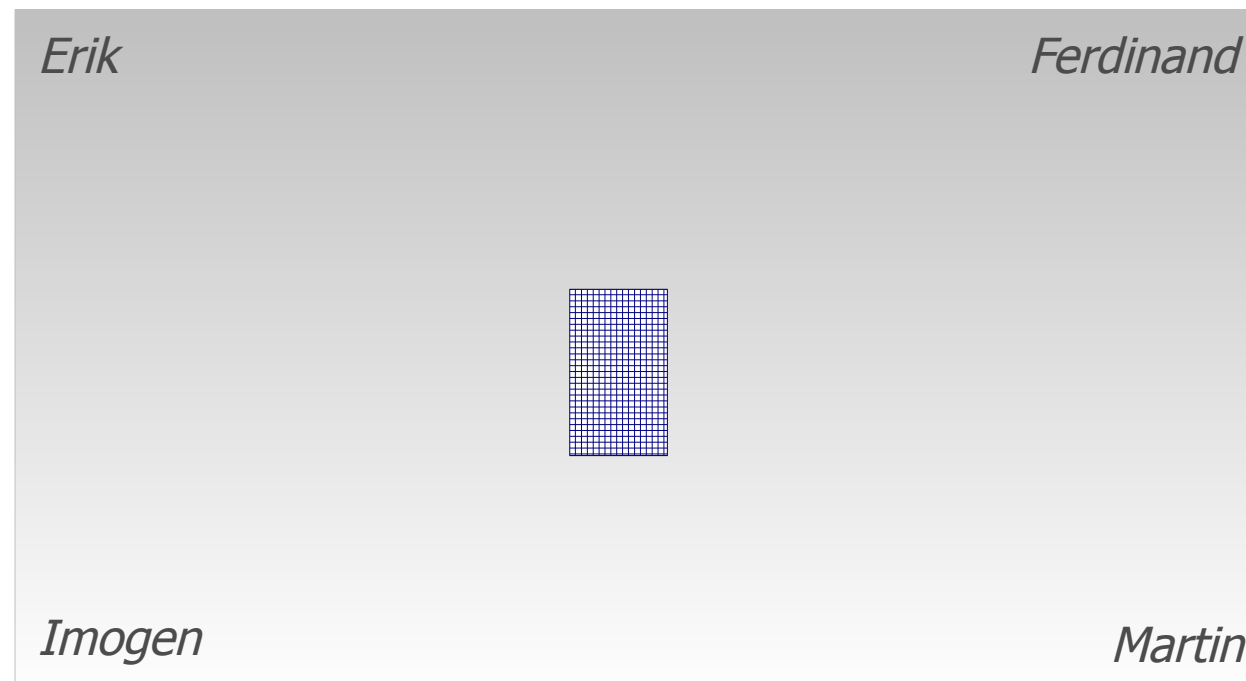
Q

Geoff can inject data into a client or device interpreter because a parameterised interface is not being used, or has not been implemented correctly, or the data has not been encoded correctly for the context, or there is no restrictive policy on code or data includes

OWASP SCP
10, 15, 16, 19, 20
OWASP ASVS
6.1, 6.3, 6.8
OWASP AppSensor
IE1, RP3
CAPEC
28, 31, 152, 160, 468
SAFECode
2, 17
OWASP Cornucopia Ecommerce Website Edition v1.01

- Content on the page is included from a less trusted source
 - JavaScript
 - CSS
 - Images
- Another third party (e.g. metrics, hosted JavaScript library)
- First party (i.e. merchant)

Deal the deck of cards



Outcomes:

- *Players have the same number of cards each*
- *Randomly select one player to lead the play for the first round e.g. Ferdinand*

Let play commence – First round

0 Requirements
0 Rounds



Schedule of requirements



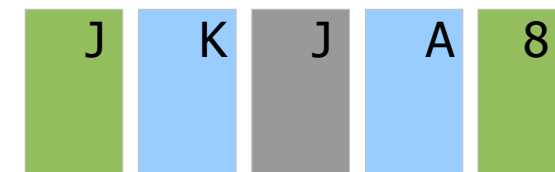
Erik

Ferdinand

Imogen

Martin

0 Requirements
0 Rounds



- Assume every player Except "Imogen" identified a security requirement, thus 1 point each for the others
- "Ferdinand" won the round with the King so he gets an additional 1 point, and leads the play for the next round



0 Requirements
0 Rounds



0 Requirements
0 Rounds

Second round

1 Requirements
0 Rounds



Schedule of requirements



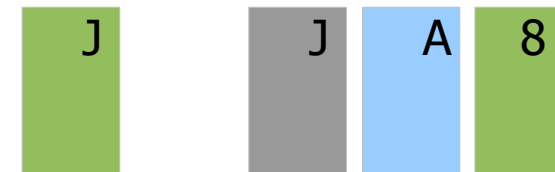
Erik

Ferdinand

Imogen

Martin

2 Requirements
1 Rounds



- Only "Ferdinand" and "Imogen" identified new requirements and they each receive 1 point
- "Martin" won the round with the Ace so he gets 1 point for that, and leads the play for the next round



0 Requirements
0 Rounds



1 Requirements
0 Rounds

Third round

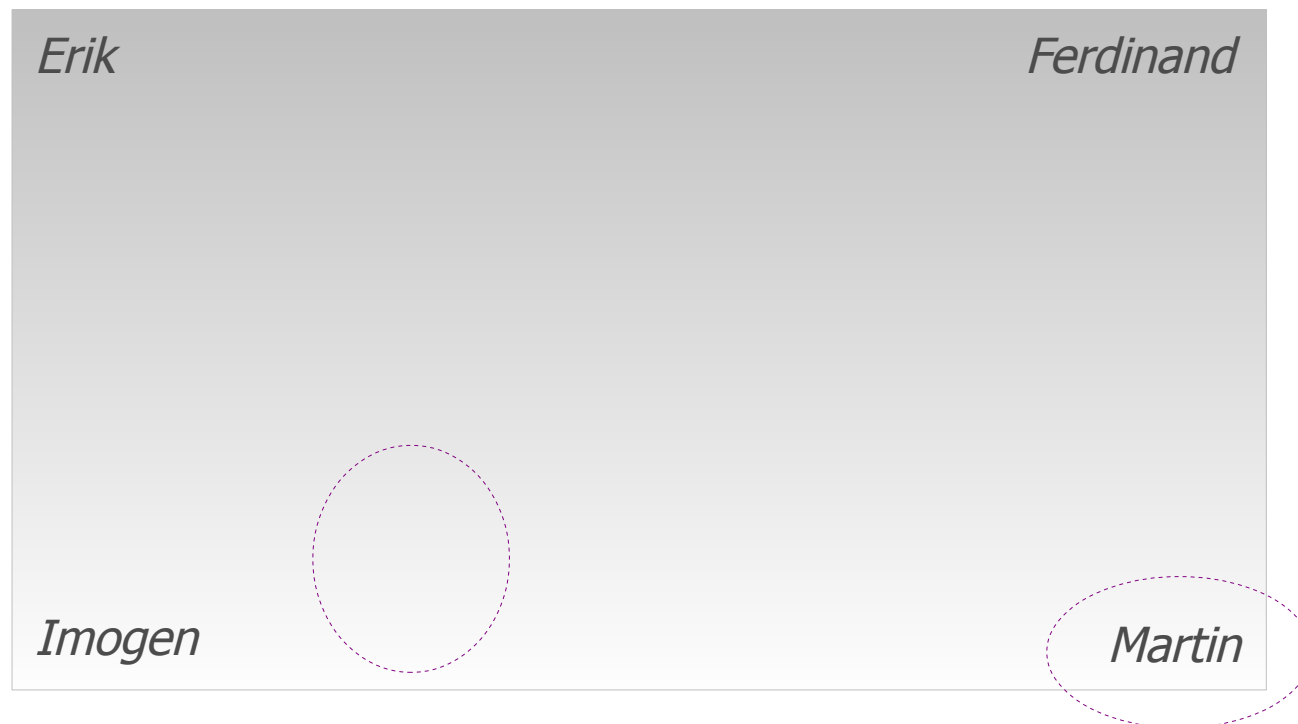
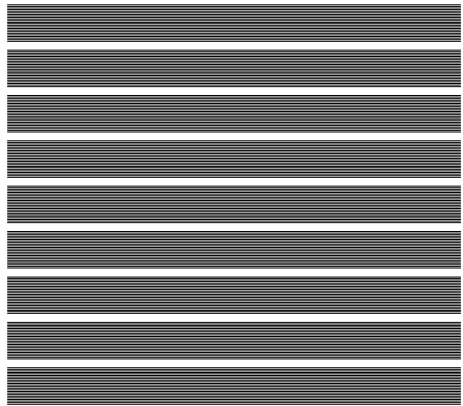
2 Requirements
0 Rounds



2 Requirements
1 Rounds



Schedule of requirements



- Everyone identified new requirements and they each receive 1 point
- "Imogen" won the round with the Queen so she gets 1 point for that, and leads the play for the next round



2 Requirements
0 Rounds



2 Requirements
1 Rounds

Fourth round

3 Requirements
0 Rounds

10

7

3 Requirements
2 Rounds

J

A

Schedule of requirements

Schedule of requirements

Erik

Ferdinand

Imogen

Martin

8

9

5

2

2 Requirements
1 Rounds

2 Requirements
1 Rounds

- Everyone identified new requirements and they again each receive 1 point
- "Ferdinand" won the round with the Jack so he gets 1 point for that, and leads the play for the final round – he also has the most points so far

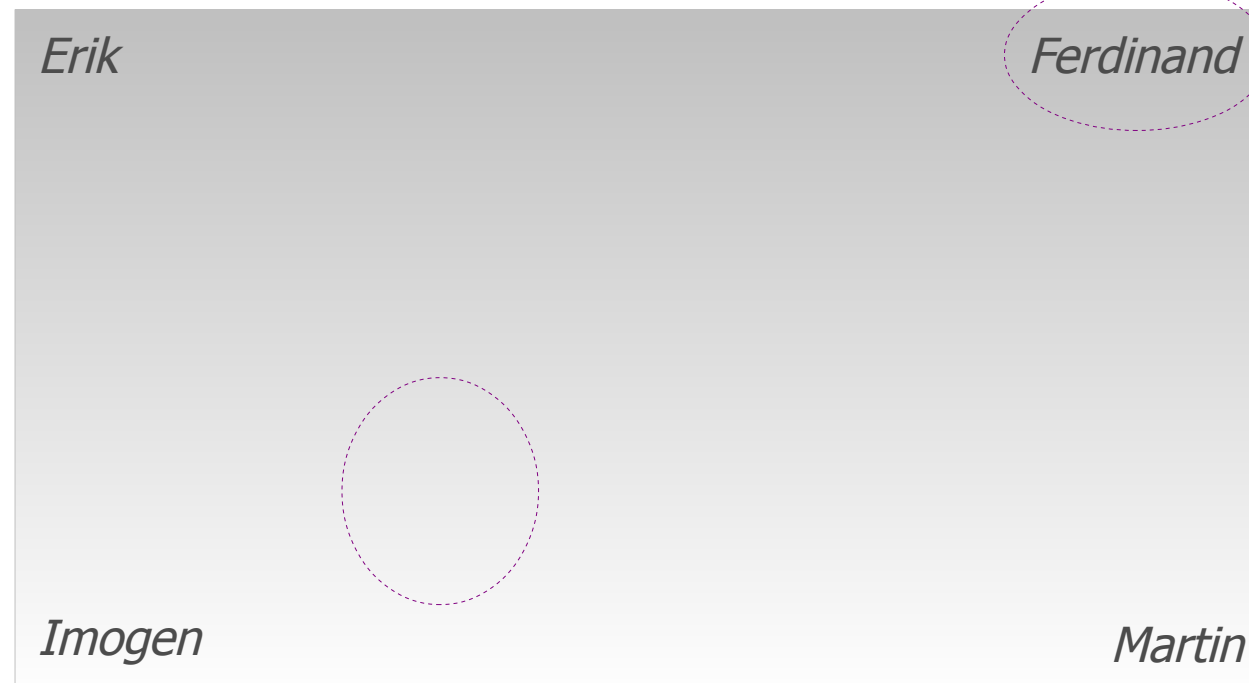
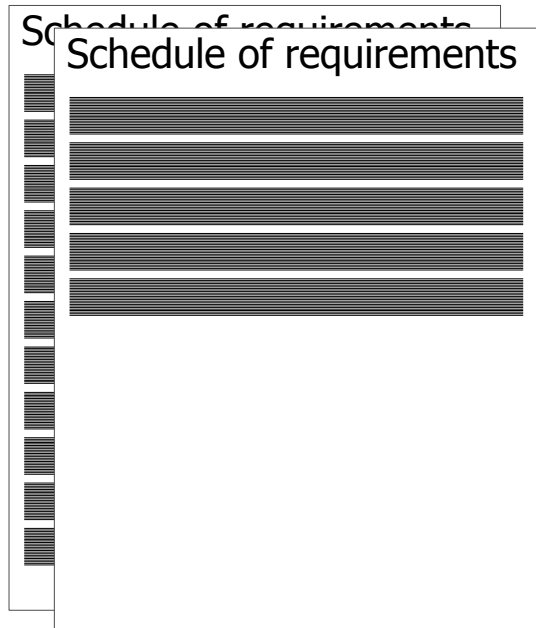
Fifth and final round

3 Requirements
0 Rounds

10

4 Requirements
2 Rounds

A



- Everyone except "Erik" identified new requirements and they each receive 1 point
- "Imogen" won the round with the 8 (trumps) so she gets 1 point for that
- Overall Ferdinand wins the game with a total of 7 points

8

4 Requirements
1 Rounds

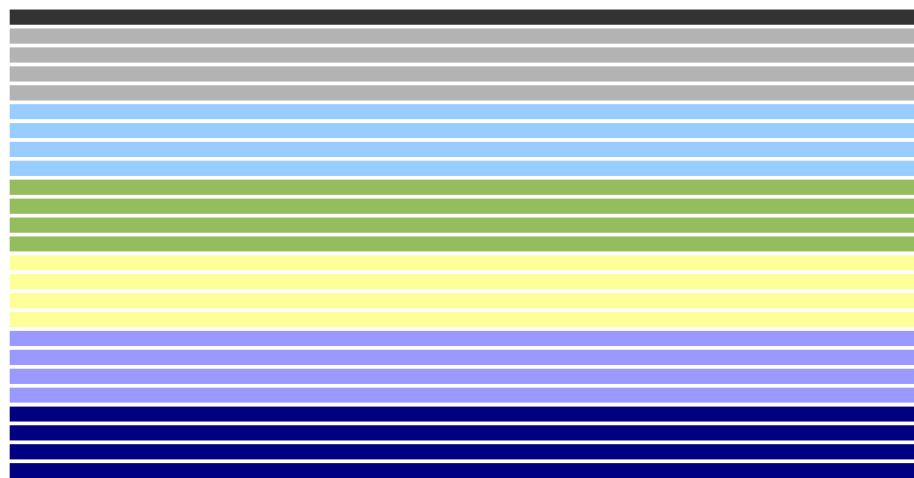
2

4 Requirements
1 Rounds

Choose your deck of cards

Cornucopia suits

-  **Data validation and encoding**
Input and output data validation and escaping
-  **Authentication**
Verification of identity claims and related processes
-  **Session management**
Maintenance of user state
-  **Authorization**
User/role permission controls
-  **Cryptography**
Hashing, digital signatures, encryption and random number generation processes and their usage including key management
-  **Cornucopia (everything else)**
Everything else including information leakage, data loss, configuration management, denial of service

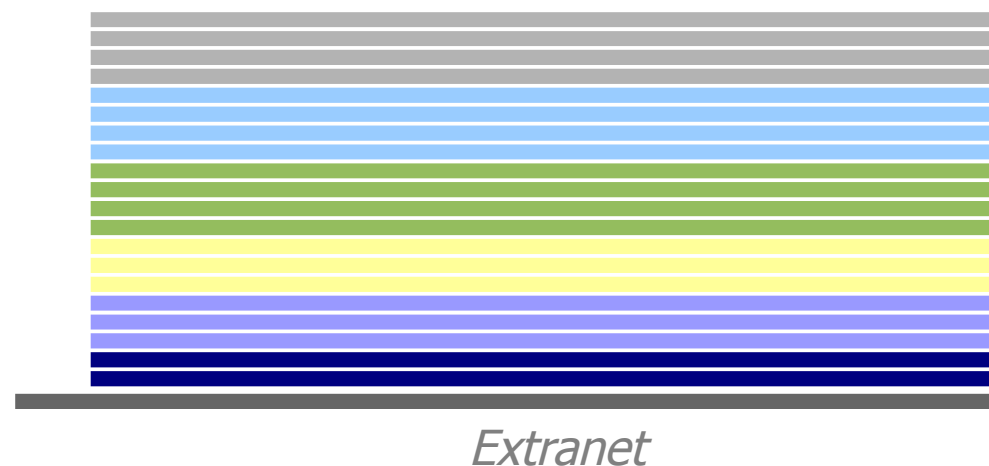


Full deck

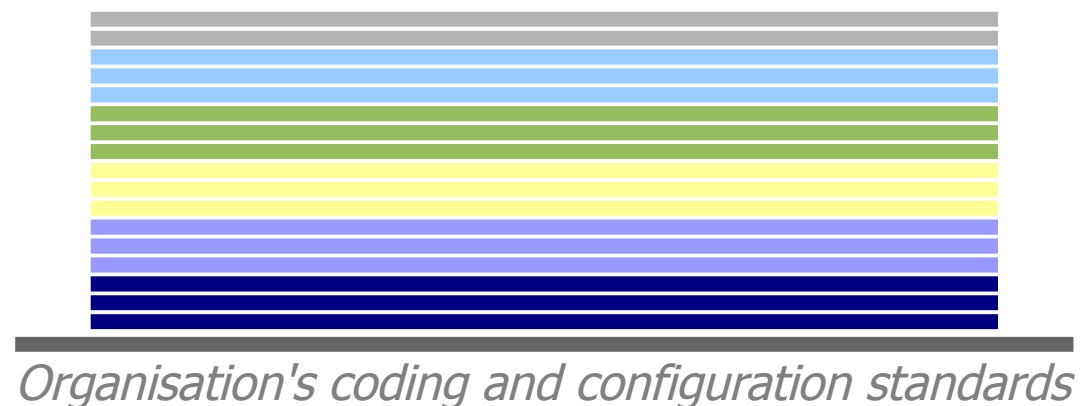
Application-specific decks

Cornucopia suits

-  **Data validation and encoding**
Input and output data validation and escaping
-  **Authentication**
Verification of identity claims and related processes
-  **Session management**
Maintenance of user state
-  **Authorization**
User/role permission controls
-  **Cryptography**
Hashing, digital signatures, encryption and random number generation processes and their usage including key management
-  **Cornucopia (everything else)**
Everything else including information leakage, data loss, configuration management, denial of service

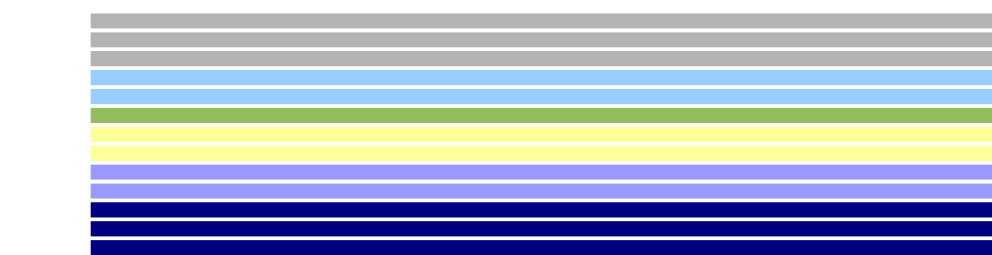


Development-specific decks



or


Compliance requirements (e.g. PCIDSS)



Cornucopia suits

- Data validation and encoding**
Input and output data validation and escaping
- Authentication**
Verification of identity claims and related processes
- Session management**
Maintenance of user state
- Authorization**
User/role permission controls
- Cryptography**
Hashing, digital signatures, encryption and random number generation processes and their usage including key management
- Cornucopia (everything else)**
Everything else including information leakage, data loss, configuration management, denial of service


Does Cornucopia matter?



Security Standards Council

Standard: PCI Data Security
Version: 2.0
Date: January 2013
Author: E-commerce Special
PCI Security Standards

Information Supplement
PCI DSS E-commerce



Information Supplement • PCI DSS E-commerce Guidelines • January 2013

5.10 Resources

Organizations should familiarize themselves with industry-accepted best practices and guidelines for securing e-commerce environments. There are a wide range of resources at varying levels of depth and technical detail. Examples of resources that may provide guidance and technical security data breach reports include:

5.10.1 Information Security Resources

Information security resources provide an in-depth review of topics important to e-commerce, such as secure application development, analysis of attack patterns, and alerts on emerging threats:

- **Open Web Application Security Project (OWASP)** (www.owasp.org). OWASP is a global not-for-profit charitable organization focused on improving the security of web applications. OWASP's mission is to make application security visible so that individuals and organizations worldwide can make informed decisions about the true risks surrounding application development and security. OWASP provides a number of resources for training and application security awareness, including: podcasts, eBooks, online publications, news feeds, blogs, videos, conferences, and in-person classroom training.

The *OWASP Development Guide* is a comprehensive reference manual for designing, developing, and deploying secure web services and applications. Individual guides include *Handling E-Commerce Payments*, *Security of Payment cards (Credit/Debit) in E-commerce Application*, and *Cornucopia E-commerce Web Site Edition*.

- **The SysAdmin, Audit, Network, and Security (SANS) Institute** (www.sans.org). The SANS Institute is a privately held, U.S. company providing information security resources, training, and

Project plan


Improvements

- Complete framework-specific card decks
- Enhance text and mappings
- Further developer feedback
- Issue further releases
- Graphical design
- Printing and distribution

Other editions

- (Ecommerce website)
- Web services
- Mobile app
- Smart meter

Project on the OWASP wiki


OWASP
 The Open Web Application Security Project


[Log in / create account](#)

Page **Discussion**

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OWASP Cornucopia

[Main](#) [How to Play](#) [FAQs](#) [Acknowledgements](#) [Road Map and Getting Involved](#) [About Ecommerce Website Edition](#)



OWASP Cornucopia
 OWASP Cornucopia is a mechanism in the form of a card game to assist software development teams identify security requirements in Agile, conventional and formal development processes. It is language, platform and technology agnostic.

Introduction
 The idea behind Cornucopia is to help development teams, especially those using Agile methodologies, to identify application security requirements and develop security-based user stories. Although the idea had been waiting for enough time to progress it, the final motivation came when [SAFECode](#) published its [Practical Security Stories and Security Tasks for Agile Development Environments](#) in July 2012.
 The Microsoft SDL team had already published its super [Elevation of Privilege: The Threat Modeling Game](#) (EoP) but that did not seem to address the most appropriate kind of issues that web application development teams mostly have to address. EoP is a great concept and game strategy, and was published under a [Creative Commons Attribution License](#). Cornucopia Ecommerce Website Edition is based on the concepts and game ideas in EoP, but those have been modified to be more relevant to the types of issues ecommerce website developers encounter. It attempts to introduce threat-modelling ideas into development teams that use Agile methodologies, or are more focused on web application weaknesses than other types of software vulnerabilities or are not familiar with STRIDE and DREAD.

The Card Decks
Ecommerce Website Edition
 Instead of EoP's STRIDE suits, Cornucopia suits were selected based on the structure of the OWASP Secure Coding Practices - Quick Reference Guide (SCP), but with additional consideration of sections in the OWASP Application Security Verification Standard, the OWASP Testing Guide and David Rook's [Principles of Secure Development](#). These provided five suits, and a sixth called "Cornucopia" was created for everything else:

- Data validation and encoding
- Authentication
- Session management
- Authorization
- Cryptography
- Cornucopia

 Each suit contains 13 cards (Ace, 2-10, Jack, Queen and King) but, unlike EoP, there are also two Joker cards. The content was mainly drawn from the SCP.
Other Decks
 Future editions such as for mobile app development will use different sources of information and suits.

Mappings
 The other driver for Cornucopia is to link the attacks with requirements and verification techniques. An initial aim had been to reference CWE weakness IDs, but these proved too numerous, and instead it was decided to map each card to [1] software attack pattern IDs which themselves are mapped to CWEs, so the desired result is achieved.
 Each card is also mapped to the 36 primary security stories in the [SAFECode](#) document, as well as to the OWASP SCP v2, ASVS 2009 and AppSensor (application attack detection and response) to help teams create their own security-related stories for use in Agile processes.

Licensing
 OWASP Cornucopia is free to use. It is licensed under the <http://creativecommons.org/licenses/by-sa/3.0/> Creative Commons Attribution-ShareAlike 3.0 license, so you can copy, distribute and transmit the work, and you can adapt it, and use it commercially, but all provided that you attribute the work and if you alter, transform, or build upon this work, you may distribute the resulting work only under the same or similar license to this one.

What is Cornucopia?
 OWASP Cornucopia is a card game used to help derive application security requirements during the software development life cycle. To start using Cornucopia:

- Download the document
- Print the cards onto plain paper or pre-scored card
- Cut/separate the individual cards
- Identify an application, module or component to assess
- Invite business owners, architects, developers, testers along for a card game
- Get those infosec folk to provide chocolate, pizza, beer, flowers or all four as prizes
- Select a portion of the deck to start with
- Play the game to discuss & document security requirements (and to win rounds)
- Remember, points make prizes!

Quick Download

- OWASP Cornucopia Ecommerce Website Edition (v1.00 EN A4 DOC)


Reference Files

- OWASP SCP requirements
- OWASP ASVS verification IDs
- OWASP AppSensor attack detection point IDs
- CAPEC IDs
- SAFECode security-focused story IDs


 The OWASP SCP does not include identity vales for the requirements, so please use this list.

News and Events

- [03 Jun 2013] Presentation at OWASP London
- [10 May 2013] Project pages created
- [13 Mar 2013] Presentation at OWASP Netherlands

Presentation

 The game rules are in the document download. But the OpenOffice project presentation includes an animated version of four demonstration rounds.

Project Leader
 Colin Watson

PCIDSS

 OWASP Cornucopia Ecommerce Website Edition is referenced in the new Payment Card Industry Security Standards Council Information supplement PCI DSS E-commerce Guidelines v2, January 2013

The project

OWASP Cornucopia

- https://www.owasp.org/index.php/OWASP_Cornucopia
- https://lists.owasp.org/mailman/listinfo/owasp_cornucopia

Download Cornucopia Ecommerce Website Edition v1.00

- https://www.owasp.org/index.php/File:OWASP-Cornucopia-Ecommerce_Website.docx

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