



Secure Software Development Threat Modeling

Objectives



- Explain the concept of a trust relationship
- Define the concept of a trust boundary
- Explain the concept of threat modeling
- Define associated terms related to threat modeling
- Apply the DREAD matrix to a systemic risk.

- Watch a pair of Microsoft videos
 - "Elevation of Privilege (EoP) Threat Modeling Card Game"
 - "<http://content1.catalog.video.msn.com/e2/ds/b541feff-6159-4f8b-8808-94945cc71aef.mp4>"
 - "Microsoft SDL Threat Modeling Tool"
 - "<http://www.microsoft.com/security/sdl/video/videoplayer.aspx?t=SDL+Threat+Modeling+Tool>"

Fail Secure

- Software reliably functions when attacked
- Is rapidly recoverable in the event of a failure
- Fails to a secure state if a failure occurs

True Crypt and fail secure

Economy of Mechanism

- The more complex the design of the software, the more likelihood for a security failure there is
 - Unnecessary functionality or unneeded security mechanisms should be avoided
 - Strive for operational ease of use

Complete Mediation

- Every access to every object must be checked for authority every time the object is accessed.
- **Example 1**
 - When a UNIX process tries to read a file, the operating system determines if the process is allowed to read the file. If so, the process receives a file descriptor encoding the allowed access. Whenever the process wants to read the file, it presents the file descriptor to the kernel. The kernel then allows the access. If the owner of the file disallows the process permission to read the file after the file descriptor is issued, the kernel still allows access. This scheme violates the principle of complete mediation, because the second access is not checked. The cached value is used, resulting in the denial of access being ineffective.

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https://myweb.msoe.edu/?user=sebern&path=msoe/Winter2011/ce2800/ce2800.shtml

Suggested Sites Web Slice Gallery Church Sound System LXR linux/include/li... Professional Audio ... Other bookmarks









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https://myweb.msoe.edu/?user=schilling&path=msoe/Winter2011/ce2800/ce2800.shtml

Suggested Sites Web Slice Gallery Church Sound System LXR linux/include/li... Professional Audio ... Other bookmarks

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<u>Name</u>	<u>Last modified</u>	<u>Size</u>	<u>Description</u>
 favicon.ico	08-Jun-2004 17:12	766	
 graphics/	01-Nov-2004 10:37	-	
 index.html	18-Nov-2010 10:17	1.9K	
 local/	08-Apr-2009 13:56	-	
 msoe.ico	08-Jun-2004 17:12	766	
 robots	06-Jul-2007 16:12	0	
 test.cgi	25-Feb-2008 14:22	65	
 test.py	25-Feb-2008 14:22	65	

Apache/2.2.8 (Ubuntu) mod_auth_kerb/5.3 DAV/2 SVN/1.4.6 mod_jk/1.2.25 mod_ldap_userdir/1.1.12-20070601 PHP/5.2.4-2ubuntu5.12 with Suhosin-Patch mod_ssl/2.2.8 OpenSSL/0.9.8g mod_perl/2.0.3 Perl/v5.8.8 Server at myweb.msoe.edu Port 443

Credit Card's Billing Name & Address:

First Name:

Last Name:

Address:

City:

State/Province:

Zip/Postal Code:

Country:

Process Now

(do not click more than once)

Open Design

- All information about crypto systems is public knowledge except the key, and the security of the system against cryptanalysis attacks is dependent on the secrecy of the key
- Not Security through obscurity

Least common mechanisms

- Mechanisms common to more than one user or process should not be shared
 - Design should compartmentalize or isolate the functions by user roles

Psychological Acceptability

- The security principle should be designed to maximize usage, adoption, and automatic application
- Discuss strong passwords as an example

Leverage Existing Components

- Use existing components when possible

Trust Relationship

- Every communication between parties must have some degree of trust associated with it
 - Trust relationship
- For simply communications systems, each system has full trust and allows the other complete access to its communication facilities
 - Not very secure

Trust Boundaries

- Distinguishes between regions of shared trust
 - Region of shared trust is a trust domain



Airport Security

Windows 98 Trust Boundary

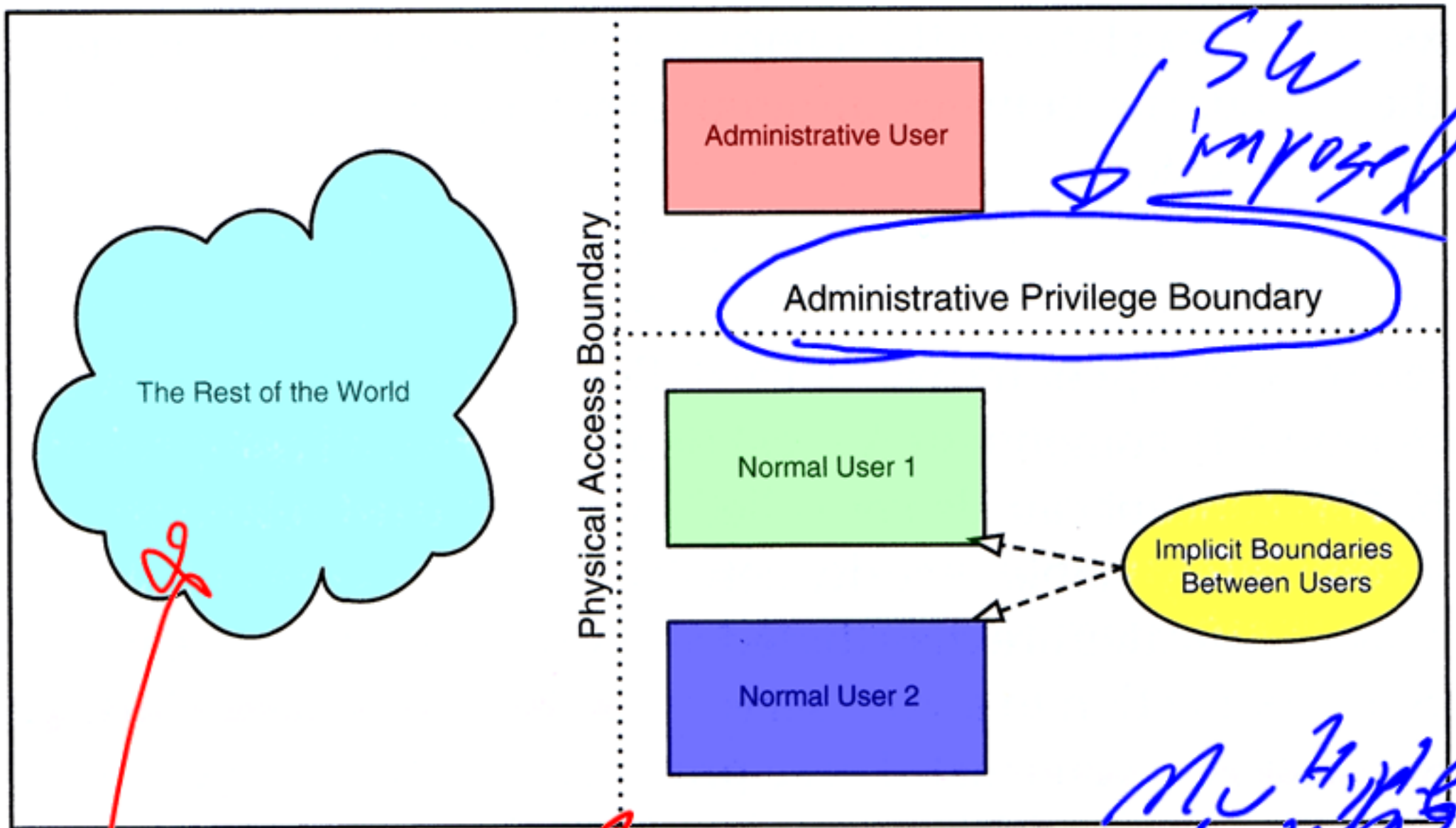
Door
Example



Wireless network
HAM radio



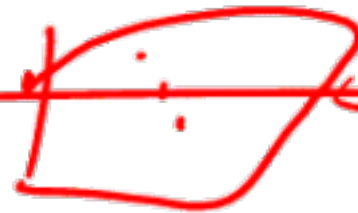
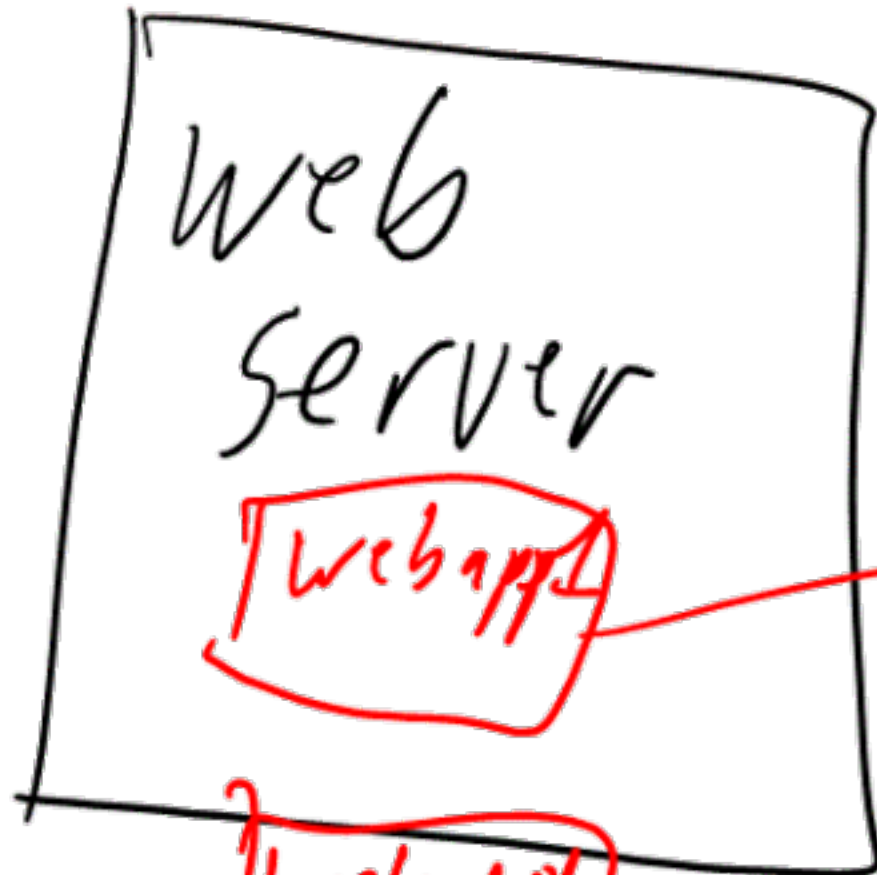
Simple trust relationships



Everyone else

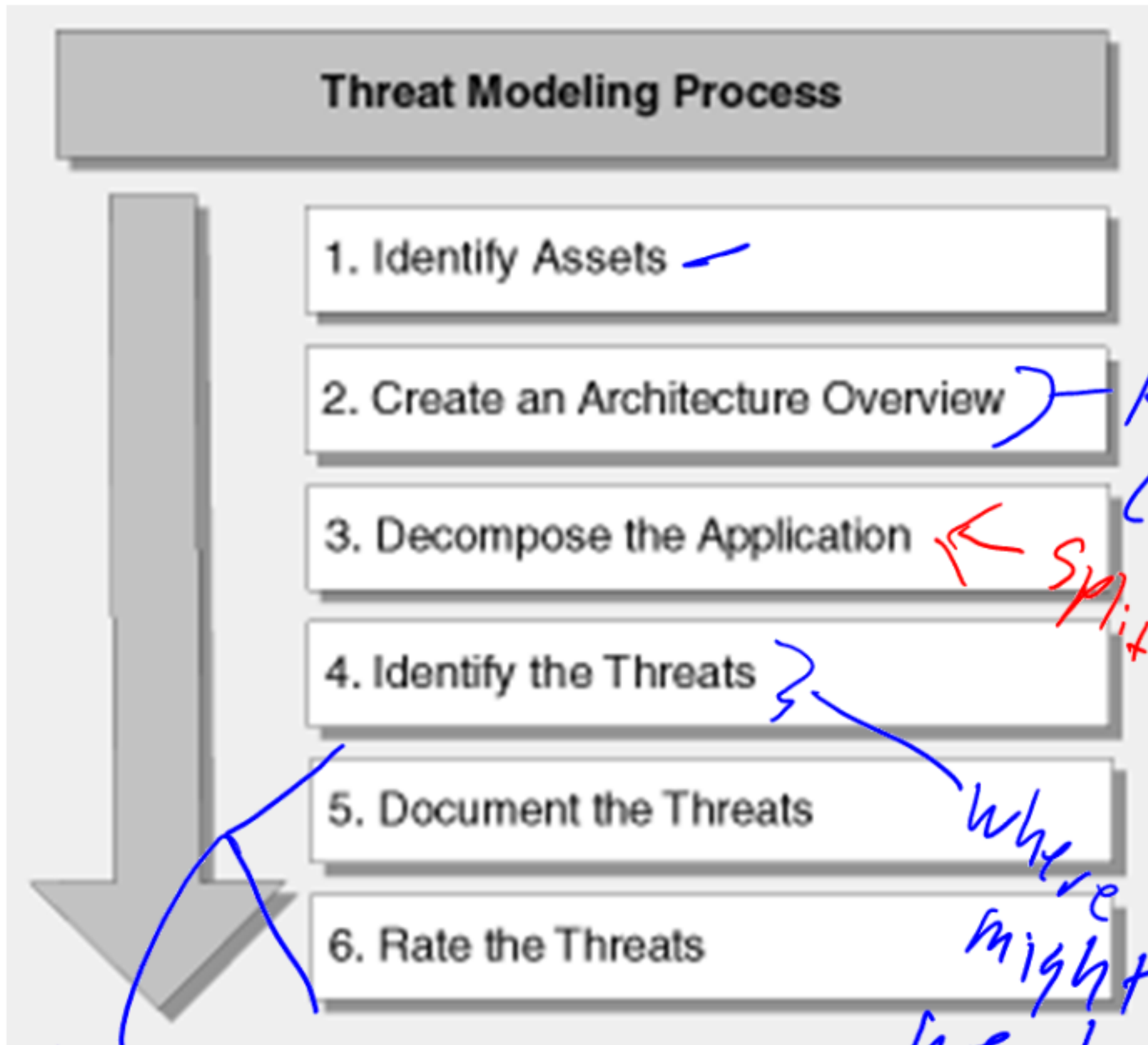
helps to secure from a physical standpoint.

emerald.msod.lv.



Trust relationship: Threat

Threat Modeling



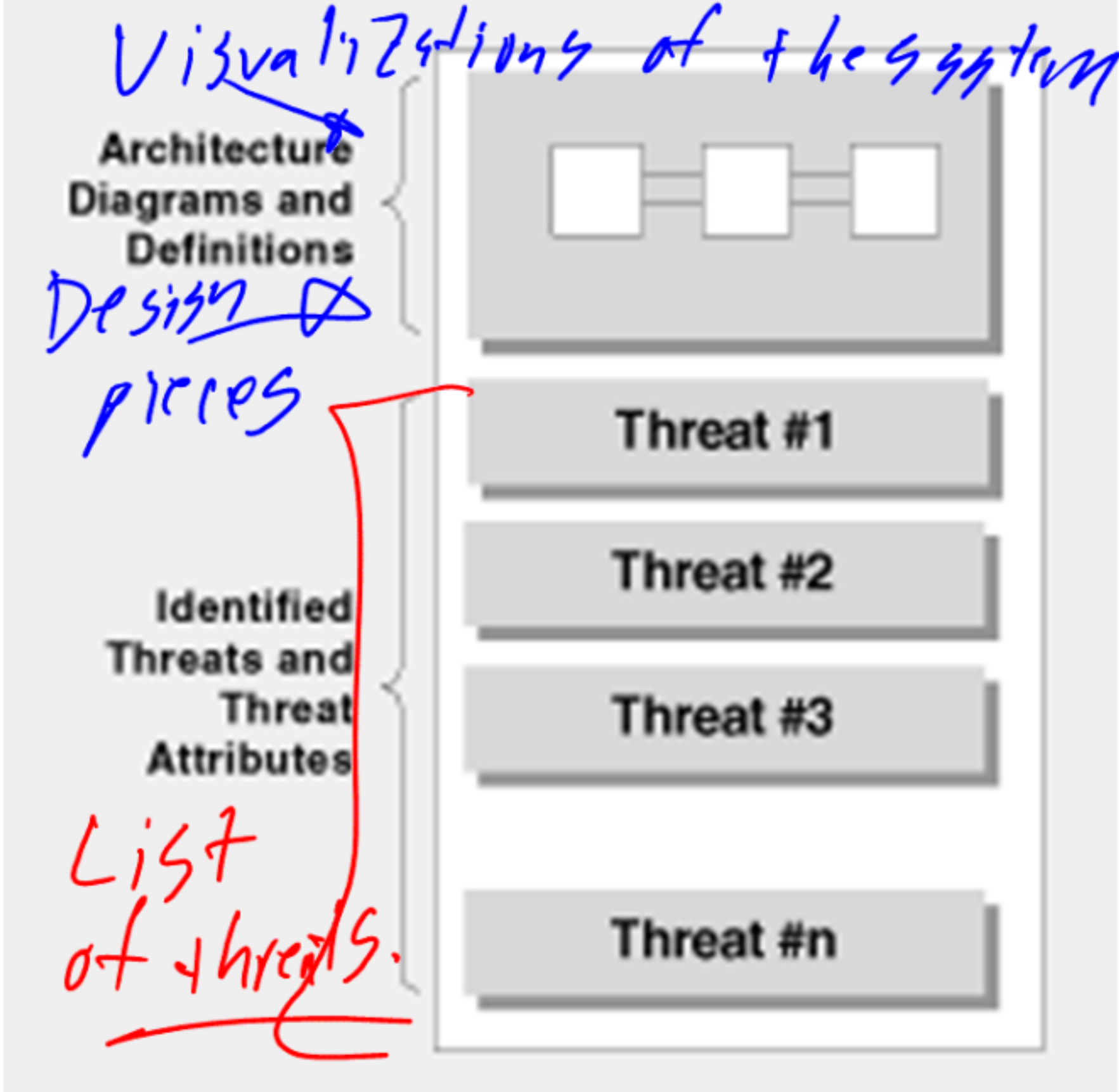
Risk assessment

Threat Modeling

High Level Design into pieces!
Split
Where might we be attacked?

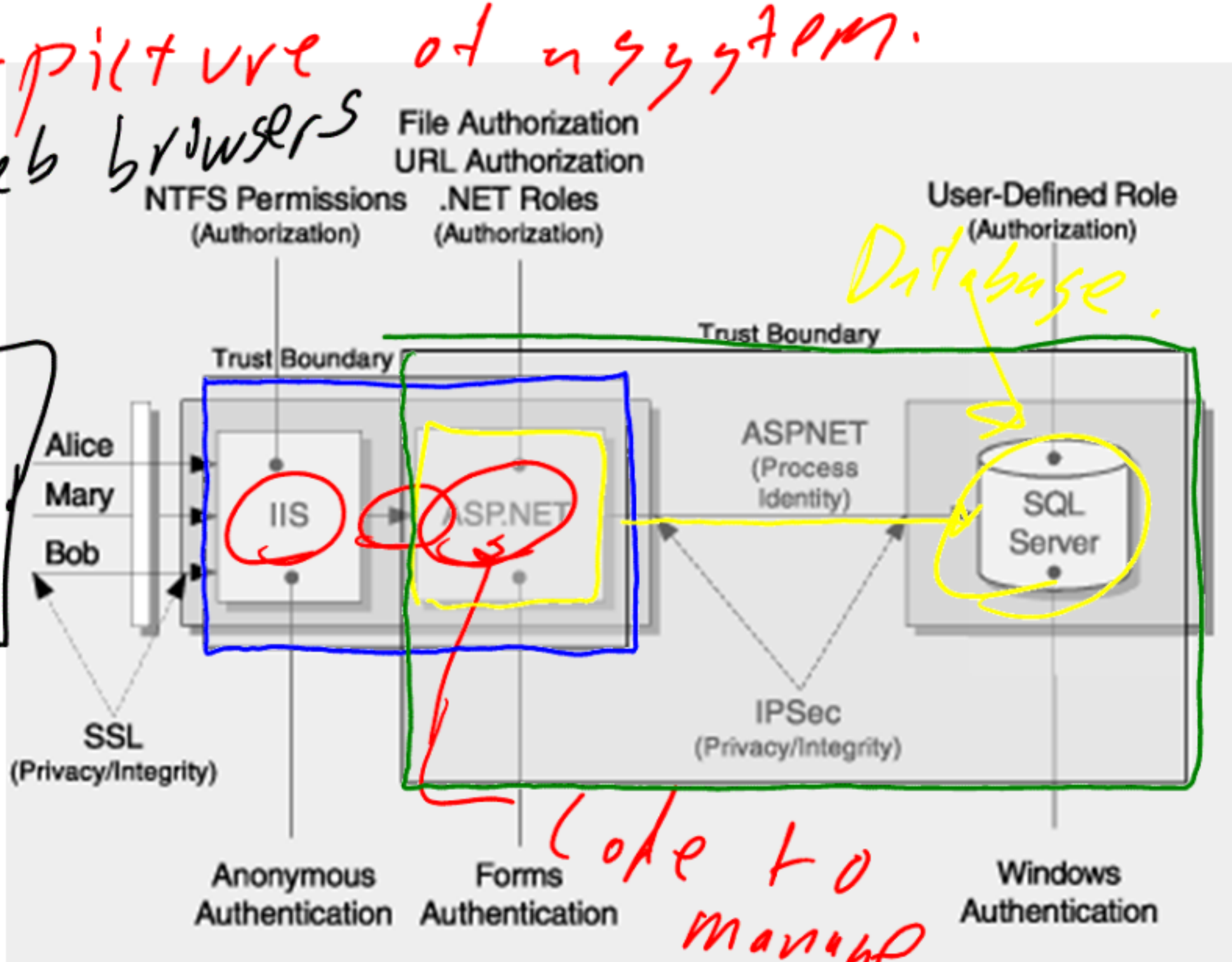


Threat Model Output



Create an Architectural Overview

Overview

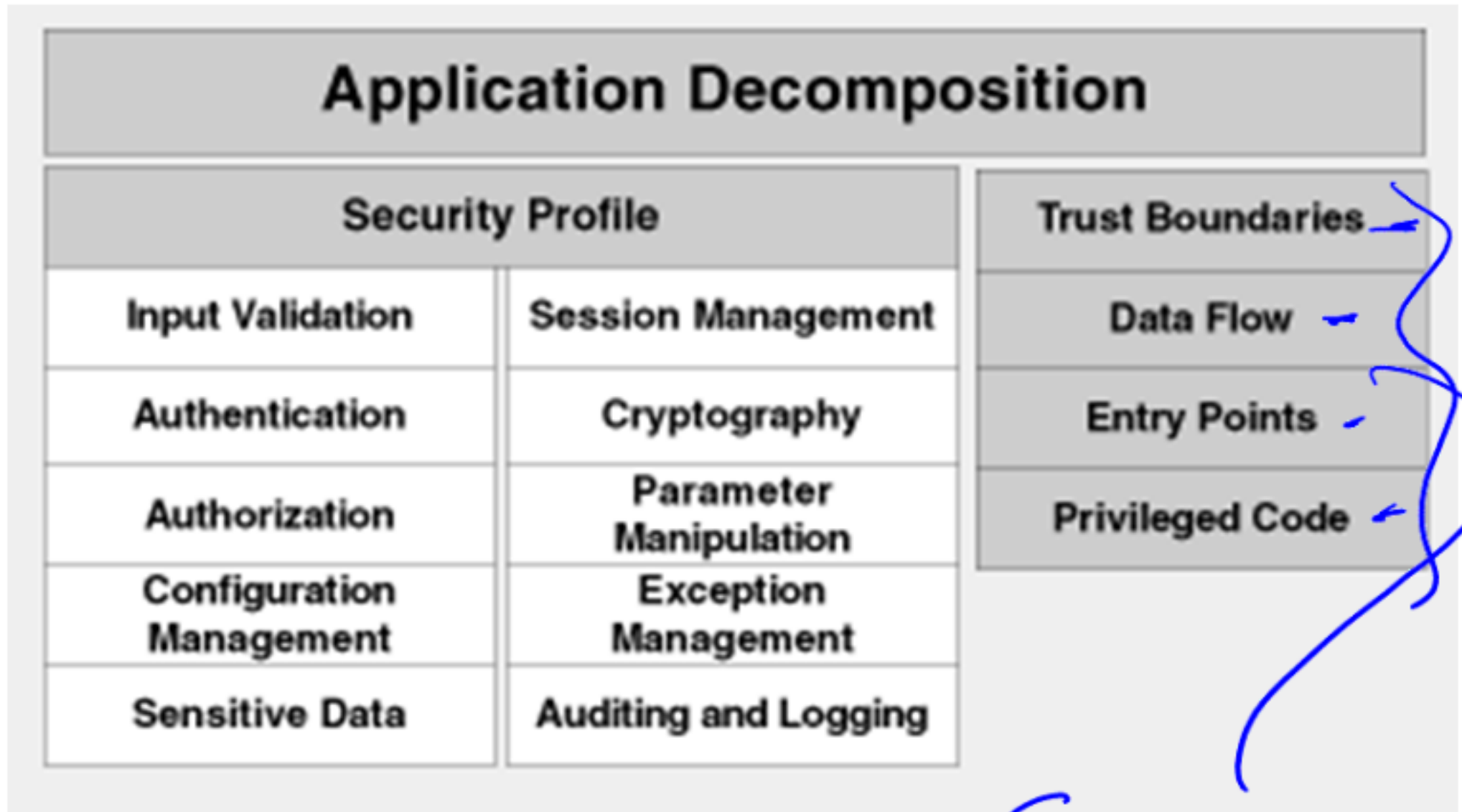


Technology Identification



Technology/Platform	Implementation Details
Microsoft SQL Server on Microsoft Windows Advanced Server 2000 <i>↑ Details</i>	Includes <u>logins</u> , <u>database users</u> , <u>user defined database roles</u> , <u>tables</u> , <u>stored procedures</u> , <u>views</u> , <u>constraints</u> , and <u>triggers</u> .
Microsoft .NET Framework	Used for Forms authentication <i>Validate user input</i>
Secure Sockets Layer (SSL)	Used to encrypt <u>HTTP traffic</u> .

Decompose the Application



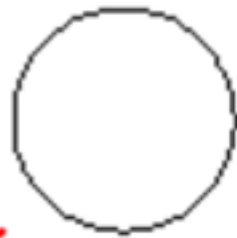
Care about

Decompose the Application

- Identify trust boundaries. —
- Identify data flow. —
- Identify entry points. —
- Identify privileged code. —
- Document the security profile. —

Data Flow Diagram (DFD): Symbols

Process/procedure



Represents a task that the driver performs.

pieces outside



Represents an entity that is external to the driver, such as a user, user process, or operating system component.

Thread, etc
Manipulates data

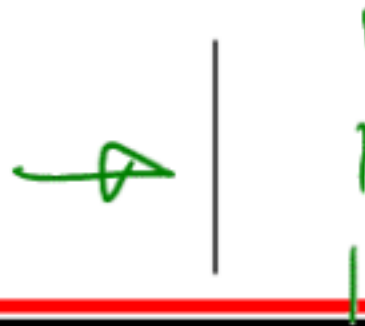


Shows the flow of data between components.

Arrow symbol



Represents a data store: a file, a device register, a data structure, and so on.



Represents a boundary between driver code and external entities.

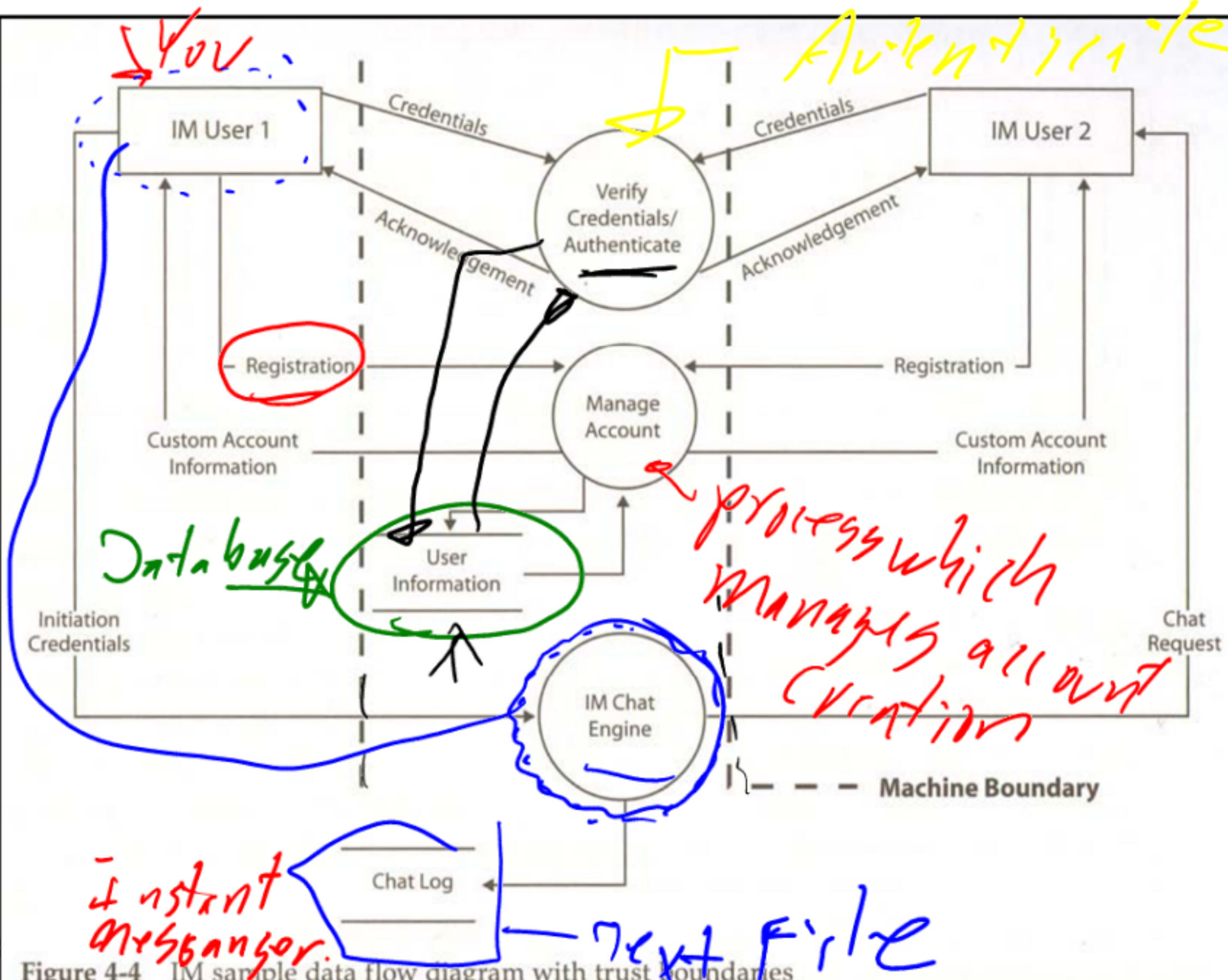
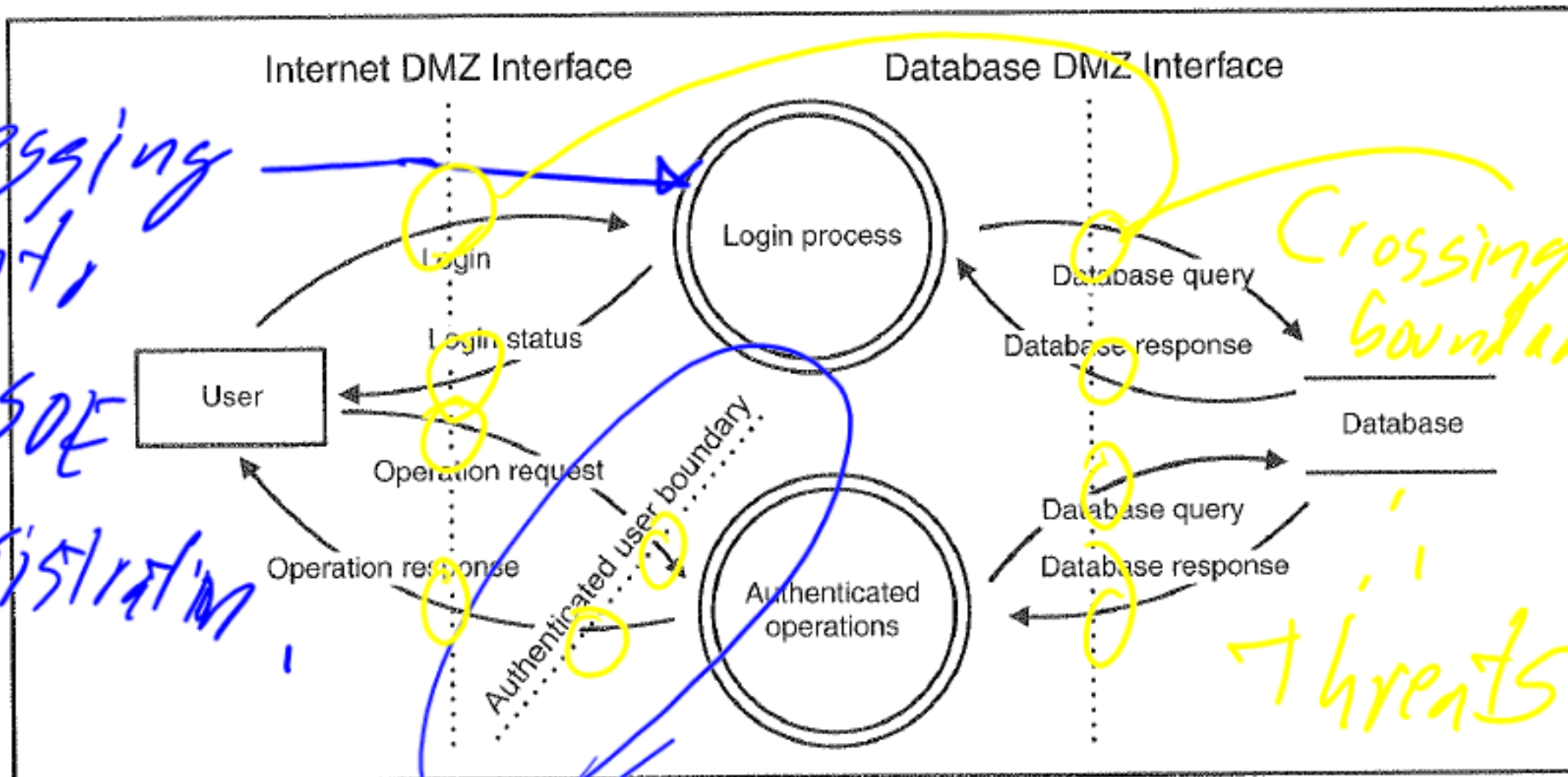


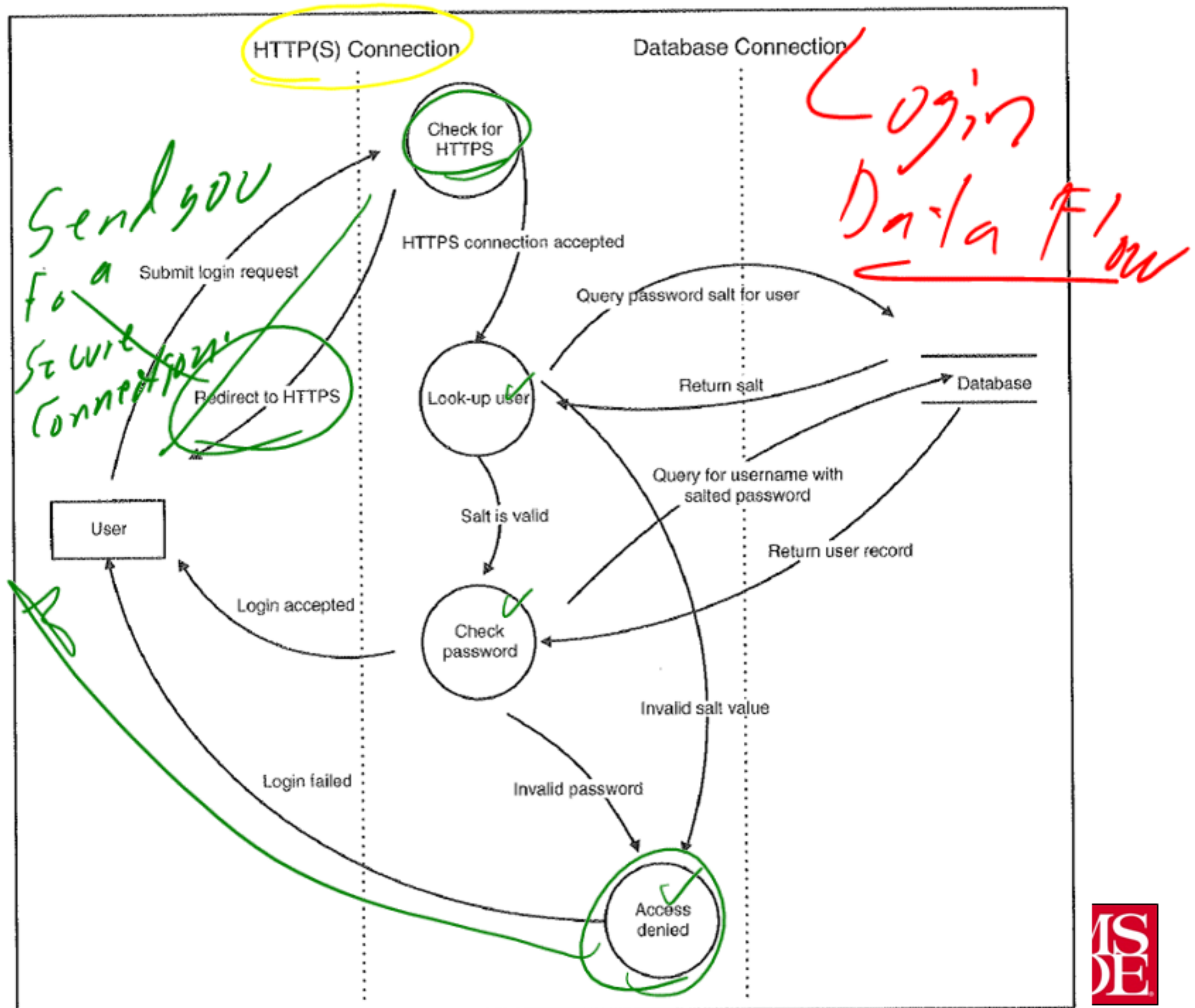
Figure 4-4 IM sample data flow diagram with trust boundaries

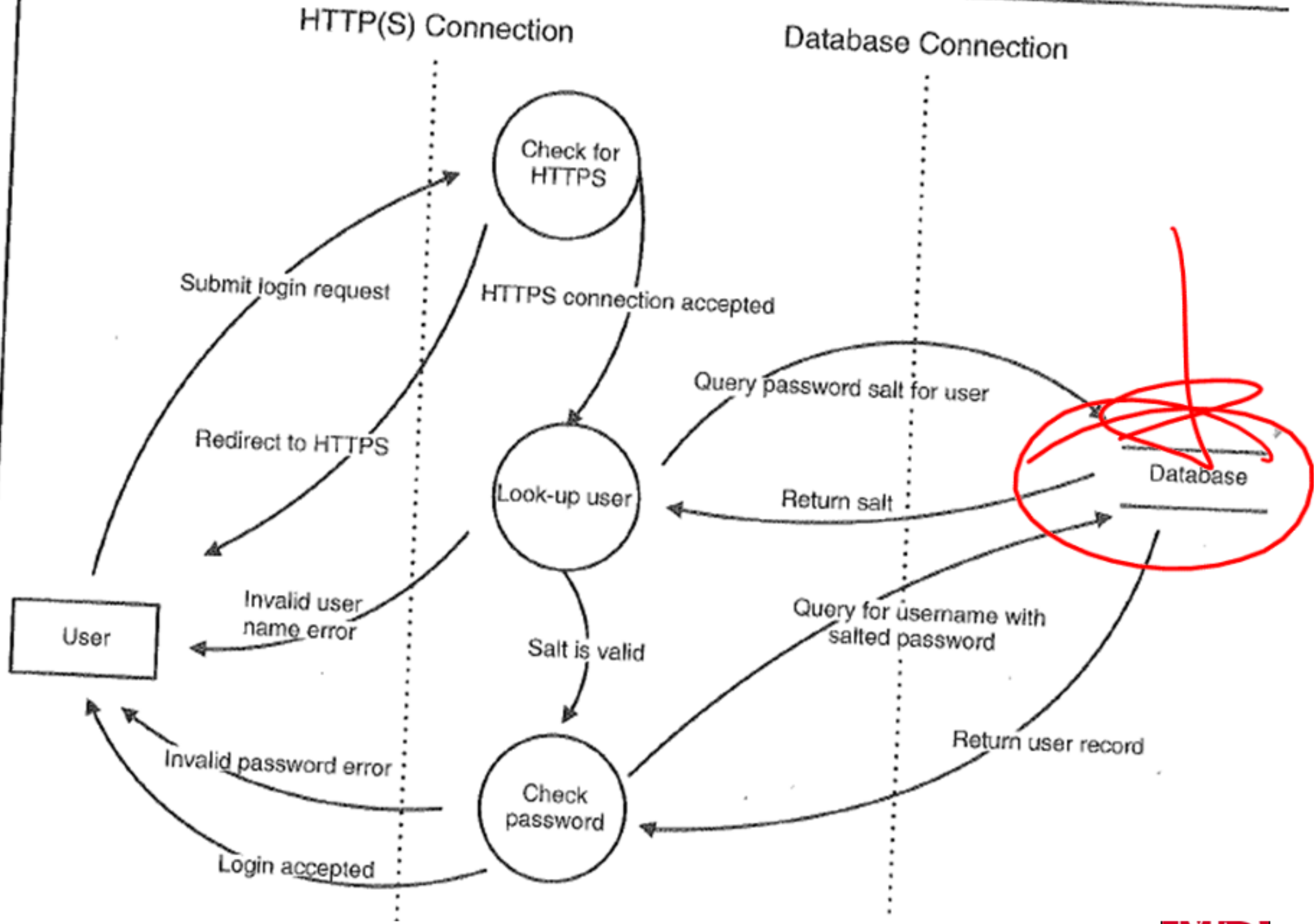
MSOE Registration System

Logging out, MSOE registration.



You are allowed to access the system.





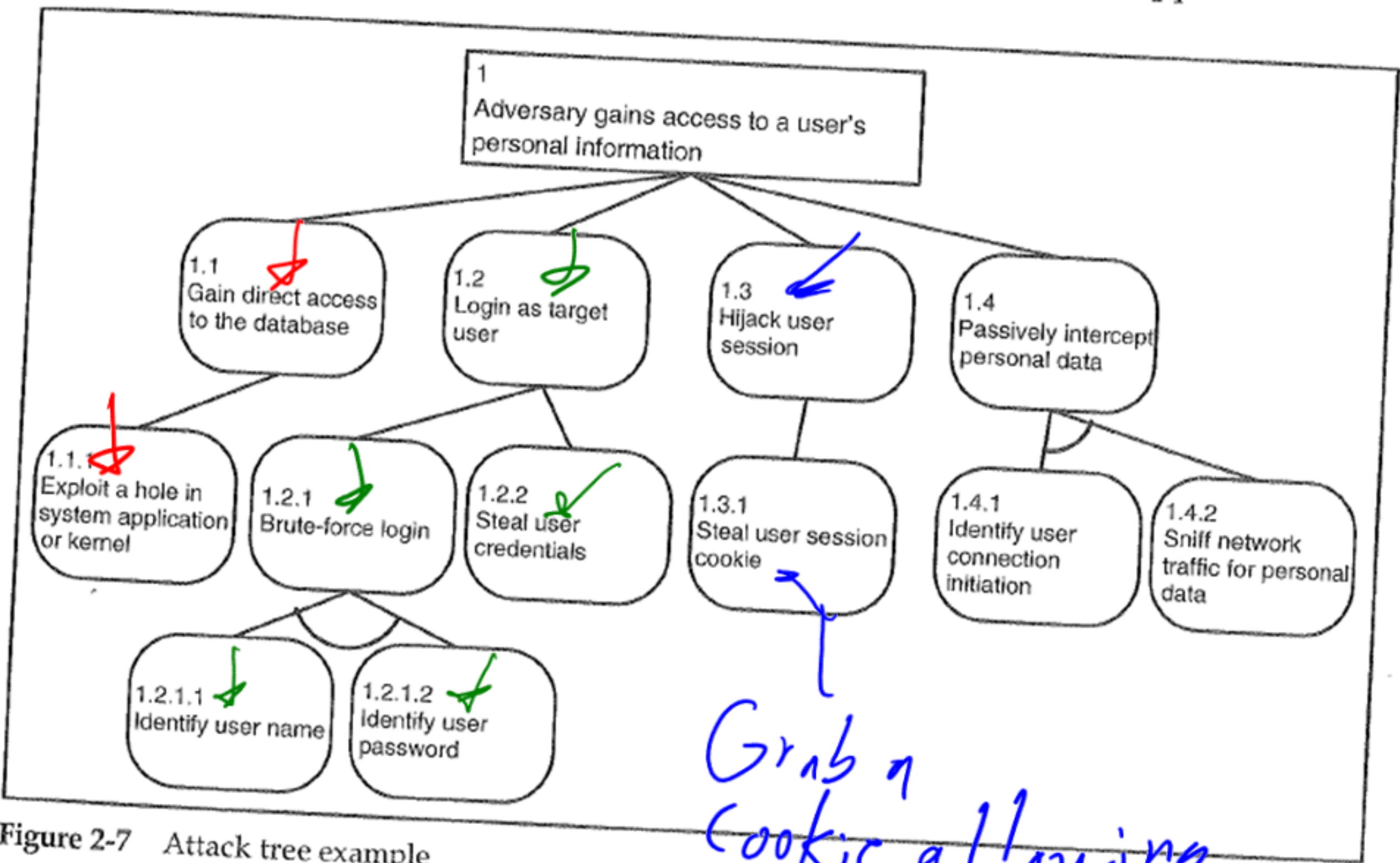
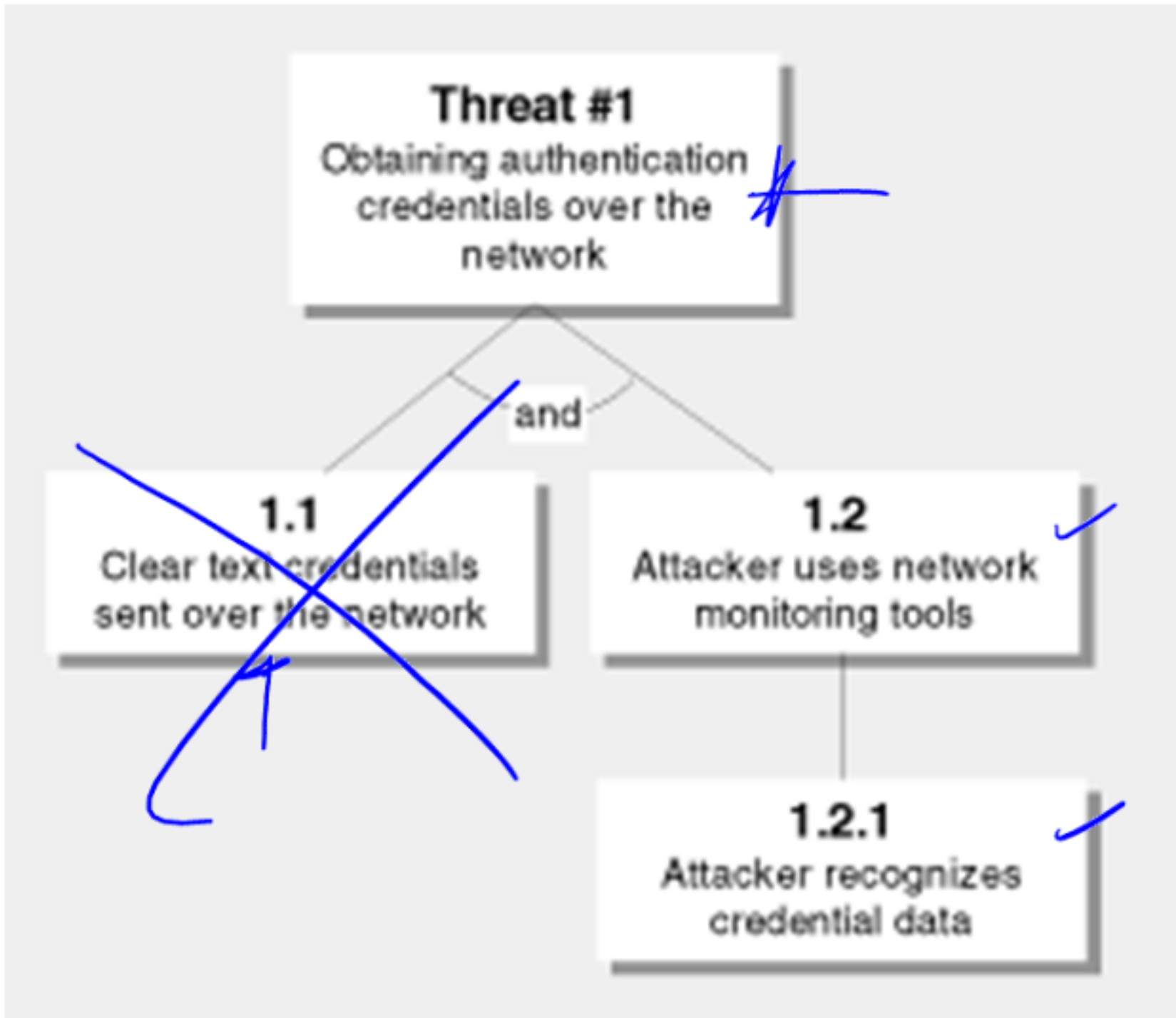


Figure 2-7 Attack tree example

Latent threats of

Grab a cookie allowing one to connect to an attack site.

Identify the Threats



Rate the Threats

- Determine the risk of each threat that is posed

- Risk = Probability * Damage Potential

How likely
is it
to occur.

What will
happen.

DREAD

- **Damage potential**: How great is the damage if the vulnerability is exploited?
- **Reproducibility**: How easy is it to reproduce the attack?
- **Exploitability**: How easy is it to launch an attack?
- **Affected users**: As a rough percentage, how many users are affected?
- **Discoverability**: How easy is it to find the vulnerability?

Dread Rubric

	Rating	High (3)	Medium (2)	Low (1)
D	Damage potential	The attacker can subvert the security system; get full trust authorization; run as administrator; upload content.	Leaking sensitive information	Leaking trivial information
R	Reproducibility	The attack can be reproduced every time and does not require a timing window.	The attack can be reproduced, but only with a timing window and a particular race situation.	The attack is very difficult to reproduce, even with knowledge of the security hole.
E	Exploitability	A novice programmer could make the attack in a short time.	A skilled programmer could make the attack, then repeat the steps.	The attack requires an extremely skilled person and in-depth knowledge every time to exploit.
A	Affected users	All users, default configuration, key customers	Some users, non-default configuration	Very small percentage of users, obscure feature; affects anonymous users
D	Discoverability	Published information explains the attack. The vulnerability is found in the most commonly used feature and is very noticeable.	The vulnerability is in a seldom-used part of the product, and only a few users should come across it. It would take some thinking to see malicious use.	The bug is obscure, and it is unlikely that users will work out damage potential.

Example

- Attacker obtains authentication credentials by monitoring the network.
- SQL commands injected into application.

Threat	D	R	E	A	D	Total	Rating
Attacker obtains authentication credentials by monitoring the network.	3	3	2	2	2	12	High
SQL commands injected into application.	3	3	3	3	2	14	High

Afterwards

- Mitigate the risks...

Security Trust – Defense in

Depth

- Layering protections so that the compromise of one is mitigated
- Running services and daemons as low privileged accounts
- Isolating different functions to different pieces of hardware
- Demilitarized zones
- Stack and heap guards

- Strong coupling
 - Strong coupling indicates a high level of trust amongst components
 - High exposure of internal interfaces
 - High risk of problems
 - Data validation error prone and difficult
- Strong cohesion
 - Strong cohesion indicates module handles only one specific task

- Modules which cross trust boundaries
 - Design decomposition which fail to decompose modules along trust boundaries

Strong coupling exploit

- Shatter class of vulnerabilities

Google Chrome

The screenshot shows the Wikipedia Main Page in a Google Chrome browser window. The address bar displays the URL http://en.wikipedia.org/wiki/Main_Page. The page layout includes a navigation sidebar on the left with sections for navigation, search, interaction, toolbox, and languages. The main content area is divided into several sections: 'Today's featured article' (The Battle of Dyrrhachium), 'Did you know...' (with a portrait of Steele MacKaye), 'In the news', 'On this day...' (September 2: National Day for Vietnam), and 'Recently featured' (Leo Ornstein). The 'In the news' section includes a portrait of Yasuo Fukuda. The 'On this day...' section includes a portrait of a historical battle scene.

Wikipedia, the free encyclo... x

← → ↻ ☆ http://en.wikipedia.org/wiki/Main_Page ▶ ⌵ ⌵ ⌵

navigation

- Main page
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- Featured content
- Current events
- Random article
- Advanced search

search

Go Search

interaction

- About Wikipedia
- Community portal
- Recent changes
- Contact Wikipedia
- Donate to Wikipedia
- Help

toolbox

- What links here
- Related changes
- Upload file
- Special pages
- Printable version
- Permanent link

languages

- Simple English
- العربية
- Bahasa Indonesia
- Bahasa Melayu
- বাংলা
- Brezhoneg
- Bosanski
- Български
- Català
- Český
- Dansk
- Deutsch

Today's featured article


The **Battle of Dyrrhachium** took place on 18 October 1081 between the Byzantine Empire, led by the Emperor Alexius I, and the Normans of Southern Italy under Robert Guiscard, Duke of Apulia & Calabria. The battle was fought outside the city of Dyrrhachium, the Byzantine capital of Illyria, and ended in a Norman victory. Following the Norman conquest of Byzantine Italy and Saracen Sicily, the Byzantine Emperor, Michael VII betrothed his son to Robert Guiscard's daughter. When Michael was deposed, Robert took this as an excuse to invade the Byzantine Empire in 1081. His army laid siege to Dyrrhachium but his fleet was defeated by the Venetians. On 18 October, the Normans engaged a Byzantine army under Alexius I Comnenus outside Dyrrhachium. The battle began with the Byzantine right wing routing the Norman left wing which broke and fled. Varangian mercenaries joined in the pursuit of the fleeing Normans but became separated from the main force and were massacred. Norman knights in the centre attacked the Byzantine centre and routed it, causing the Byzantines to flee. After the capture of Dyrrhachium in February 1082, the Normans advanced inland capturing most of Macedonia and Thessaly. [\(more...\)](#)

Recently featured: [Leo Ornstein](#) – [Dartmouth College](#) – [Local Government Commission for England](#)


[Archive](#) – [By email](#) – [More featured articles...](#)

Did you know...

From Wikipedia's newest articles:

- ... that 19th-century American actor and playwright **Steele MacKaye** [\(pictured\)](#) invented a variety of theatrical devices, including folding theatre seats? 
- ... that 16th century noblewoman **Marguerite de La Rocque** was marooned on an island in the [Gulf of St Lawrence](#) by her relative, the privateer de Roberval, as punishment for an affair?
- ... that **Charles Van Riper**, a severe stammerer, was a pioneer in the development of speech pathology?
- ... that **Lexie Fyfe** became a professional wrestler while working in the billing department of a clinical laboratory firm at the invitation of a co-worker? [August 2008 \(UTC\)](#)
- ... that the book *[Help at Any Cost](#)* triggered hearings by the United States House Committee on Education and Labor into behavior modification techniques used by the tough love teen industry?
- ... that the 19th century Mexican soprano **Ángela Peralta** once sang Donizetti's opera *Maria di Rohan* in a theatre improvised from a disused coal pit in [La Paz, Baja California](#)?


In the news

- Japanese Prime Minister **Yasuo Fukuda** [\(pictured\)](#) resigns less than a year after taking office following Shinzo Abe's resignation. 
- **Hurricane Gustav** makes landfall on the U.S. Gulf Coast in Louisiana after causing at least 66 deaths in Haiti, 8 more in the Dominican Republic, and 11 in Jamaica.
- John McCain chooses **Sarah Palin**, the Republican Governor of Alaska, as his vice-presidential running mate in the 2008 U.S. presidential election.
- **Russia officially recognizes** the independence of Abkhazia and South Ossetia; the latter announces it will become part of Russia.
- Over 1.2 million people in Bihar, India are affected by **flooding** as the Koshi River changes its course.

[Wikinews](#) – [Recent deaths](#) – [More current events...](#)

On this day...

September 2: National Day for Vietnam (1945)

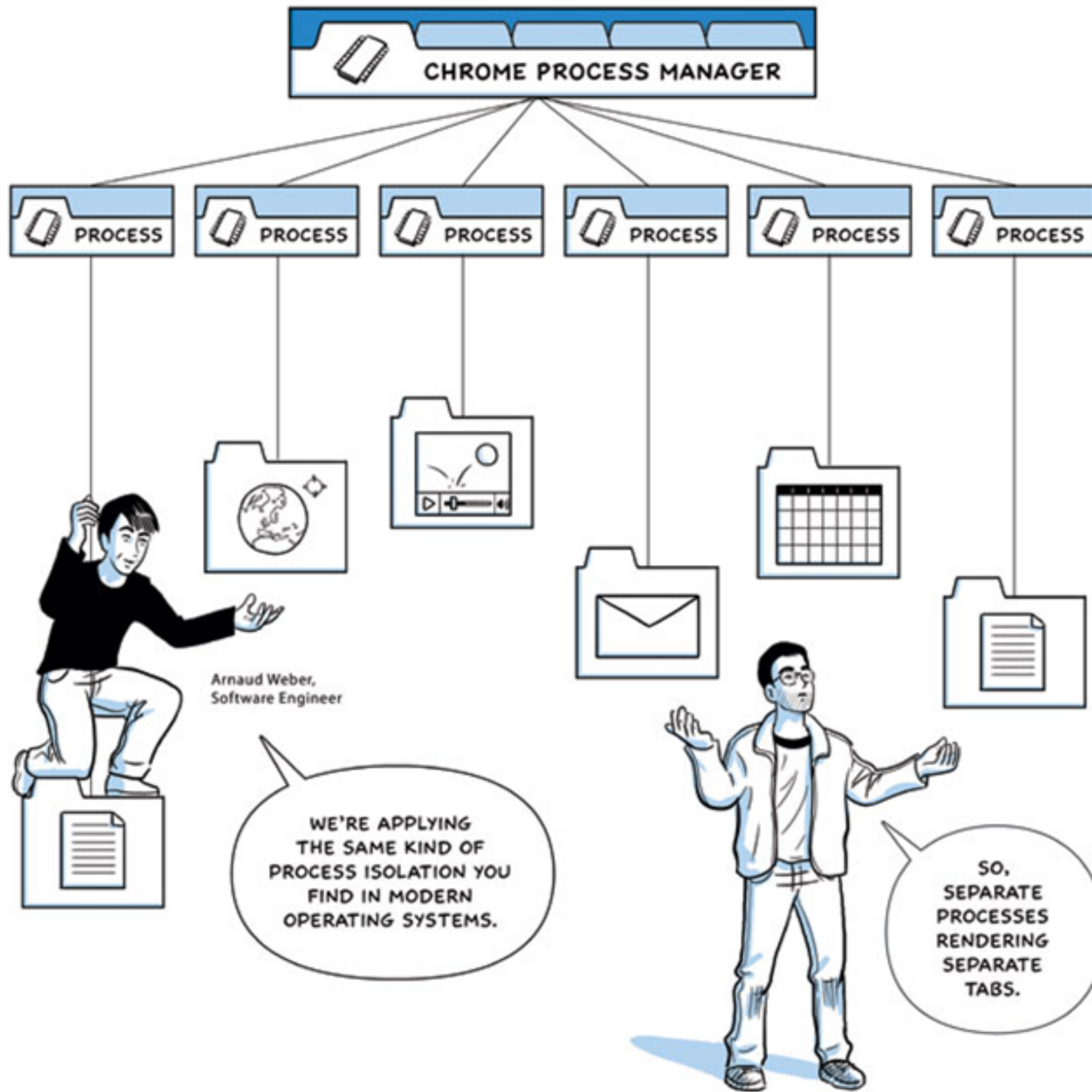
- 31 BC – Final War of the Roman Republic: Troops supporting Octavian defeated the forces of Mark Antony and Cleopatra in the naval **Battle of Actium** on the Ionian Sea near Actium in Greece. 
- 1666 – A large fire began on London's Pudding Lane and **burned the city** for three days [\(pictured\)](#), destroying St Paul's Cathedral and the homes of 70,000 of the city's 80,000 inhabitants.
- 1898 – Mahdist War: Forces led by Horatio Kitchener defeated Sudanese tribesmen at the **Battle of Omdurman** in Omdurman, Khartoum, Sudan, establishing British dominance in northeastern Africa.
- 1945 – On the deck of the United States Navy battleship USS *Missouri* in Tokyo Bay, representatives from the Empire of Japan and several Allied Powers signed the **Japanese Instrument of Surrender**, formally ending World War II.
- 1998 – Swissair **Flight 111** en route from New York City to Geneva crashed into the Atlantic Ocean, killing all 229 on board.

[More events: September 1](#) – [September 2](#) – [September 3](#)

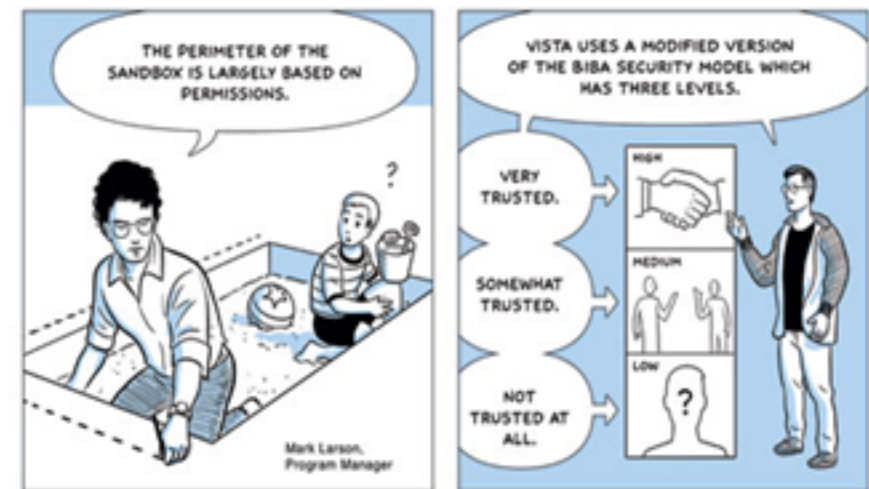
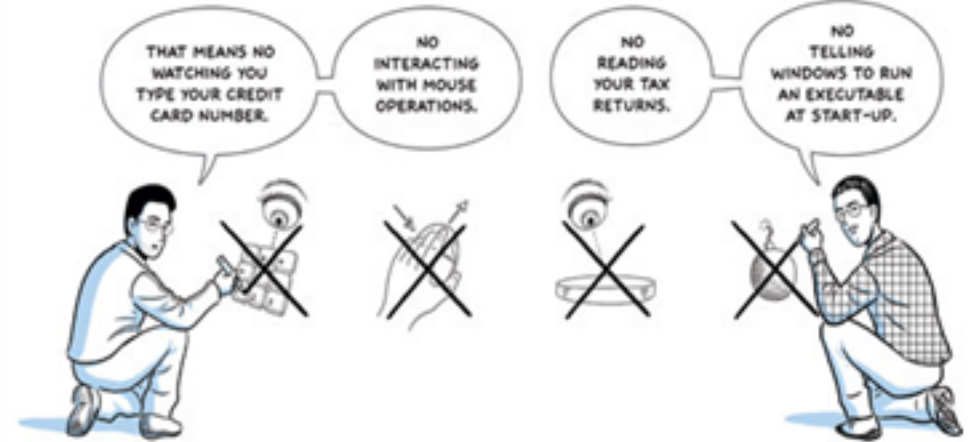
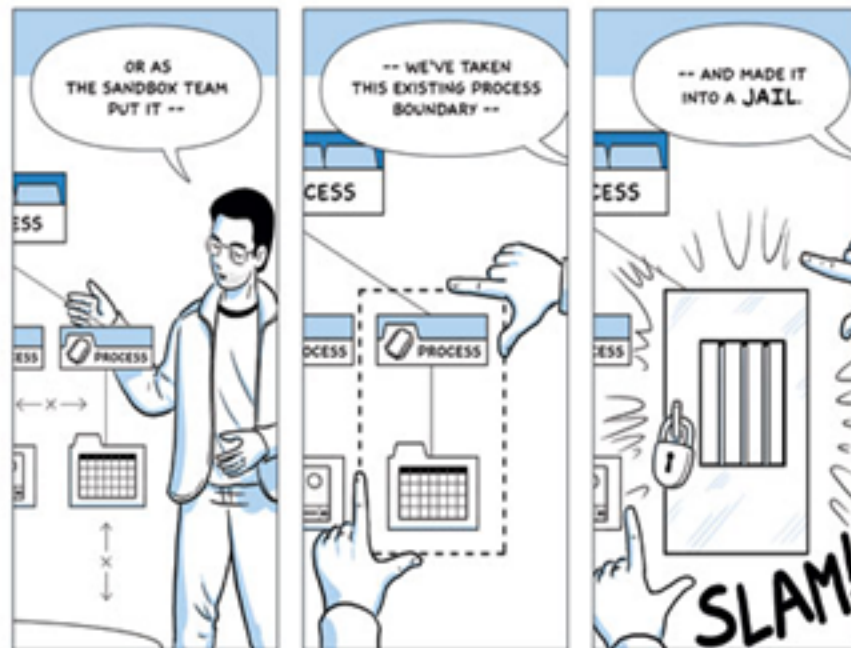
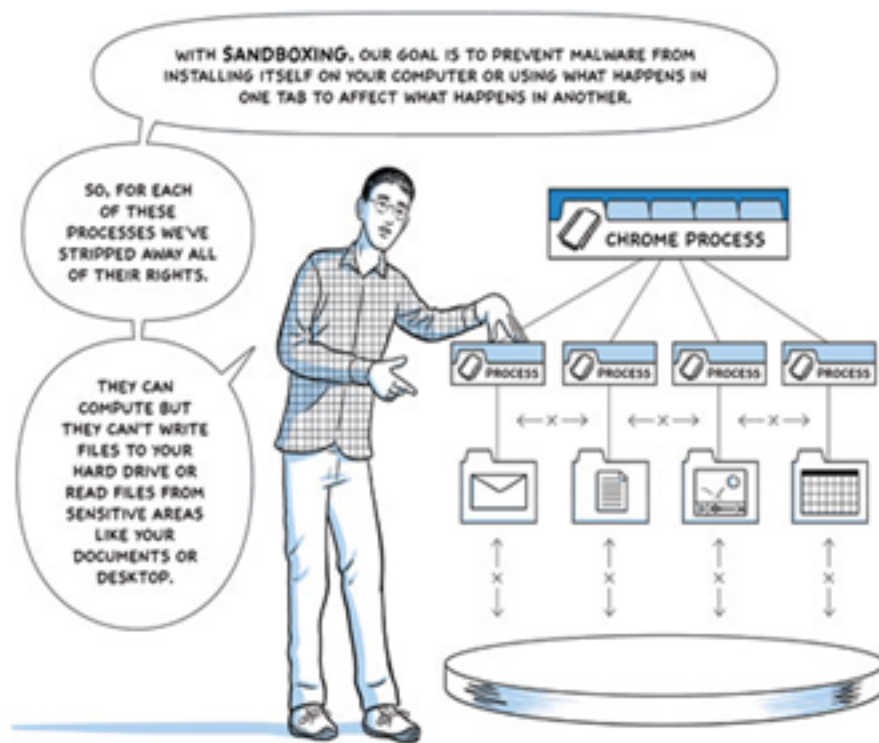
Google Chrome

Why is Google
Building a Browser?

Google Chrome



Google Chrome





Online Banking

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(6 - 32 characters)

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Brooklyn DECKER

VIDEO PHOTOS

ALL MODELS

Brooklyn Decker was photographed by Raphael Mazzucco in Carriacou Island, The Grenadines. Swimsuit by Sugarwater.

SWEETSTAKES Sports Illustrated Rolvinic

start Firefox Windows Task... Presentation1 LecturaArchit... Jax Paint Sho... 2009 Sports IL... 12:02 PM

Google Chrome

- Each tab is its own process
 - Not thread
 - "prevent malware from installing itself" or "using what happens in one tab to affect what happens in another",
- Can not write files or read from sensitive areas (e.g. documents, desktop)
- two levels of security, user and sandbox
 - *sandbox* can only respond to communication requests initiated by the *user*.[\[34\]](#)
- Plugins are run in separate processes
 - communicate with the renderer in dedicated per-tab processes.¹
- *Incognito* mode prevents the browser from storing any history information or [cookies](#)
 - Referred to as a [porn mode](#)