VALUE DRIVEN THREAT MODELING

Security By Design

By Avi Douglen, CEO Bounce Security

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Summary

- Threat Modeling: most effective security activity
- Developers should Threat Model too!
  - *Not just the security team*

- Can be done quick and agile
- Prioritize by business value

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About Me

- Email: AviD@BounceSecurity.com
- Twitter: @sec_tigger
- He / Him

- The important things:
  - *Whisky: smokey*
  - *Beer: stout*
  - *Coffee: strong*

- Software Security @ Bounce SECURITY
- Researcher / Developer / Architect
- Moderator Security.StackExchange
- Volunteer High School teacher
- OWASP Israel Leader
- Threat Model Project Leader

- Worldwide organization
- Dedicated to software security
- Free and Open source
- All volunteers
- Lots of projects
  - *Libraries*
  - *Tools*
  - *Guides*

- Israel chapter from 2006
- AppSecIL conference
  - *September 6th*
  - *Over 700 attending*
- Secure Coding Training
  - *September 5th*
  - *400 devs expected*
- FREE

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What is Threat Modeling?

- Structured security-based analysis
- Framework to understand threats
- Review of Design Elements
- Prioritize Mitigations by Risk

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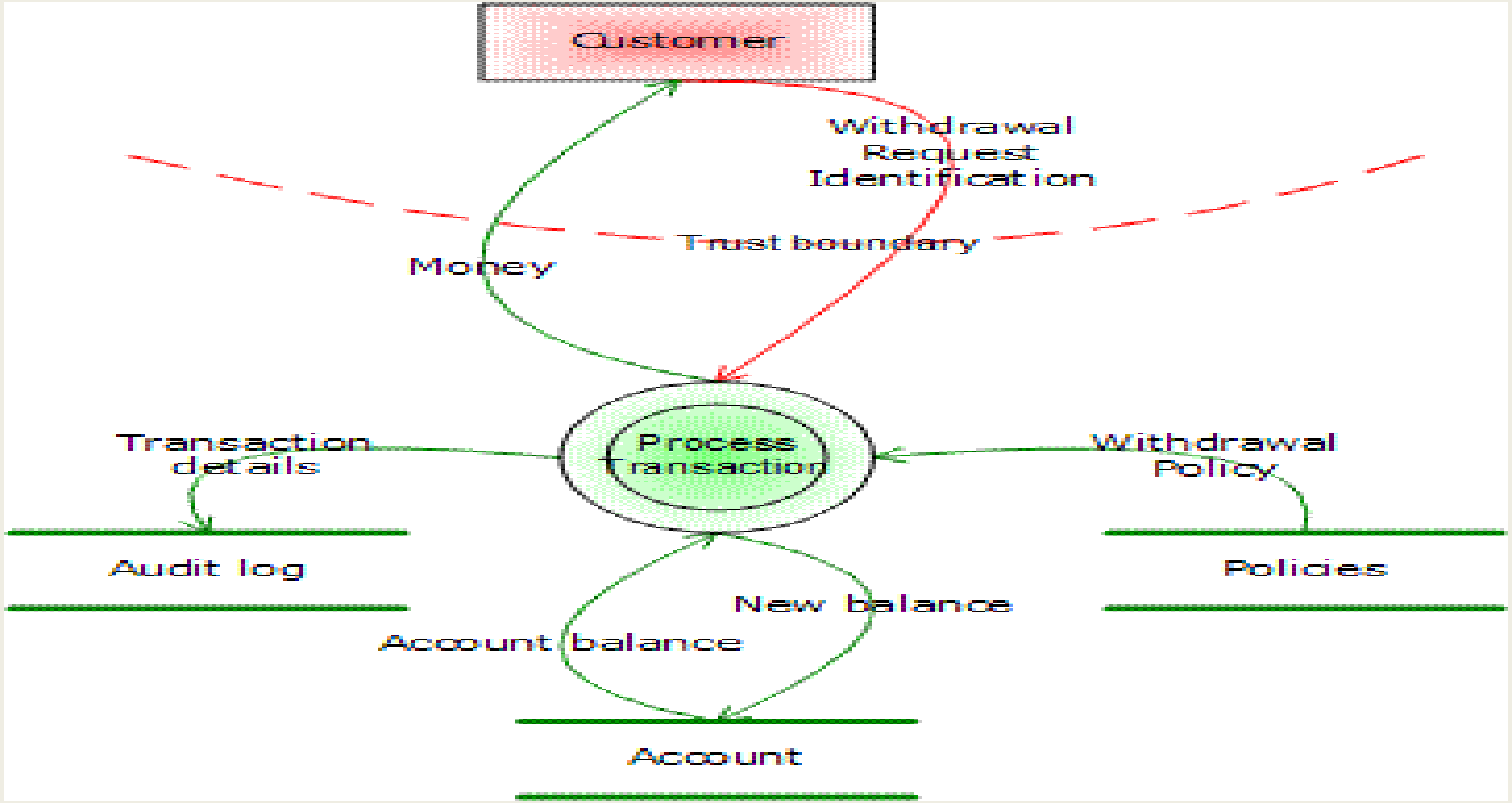
Why Threat Modeling?

- Discover unexpected potential attacks
- Understand risk and prioritize vulnerabilities
- Focus security efforts more efficiently
- Communication
- Documenting mitigations

“Classic” Threat Modeling

- Data Flows and Attack Surface
- Focus on Assets, Trust Boundaries
- Visually with DFDs or other diagrams

Data Flow Diagram



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Process Outline

- Step#0: Scoping the Model
- Step#1: Decompose the Application
- Step#2: Identify the Threats (and risk level)
- Step#3: Determine the Countermeasures
- Step#4: Analyze Result

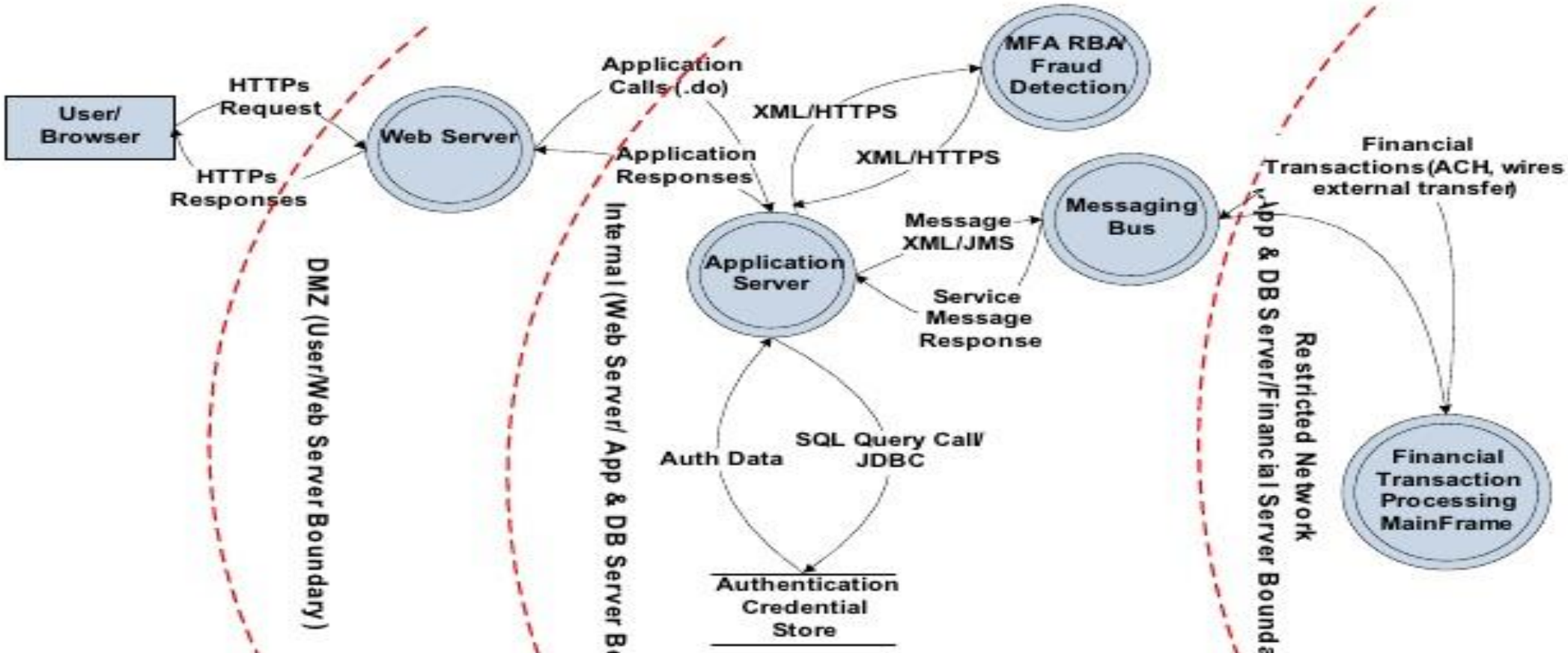
Classic Methodologies

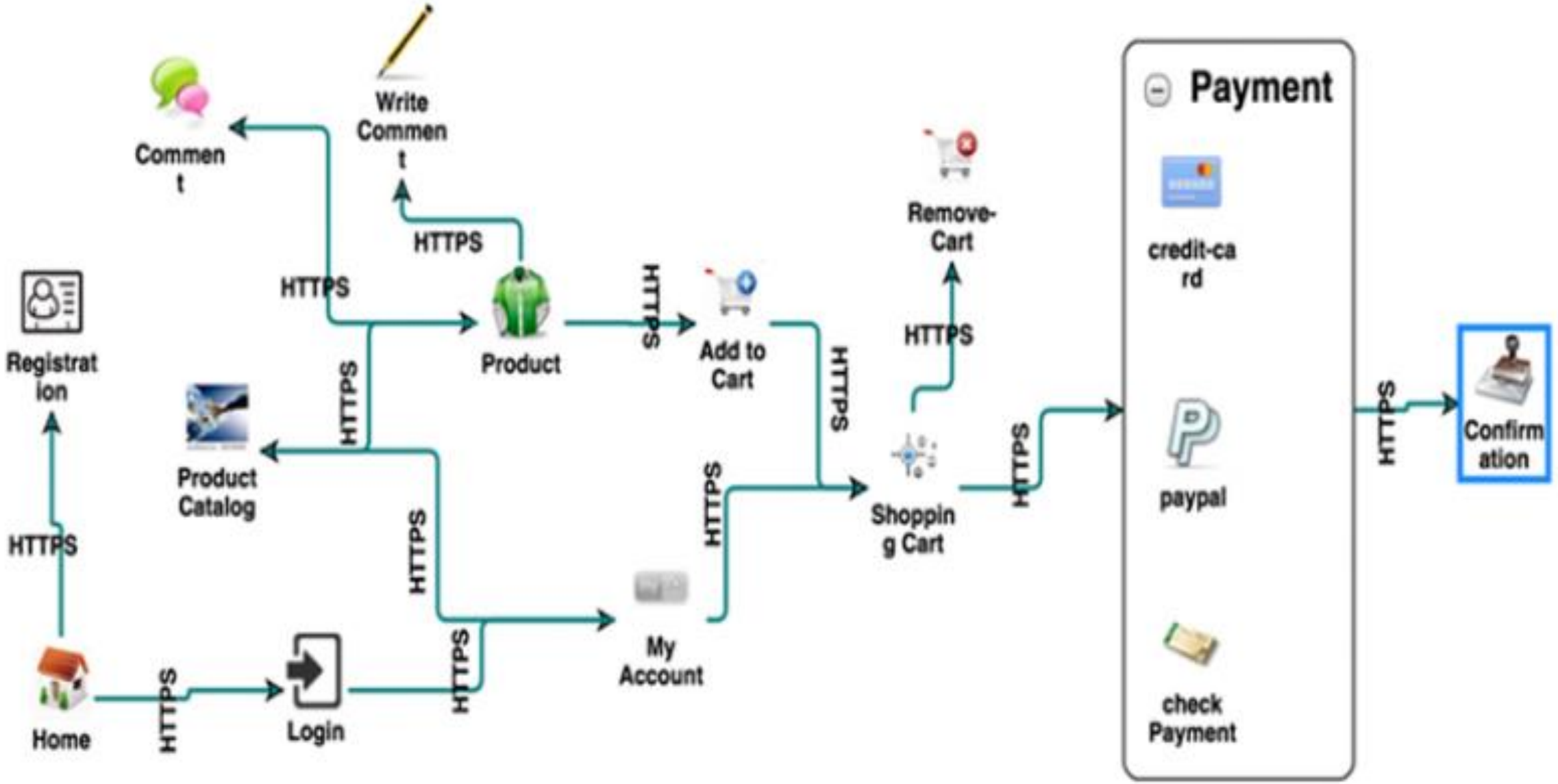
- STRIDE / STRIDE-per-element
- Attack Trees
- Asset-Focused
- Software-centric
- Attacker-focused
- Risk-Based

STRIDE Per-Element

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

Data flow diagram-Online Banking Application

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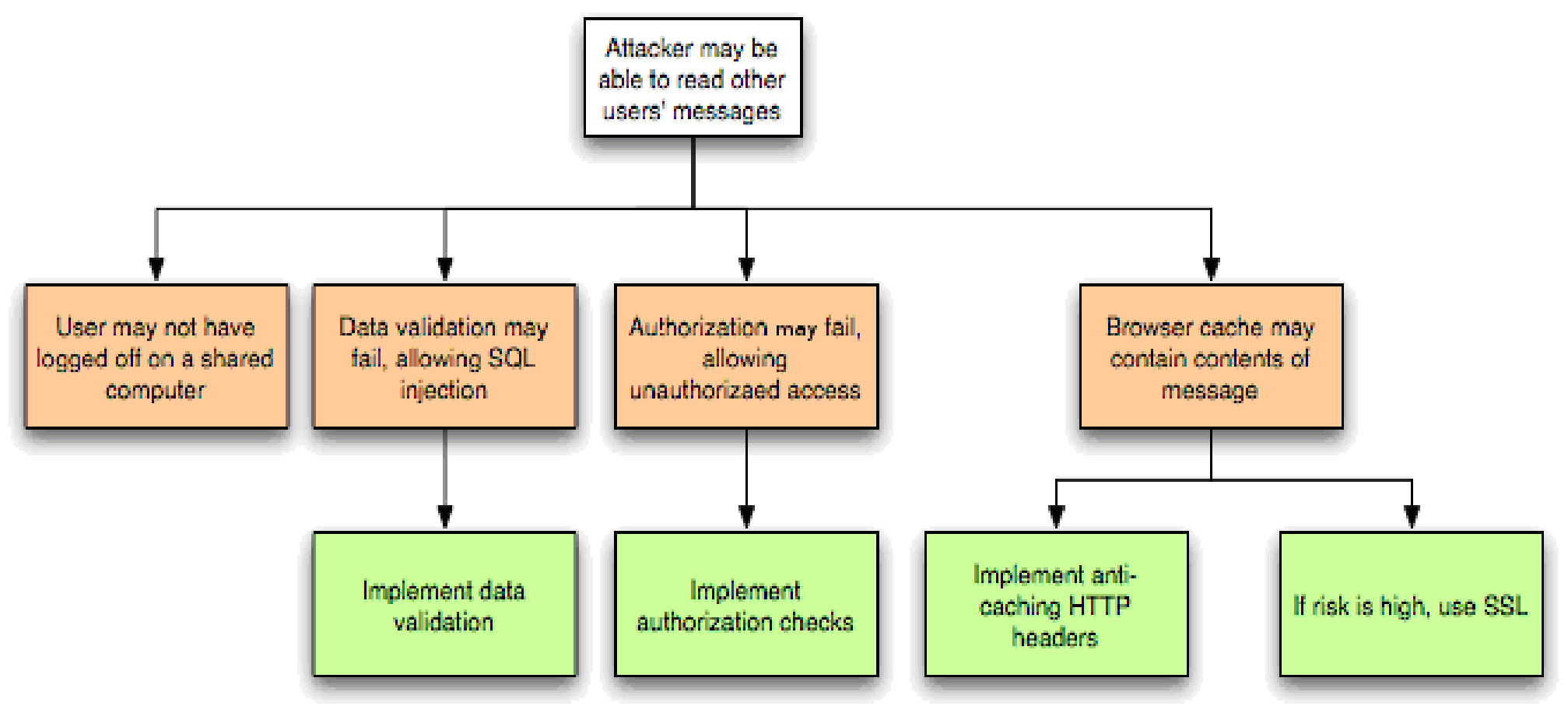
check Payment

Attack Trees



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P.A.S.T.A

- Risk-Based Methodology for higher assurance
- **P**rocess for **A**ttack **S**imulation and **T**hreat **A**nalysis

- Seven stage process:


1. Define Objectives
Identify Business Objectives
Identify Security & Compliance Requirements
Business Impact Analysis
2. Define Technical Scope
Capture the boundaries of the technical environment
Capture Infrastructure | Application | Software Dependencies
3. Application Decomposition
Identify Use Cases | Define App Entry Points & Trust levels
Identify Actors | Assets| Services | Roles| Data Sources
Data Flow Diagramming (DFDs) | Trust Boundaries
4. Threat Analysis
Probabilistic Attack Scenarios Analysis
Regression Analysis on Security Events
Threat Intelligence Correlation & Analytics
5. Vulnerability & Weakness Analysis
Queries of Existing Vulnerability Reports & Issues Tracking
Threat to Existing Vulnerability Mapping Using Threat Trees
Design Flaw Analysis Using Use & Abuse Cases
Scorings (CVSS/ CWSS) | Enumerations (CWE/CVE)
6. Attack Modeling
Attack Surface Analysis
Attack Tree Development | Attack Library Mgt
Attack to Vulnerability & Exploit Analysis using Attack Trees
7. Risk & Impact Analysis
Qualify & quantify business impact
Countermeasure Identification & Residual
ID risk mitigation

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Common Objections

- “Security is everybody’s job”

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Common Objections

- Takes too much time!

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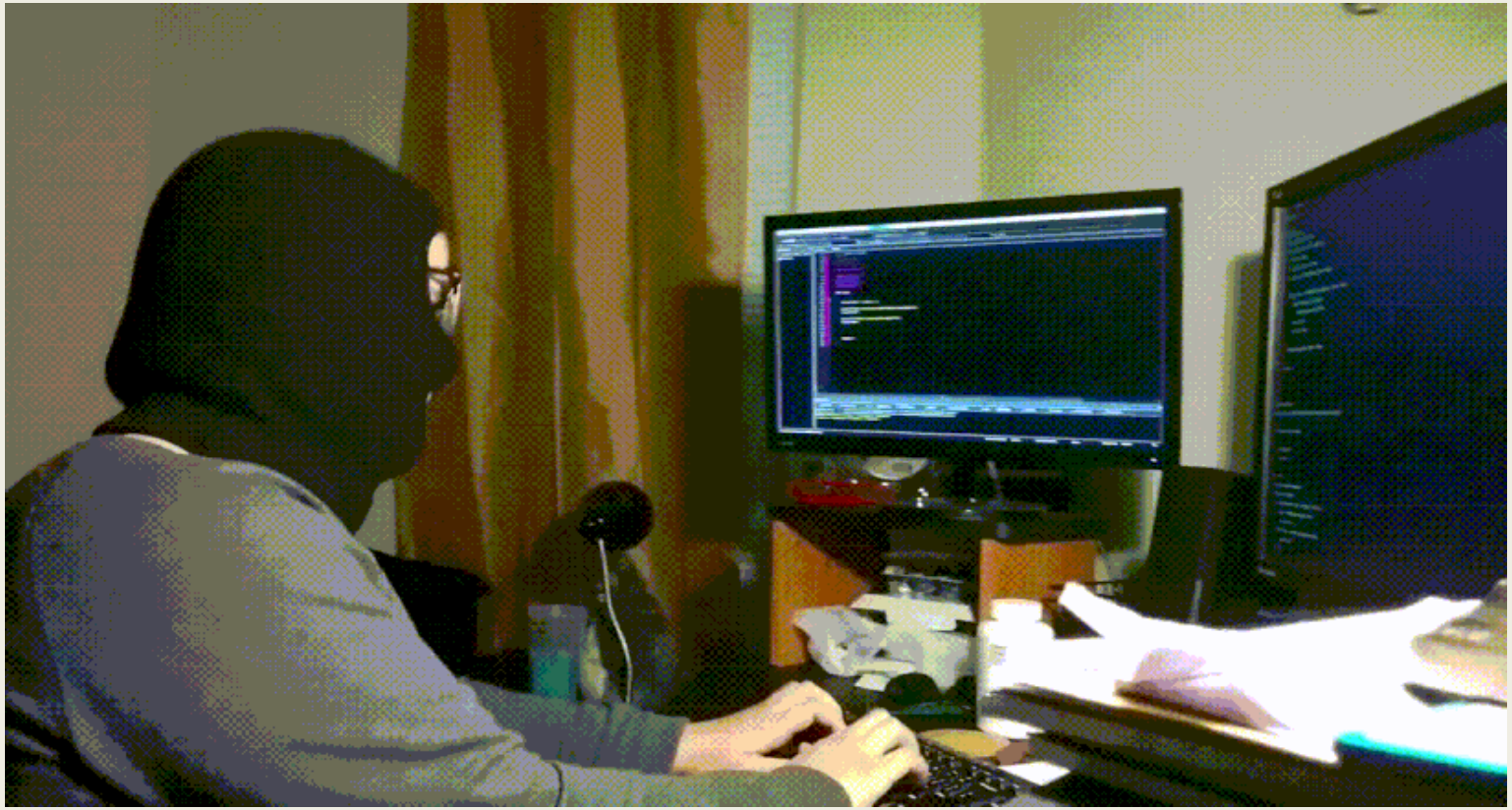
Common Objections

- “Think like an attacker”



Common Objections

- Big Model Up Front

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Common Objections

- Use case vs. user story approach

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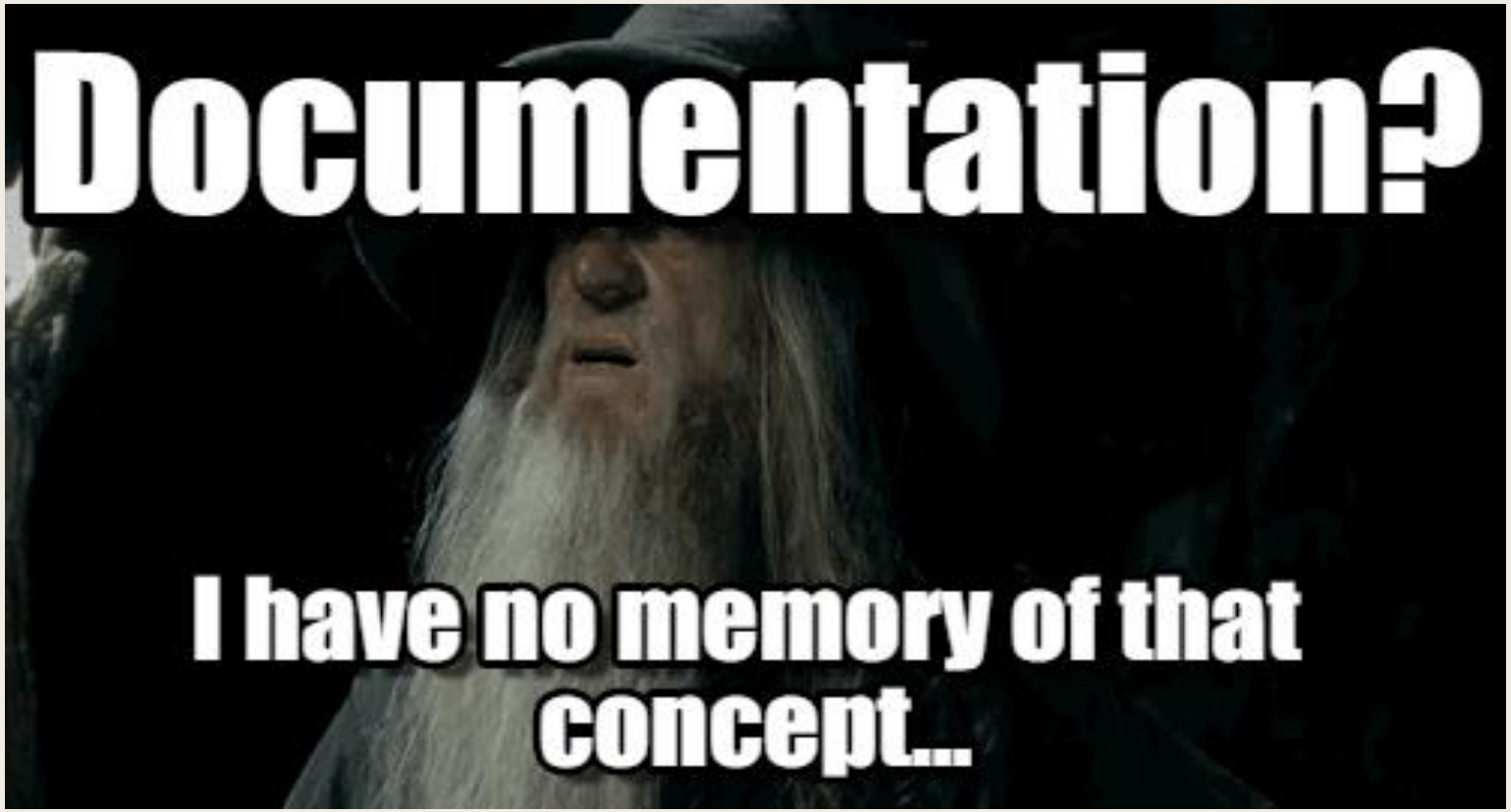
Common Objections

- Threat model separate from design



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Common Objections

- Usually out of date, often before its complete

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Common Objections

- Wasted time on unrealistic threats

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Common Objections

- Mismatch with Security Team

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Common Objections

- Security team doesn’t scale

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Common Objections

- Security team drops in and out

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Common Objections

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Core of Classic TM

- 4 core questions of threat modeling:
  1. *What are you building?*
  2. *What can go wrong?*
  3. *What are you going to do about it?*
  4. *Did we do a good job?*

- "All Threat Models are wrong, some are useful"

Value Driven Threat Modeling

- Accept that it's wrong, focus on the usefulness

1. Why are we building this?
2. What needs to go right?
3. How do we make sure that happens?

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Value Driven Process

- Start from standard baseline
  - *Skip obvious threats (e.g. XSS, HTTPS)*
  - *Relies on basic code hygiene*
  - *Security training for all developers and testers!*
  - *Threat Library*

- Threat model each User Story / Epic
  - *During "Discovery" or Sprint Planning*
  - *Agile approach of "just enough" threat model*
  - *Threat model goes into the User Story*

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Value Driven Process

- Find the value of each feature
  - *Follow the money!*
  - *How do people die?*

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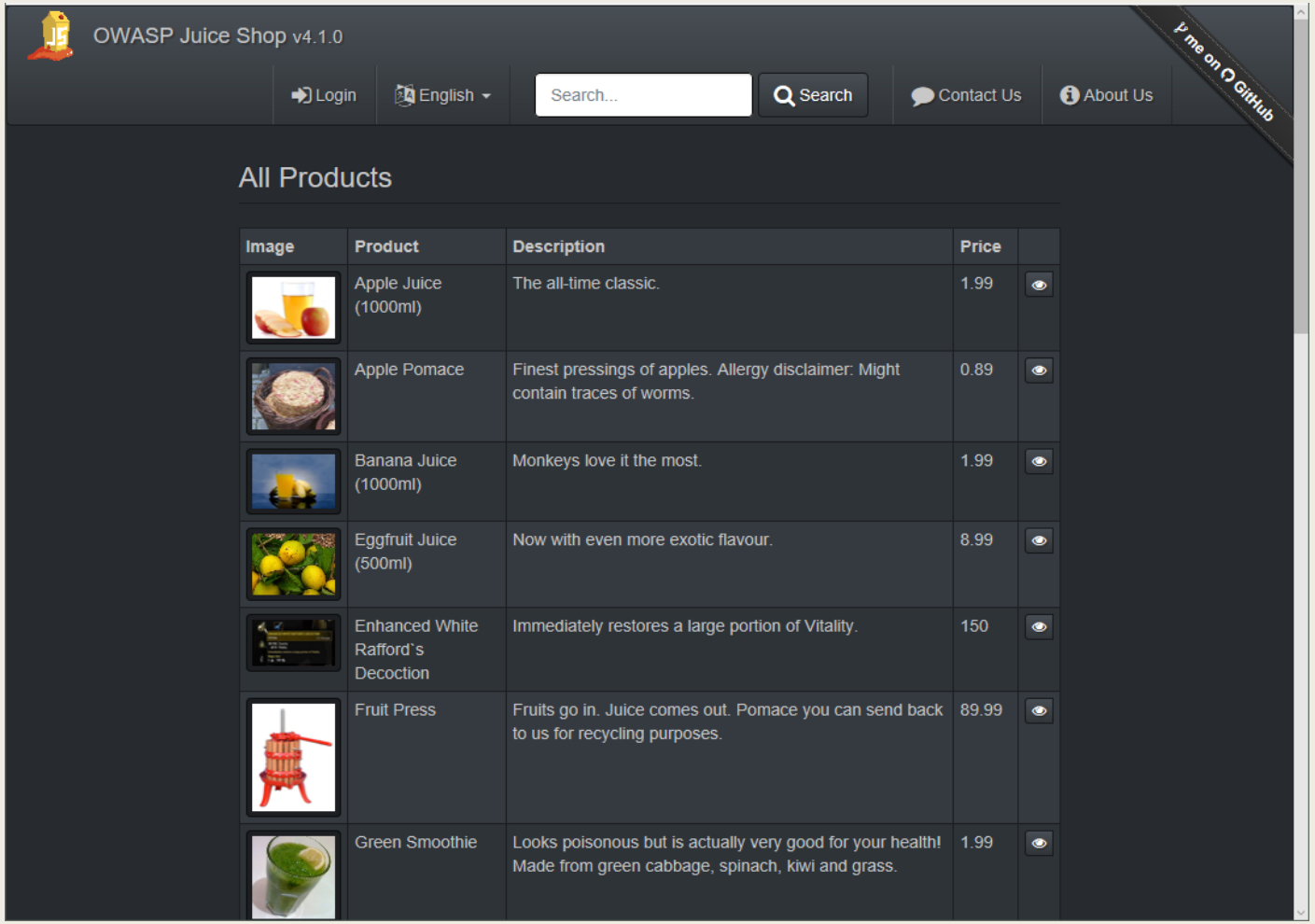
Value Driven Process

- State story goals
- Describe correct flow and conditions

- Highlight assumptions and failure states
- Validate assumptions and enforce conditions
- Explicitly handle failure states

OWASP Juice Shop



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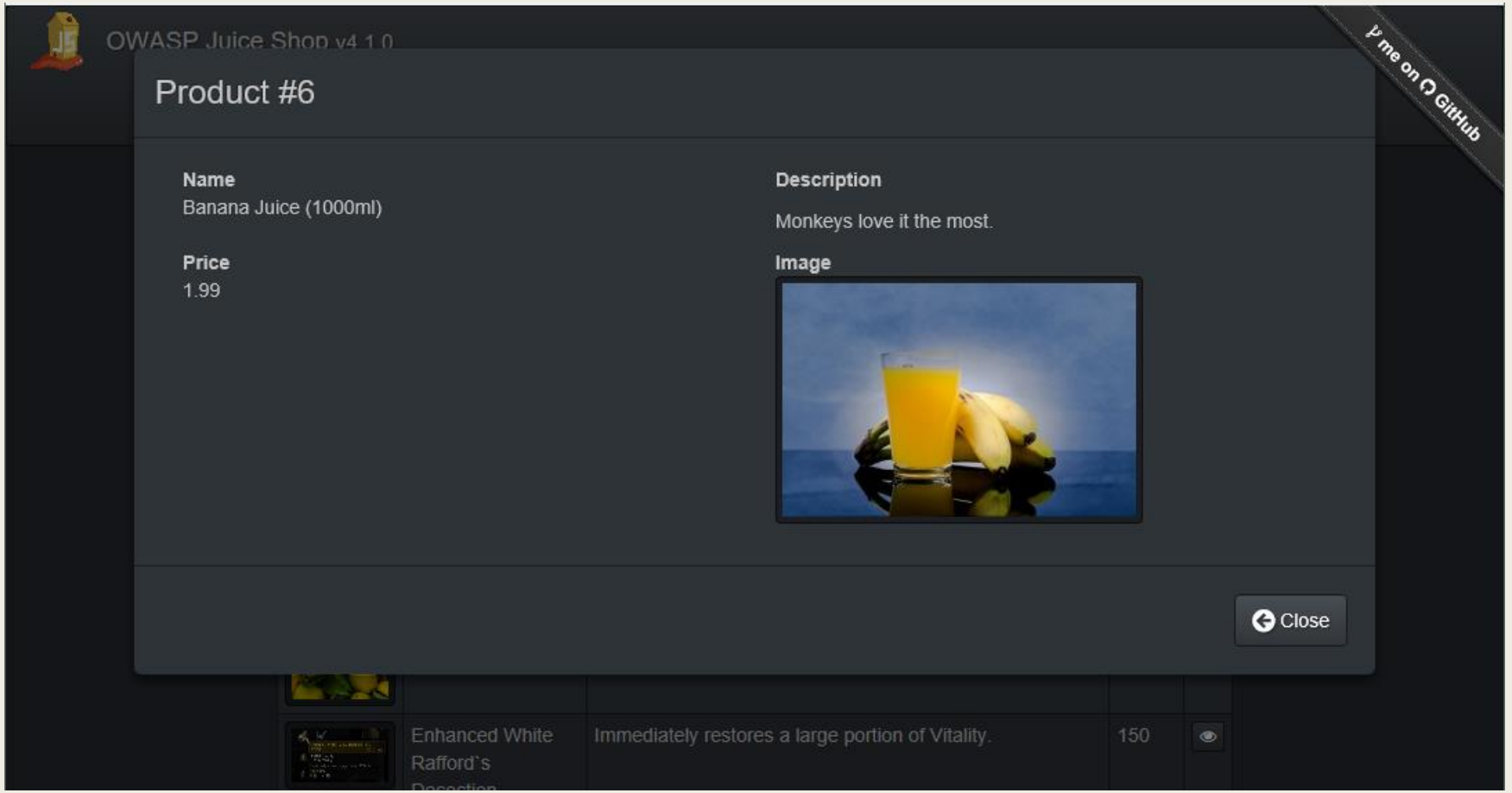

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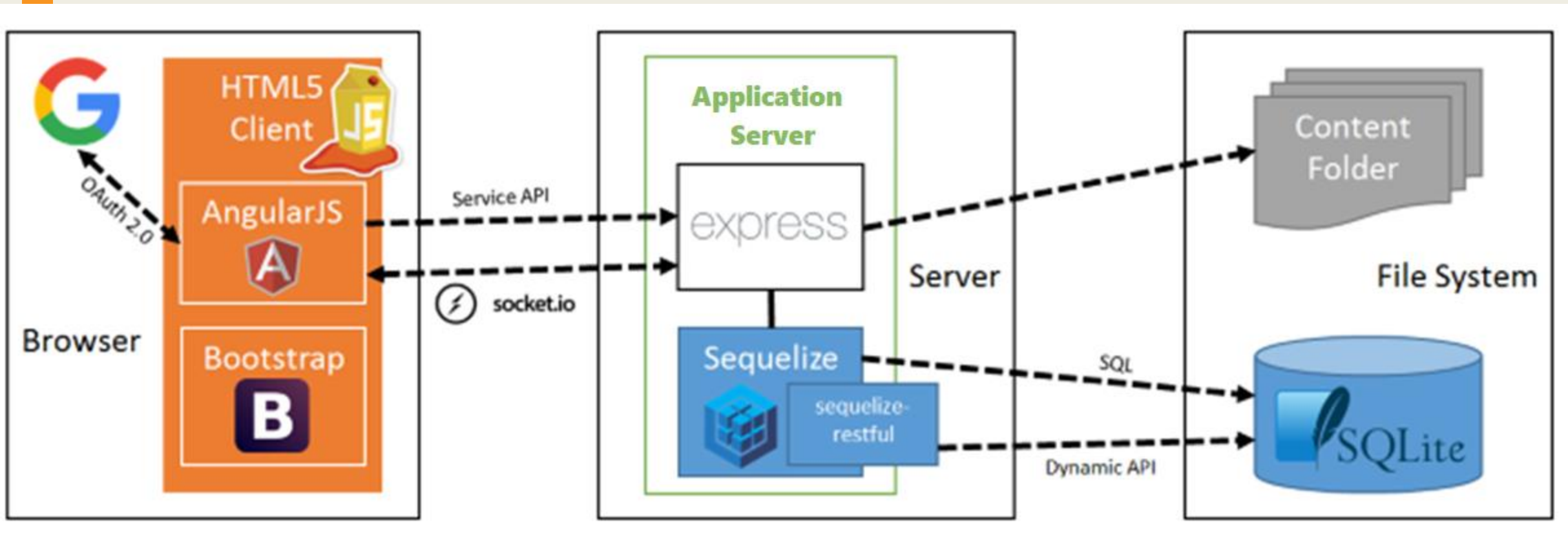

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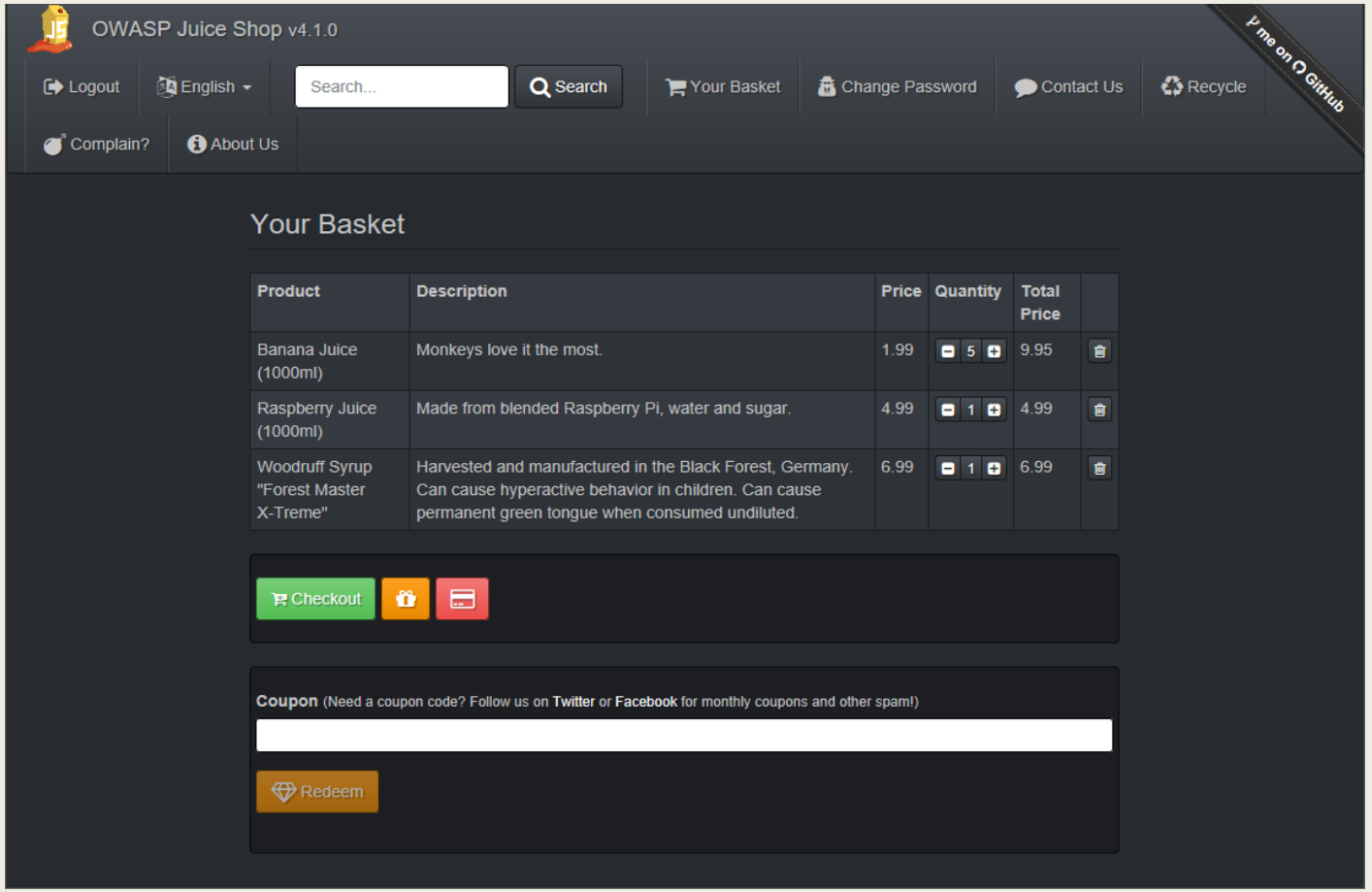

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OWASP Juice Shop

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Value Driven Techniques

- Definition of Done
- Acceptance Criteria

When I login with a wrong password,

I should be locked out after X times.

Value Driven Techniques

- Security unit tests

Test that user accounts are locked after X attempts

Test that locked user accounts are unlocked after Y time

Value Driven Techniques

- Abuser stories

As an attacker,

I want to try a large number of passwords,

so that I can impersonate another user

and steal their juicebox

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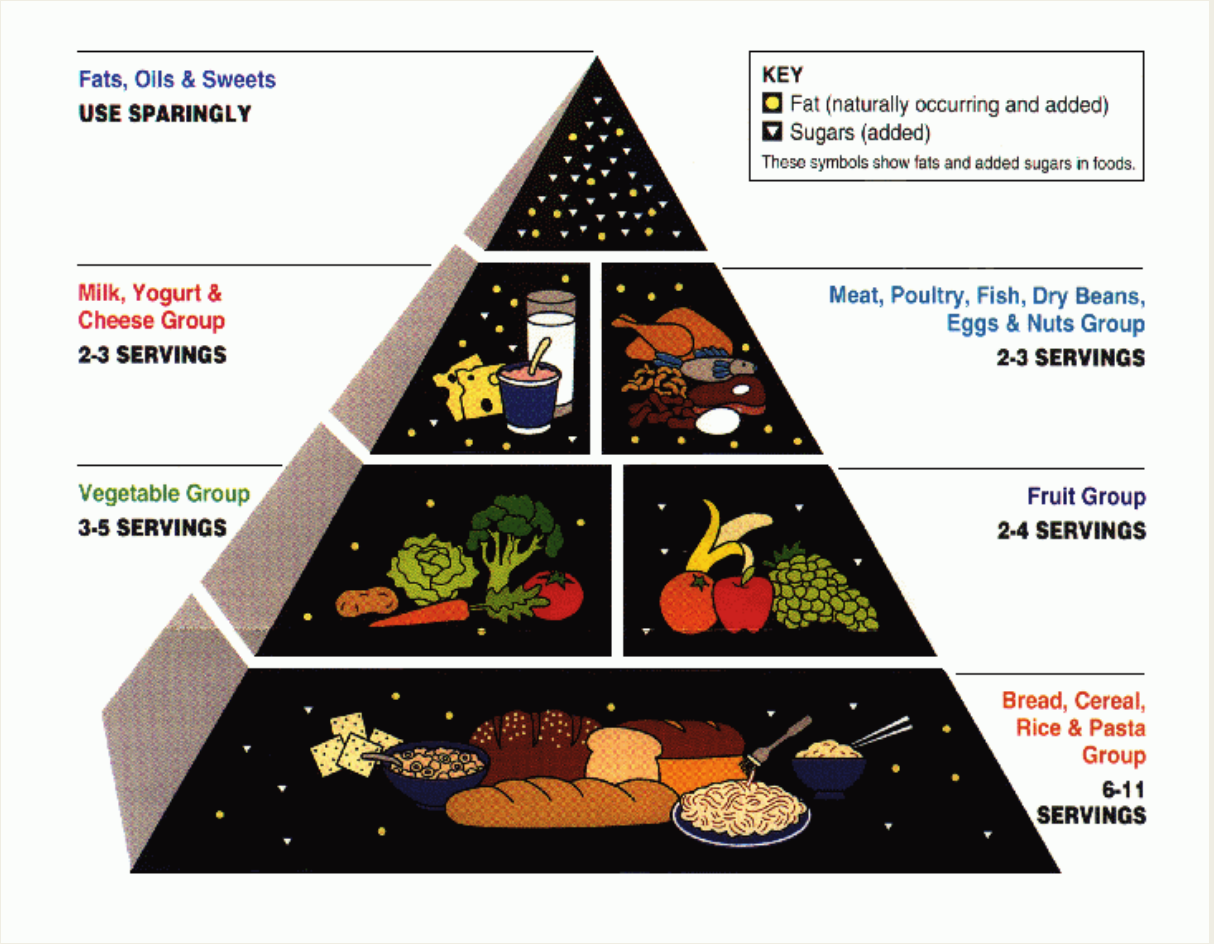
Value Driven Techniques

- Threat Pyramid



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Value Driven Techniques

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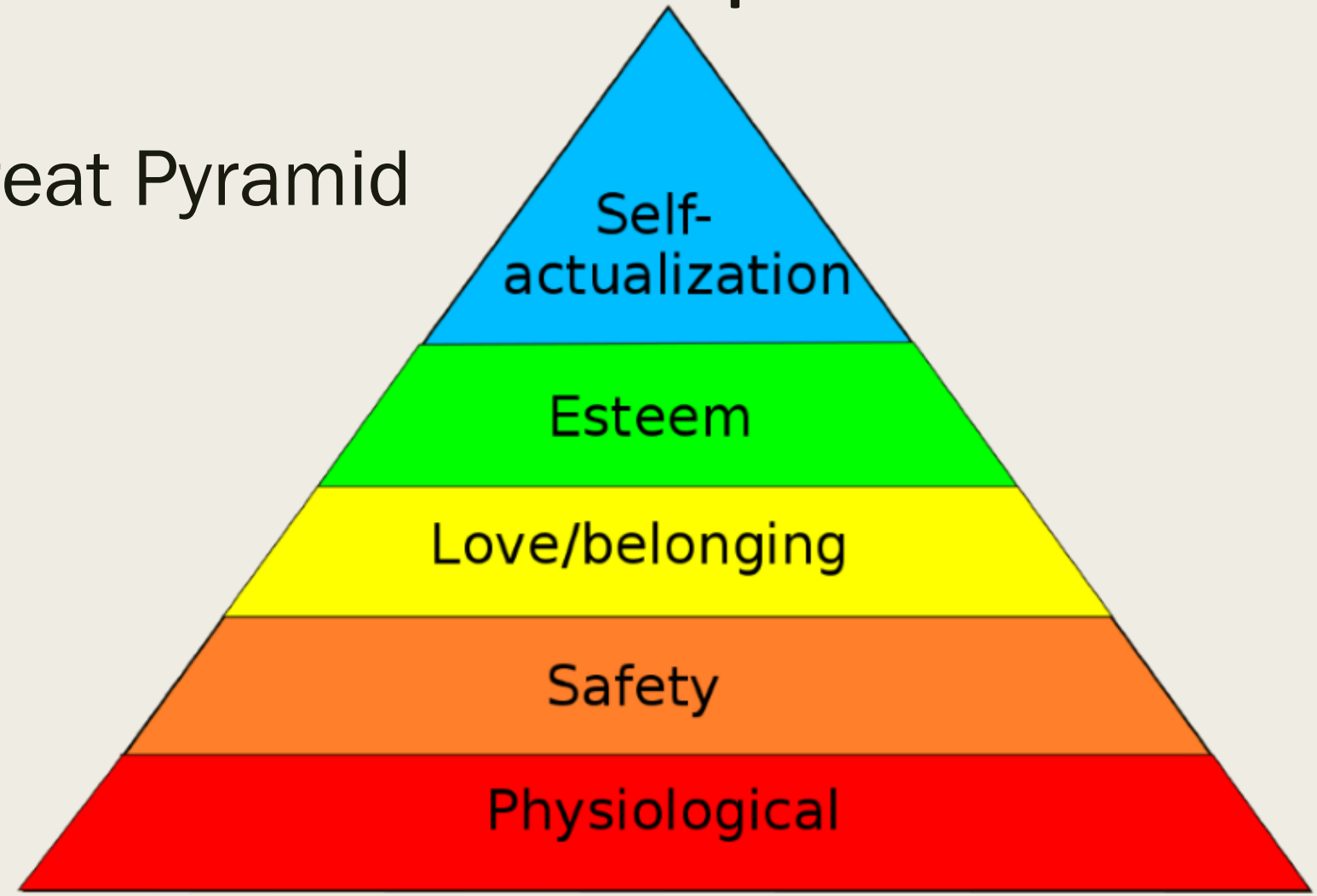

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Value Driven Techniques

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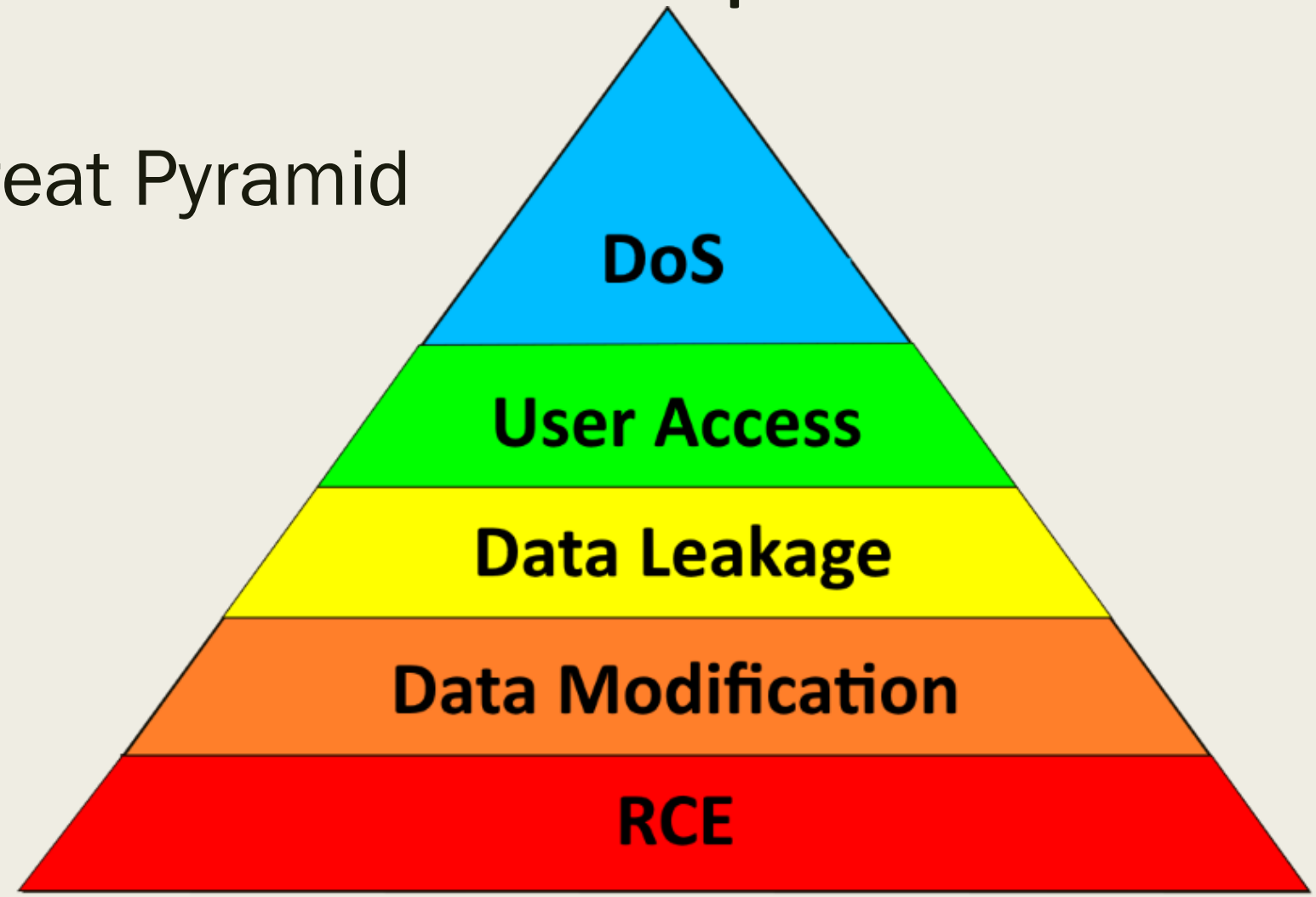

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Value Driven Techniques

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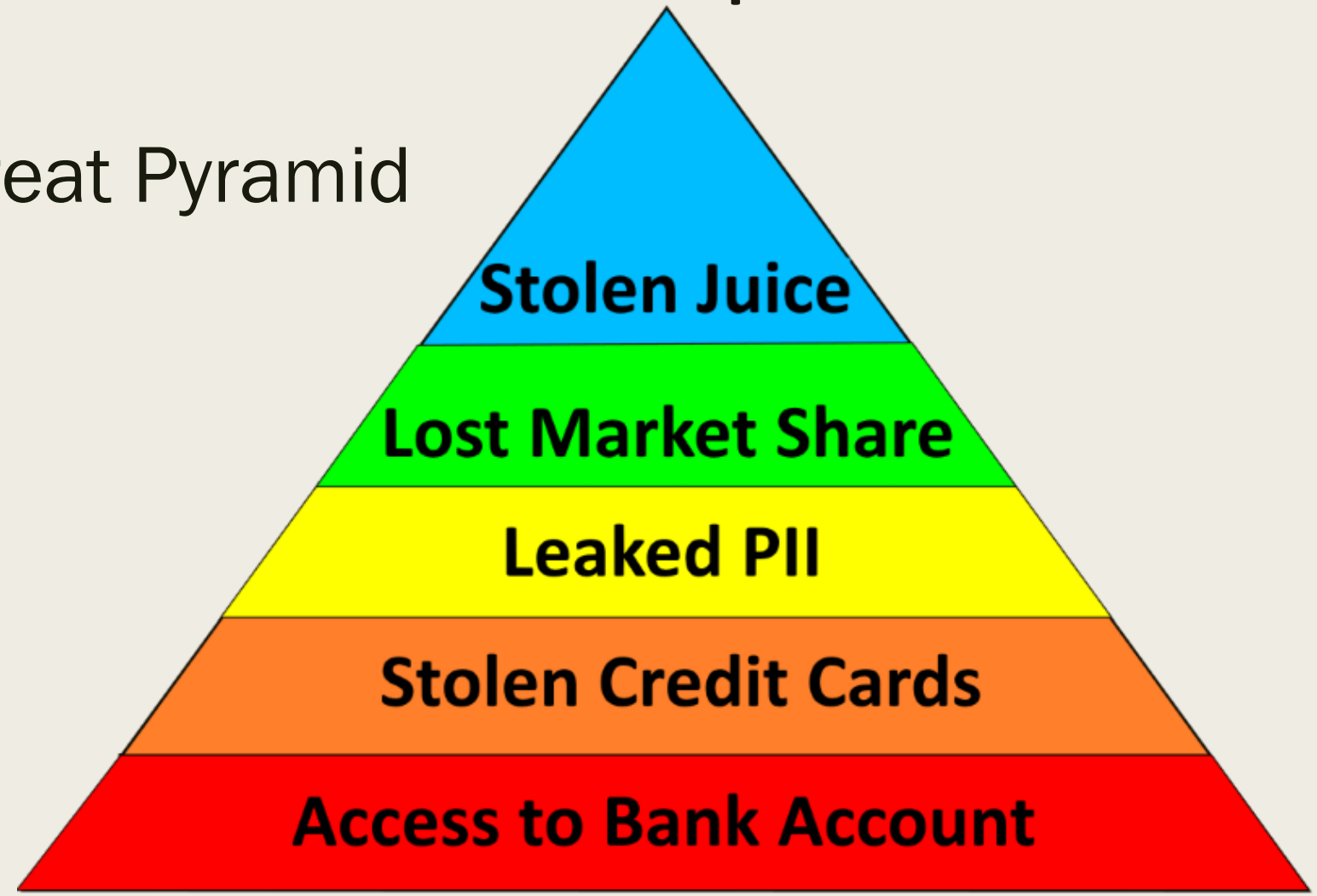

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Value Driven Techniques

Story Points

Relative estimate of effort

↓

Sorry Points

Relative estimate of impact

“What if it goes horribly wrong?”

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Benefits

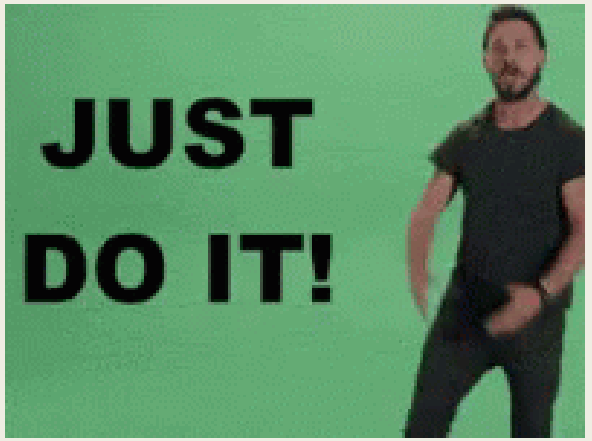
- Enables protection of application
- Efficient security investment
- Can integrate as part of agile design
- Justify NOT implementing security feature
- Don’t need piles of expensive consultants
- Take ownership of security requirements

Limitations

- Not complete
- Misses a LOT of threats
- Relies on developer experience
- Security champion must be part of team
- Low assurance for high risk systems

Summary

- Developers – start threat modeling!!
- TM should be part of dev workflow
- Focus on business value
- Start with the useful part of TM – and stop there
- Skip the overkill – until you really need it



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THANKS FOR LISTENING!

Find me on Twitter: @sec_tigger

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