An Introduction to Cyber Security – CS 573

Instructor: Dr. Edward G. Amoroso
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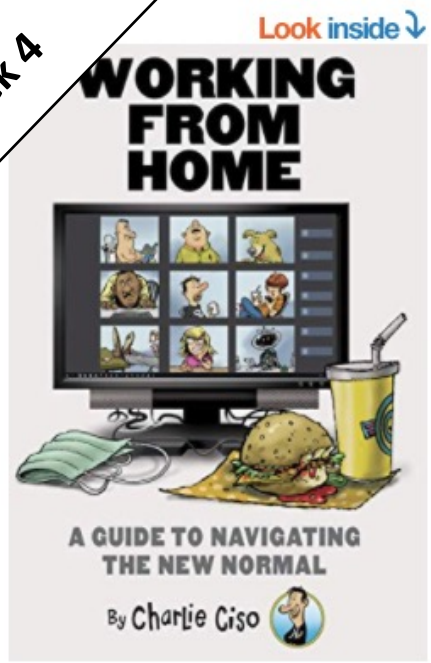
Week 4



Working from Home: A Guide to Navigating the New Normal

Kindle Edition

by Edward Amoroso (Author), Rich Powell (Author) | Format: Kindle Edition

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If you are in need of some Pandemic entertainment and world-class comic relief, then "Working from Home: A Guide to Navigating the New Normal" is for you! This step-by-step guide, written by a fictitious social media sensation (and sometimes cybersecurity expert) named Charlie Ciso, will teach you to:

•Build a fake Zoom backdrop that will get you promoted to senior VP in ten days or less

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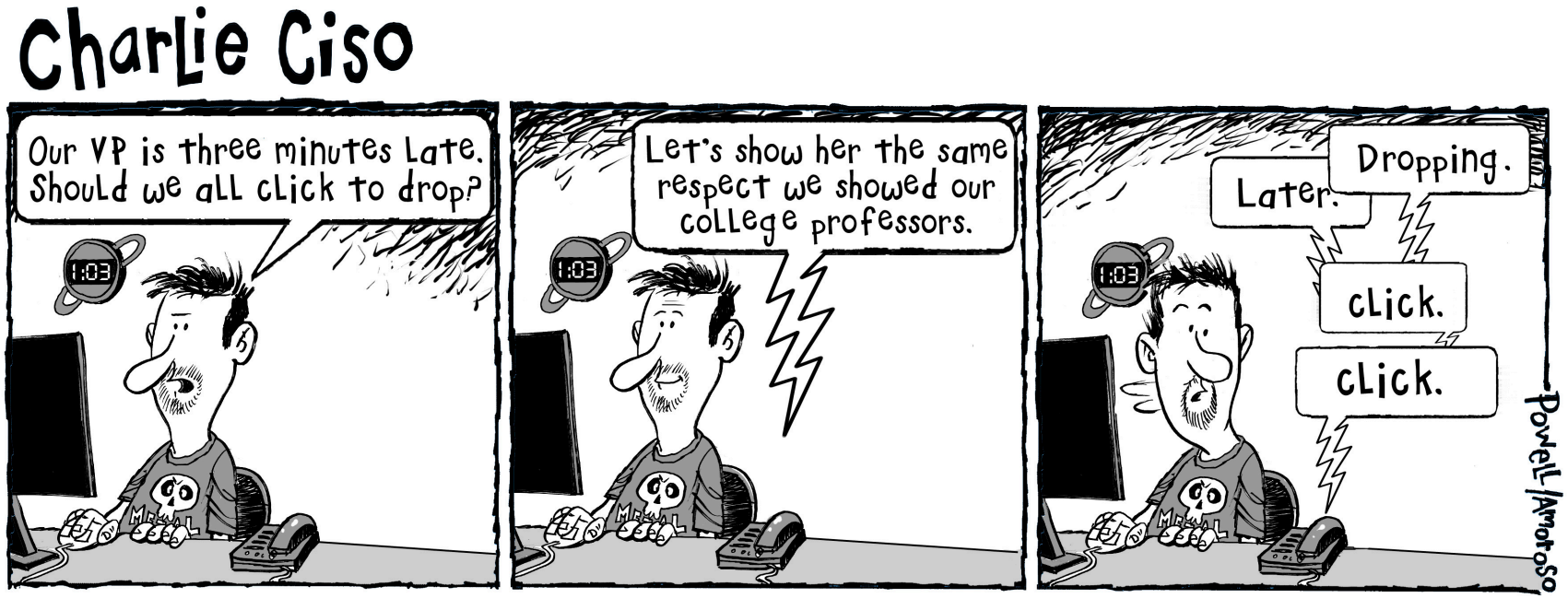

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Week 4

Required Text – $9.99 Download from Amazon.com

$25.00 Printed Paperback Book from Amazon.com

From CIA to APT: An Introduction to Cyber Security

Edward G. Amoroso & Matthew E. Amoroso

Week 4

Required Week Four Readings

1. "A Man-in-the-Middle Attack on UMTS," U. Meyer and S. Wetzel https://www.cs.stevens.edu/~swetzel/publications/mim.pdf

2. **Chapters 12 through 16: *From CIA to APT: An Introduction to Cyber Security*, E. Amoroso & M. Amoroso**

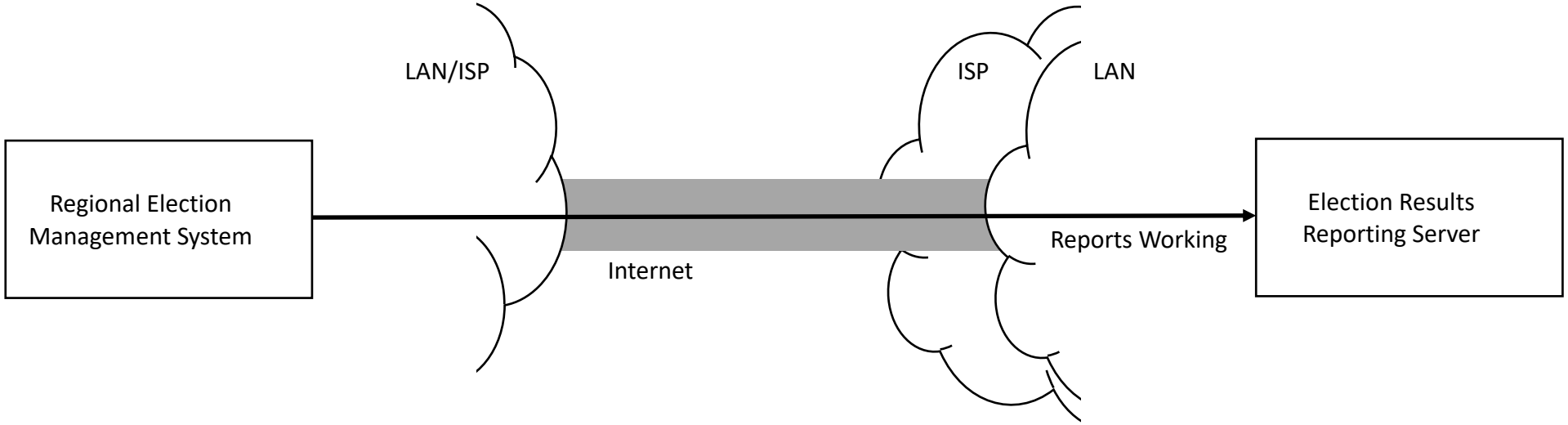
Twitter: @hashtag_cyber
LinkedIn: Edward Amoroso

Week 4: Threat-Vulnerability Analysis

Can You Stop DDOS Attacks?

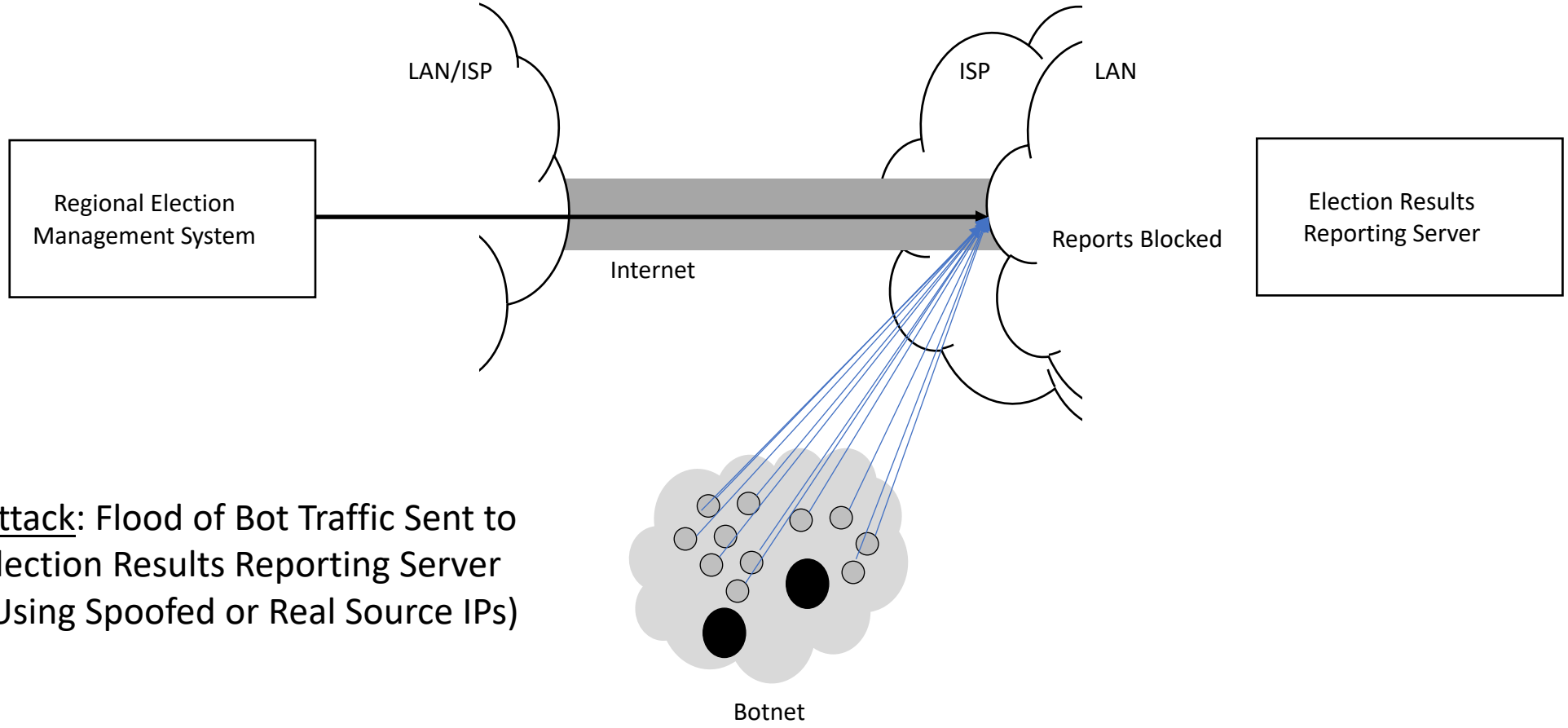
Week 3

Case Study: Mitigating Inbound Election Reporting DDOS



Week 3

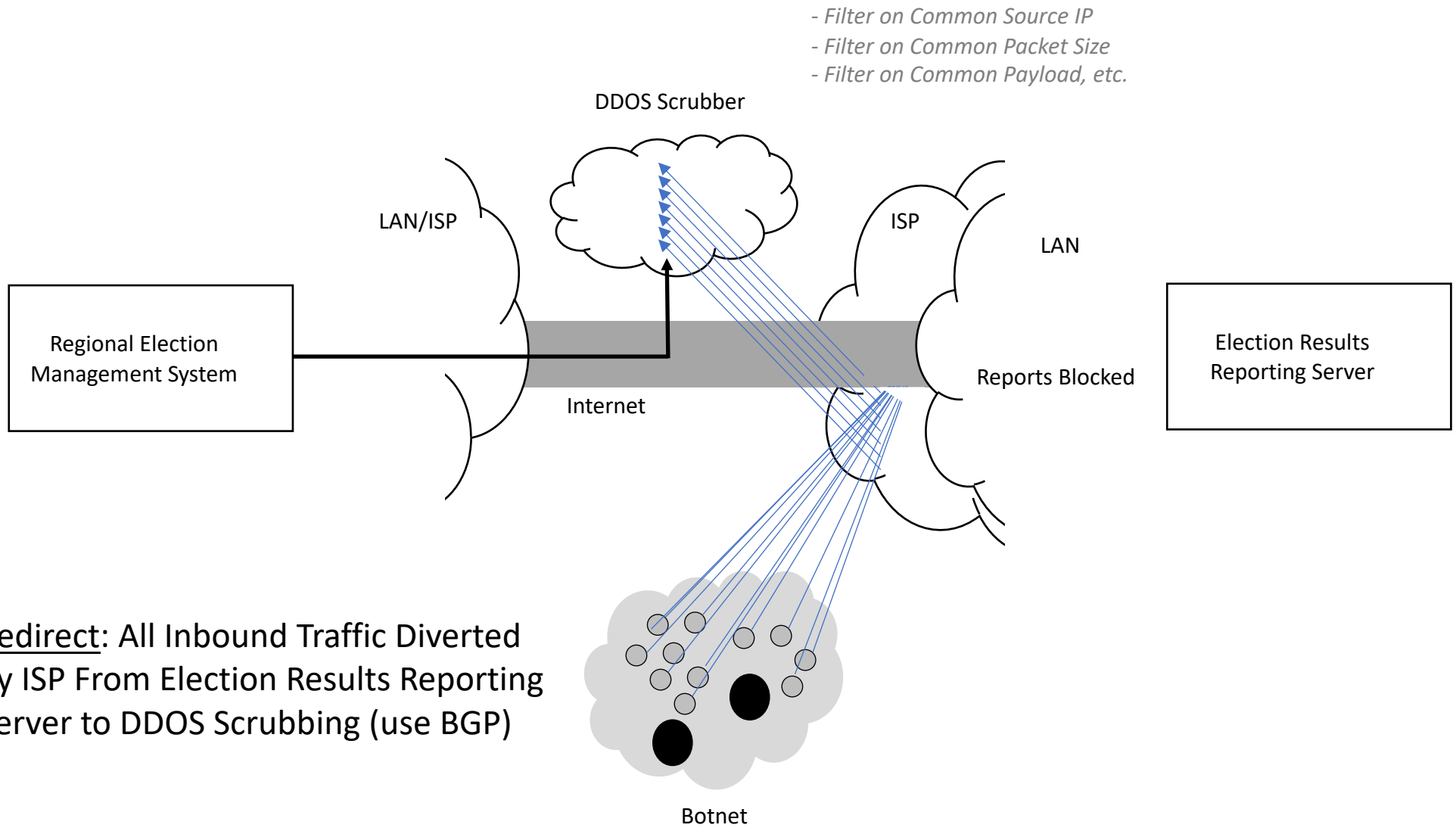
Case Study: Mitigating Inbound Election Reporting DDOS



Attack: Flood of Bot Traffic Sent to Election Results Reporting Server (Using Spoofed or Real Source IPs)

Week 3

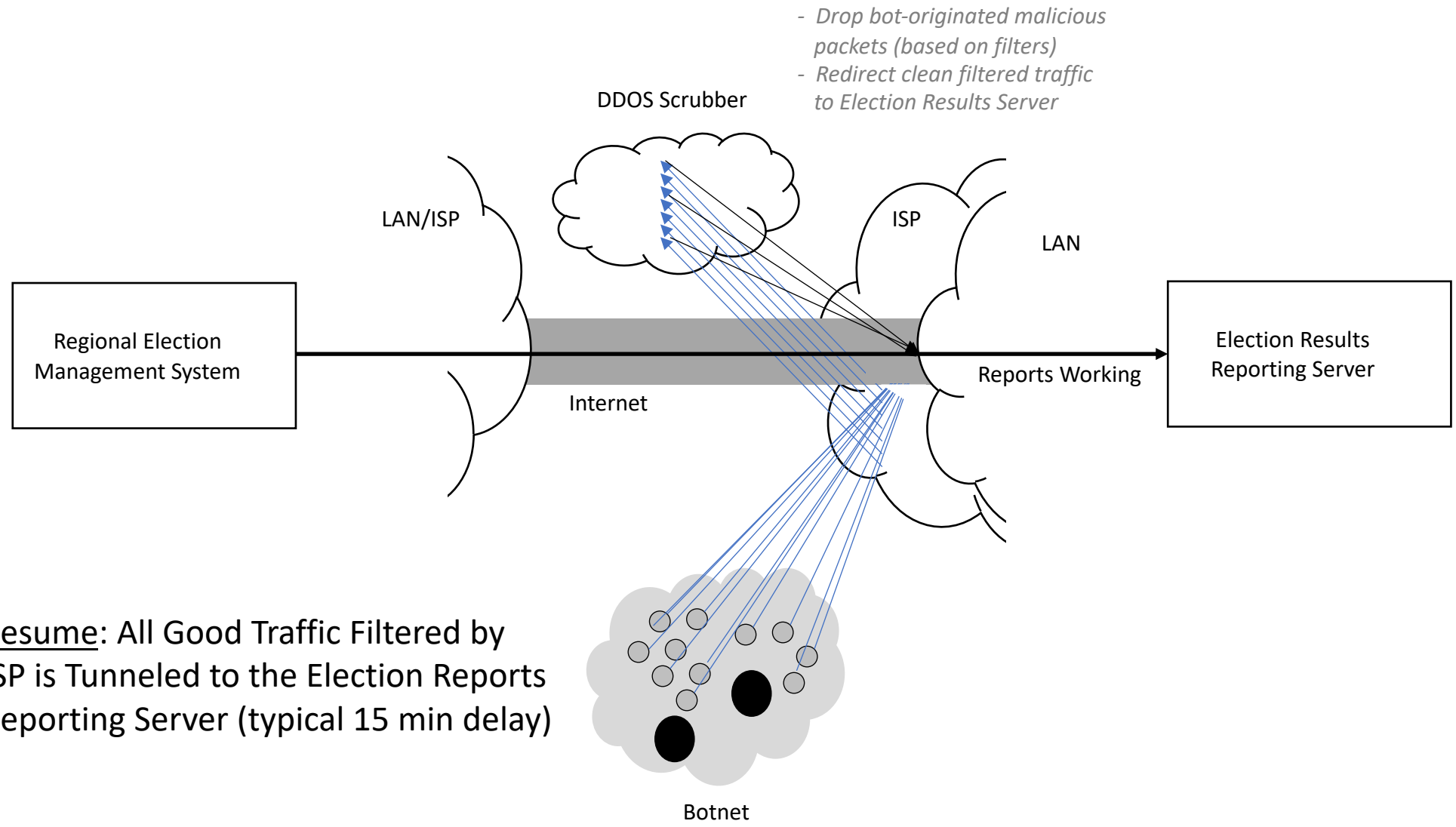
Case Study: Mitigating Inbound Election Reporting DDOS



Redirect: All Inbound Traffic Diverted by ISP From Election Results Reporting Server to DDOS Scrubbing (use BGP)

Week 3

Case Study: Mitigating Inbound Election Reporting DDOS



Resume: All Good Traffic Filtered by ISP is Tunneled to the Election Reports Reporting Server (typical 15 min delay)

What are the Foundational Issues in Cyber Security?

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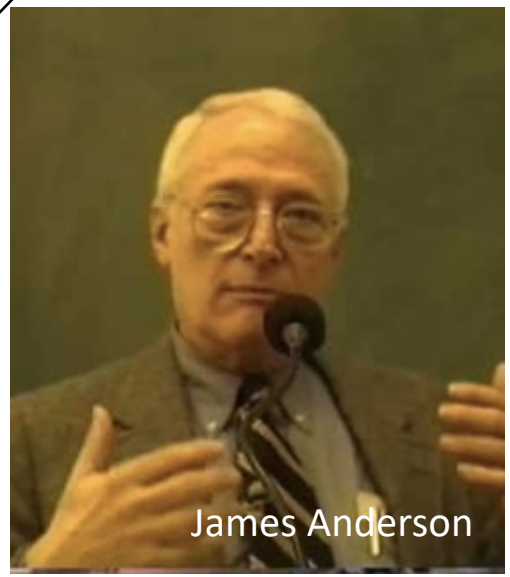

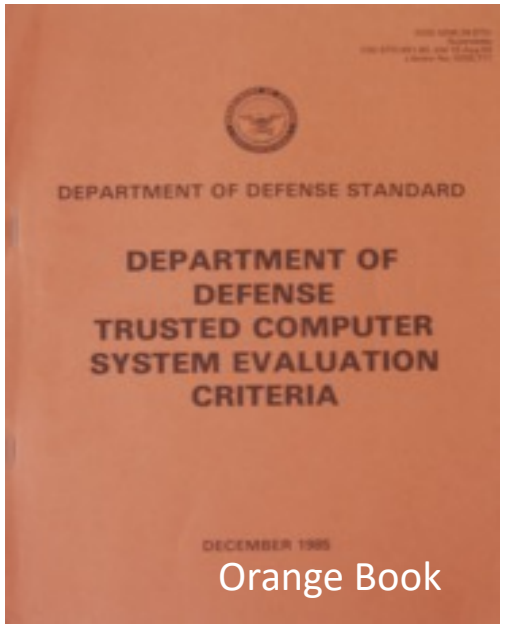

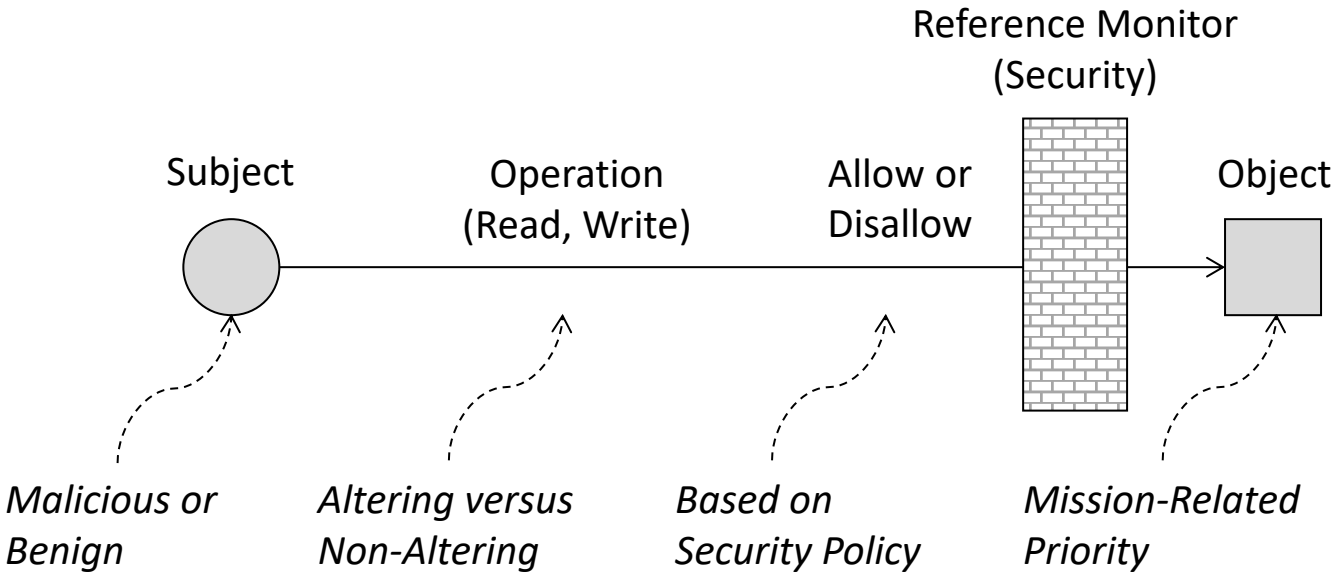

Cyber Security: Subject-Object Reference Model

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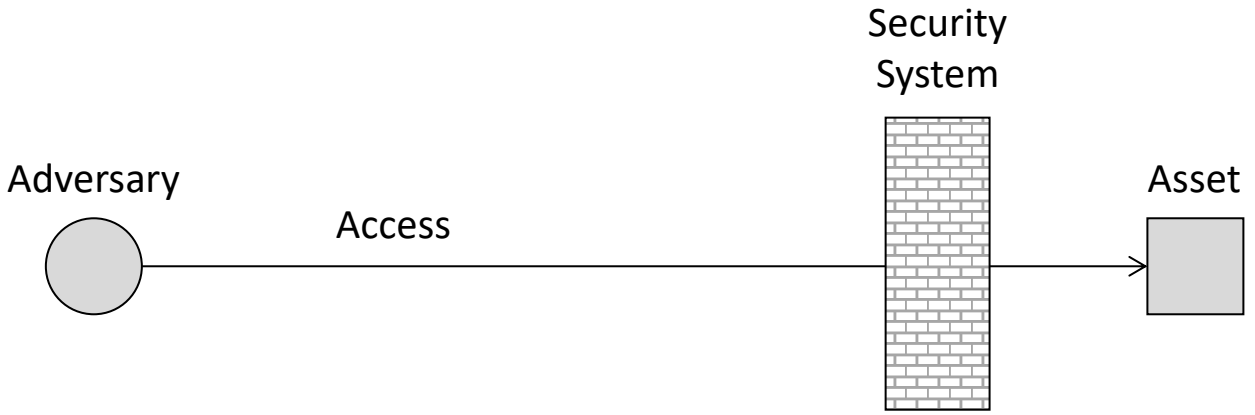

Cyber Security: Basic Operational Framework

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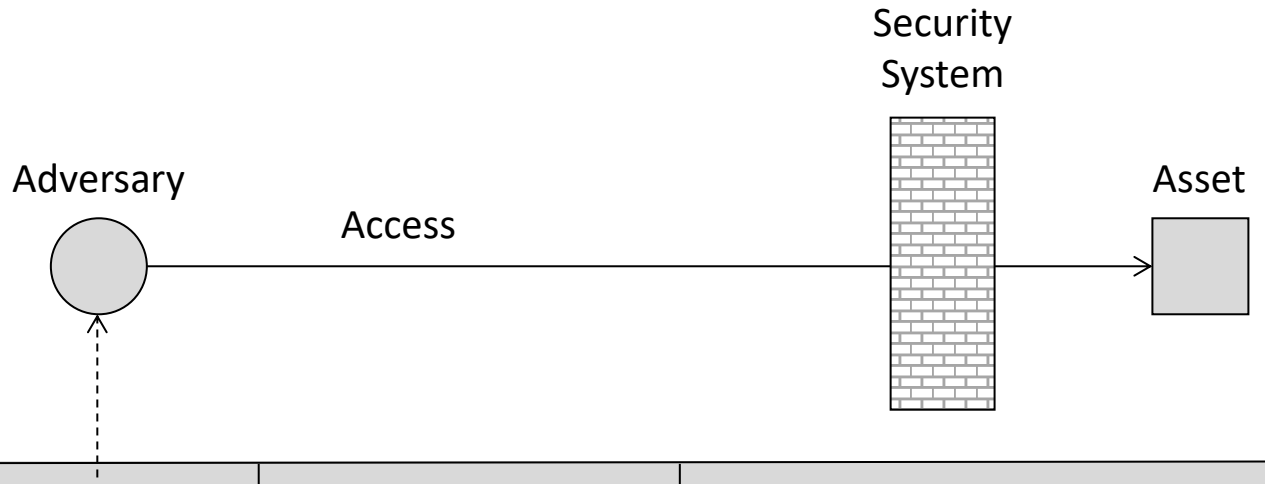


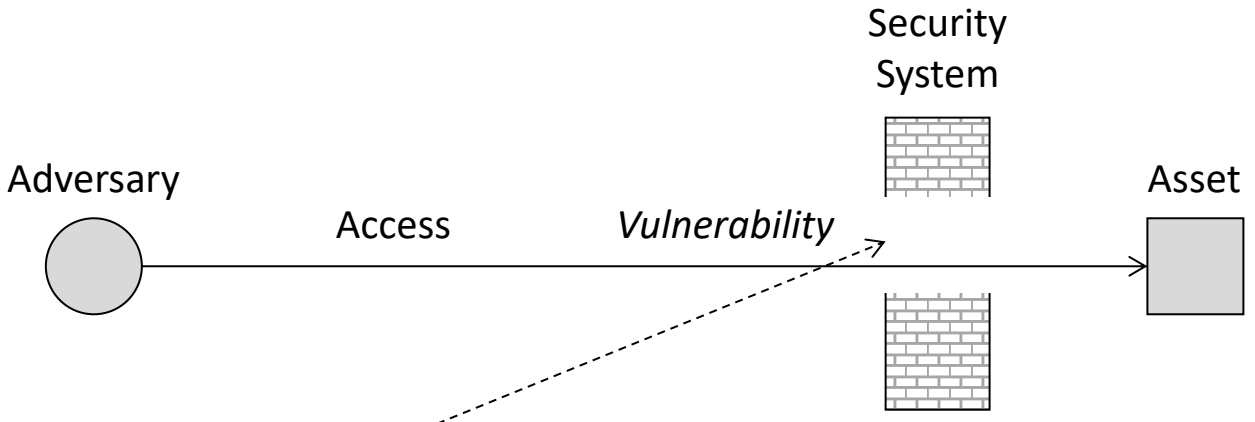
Incomplete List

Adversary Type	*Motivation*	*Defining Attributes*
Hacker	Mischief	Individually Capable, Predictable
Hacktivist	Anger	Group Capable, Unpredictable
Criminal	Greed	Well Funded, Financial Motivation
Nation-State	Dominance	World Class Capability and Support

Cyber Security: Adversary Types

Week 4

Week 4



Incomplete List

Vulnerability Type	*Root Cause*	*Defining Attributes*
System Flaw	Complexity	Insufficient design, test, build, operate
Lack of Security	Budget	Attention not paid to proper protection
Human Actions	Ignorance	Lack of security awareness and training
Organizational	Irresponsibility	Inadequate staff, procedures, and process

Cyber Security: Vulnerability Types

Week 4

HELPNETSECURITY

TOP 10 MOST EXPLOITED VULNERABILITIES FROM 2020

1. CVE-2020-0796: Windows SMBv3 Client/Server Remote Code Execution Vulnerability (codename: *SMBGhost*)

2. CVE-2020-5902: F5 Networks BIG-IP TMUI RCE vulnerability

3. CVE-2020-1472: Microsoft Netlogon Elevation of Privilege (codename: *Zerologon*)

4. CVE-2020-0601: Windows CryptoAPI Spoofing Vulnerability (codename: *CurveBall*)

5. CVE-2020-14882: Oracle WebLogic Server RCE

6. CVE-2020-1938: Apache Tomcat AJP File Read/Inclusion Vulnerability (codename: *GhostCat*)

7. CVE-2020-3452: Cisco ASA and Firepower Path Traversal Vulnerability

8. CVE-2020-0688: Microsoft Exchange Server Static Key Flaw Could Lead to Remote Code Execution

9. CVE-2020-16898: Windows TCP/IP Vulnerability (codename: *Bad Neighbor*)

10. CVE-2020-1350: Critical Windows DNS Server RCE (codename: *SIGRed*)

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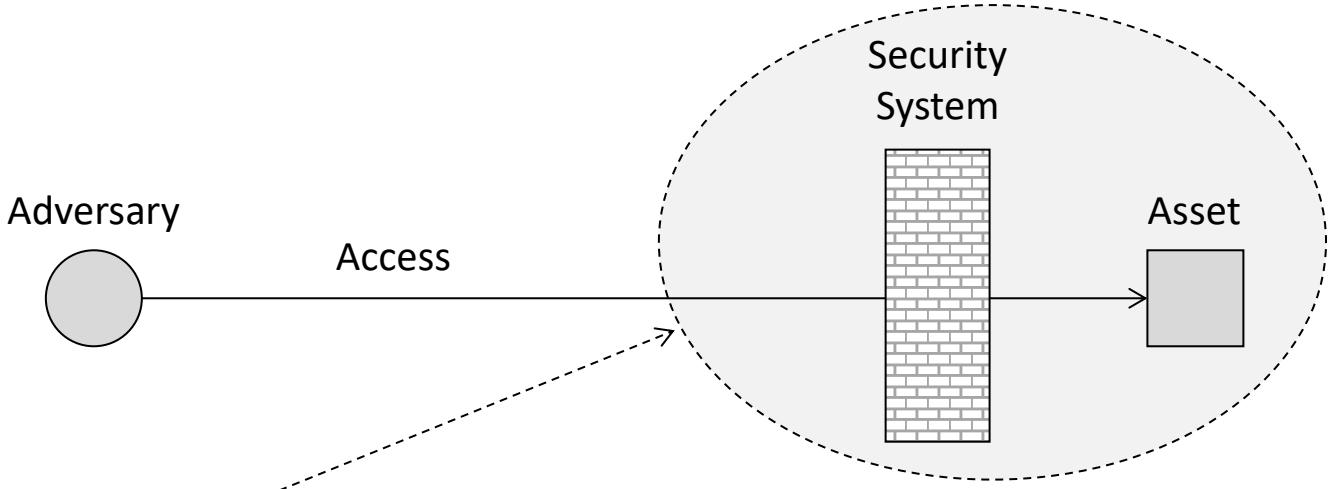


Threat Type	*Motivation*	*Defining Attributes*
Disclosure	Secrets	Personal and Business Information
Integrity	Degradation	Remote Operational Control/Change
Denial of Service	Disruption	Distributed Botnet Attacks Common
Theft/Fraud	Money/Goods	Ingenious and Clever Means for Theft

Complete List

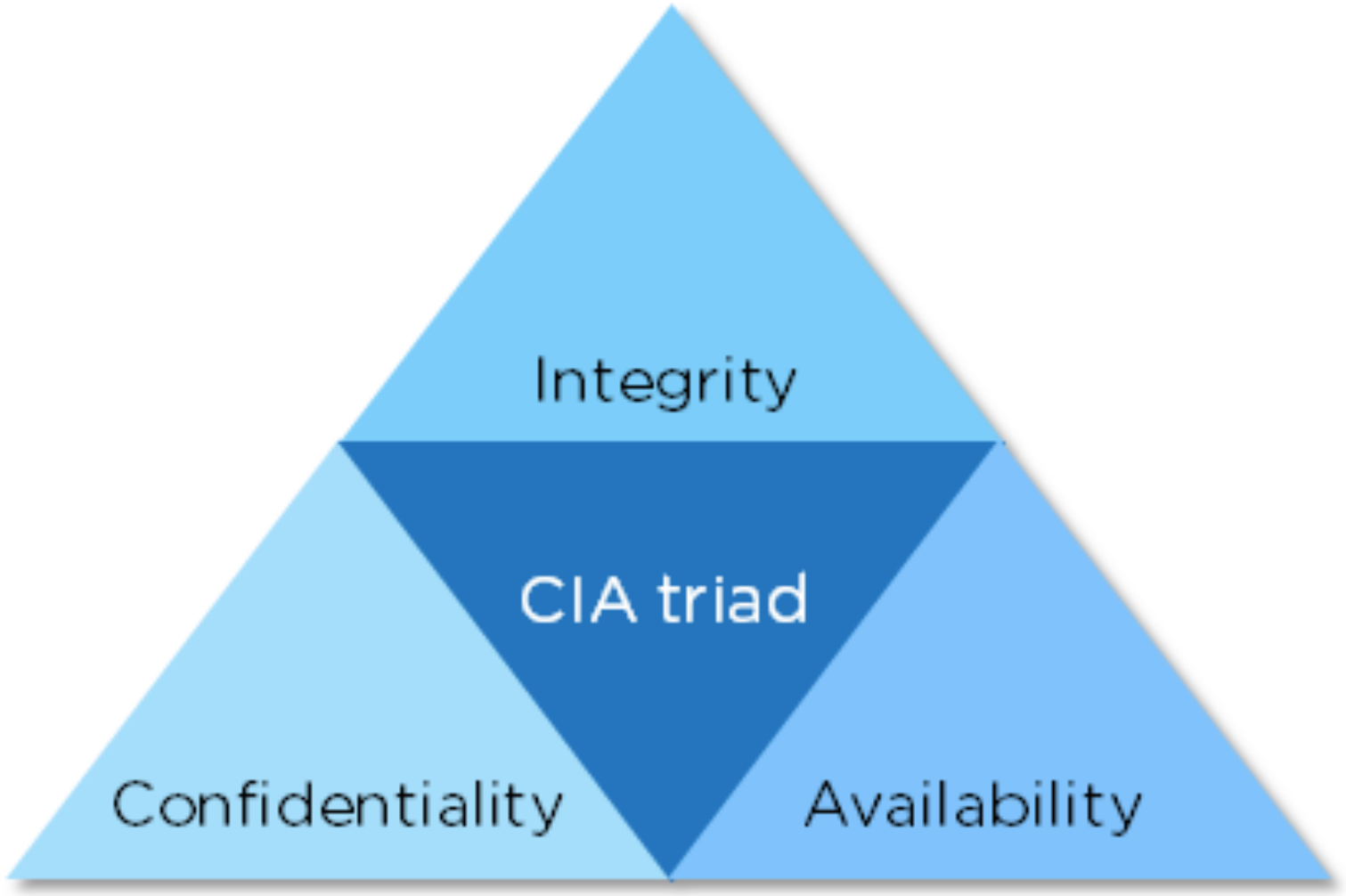
Cyber Security: Threat Types

What Cyber Security Definitions Should I Memorize?

Week 4

Def: <u>Assets</u> – Resources required for organization to meet its mission.

Week 4



Def: <u>Threats</u> – Malicious outcomes levied against assets.

Week 4

Def: <u>Confidentiality Threat</u> – Information disclosed to unauthorized parties.

Week 4

Def: <u>Privacy Threat</u> – *Personal information* disclosed to unauthorized parties.

Week 4

Def: <u>Integrity Threat</u> – Asset maliciously altered (includes destroyed).

Week 4

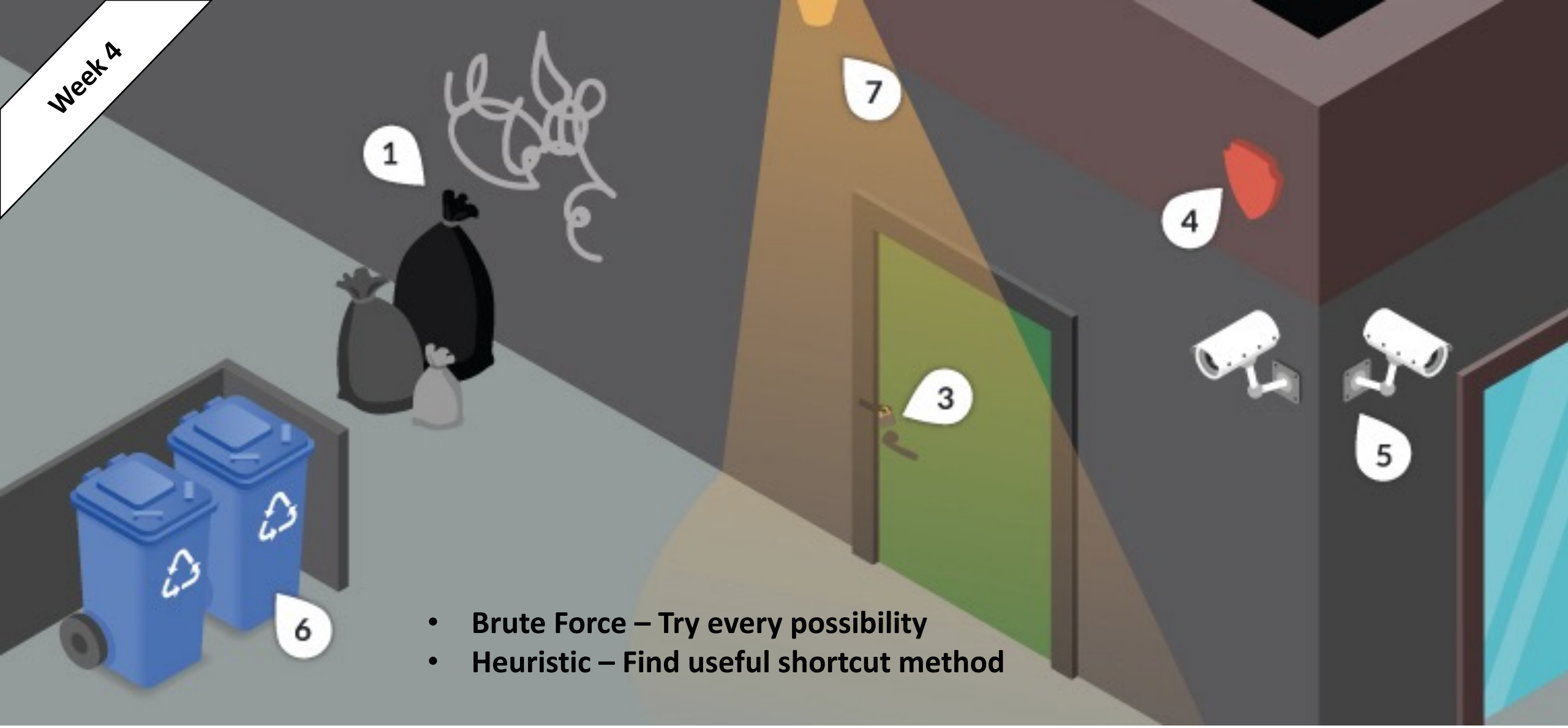
Def: <u>Availability Threat</u> – Asset maliciously blocked from authorized use.

Week 4

Def: <u>Theft/Fraud</u> – Stealing service or product without paying.

Week 4

Def: <u>Vulnerability</u> – System bug or attribute that can be maliciously exploited.



Def: <u>Attack</u> – Sequence of steps to exploit a vulnerability.

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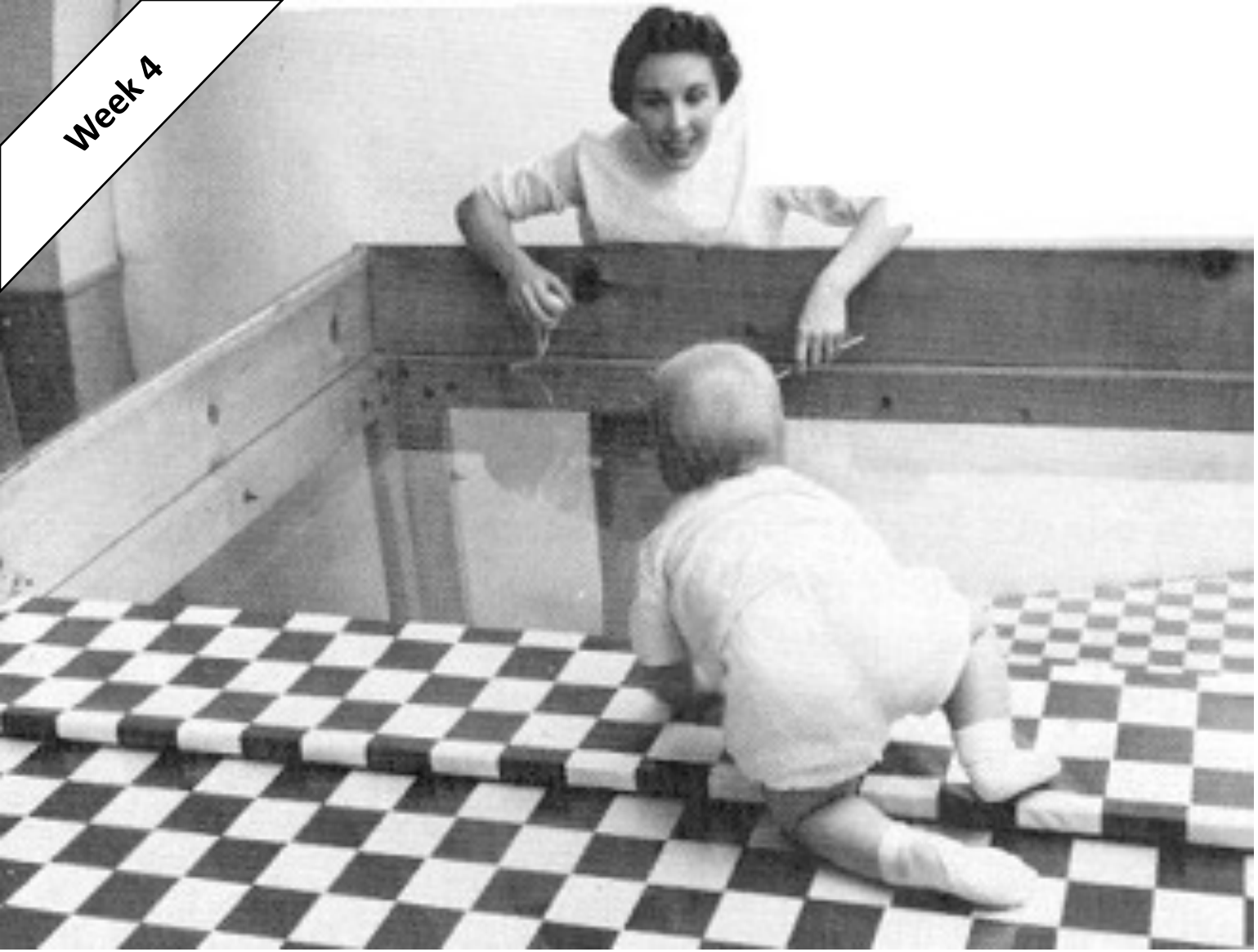

Risk (R) equals
Probability (P) of Threat
times
Consequence (C) of Threat

R = P * C

Def: <u>Risk</u> – Probability “Times” Consequence

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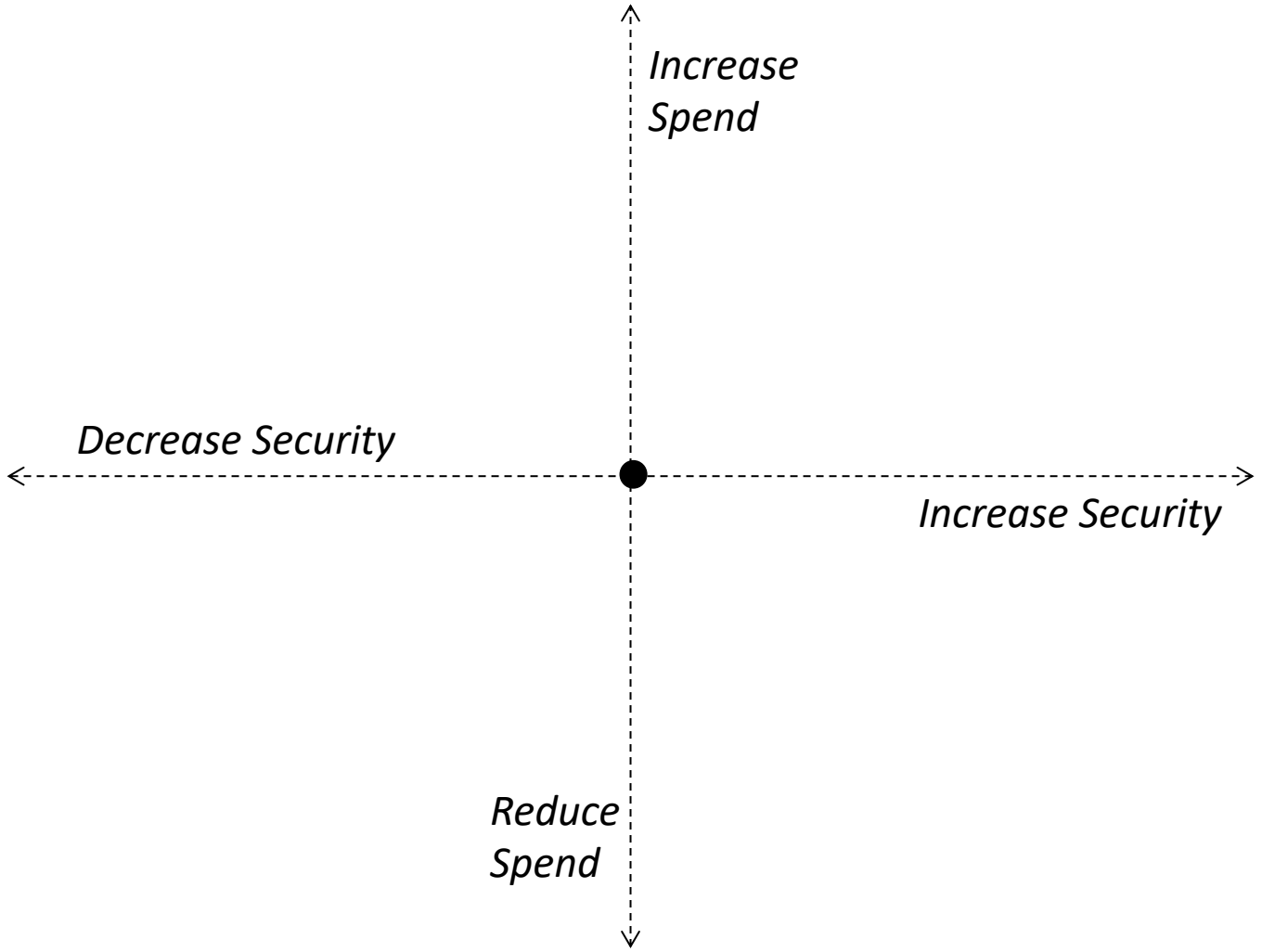
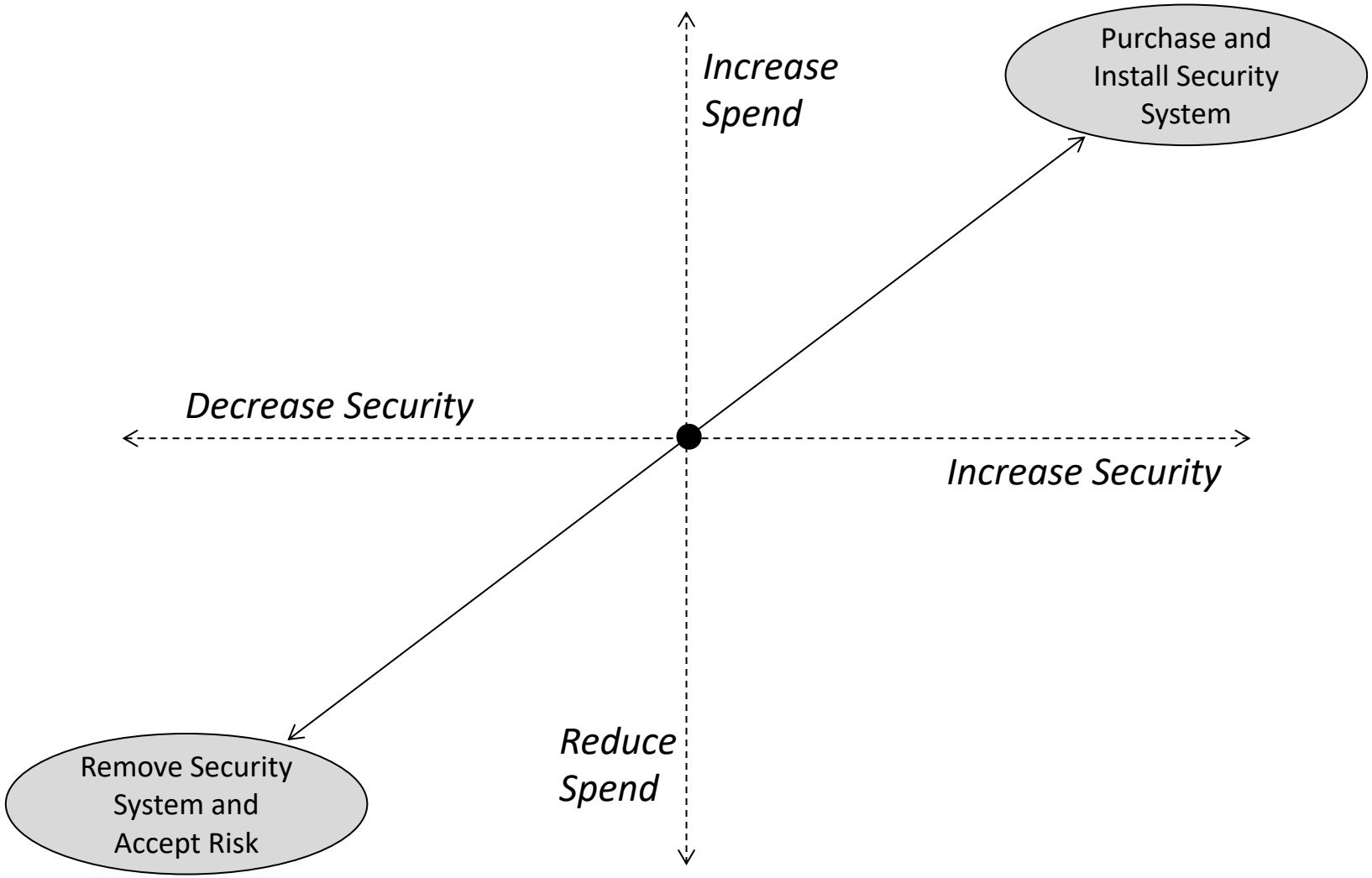


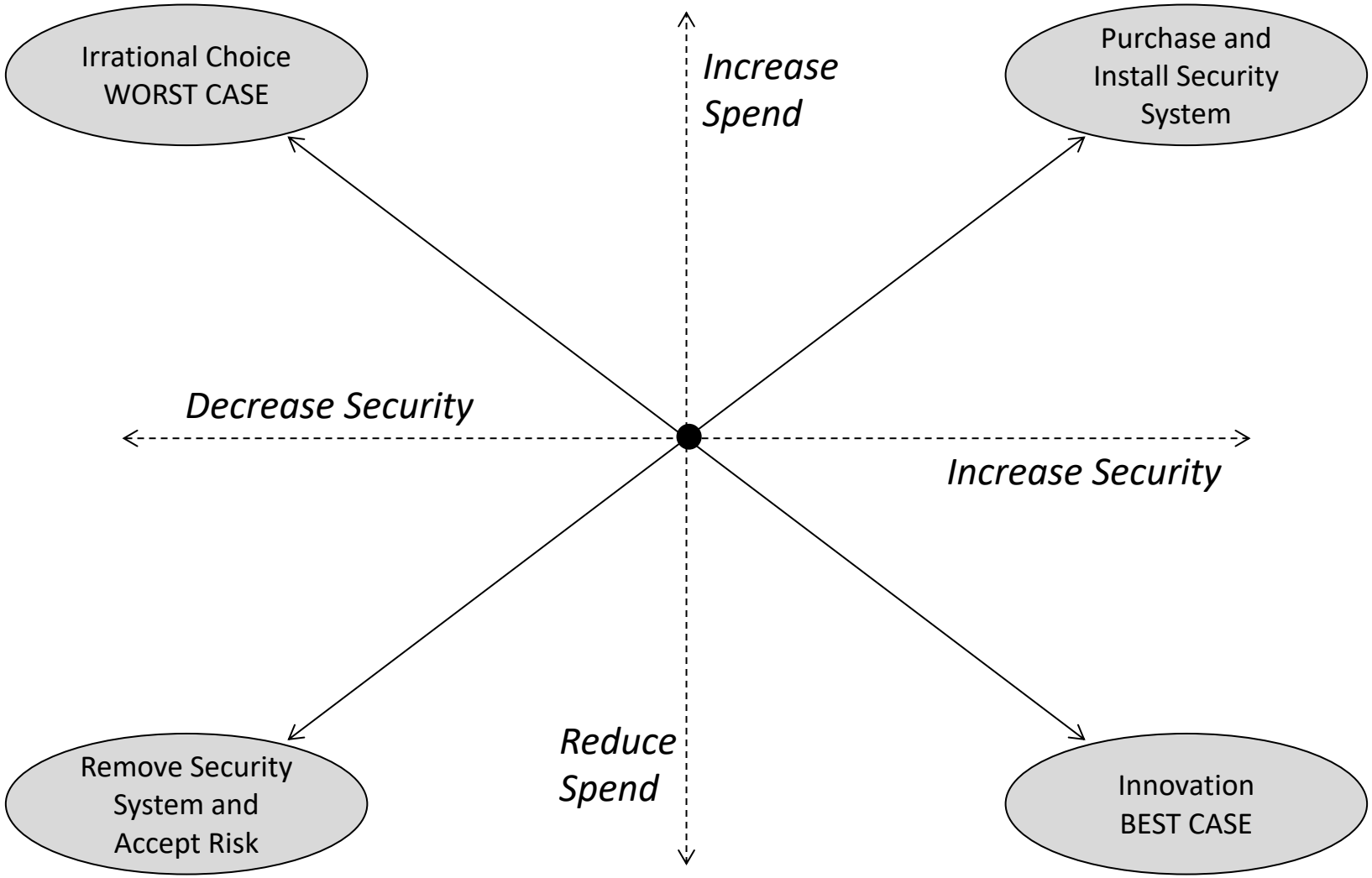
Security Risk Assessment – Decision Framework

Week 4



Security Risk Assessment – Decision Framework

Week 4



Security Risk Assessment – Decision Framework

Week 4

FAIR Model – Security Risk Assessment

How Are Assets Prioritized?

Week 4

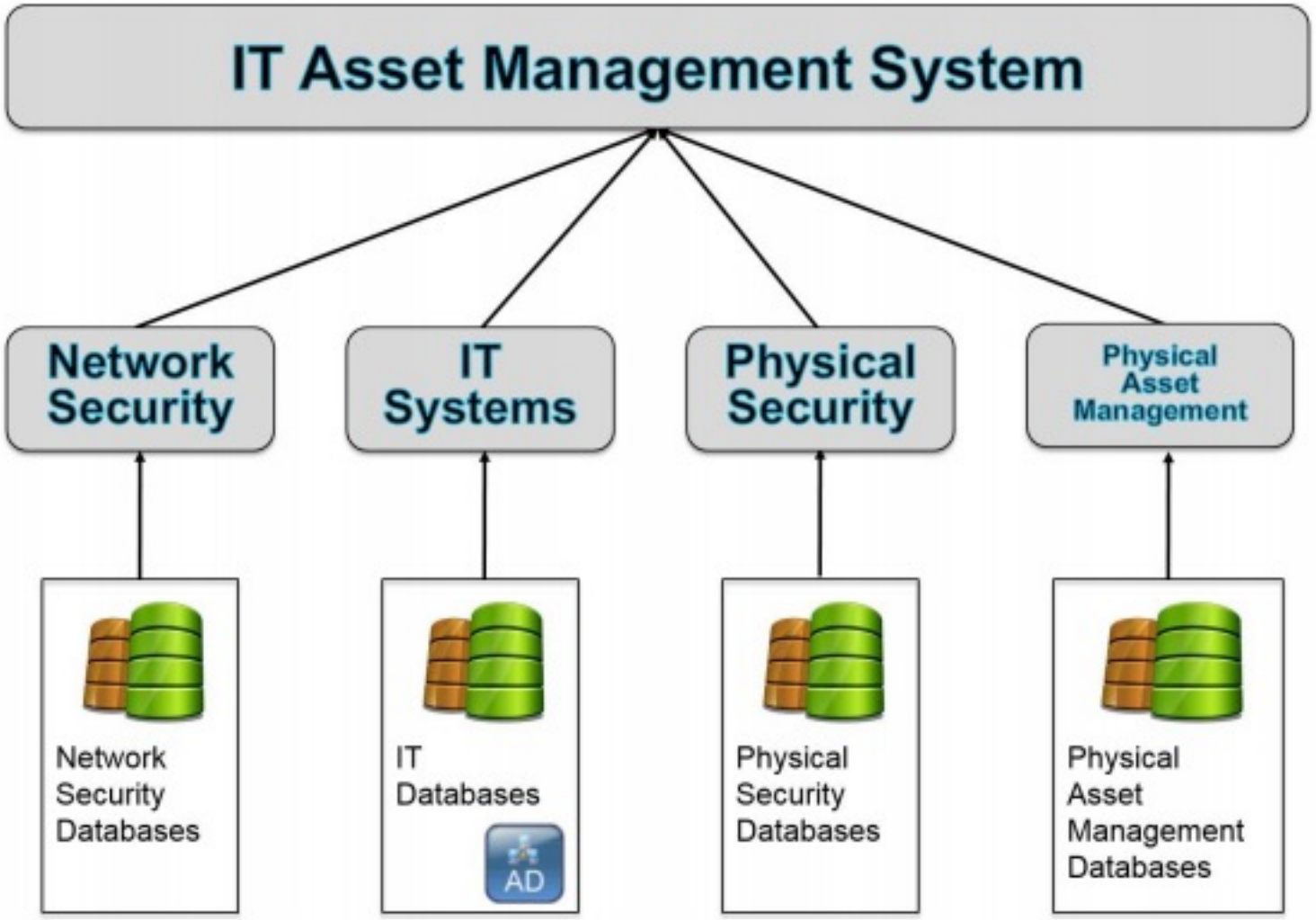
Illustrating Tiered Prioritization of Assets

Week 4

Illustrating Tiered Prioritization of Assets

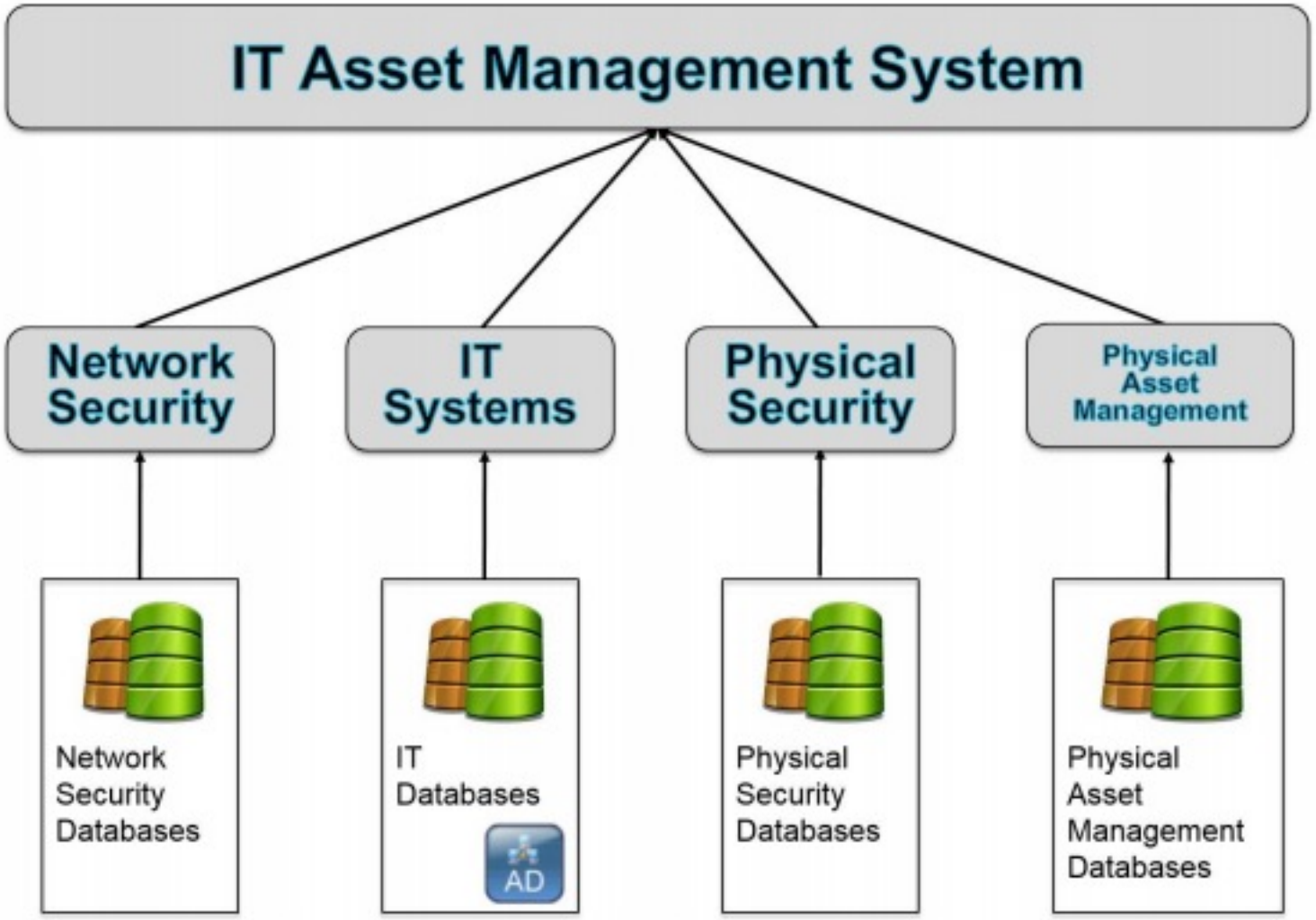
- ☑ Replaceability
- ☑ Convenience
- ☑ Sensitivity
- ☑ Emotion
- ☑ Dependence
- ☑ Liability
- ☑ Stewardship
- ☑ Finance
- ☑ Preference

Week 4



NIST IT Asset Management System Model

Week 4



NIST IT Asset Management System Model

- ☑ Replaceability
- ☑ Convenience
- ☑ Sensitivity
- ☑ Emotion
- ☑ Dependence
- ☑ Liability
- ☑ Stewardship
- ☑ Finance
- ☑ Preference

What is a Threat Asset Matrix?
(Hint: It is Your Midterm Assignment)

Week 4

Attack tree

From Wikipedia, the free encyclopedia

This article **needs additional citations for verification**. Please help improve this article by adding citations to reliable sources. Unsourced material may be challenged and removed.

Find sources: "Attack tree" – news · newspapers · books · scholar · JSTOR *(April 2012) (Learn how and when to remove this template message)*

Attack trees are conceptual diagrams showing how an asset, or target, might be attacked. Attack trees have been used in a variety of applications. In the field of information technology, they have been used to describe threats on computer systems and possible attacks to realize those threats. However, their use is not restricted to the analysis of conventional information systems. They are widely used in the fields of defense and aerospace for the analysis of threats against tamper resistant electronics systems (e.g., avionics on military aircraft).[1] Attack trees are increasingly being applied to computer control systems (especially relating to the electric power grid).[2] Attack trees have also been used to understand threats to physical systems.

Some of the earliest descriptions of attack trees are found in papers and articles by Bruce Schneier,[3] when he was CTO of Counterpane Internet Security. Schneier was clearly involved in the development of attack tree concepts and was instrumental in publicizing them. However, the attributions in some of the early publicly available papers on attack trees[4] also suggest the involvement of the National Security Agency in the initial development.

Attack trees are very similar, if not identical, to *threat trees*. Threat trees were discussed in 1994 by Edward Amoroso.[5]

Week 4


MISSILE DEFENSE AGENCY
The Ballistic Missile Defense System
SENSORS
An effective layered defense incorporates a wide-range of sensors to detect and track threat missiles through all phases of their trajectory. Satellites and a family of land- and sea-based radars provide worldwide sensor coverage.
SATELLITE SURVEILLANCE
FORWARD-BASED RADAR
UPGRADED EARLY WARNING RADAR
AEGIS BMD SPY-1 RADAR
SEA-BASED X-BAND RADAR
LONG RANGE DISCRIMINATION RADAR
BOOST/ASCENT Defense Segment
MIDCOURSE Defense Segment
TERMINAL Defense Segment
Potential New Technologies
SM-3 Standard Missile-3
AEGIS Ballistic Missile Defense
AEGIS ASHORE
Vertical Launch System
Deckhouse
EKV Exoatmospheric Kill Vehicle
GBI Ground-Based Interceptor
GMD Ground-Based Midcourse Defense
SM-3 Standard Missile-3
AEGIS Sea-Based Terminal
THAAD Terminal High Altitude Area Defense
PAC-3 Patriot Advanced Capability-3
THE SYSTEM OF ELEMENTS
C2BMC Command and Control, Battle Management, and Communications
The Command and Control, Battle Management, and Communications (C2BMC) program is the hub of the Ballistic Missile Defense System (BMDS). It is a vital operational system that enables the U.S. President, Secretary of Defense and Combatant Commanders at strategic, regional and operational levels to systematically plan ballistic missile defense operations, to collectively see the battle develop, and to dynamically manage designated networked sensors and weapons systems to achieve global and regional mission objectives.
NMCC
USSTRATCOM
USNORTHCOM
USPACOM
USEUCOM
USCENTCOM

Week 4

	Threat 1	Threat 2	. . .	Threat m	*List the threats (Probably CIA)*
Asset 1					
Asset 2					
.					
.					
.					
Asset n					
List the assets (Based on mission)					

Developing a Threat-Asset Matrix

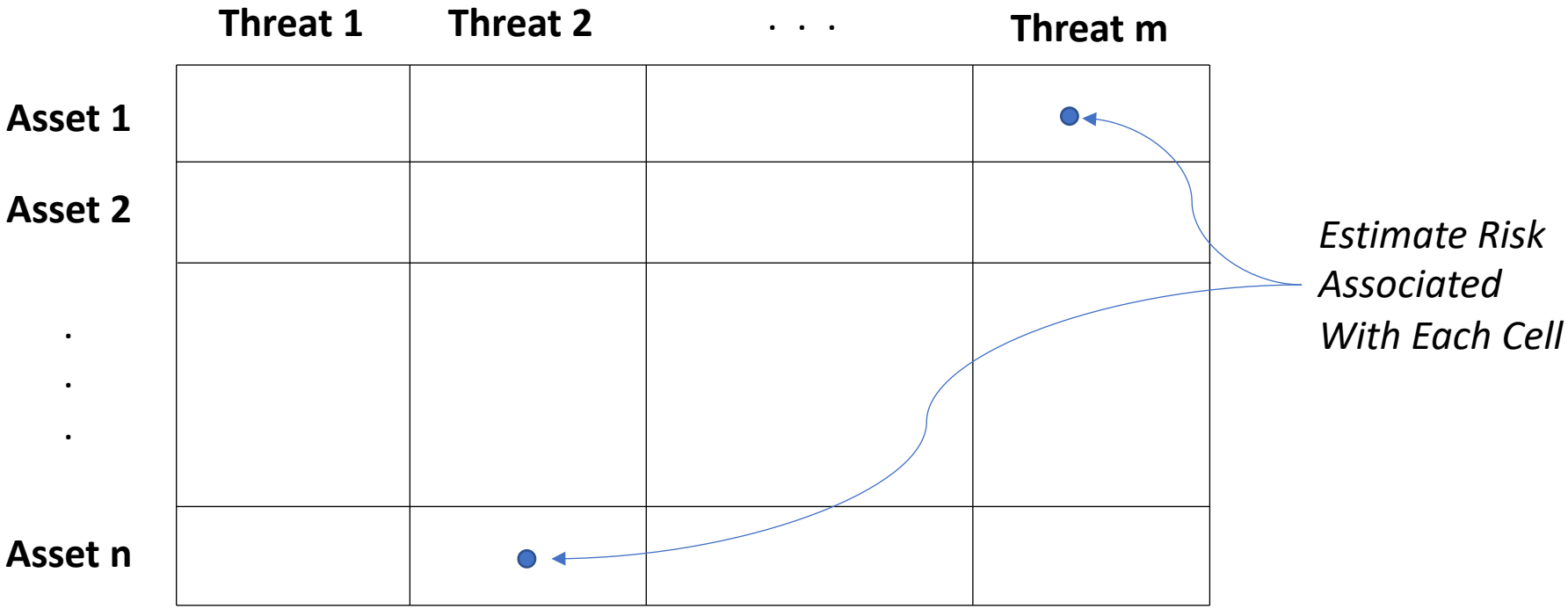
Week 4

Developing a Threat-Asset Matrix

	Threat 1	Threat 2	. . .	Threat m
Asset 1				
Asset 2				
. . .				
Asset n				

Create (m x n) Matrix of Threat-Asset Pairs

Week 4



Developing a Threat-Asset Matrix

Week 4

Developing a Threat-Asset Matrix

	Confidentiality	Integrity	Availability
Hardware			P = 3, 2, 1 C = 3, 2, 1 R = P * C
Software			
Information			

Estimate probability P and consequence C on simple scale (3, 2, 1)

Week 4

Developing a Threat-Asset Matrix

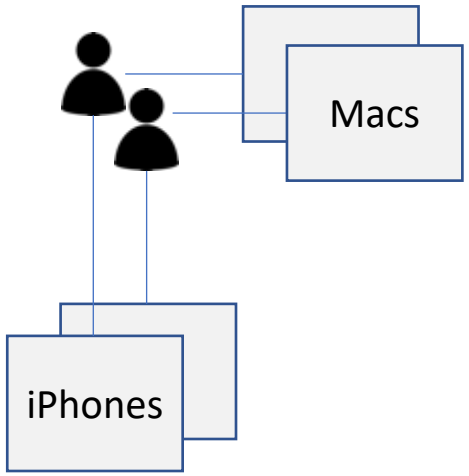
	Confidentiality	Integrity	Availability
Hardware	P = 3, 2, 1 C = 3, 2, 1 R = P * C	P = 3, 2, 1 C = 3, 2, 1 R = P * C	P = 3, 2, 1 C = 3, 2, 1 R = P * C
Software	P = 3, 2, 1 C = 3, 2, 1 R = P * C	P = 3, 2, 1 C = 3, 2, 1 R = P * C	P = 3, 2, 1 C = 3, 2, 1 R = P * C
Information	P = 3, 2, 1 C = 3, 2, 1 R = P * C	P = 3, 2, 1 C = 3, 2, 1 R = P * C	P = 3, 2, 1 C = 3, 2, 1 R = P * C

Perform risk estimates one-by-one for entire threat-asset matrix

Week 4

Case Study: Manage and Secure Assets for ACME Software-R-Us Inc.

Week 4



Case Study: Manage and Secure Assets for ACME Software-R-Us Inc.

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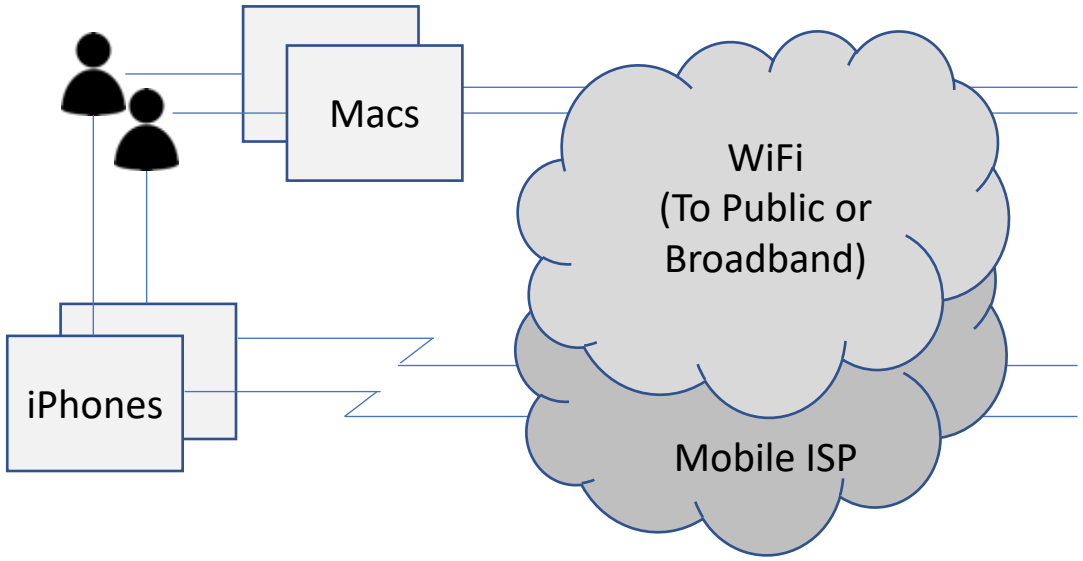

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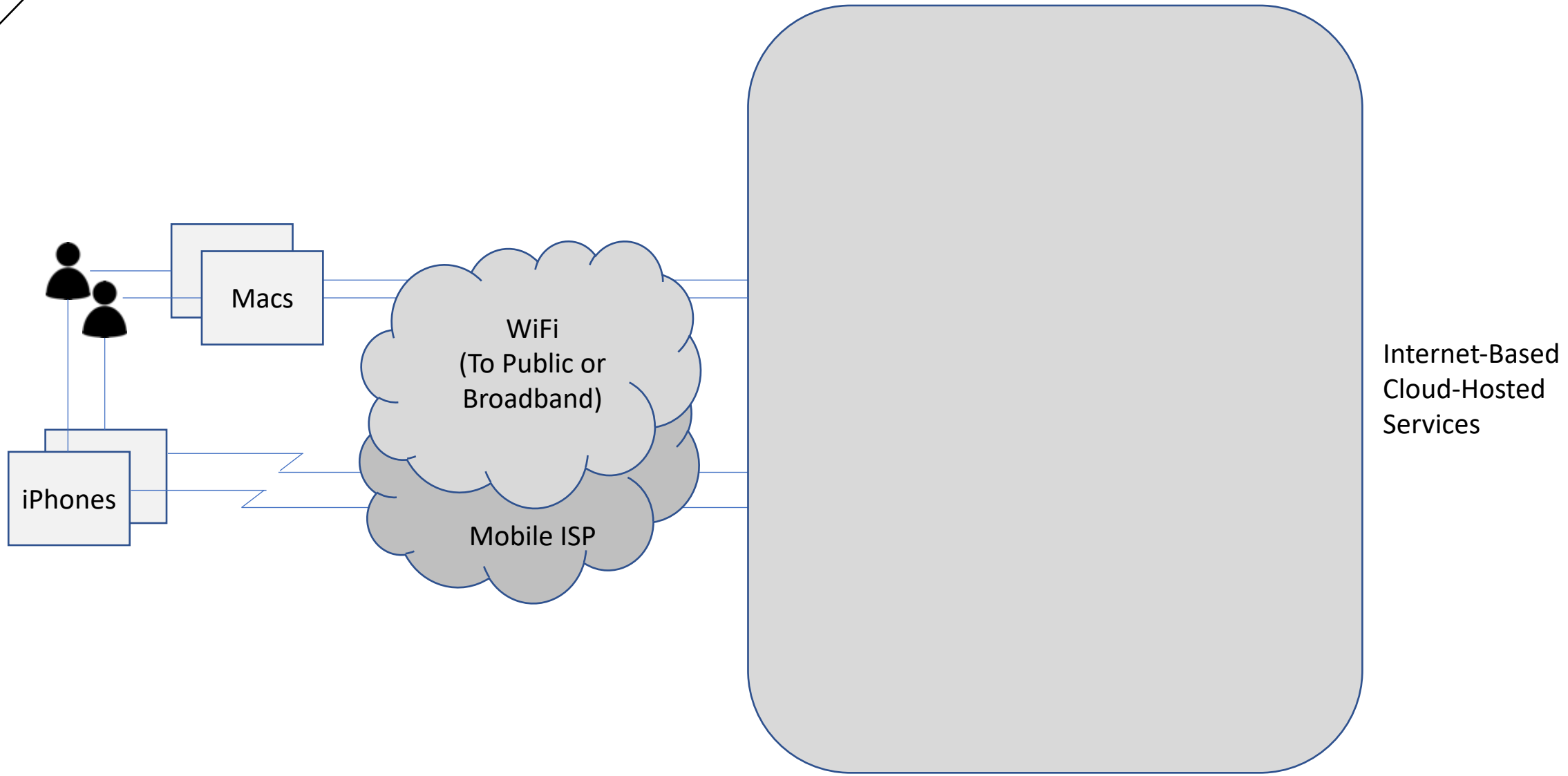

Case Study: Manage and Secure Assets for ACME Software-R-Us Inc.

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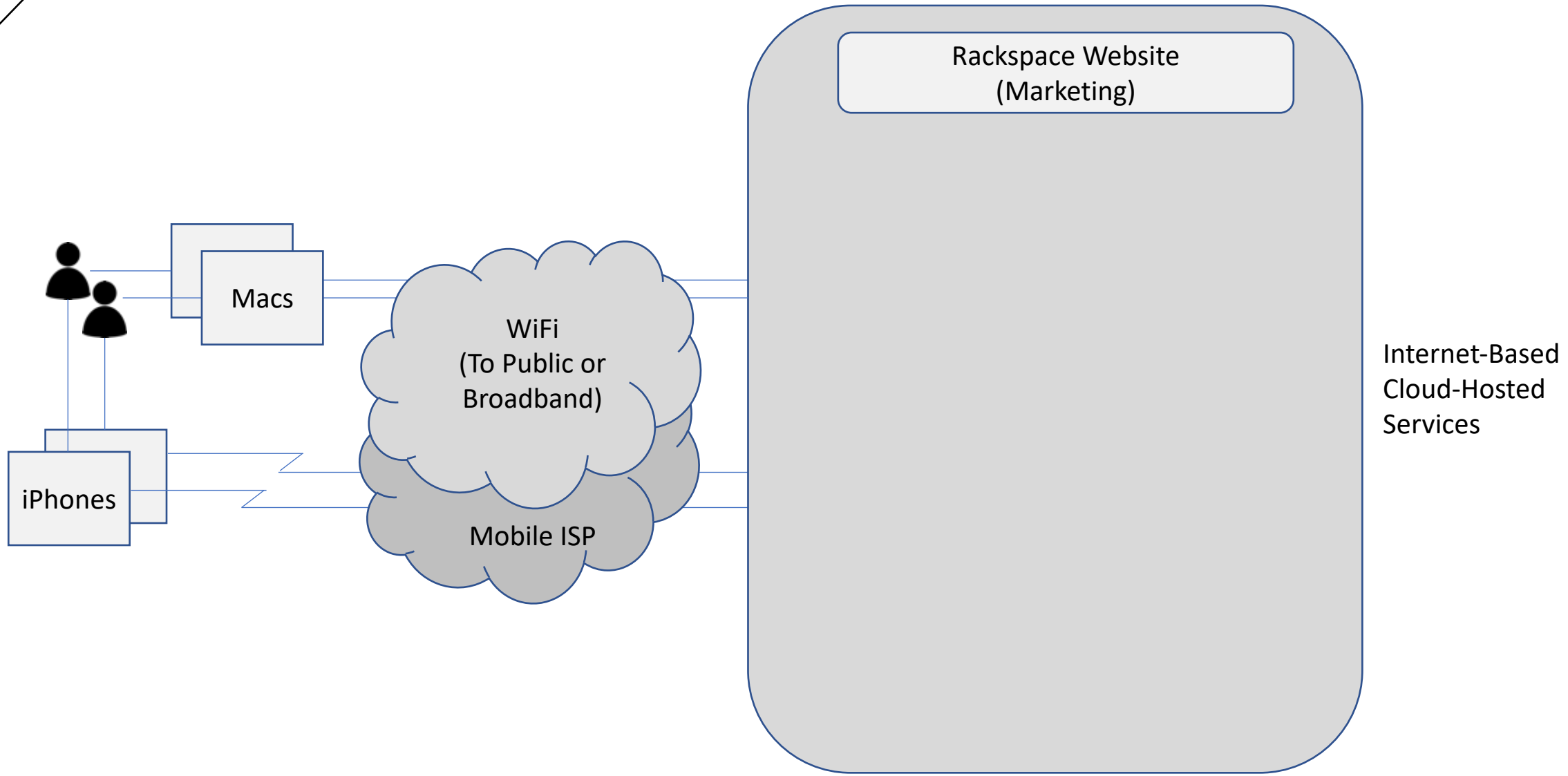
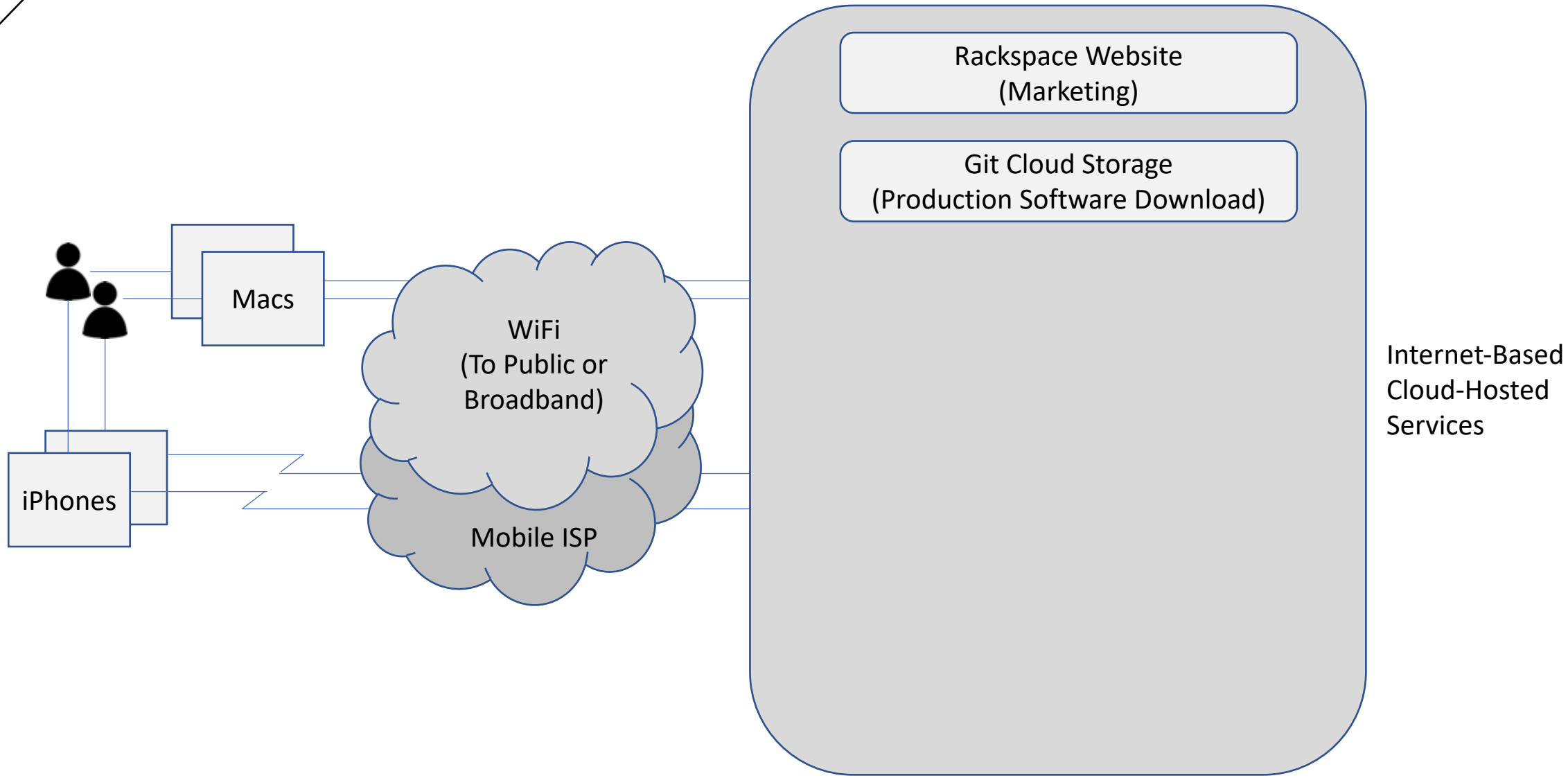


Case Study: Manage and Secure Assets for ACME Software-R-Us Inc.

Week 4



Case Study: Manage and Secure Assets for ACME Software-R-Us Inc.

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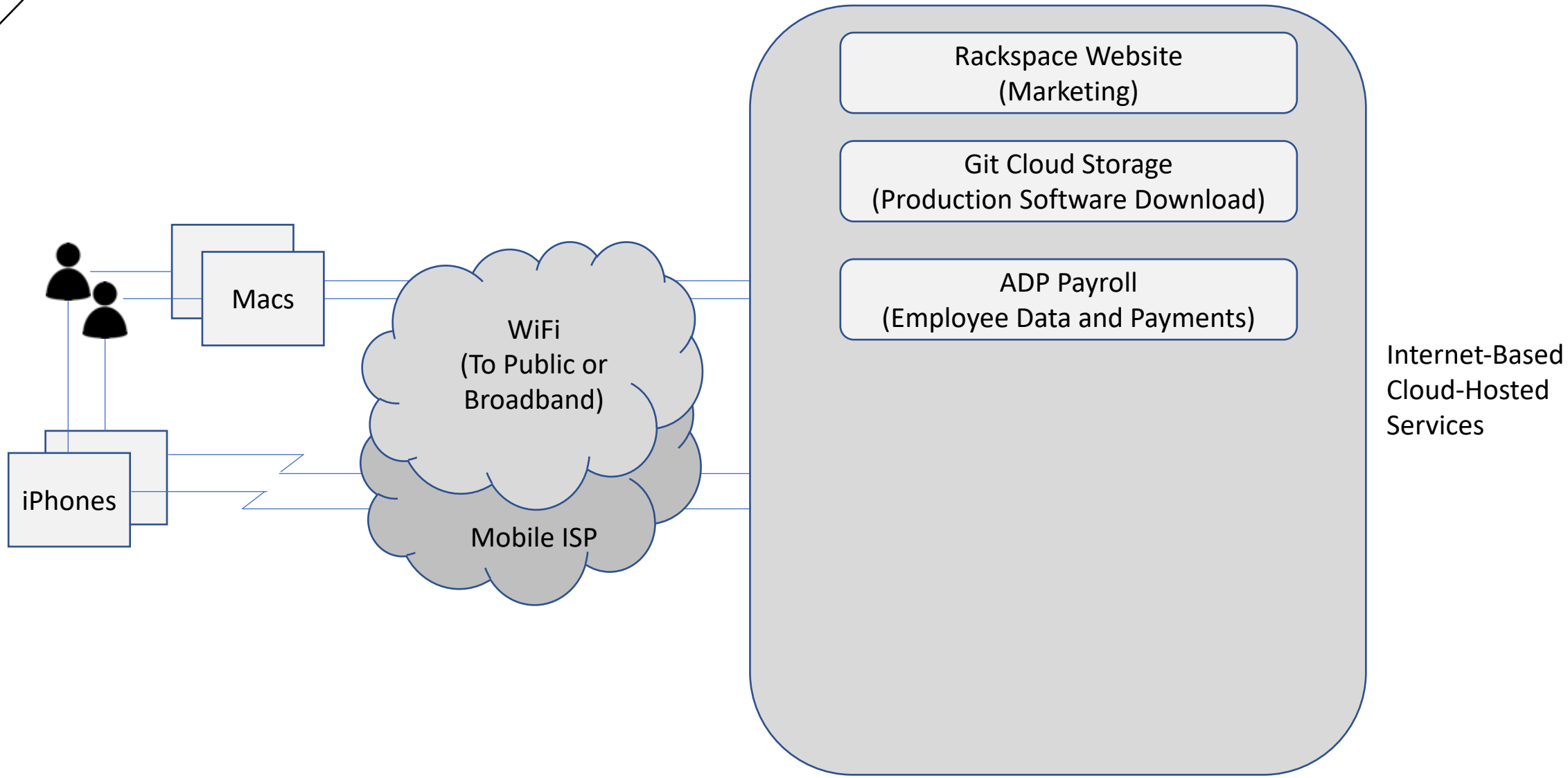

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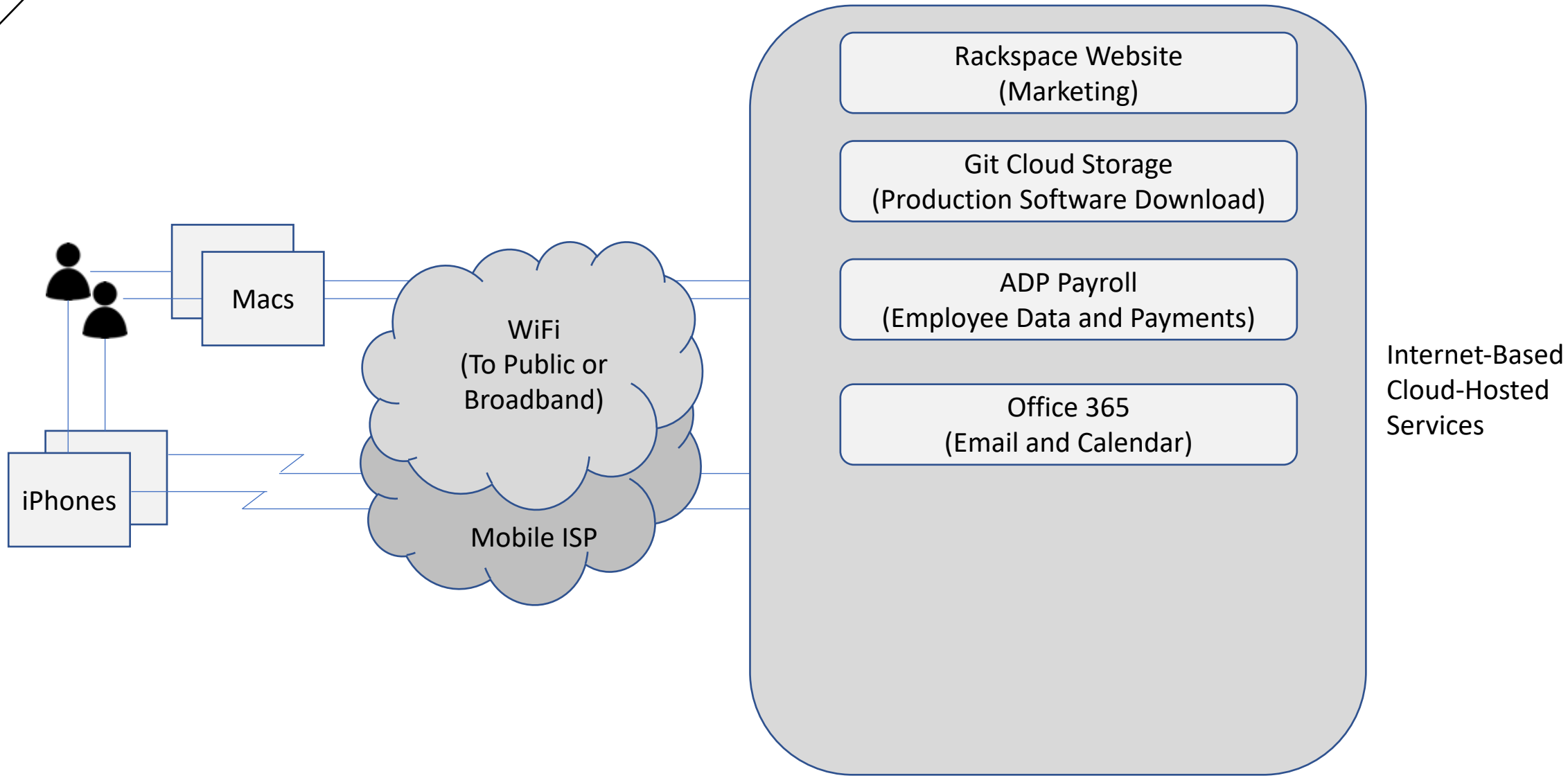

Case Study: Manage and Secure Assets for ACME Software-R-Us Inc.

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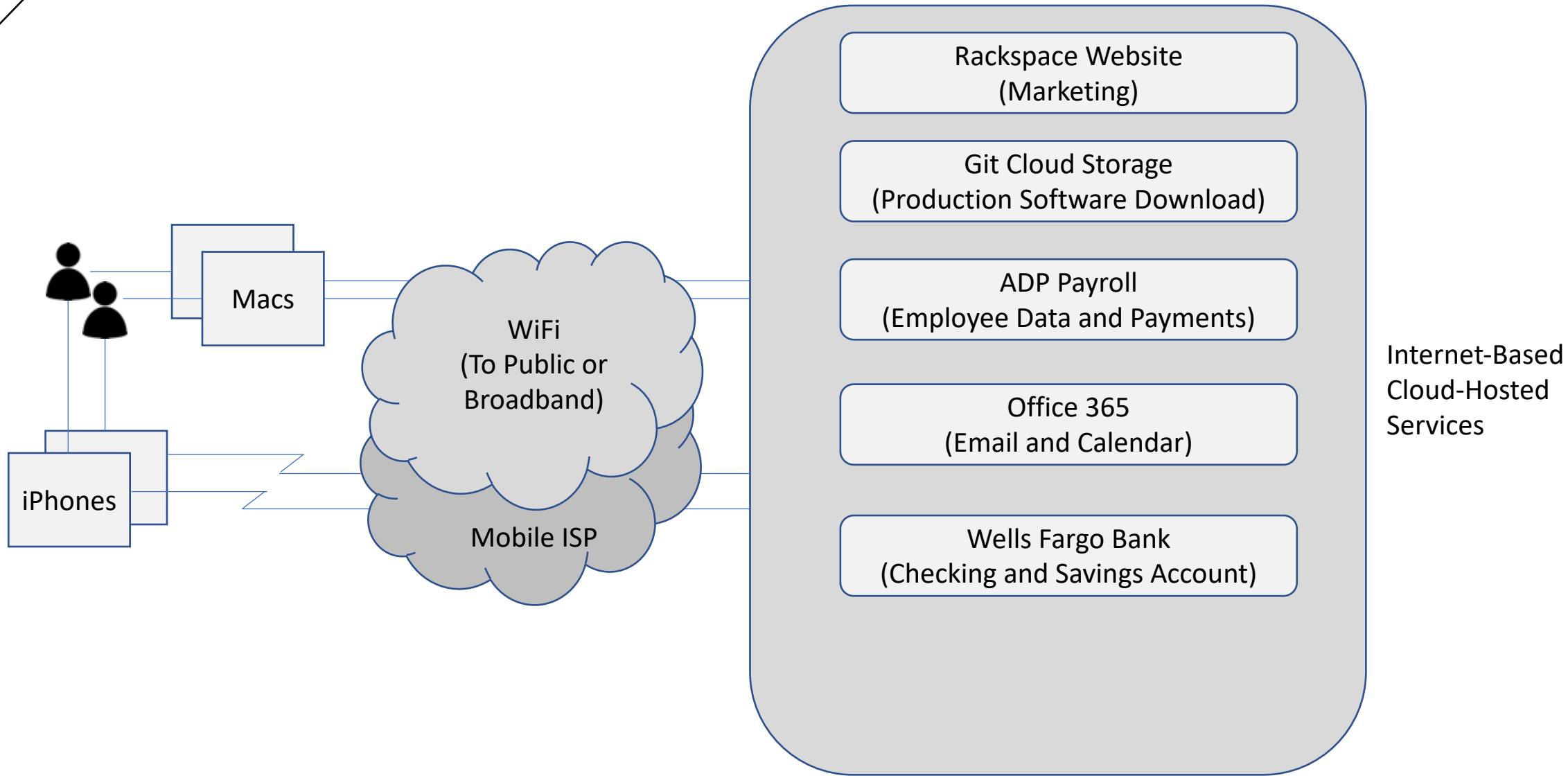

Case Study: Manage and Secure Assets for ACME Software-R-Us Inc.

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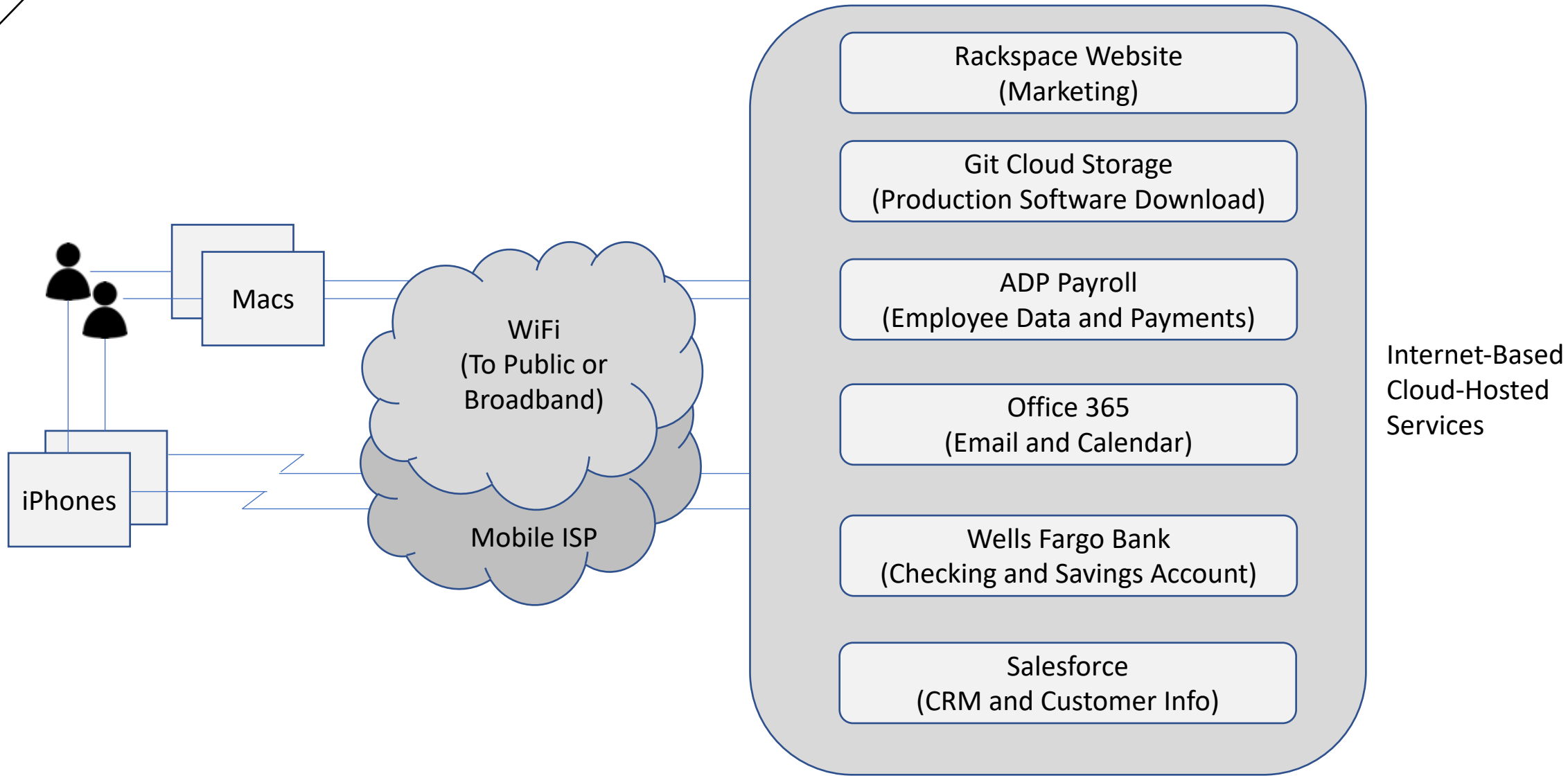

Case Study: Manage and Secure Assets for ACME Software-R-Us Inc.

Week 4

Illustrating a Threat-Asset Matrix: ACME Software-R-US Inc.

Week 4

Developer MACs (Software, etc.)

Illustrating a Threat-Asset Matrix: ACME Software-R-US Inc.

Week 4

Developer MACs (Software, etc.)

Developer iPhones (Email, Photos, etc.)

Illustrating a Threat-Asset Matrix: ACME Software-R-US Inc.

Week 4

Developer MACs (Software, etc.)

Developer iPhones (Email, Photos, etc.)

Rackspace Website (Papers, PDFs, etc.)

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Salesforce (CRM, Customer Data, etc.)

Eight major asset types

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	Confidentiality	Integrity	Availability	Theft/Fraud
Developer MACs (Software, etc.)				
Developer iPhones (Email, Photos, etc.)				
Rackspace Website (Papers, PDFs, etc.)				
Git Cloud Storage (Production Software)				
ADP Payroll (Employee PII, etc.)				
Office 365 (Email, Calendars, etc.)				
Wells Fargo Bank (Checking Acct, etc.)				
Salesforce (CRM, Customer Data, etc.)				

Four major threat types

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Rackspace Website (Papers, PDFs, etc.)				
Box Cloud Storage (Production Software)				
ADP Payroll (Employee PII, etc.)				
Office 365 (Email, Calendars, etc.)				
Wells Fargo Bank (Checking Acct, etc.)				
Salesforce (CRM, Customer Data, etc.)				

Create an (8 X 4) matrix = 32 cells to analyze

Illustrating a Threat-Asset Matrix: ACME Software-R-US Inc.

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Cell 1: Software (source code) in development on the Mac is valuable to a competitor, but Mac is reasonably well protected against malware:
Estimate: **P = 2, C = 3, R = 6**

	Confidentiality	Integrity	Availability	Theft/Fraud
Developer MACs (Software, etc.)	6			
Developer iPhones (Email, Photos, etc.)				
Rackspace Website (Papers, PDFs, etc.)				
Box Cloud Storage (Production Software)				
ADP Payroll (Employee PII, etc.)				
Office 365 (Email, Calendars, etc.)				
Wells Fargo Bank (Checking Acct, etc.)				
Salesforce (CRM, Customer Data, etc.)				

Illustrating a Threat-Asset Matrix: ACME Software-R-US Inc.

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Cell 2: Contacts and email are somewhat valuable to a competitor, but iPhone is biometrically well-protected against physical access:
Estimate: **P = 1, C = 2, R = 2**

	Confidentiality	Integrity	Availability	Theft/Fraud
Developer MACs (Software, etc.)	6			
Developer iPhones (Email, Photos, etc.)	2			
Rackspace Website (Papers, PDFs, etc.)				
Box Cloud Storage (Production Software)				
ADP Payroll (Employee PII, etc.)				
Office 365 (Email, Calendars, etc.)				
Wells Fargo Bank (Checking Acct, etc.)				
Salesforce (CRM, Customer Data, etc.)				

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Cell 3: Website reasonably well-administered but nothing all that sensitive is stored in the marketing oriented site (no eCommerce).
Estimate: **P = 1, C = 1, R = 1**

	Confidentiality	Integrity	Availability	Theft/Fraud
Developer MACs (Software, etc.)	6			
Developer iPhones (Email, Photos, etc.)	2			
Rackspace Website (Papers, PDFs, etc.)	1			
Box Cloud Storage (Production Software)				
ADP Payroll (Employee PII, etc.)				
Office 365 (Email, Calendars, etc.)				
Wells Fargo Bank (Checking Acct, etc.)				
Salesforce (CRM, Customer Data, etc.)				

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Cell 4: This represents public cloud storage and customer download support for the company's production software, thus high risk estimated. Estimate: **P = 3, C = 3, R = 9**

	Confidentiality	Integrity	Availability	Theft/Fraud
Developer MACs (Software, etc.)	6			
Developer iPhones (Email, Photos, etc.)	2			
Rackspace Website (Papers, PDFs, etc.)	1			
Git Cloud Storage (Production Software)	9			
ADP Payroll (Employee PII, etc.)				
Office 365 (Email, Calendars, etc.)				
Wells Fargo Bank (Checking Acct, etc.)				
Salesforce (CRM, Customer Data, etc.)				

Illustrating a Threat-Asset Matrix: ACME Software-R-US Inc.

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Cells 5 - 8: These are well-managed SaaS services with sensitive data stored and accessible to hackers. Estimated suitable risk profiles for each.

	Confidentiality	Integrity	Availability	Theft/Fraud
Developer MACs (Software, etc.)	6			
Developer iPhones (Email, Photos, etc.)	2			
Rackspace Website (Papers, PDFs, etc.)	1			
Git Cloud Storage (Production Software)	9			
ADP Payroll (Employee PII, etc.)	P = 1, C = 2, R = 2			
Office 365 (Email, Calendars, etc.)	P = 2, C = 3, R = 6			
Wells Fargo Bank (Checking Acct, etc.)	P = 1, C = 2, R = 2			
Salesforce (CRM, Customer Data, etc.)	P = 2, C = 3, R = 6			

Illustrating a Threat-Asset Matrix: ACME Software-R-US Inc.

Week 4

	Confidentiality	Integrity	Availability	Theft/Fraud
Developer MACs (Software, etc.)	6			
Developer iPhones (Email, Photos, etc.)	2			
Rackspace Website (Papers, PDFs, etc.)	1			
Git Cloud Storage (Production Software)	9			
ADP Payroll (Employee PII, etc.)	2			
Office 365 (Email, Calendars, etc.)	6			
Wells Fargo Bank (Checking Acct, etc.)	2			
Salesforce (CRM, Customer Data, etc.)	6			

Illustrating a Threat-Asset Matrix: ACME Software-R-US Inc.

Week 4

	Confidentiality	Integrity	Availability	Theft/Fraud
Developer MACs (Software, etc.)	6	6	2	2
Developer iPhones (Email, Photos, etc.)	2	2	2	2
Rackspace Website (Papers, PDFs, etc.)	1	6	3	1
Git Cloud Storage (Production Software)	9	9	9	9
ADP Payroll (Employee PII, etc.)	2	2	2	2
Office 365 (Email, Calendars, etc.)	6	6	3	1
Wells Fargo Bank (Checking Acct, etc.)	2	2	1	3
Salesforce (CRM, Customer Data, etc.)	6	6	1	4

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Business Asset	Estimated Risk
Git Cloud Storage (Production Software)	Total Risk = 36 – 1st Highest Risk Asset
Salesforce (CRM, Customer Data, etc.)	Total Risk = 17 – 2nd Highest Risk Asset
Developer MACs (Software, etc.)	Total Risk = 16 – 3rd Highest Risk Asset
Office 365 (Email, Calendars, etc.)	Total Risk = 16 – 3rd Highest Risk Asset
Rackspace Website (Papers, PDFs, etc.)	Total Risk = 11 – 4th Highest Risk Asset
Developer iPhones (Email, Photos, etc.)	Total Risk = 8 – Lowest Risk Asset
ADP Payroll (Employee PII, etc.)	Total Risk = 8 – Lowest Risk Asset
Wells Fargo Bank (Checking Acct, etc.)	Total Risk = 8 – Lowest Risk Asset

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What is Your Midterm Assignment?

Week 4

- Identify and describe a fictitious enterprise network (you can draw or describe) and carefully list the valued assets for this network.
- (It would be recommended to keep the number of assets more than 10 but less than 25.)
- Then, create a threat-asset matrix for your fictitious example and estimate the security risk for each individual cell in the matrix.
- Write a 1-2 sentence justification for each risk estimate.
- You are welcome to draw the matrix by hand (scan and cut the image into your paper) or you can use a tool such as Excel or PowerPoint.
- Submit your assignment via the Course Site

Assignment 1: Due March 27