18th Annual FIRST Conference

Design your network to aid forensics investigation

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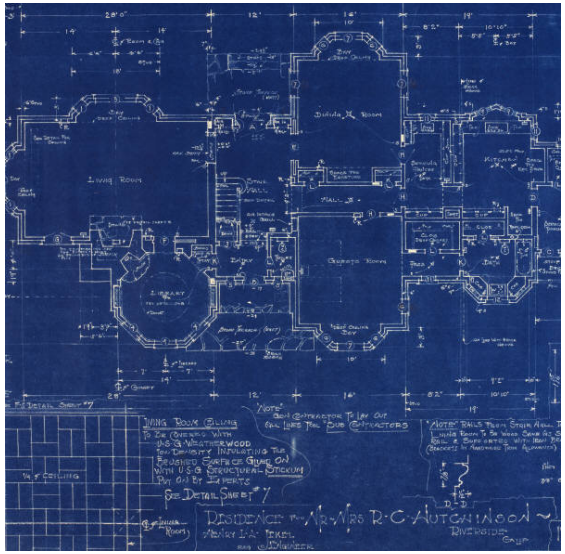
Master Outline

- Introduction
- Incident Management & Investigation
- Network Design
- Consider Risk
- Network Monitoring
- Reporting
- Incorporating Security Monitoring
- Monitoring Examples
- Valuable Assets
- Summary



1. Introduction

Description

This course will review network design and monitoring with the intent of identifying and providing adequate compromise detection, developing appropriate security response to suspicious "events", and increasing readiness for forensics investigation.

The key to success will be participation by all session attendees!

Presentation Dynamics

- Please ask questions
- Discussion
- Share
- Please ask questions
- Storytelling
- My goals:
  - Stimulate your thought processes
  - Learn from your questions
  - Send you home with at least one new idea

Who Am I?

- Employers
  - Academia
  - Government
  - Business
- Job Positions
  - Programming
  - System admin
  - Network admin
  - Security admin

Who Are You?

- Employers
  - Academia
  - Government
  - Business
- Job Positions
  - Programmers
  - Application admin
  - System admin
  - Network admin
  - Security admin
  - Sales/Marketing
  - Management
  - End User

Origins: Floppy Net to Internet

- In the beginning there was….
  - The computer doesn't work right!
- Then came…..
  - Where did my file go?
  - Who changed that information?
- Followed by……
  - Why is my computer so slow?
  - Who is using all the bandwidth?
- Today……
  - Hey, my online account holder is asking me for information.
  - My bank emailed me because I have a credit card problem.
  - If I can just help out that poor family in Nigeria.
  - Wow, look at this cool program "Joe Smith" just sent me.
  - Man, IRC is so great. I can trade all sorts of stuff!

First Indications of a Problem

- If you don't monitor
  - Website defacement
  - File modified or deleted
  - New user account
  - Configuration changes
  - Locked out user ID
- If you do monitor
  - IDS/IPS Alerts
  - Firewall Logs
  - No different from "don't monitor"

Resolving a Problem

- Is the alert significant?
- Was the penetration successful?
- Did something change?
- Who made the modification?
- How did the change occur?
- What can we do to prevent it from happening again?
- Should we “reinstall”?

The Network is Important

- You can't hide a flow
- Monitor many devices more easily
- First line of defense
- Most "bang for the buck"
- Best place to begin

What is the Current Status of Your Network?

- Equipment type
- Size
- Age
- Policies
- Diagrams
- Internet connections
- Flows
- Staff
- Management Support

Your network is a valuable asset!

2. Incident Management & Investigation

And now, for something,
well, not entirely different…..

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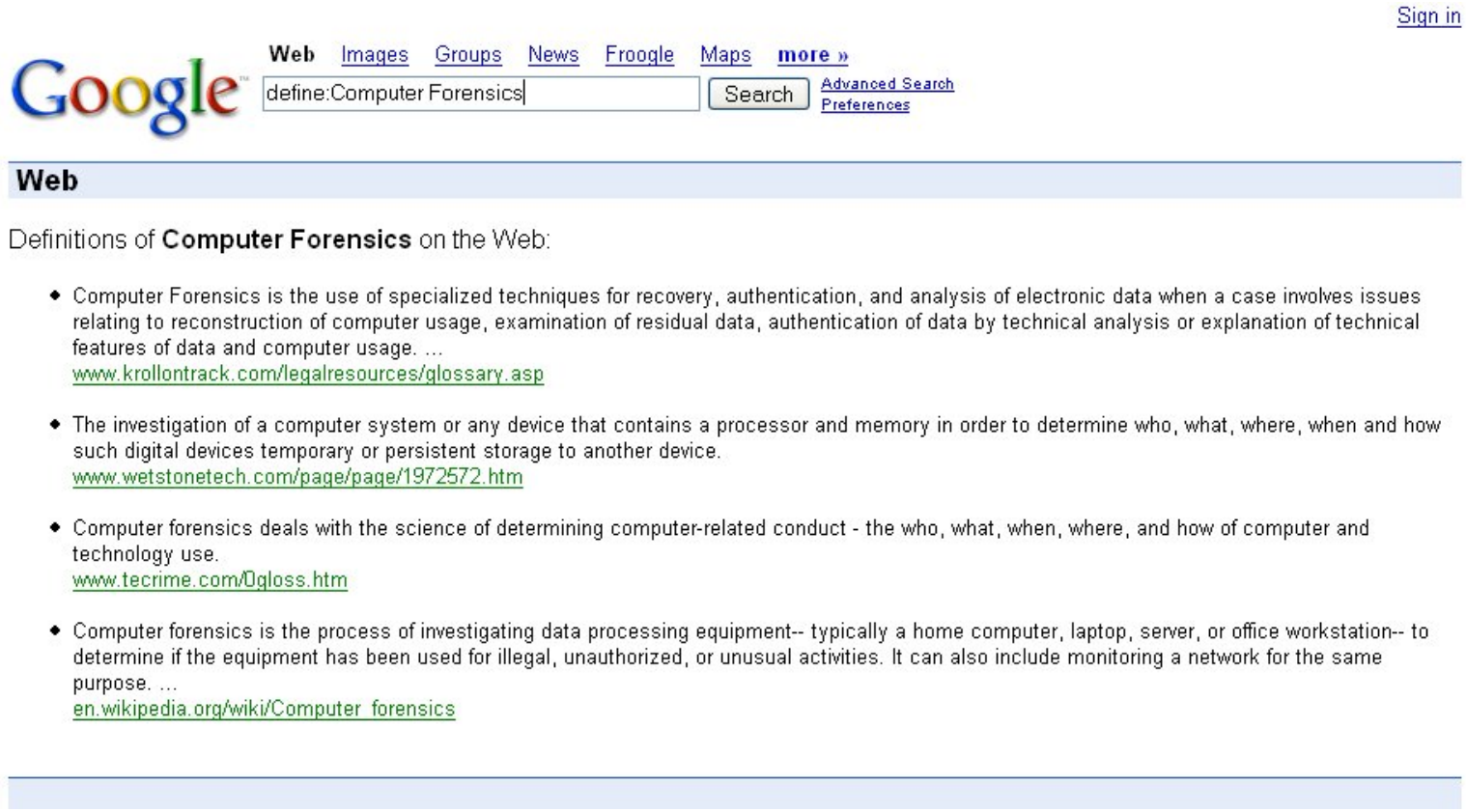
What Does “Computer Forensics” Mean?



Typical Attack

- Reconnaissance
- Vulnerability mapping
- Initial attack
- Escalation (if necessary)
- Ensure continuing access
- Utilize the system
- Hide tracks (log files, processes….etc)

Common Avenues of Attack

- Application Vulnerabilities
- Worms and viruses
- Open proxies (Squid, etc…)
- Compromised hosts
- Web and web services
- Email
- Instant messaging
- Etc……

What Do Hackers Do?

- Rootkits
- Backdoors
- Hidden files
- Hidden processes
- Denial of Service
- Steal Information
- Botnets
- Etc……..

Investigation is a Process

- Begin a “Record of Investigation”
- Involvement management
- Set objectives
- Conduct interviews
- Collect evidence
- Analyze evidence
- Establish a “Modus Operandi”
- Document findings in a report

If “Investigation is a Process” What Does That Mean?

- Documented
- Approved by management
- Tested
- Maintained
- Understood
- Practiced

Policy: What's Your Plan?

- The policy says?
- Can I have a copy of that policy?
- What's the procedure?
- Can I have a copy of the procedure?
- Do we really do this?
- Who is responsible?
- Where are the results?
- What do we do with the results?
- How do things get fixed?
- Why bother??????

The best-laid plans of mice and men often go awry. Robert Burns

Some Objectives of a Process

- Determine the extent of the compromise
- Contain the attack
- Determine the exact mechanism & details of attack
- Stop the attack (maybe)
- Provide recommendations recovering the environment
- Report findings
- Prevention
- Prosecute

What Does “Prosecute” Imply?

- Documentation
- Evidence collection
- Evidence storage
- Rights of individuals
- Local, state, and federal laws
- Interaction with law enforcement
- Interaction with justice system

Report Findings

- Types of reporting
- Appropriate content
- Standardized formats
- Prevention
- Receiving executive
- Policy

Evidence Sources

- Potentially any log file
  - Firewall logs
  - IDS/IPS logs
  - System logs
  - Router logs
  - Application logs (web, e-mail…)
  - Proxy logs
  - Web logs
  - Authentication logs
- Configuration files are good too
  - Router/switch
  - Network appliance
  - And yes firewall

Additional Evidence Sources

- Network session captures (ethereal, tcpdump, NAM, netflow)
- System analysis (binaries, suspect files, malware)
- Network architecture

Summary of Key Elements

- Process
- Documentation
- Evidence collection
- Evidence analysis
- Reporting results

3. Network Design

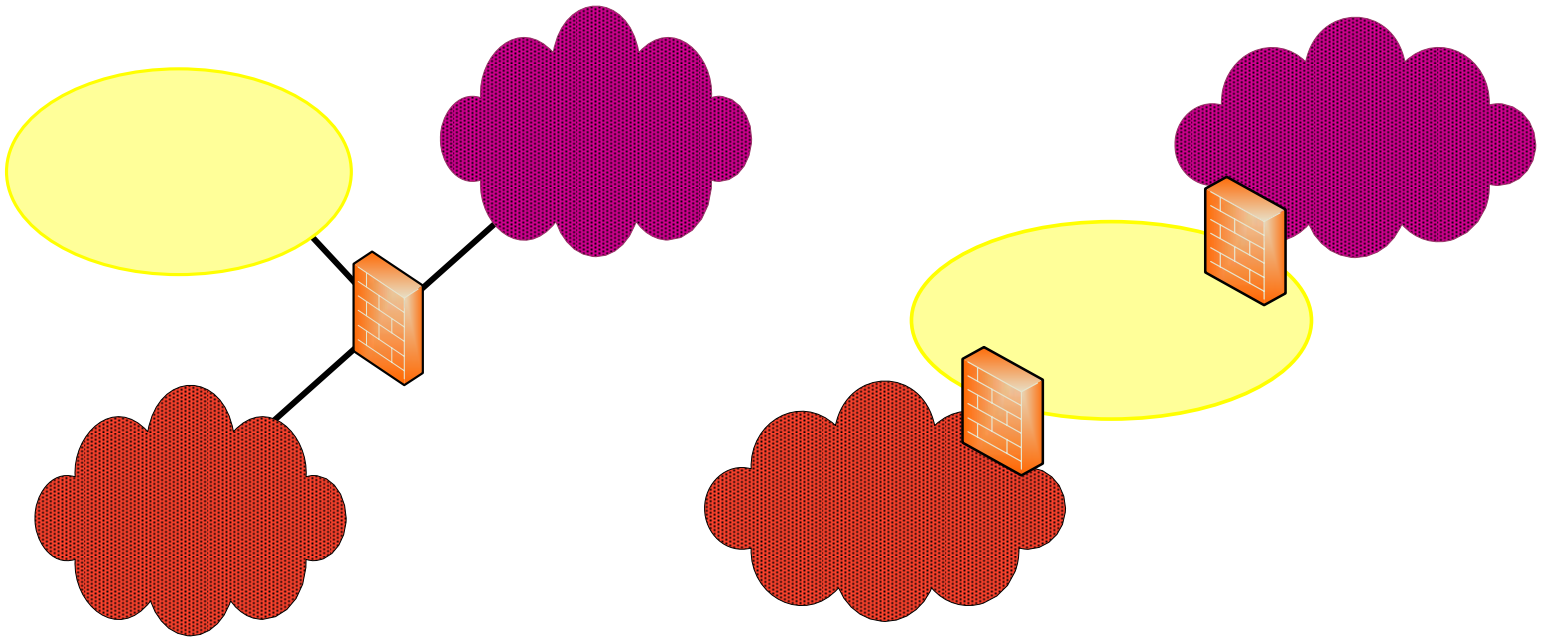
What Does Your Network Do?

- What type of network do you have?
  - Intranet
  - Extranet
  - B2B
  - Internet portal
  - Remote office
  - Remote employee
  - Combination, probably several!
- What function does your network provide?
  - Email
  - Web services
  - Business critical applications
  - Financial applications
  - Remote employee
  - Others, probably a lot!

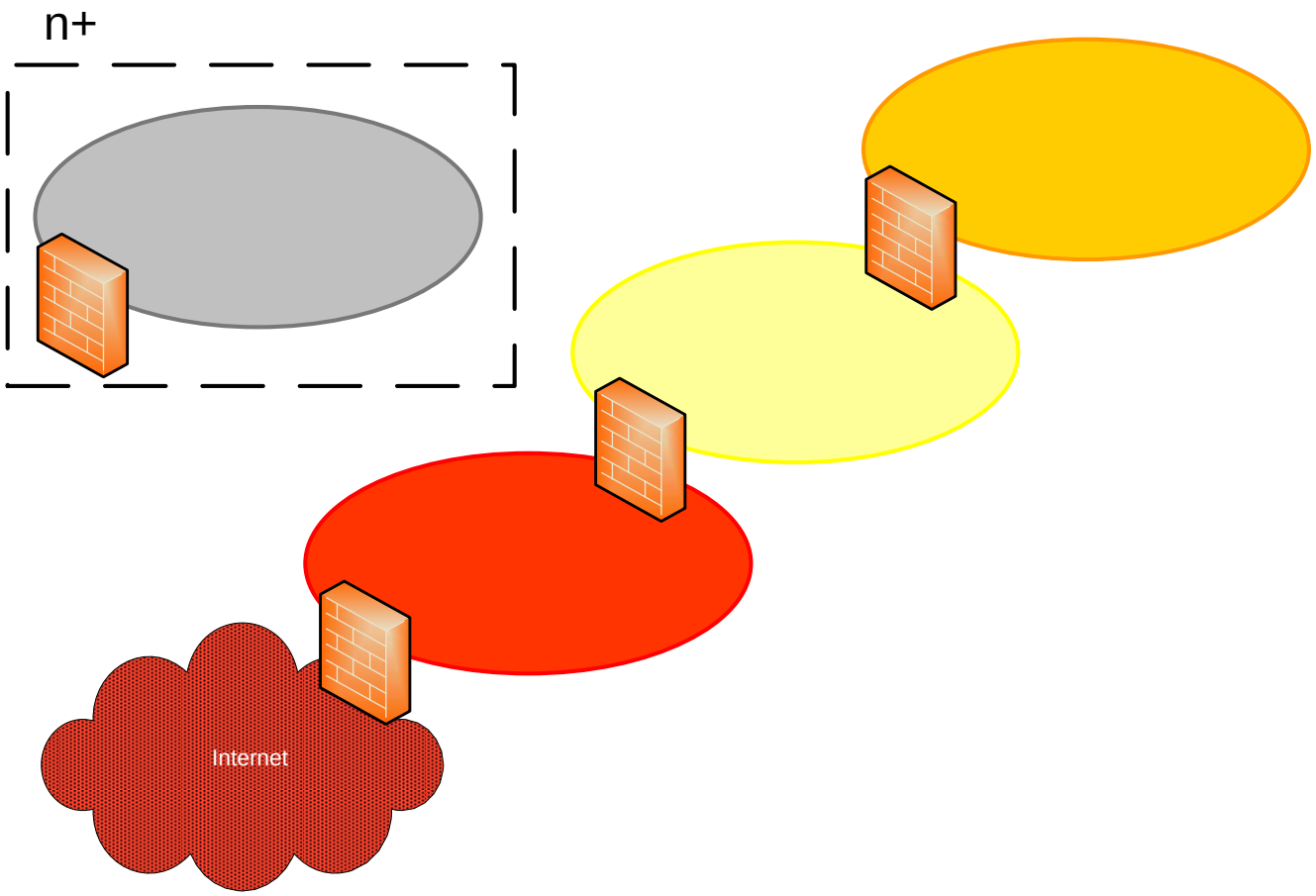
Problems with a Dynamic Infrastructure

- Old documentation
- Aging network infrastructure
- Firewall limitations
- Maintenance contract costs
- Quality control of network changes
- Network management
- IP address management
- Bandwidth usage monitoring
- Ineffective IDS system
- Undependable security logs
- Audit issues
- Increase monitoring and data analysis
- Reactive vs. proactive posture
- Team expertise
- Professional development

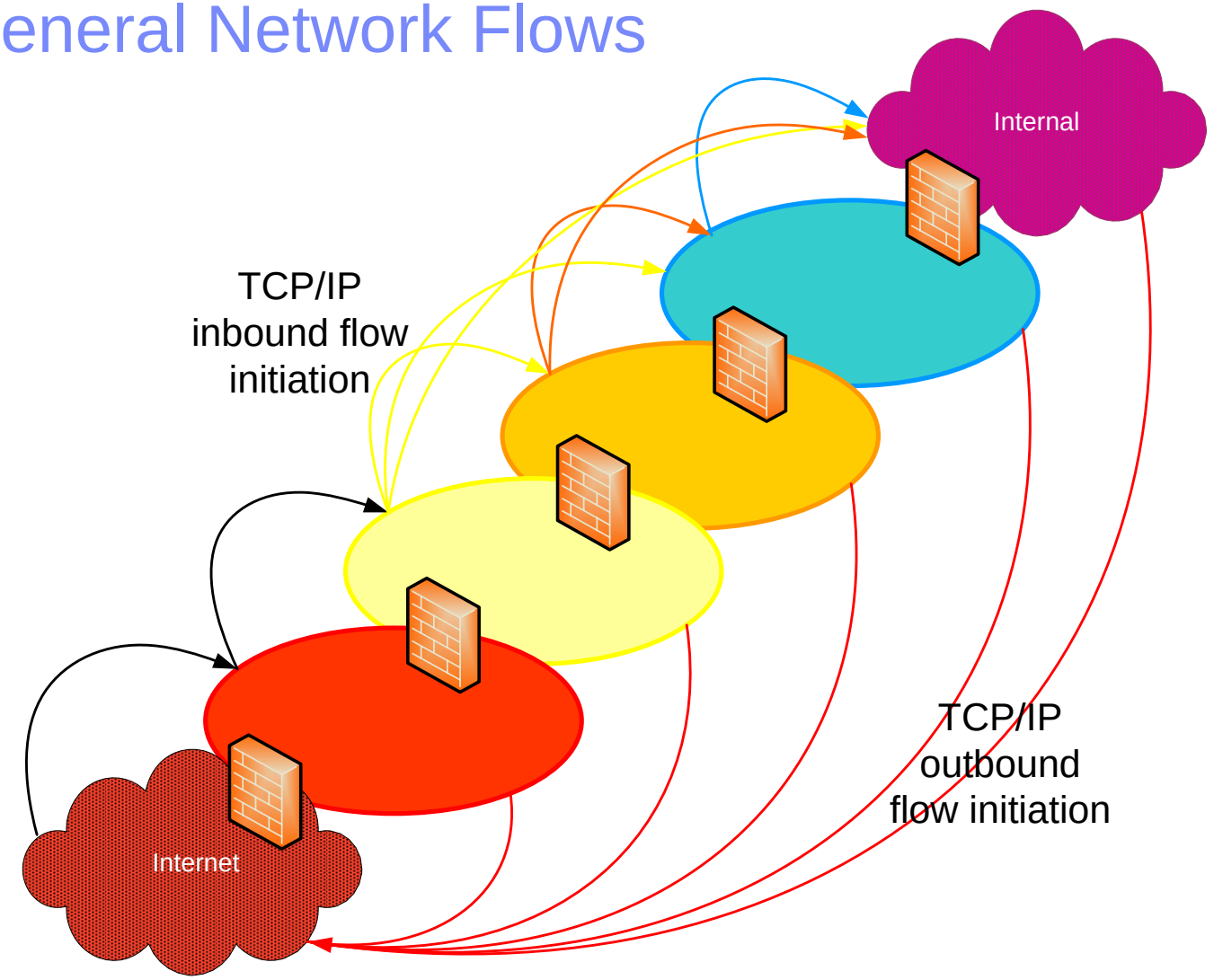
Network Topology: Layer/Zone Method



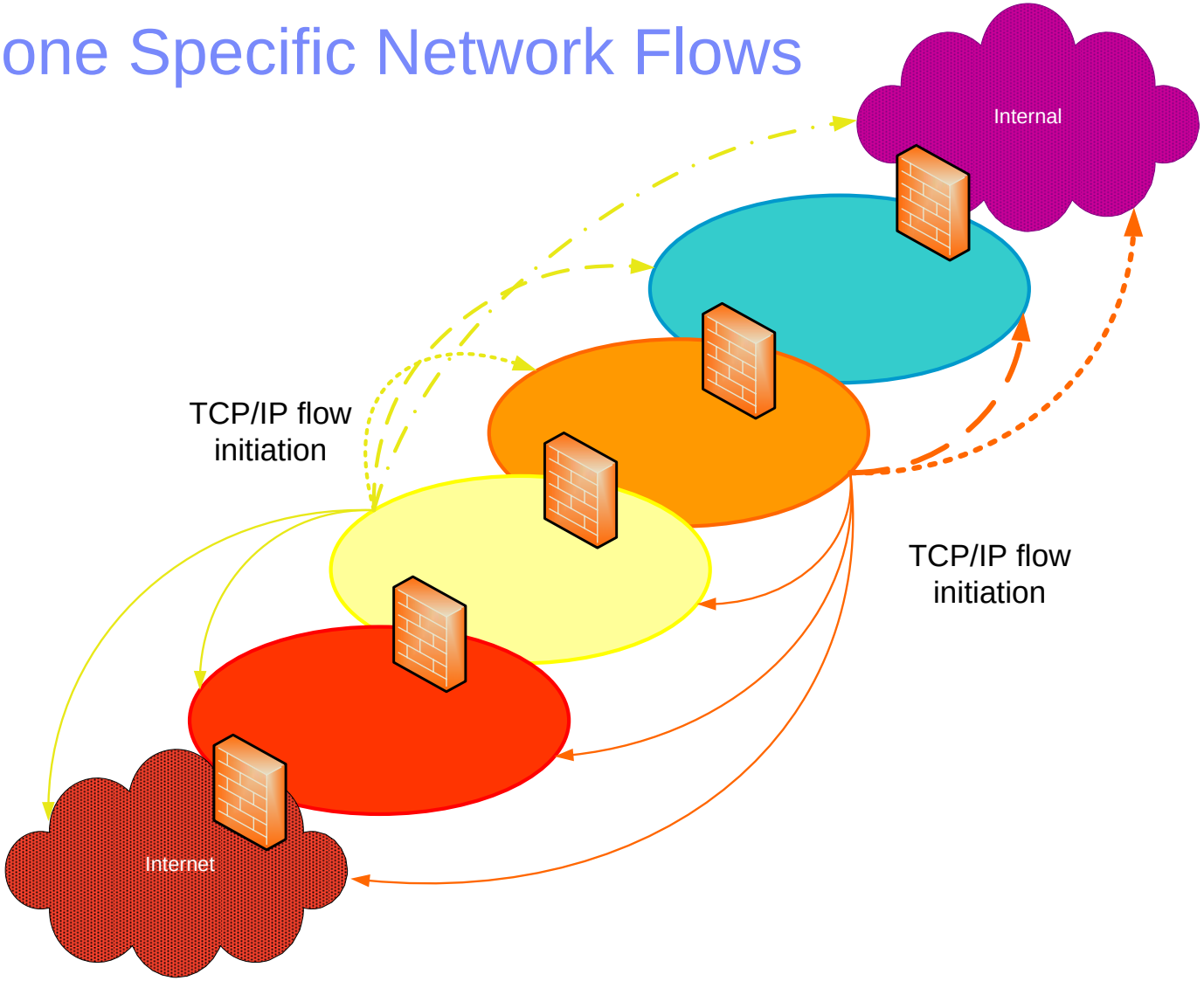
Topology: Layer/Zone Method



General Network Flows

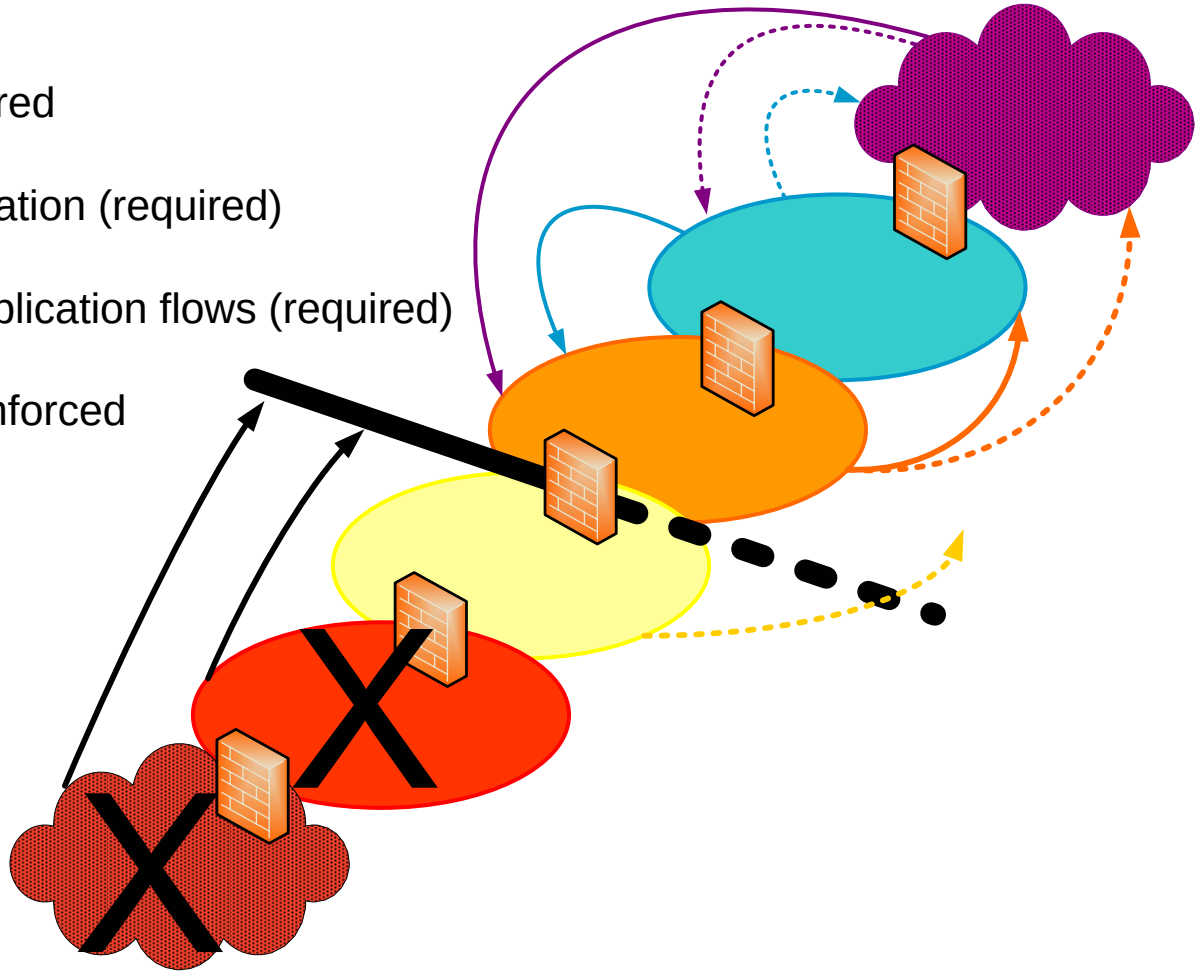


Zone Specific Network Flows



Specialized Network Flows

- SSH / SSL required
- Strong authentication (required)
- Encryption of application flows (required)
- Requirements enforced



Documentation

- Having adequate documentation for the network is critical to security
- As the network becomes larger the documentation becomes more critical
- Items to document include:
  - Internet connections
  - Firewall locations
  - Flows
  - Much more….

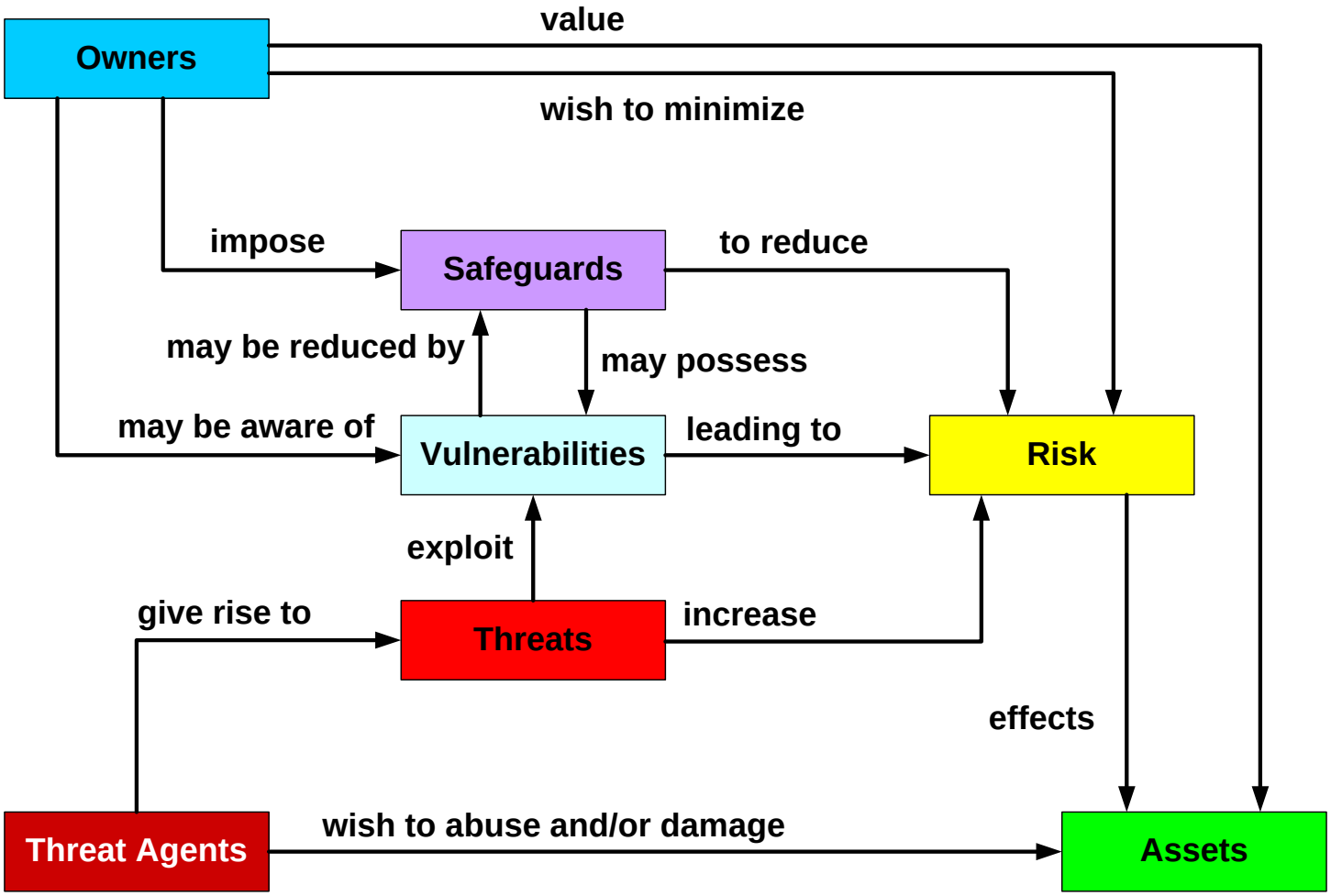
4. Consider Risk

Define: Network Security

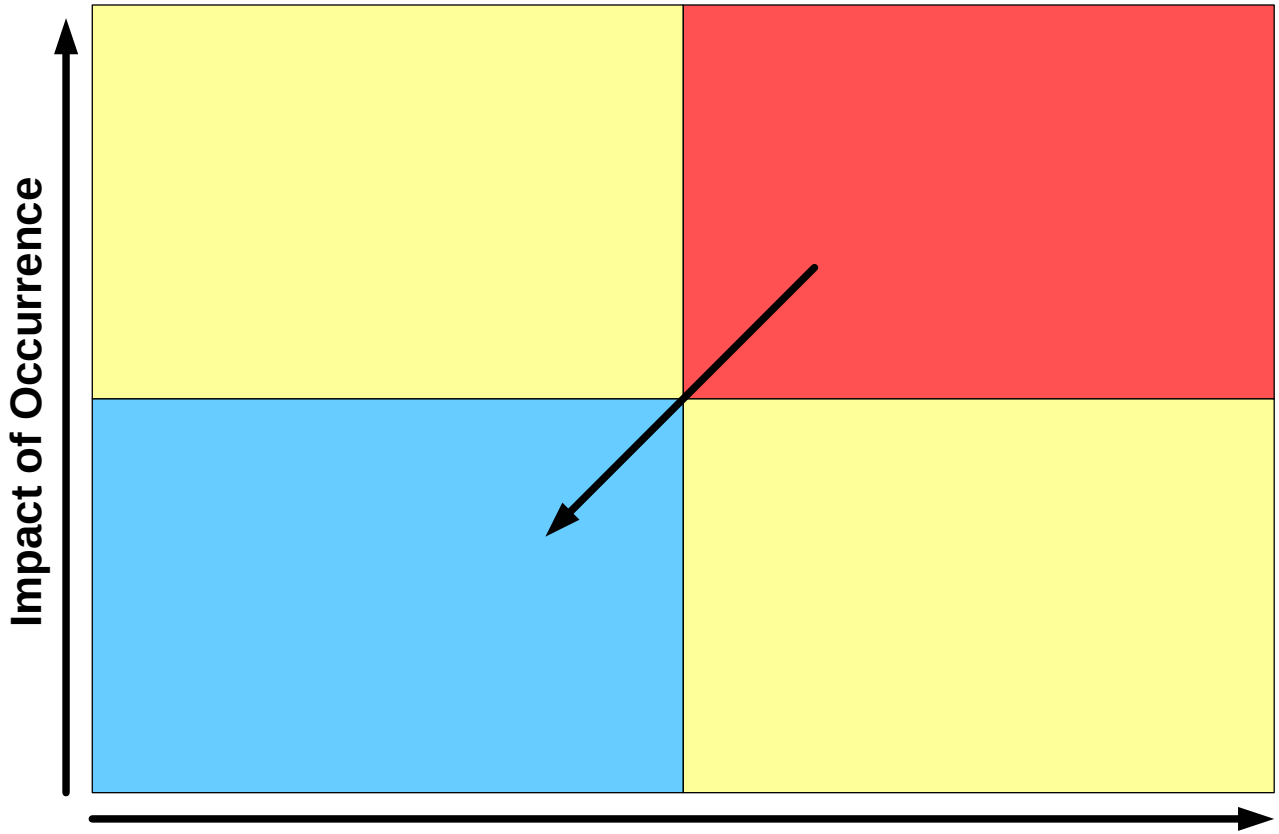
Network security is the effort to create a secure computing platform, designed so that agents (users or programs) cannot perform actions that they are not allowed to perform, but can perform the actions that they are allowed to. The actions in question can be reduced to operations of access, modification and deletion. Network security can be seen as a subfield of security engineering, which looks at broader security issues in addition to network security.*

*Source unknown

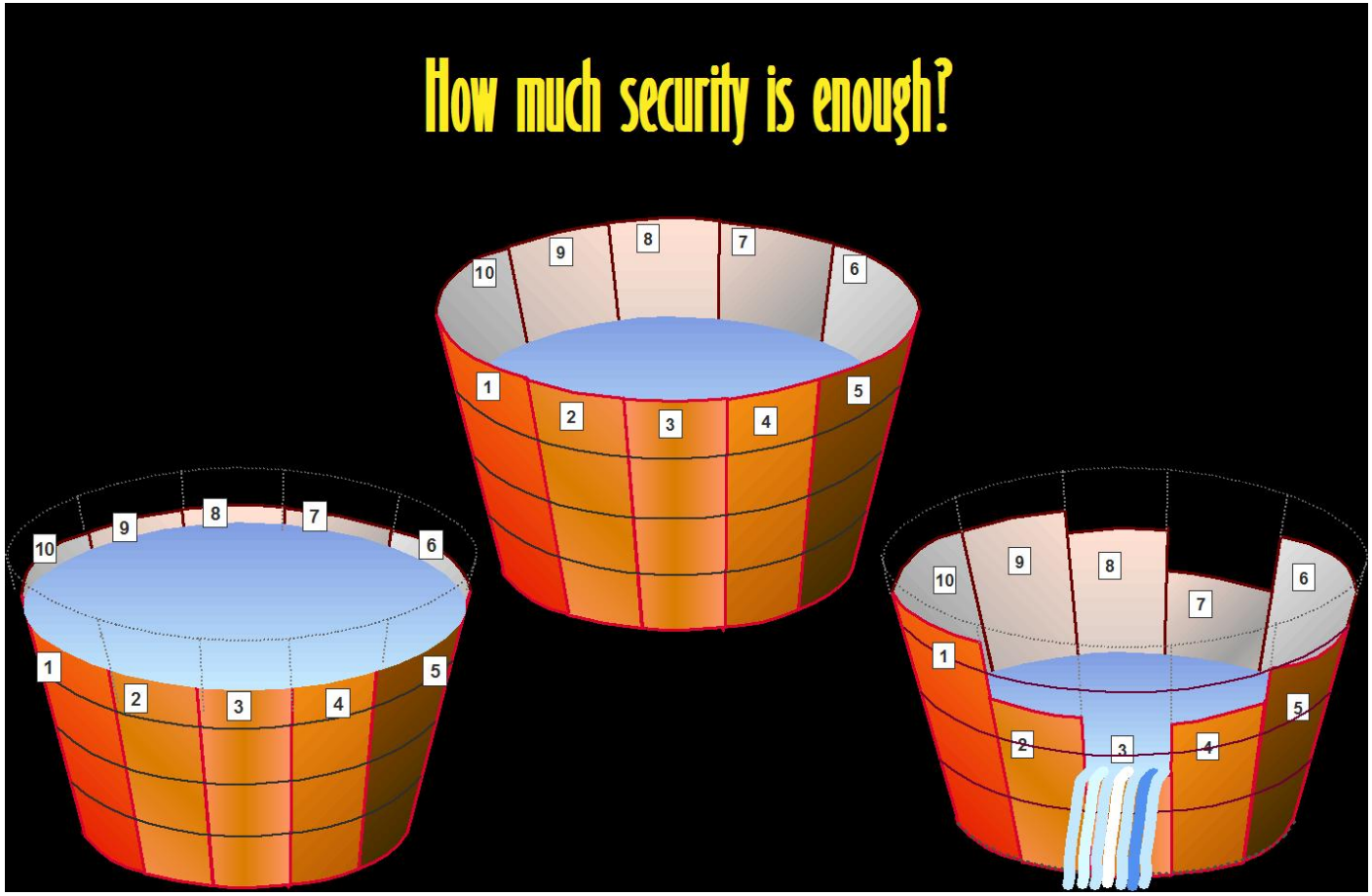
Risk: Flow Diagram



Risk: The Goal



Design your network to aid forensics investigation



"Security is a journey not a destination"

Summary of Key Elements

- Risk can never be eliminated
- Managing risk is a continuous process
- Low impact and low likely hood is the goal
- Law of diminishing returns

5. Network Monitoring

Logging

- Centralized log collection
- Redundant collection devices
- How many messages can you send to a collector
  - Std syslog
  - Syslog NG
- Secure storage area

File Modifications

- Device configuration files (network and system)
- Binaries
- Specific files
- Change control – enforced
- Review
- Audit
- Alerting
- Reporting

Security: Discovery……..

- Location (inside / outside)
- Software variety
- Scan activity
  - Daily
  - Monthly
  - Quarterly
- Known / unknown
- Data review
- Reporting

Patch Management

- Business Objective
  - Ensure appropriate security patches are installed on all servers and network devices within the designated timeframes
- Business Risk
  - If this process is not executed effectively and efficiently, the result could lead to a vulnerable server and/or unnecessary downtime.

Authentication

- Business Objective
  - Each user's identity must be verified (authenticated) when the user attempts to logon to a system or application.
- Business Risk
  - If this process is not executed effectively and efficiently, the result could lead to a compromise.

Advanced Monitoring

- Intrusion Detection Systems (IDS)
- Intrusion Prevention Systems (IPS)
- Cisco Network Analysis Module (NAM) Data
- Cisco Monitoring, Analysis & Response System (MARS)
- Honeypots

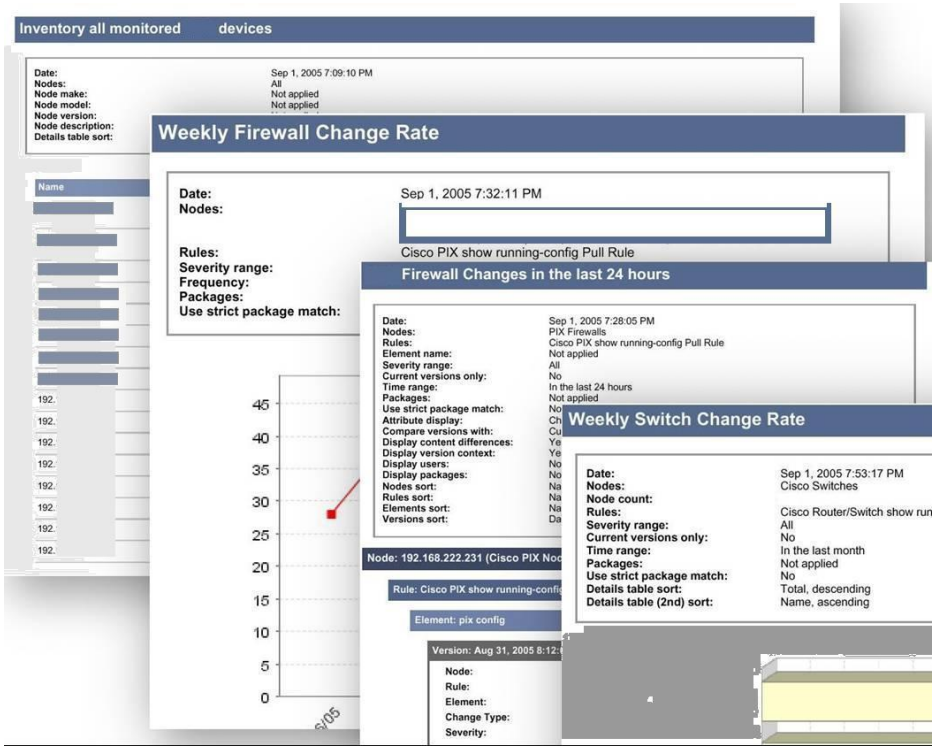
6. Reporting

Reporting

- Why provide reports?
- What do we report?
- How much information do we provide?
- Tools?
- Opportunity?

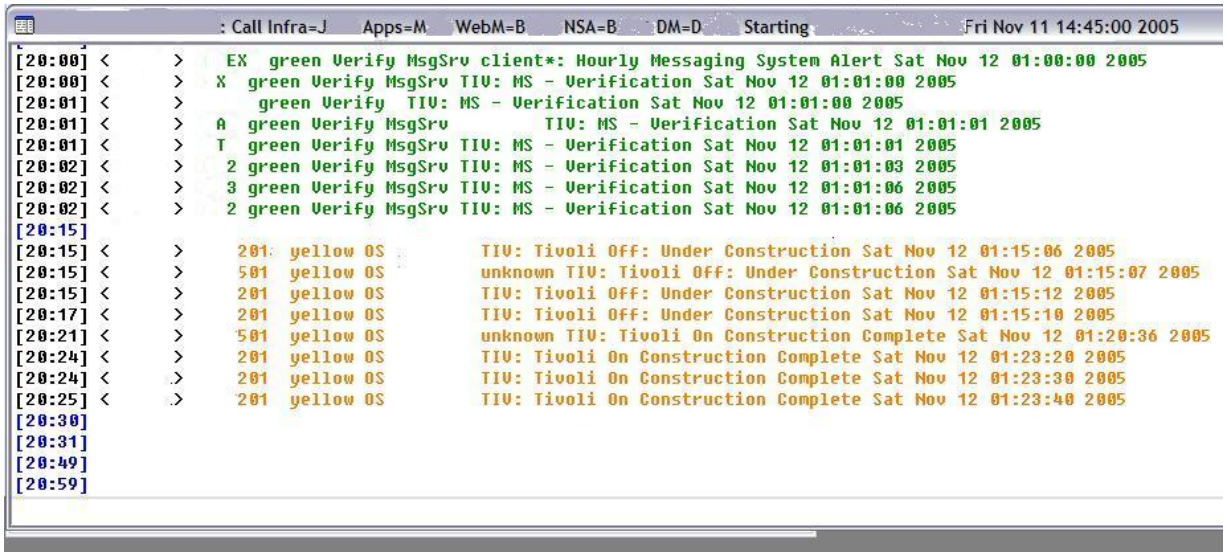
Management Reporting

- Security more than a problem
- They want specific information
- We can show attacks
- Demonstrate prevention
- Support policies
- Security can help



Security Reporting

- Email
- Paging
- IRC



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7. Incorporating Security Monitoring into the Network

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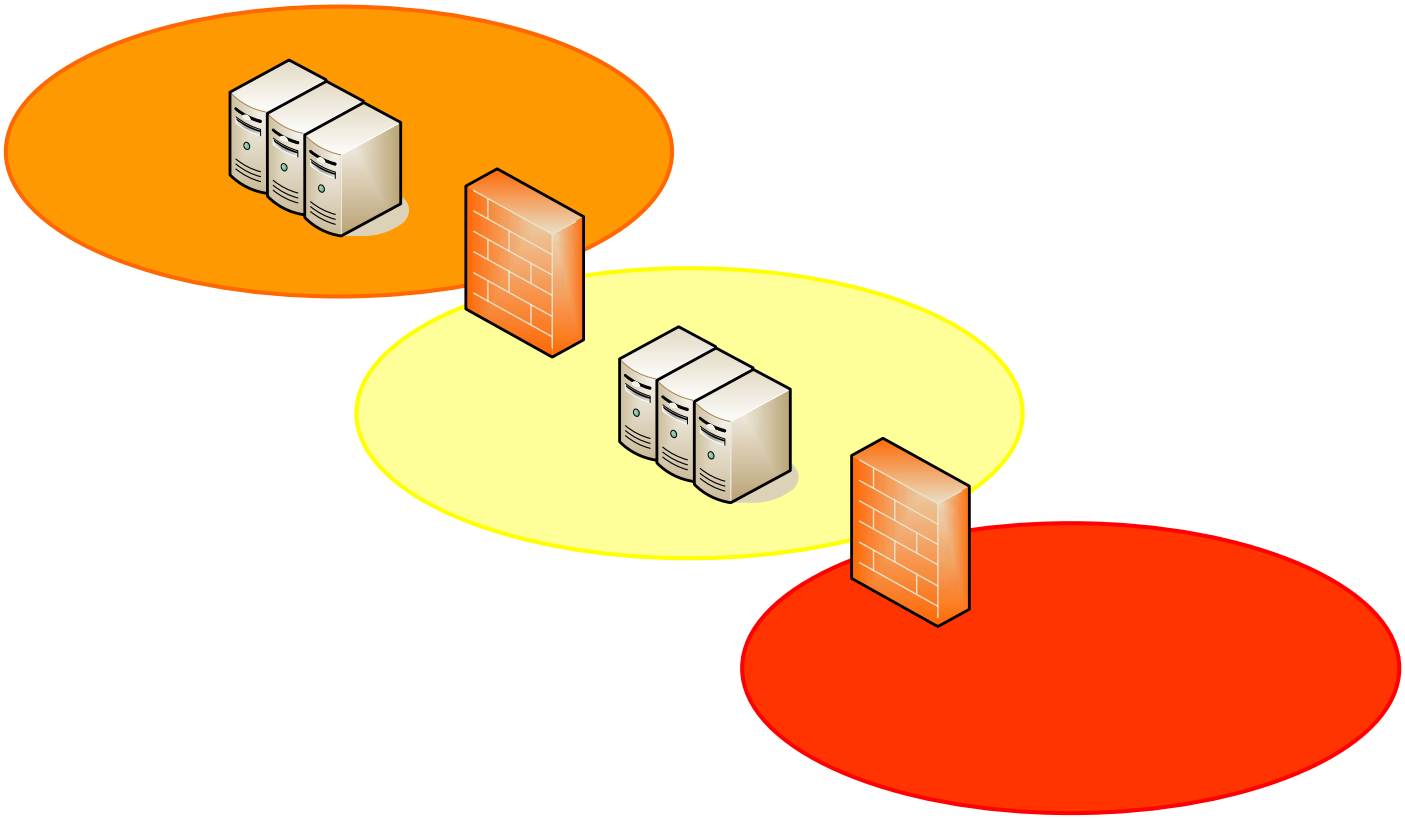
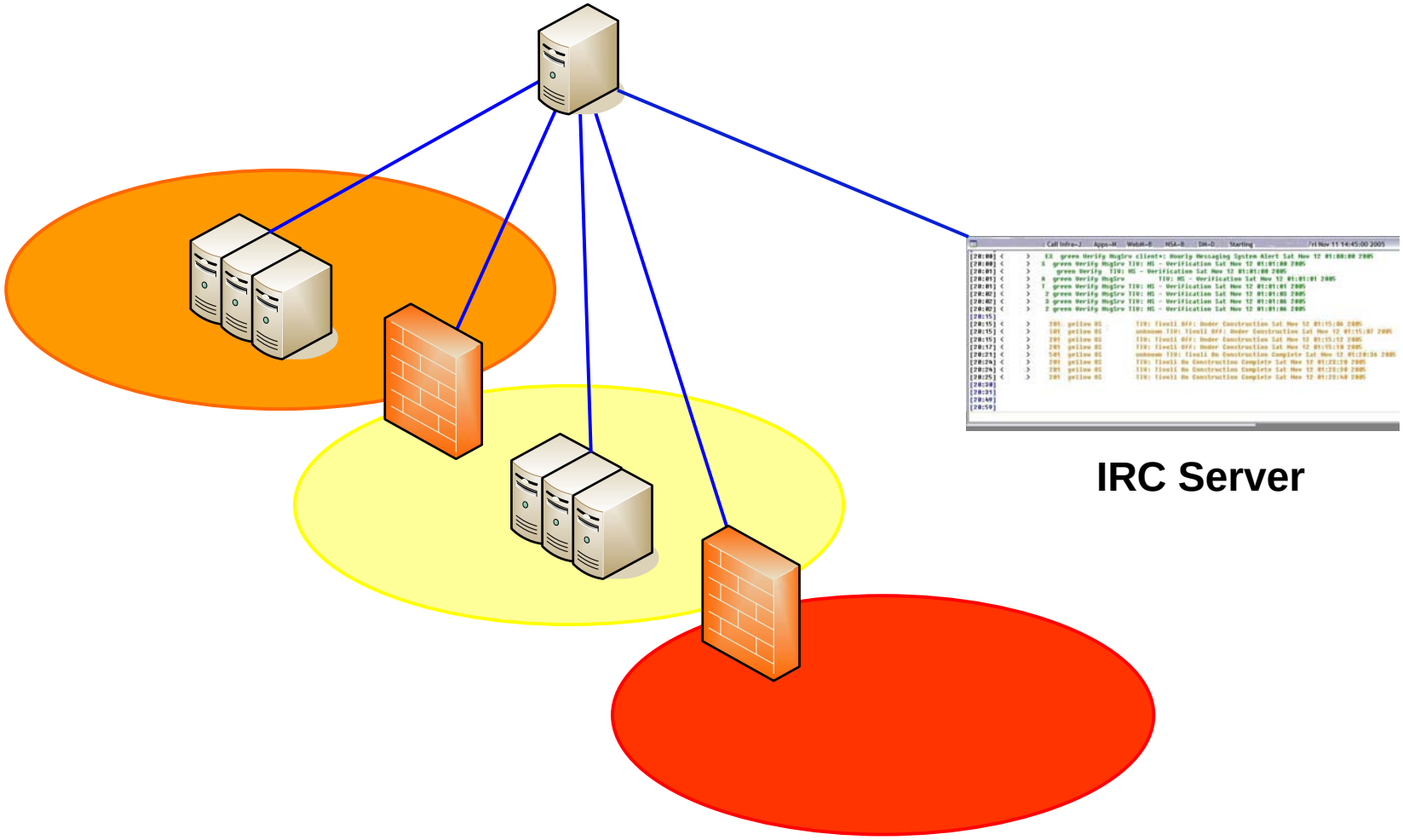
Network Depicted as Security Domains

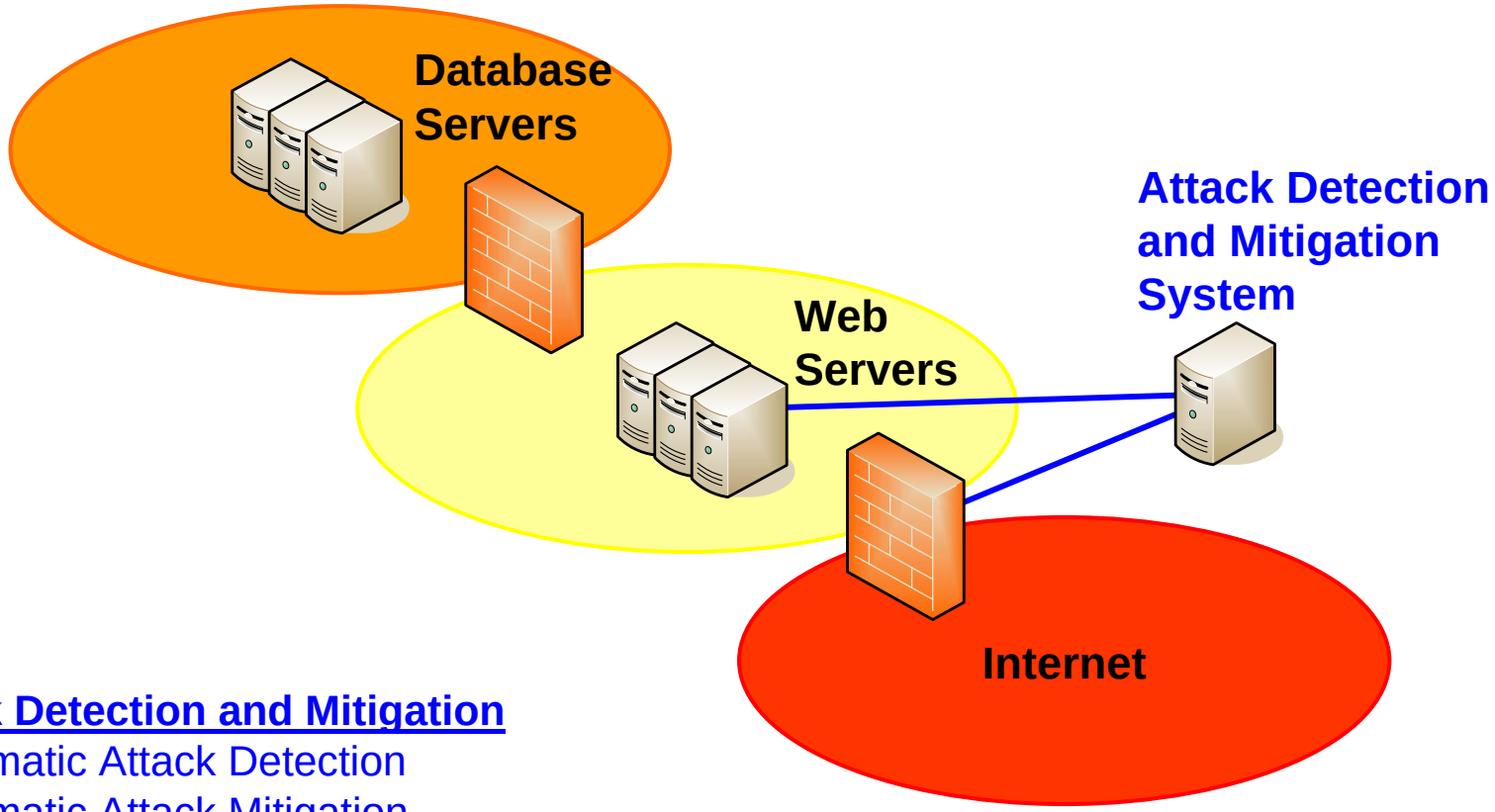


Centralized Logging



IRC Server

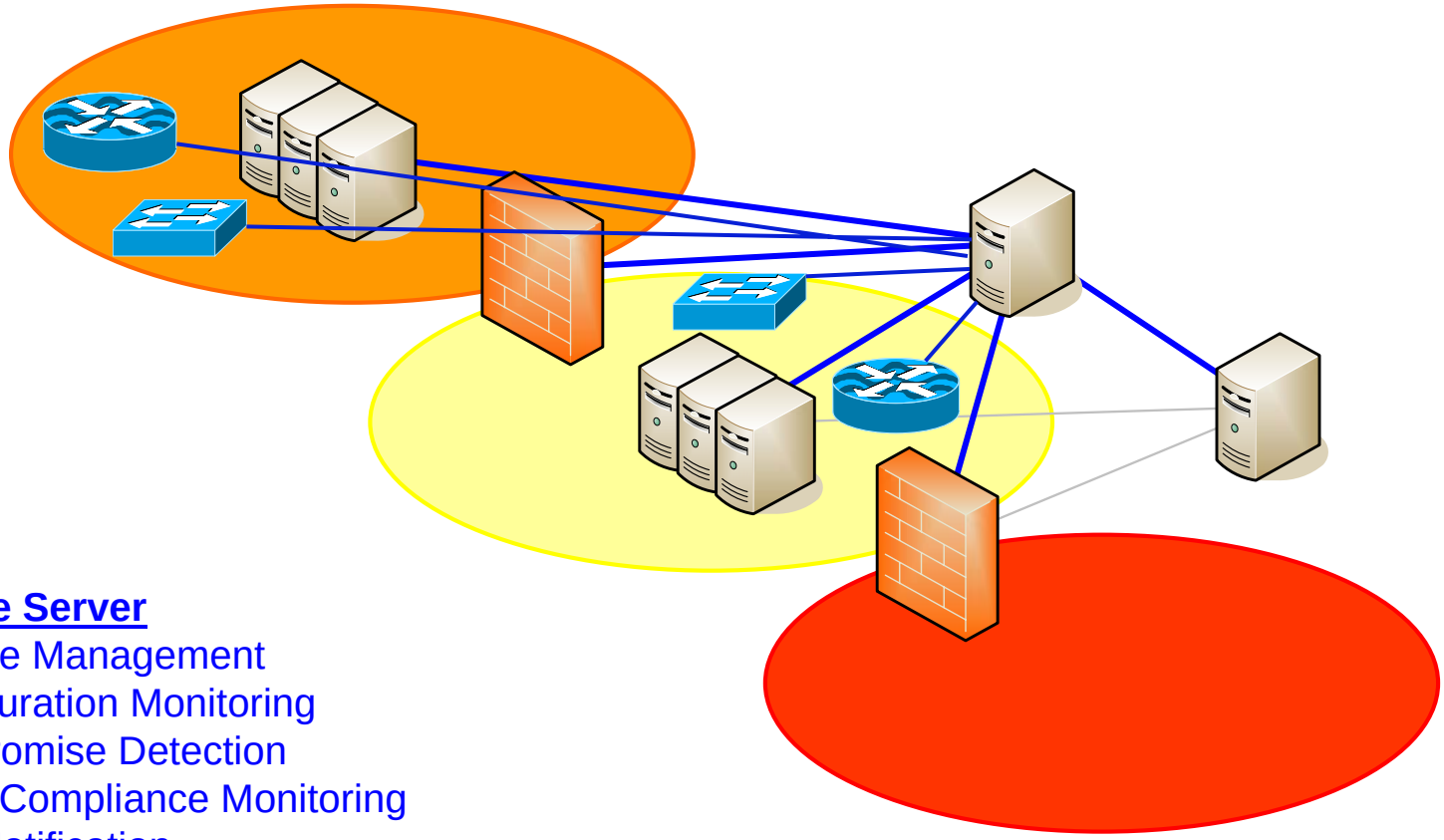
Attack Detection and Mitigation



Attack Detection and Mitigation

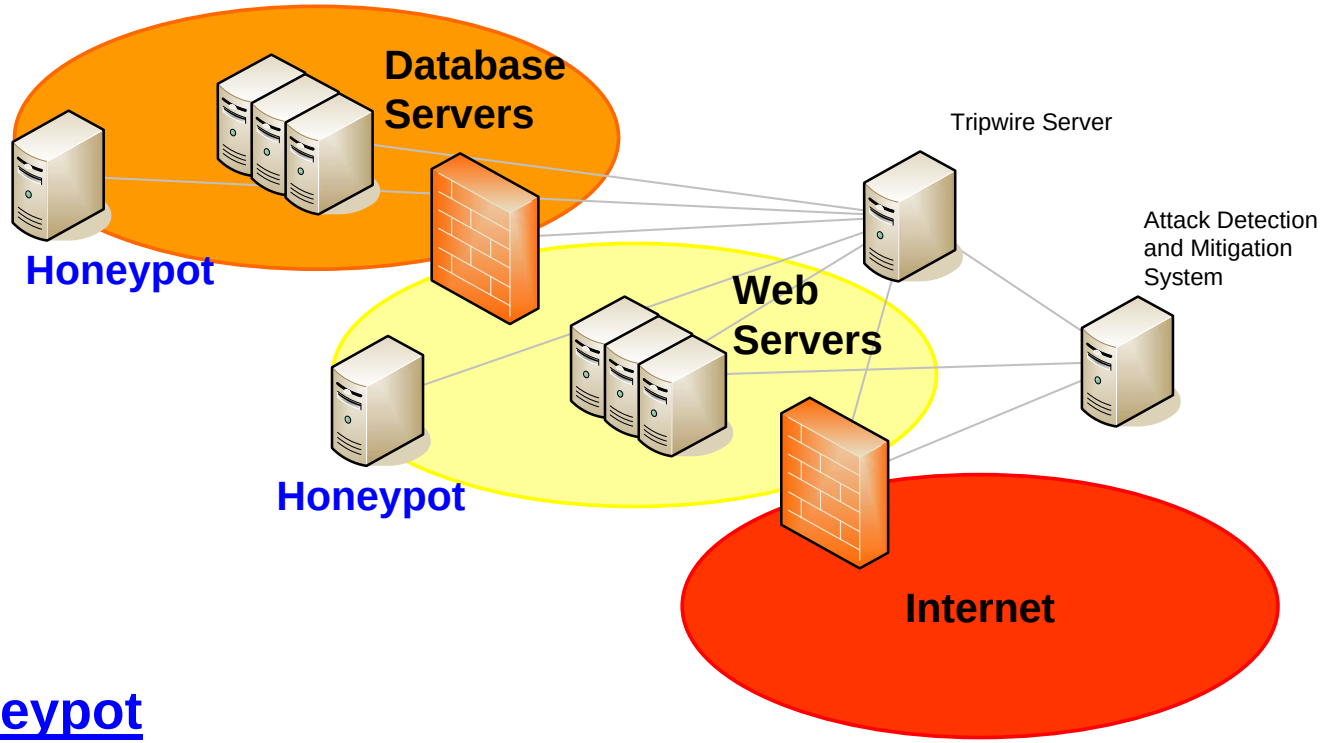
- Automatic Attack Detection
- Automatic Attack Mitigation
- Alert Notification
- Report Generation

Monitoring File Change



Tripwire Server
- Change Management
- Configuration Monitoring
- Compromise Detection
- Policy Compliance Monitoring
- Alert Notification
- Report Generation

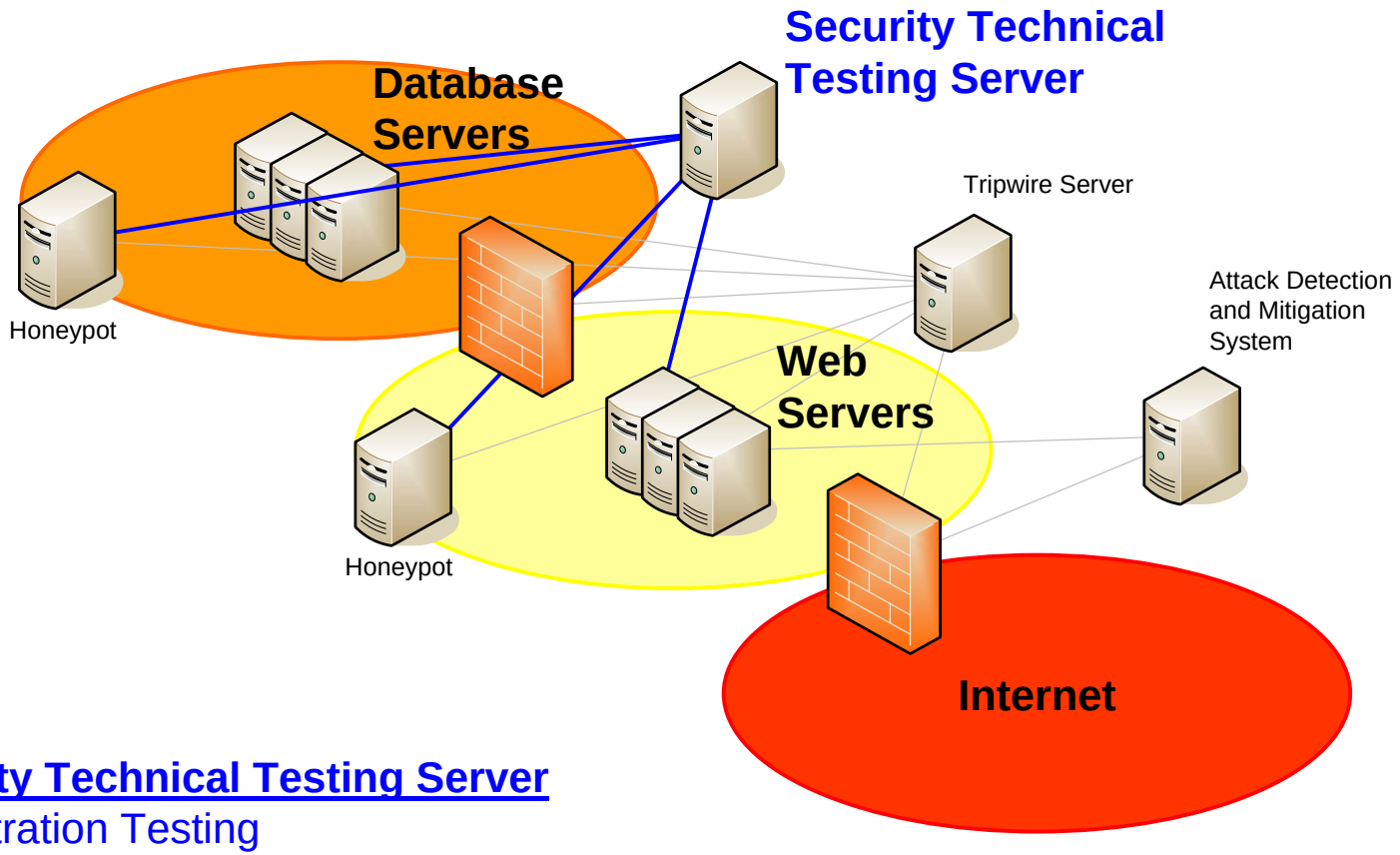
Honeypot



Honeypot

- Intrusion Detection
- Alert Notification
- Report Generation

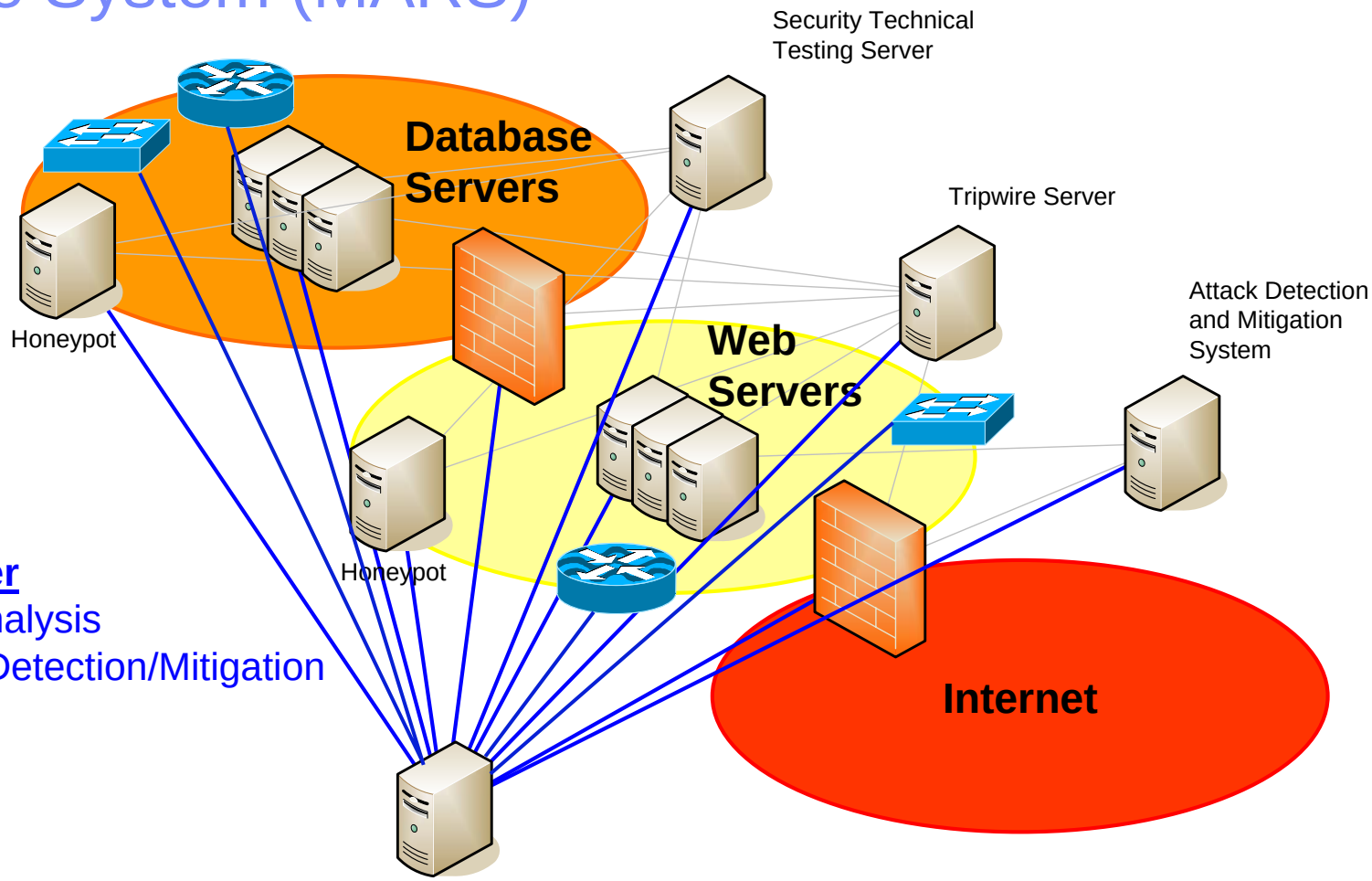
Security Technical Testing



Security Technical Testing Server

- Penetration Testing
- Patch Monitoring
- Policy Compliance Monitoring
- Report Generation

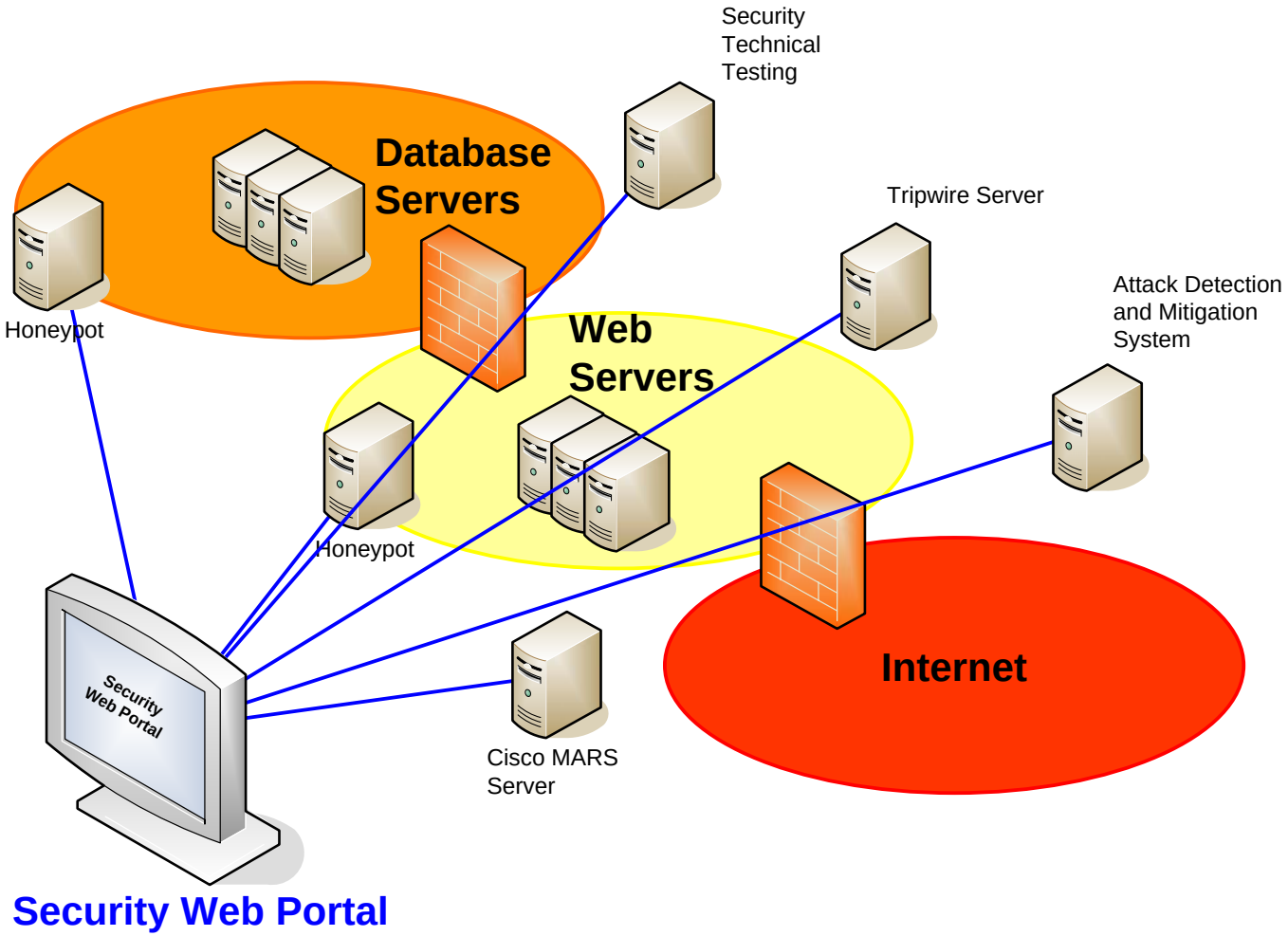
Cisco Security Monitoring, Analysis, and Response System (MARS)



Cisco MARS Server

- Advanced Data Analysis
- Automatic Attack Detection/Mitigation
- Alert Notification
- Report Generation

Security Web Portal

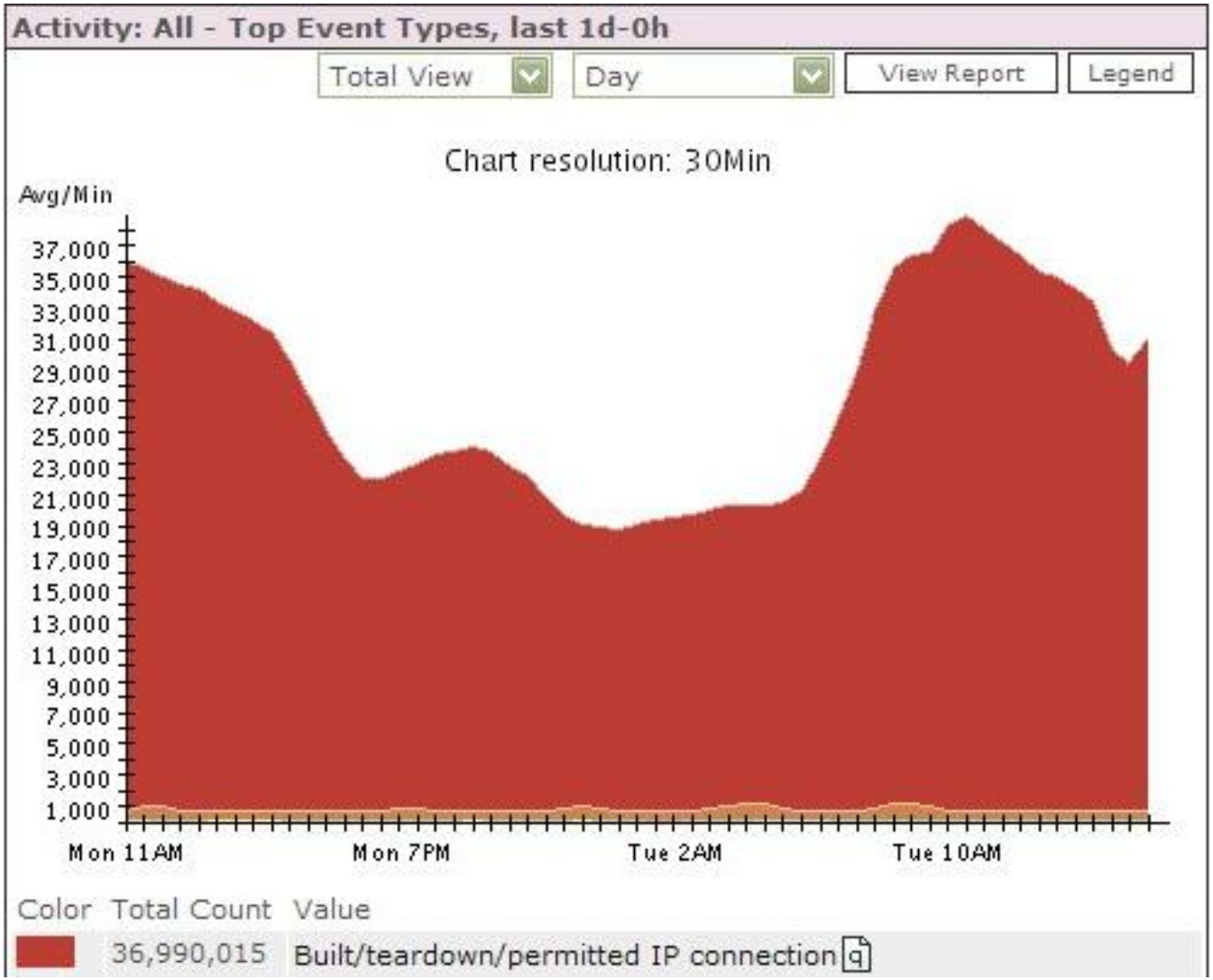


8. Monitoring Examples

Network Diagram

Network Graphic Removed: Not intended for general distribution.

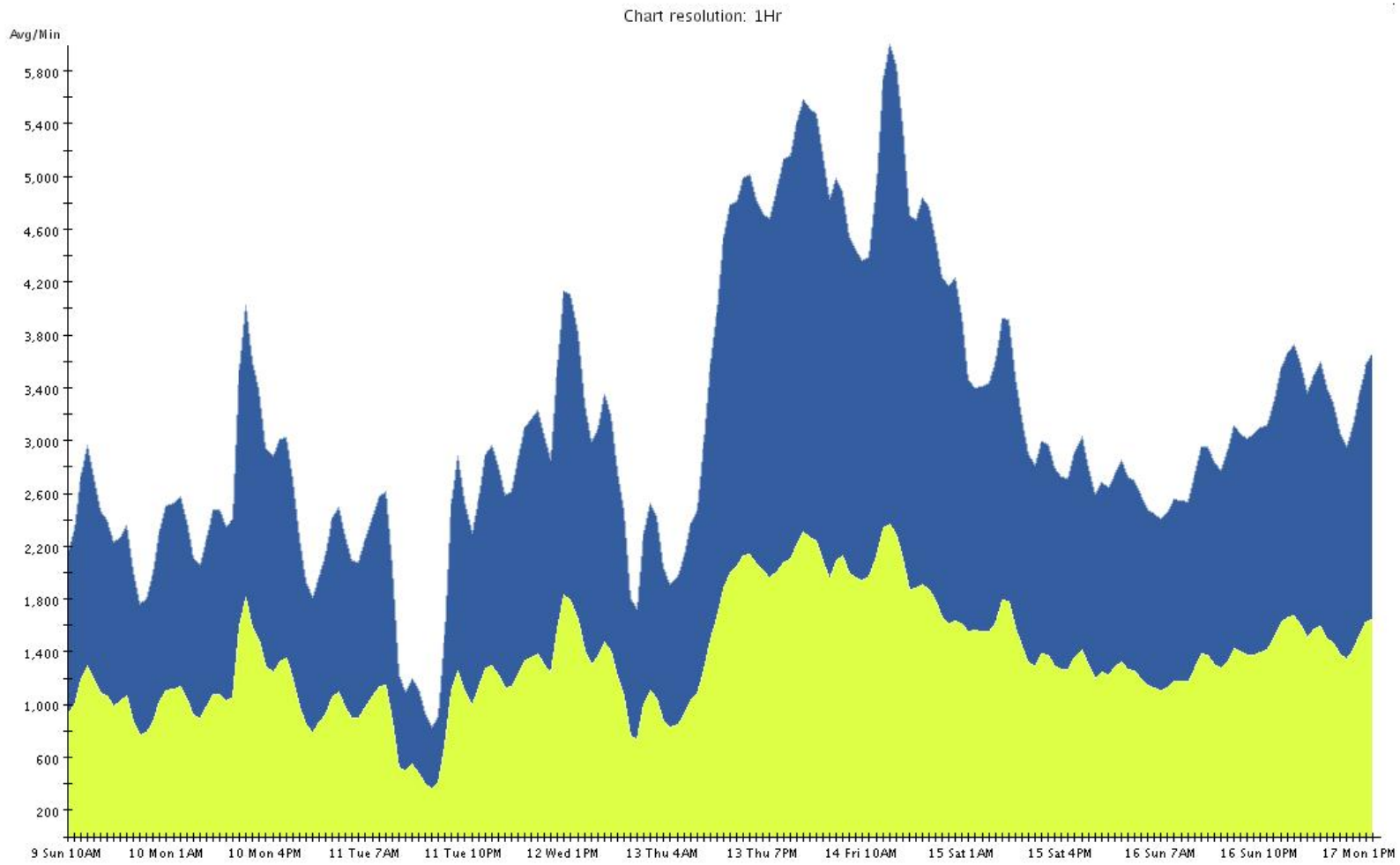
Sessions in 24 Hours



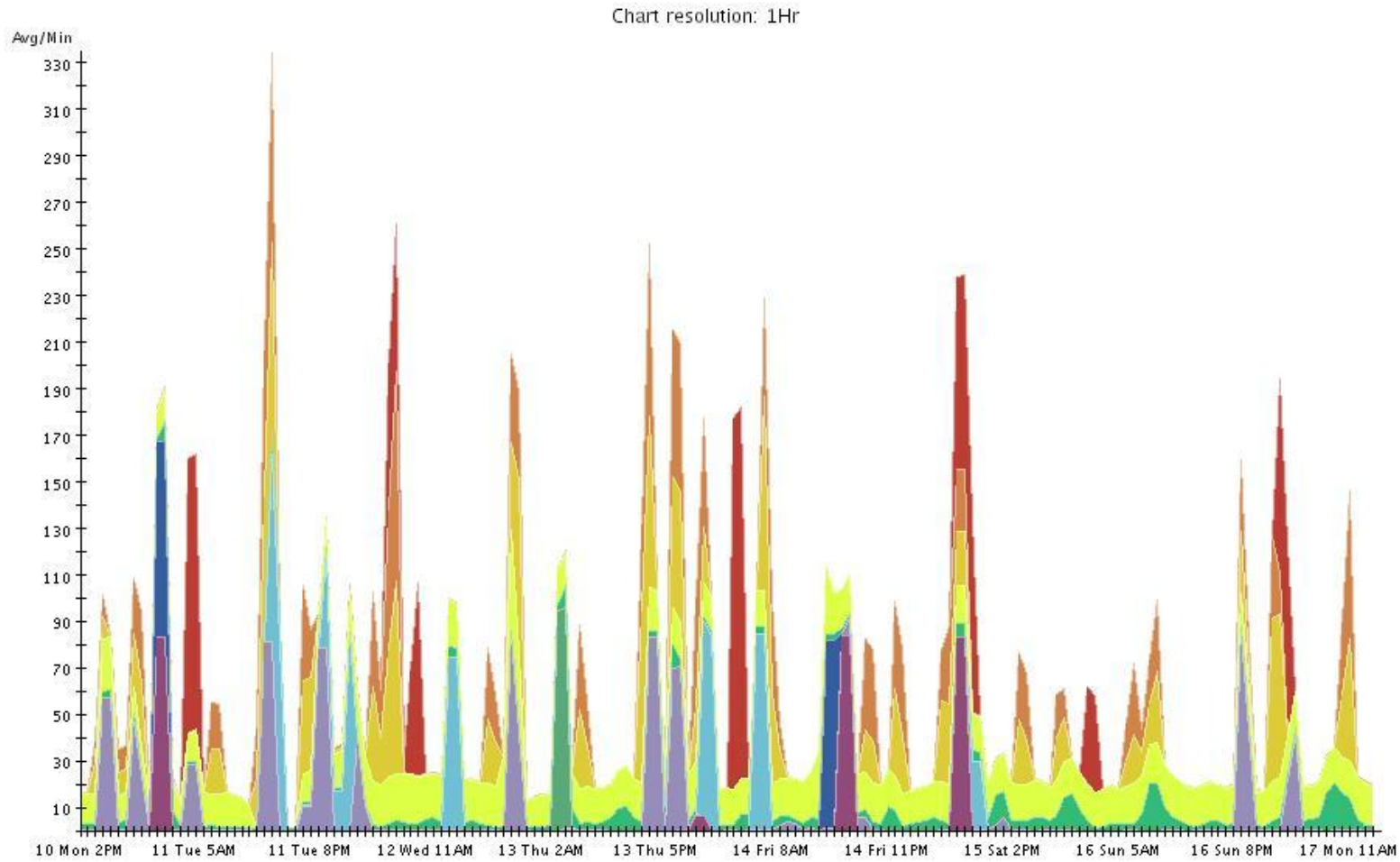
Example 1: Identifying an Attack

- Customer with a business requirement for Secure Shell, SSH, access from the Internet.
- Several User IDs are constantly being locked out as the result of too many failed logins
- Sometimes the user IDs are relocked out as fast as they can be unlocked

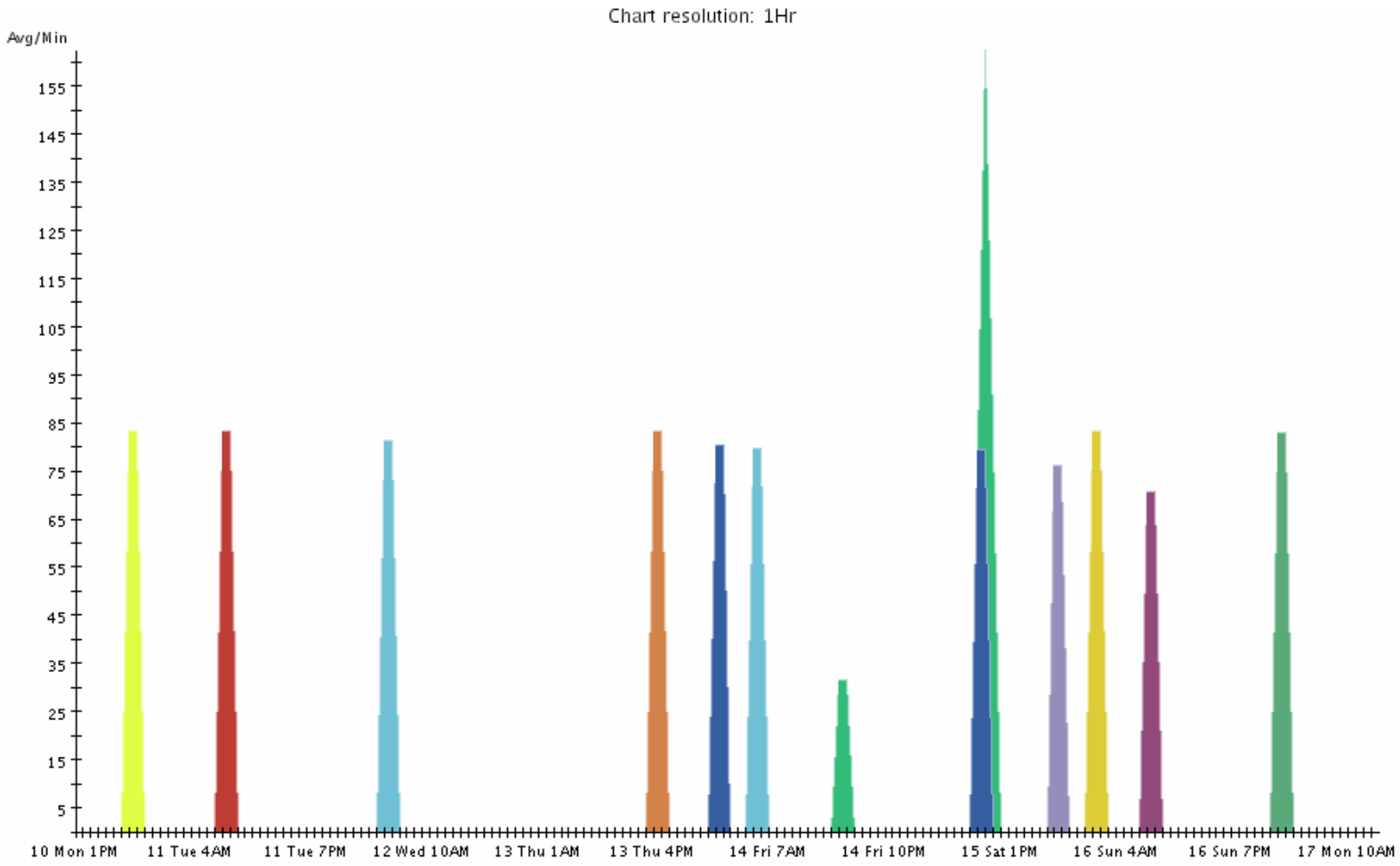
Total Traffic for One Week



Total Attacks During Week

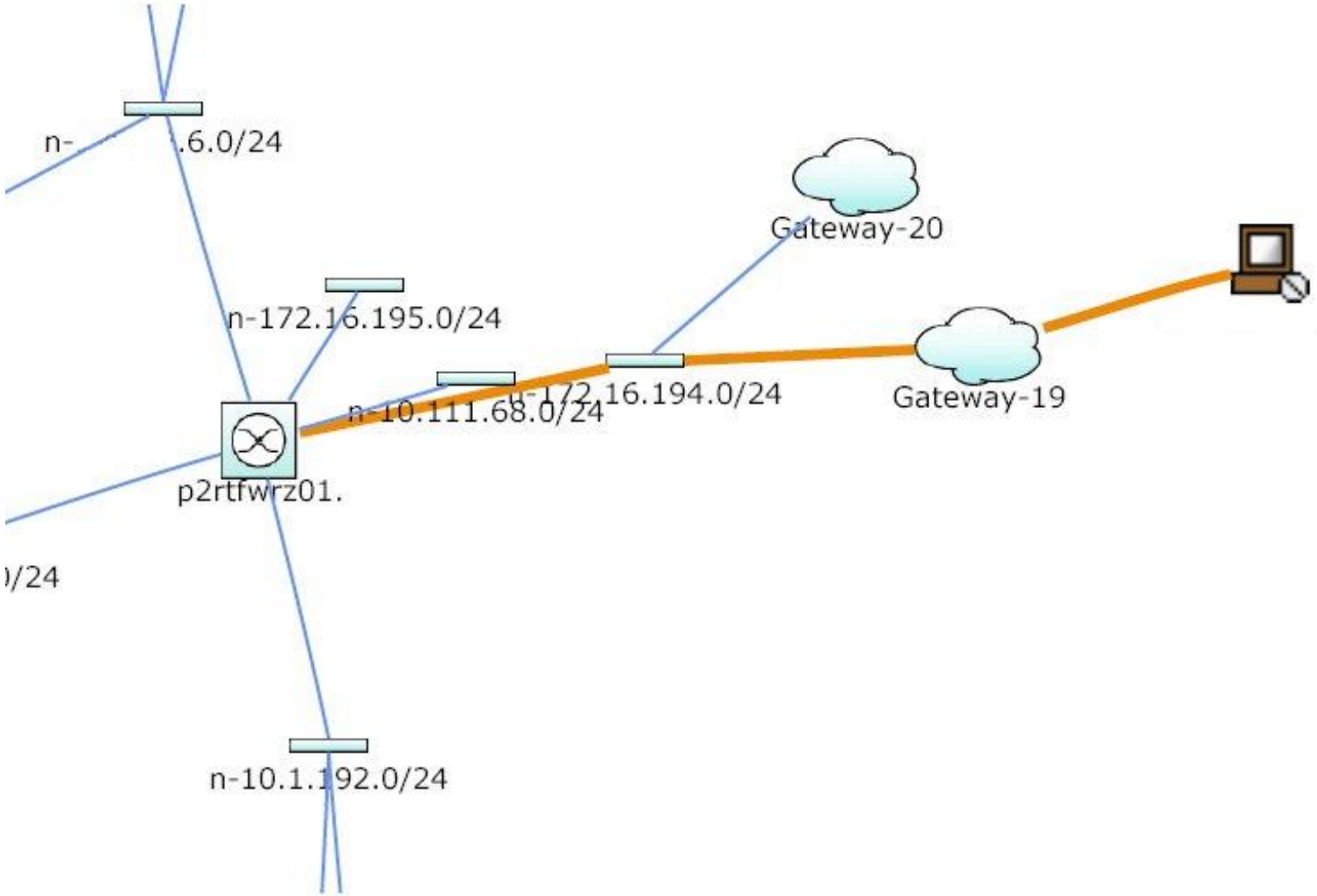


Secure Shell (SSH) Attacks During Week



Another Possible Solution…..

Example 2: Attack Diagram



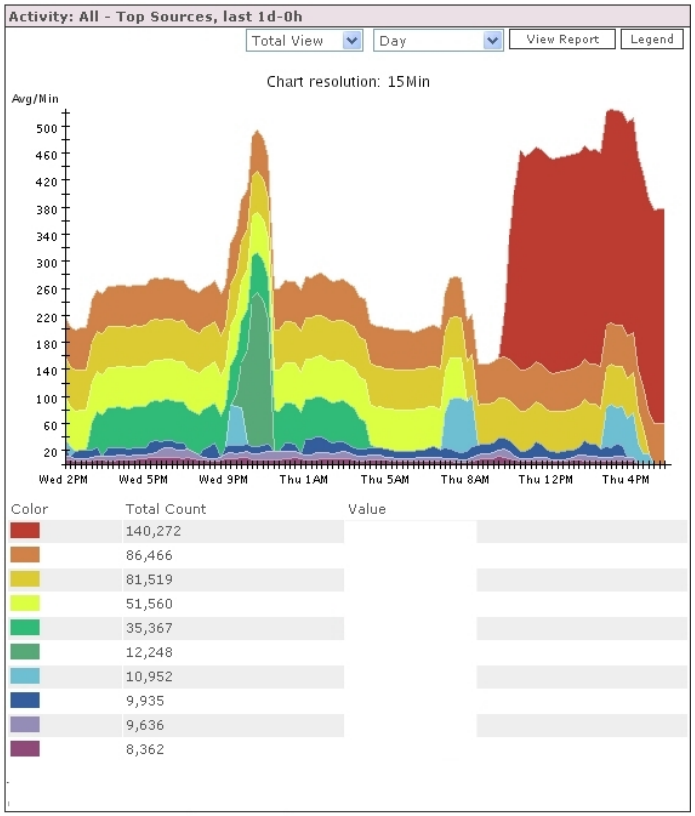
Example 3: Flow Tracking

Network Graphic Removed: Not intended for general distribution.

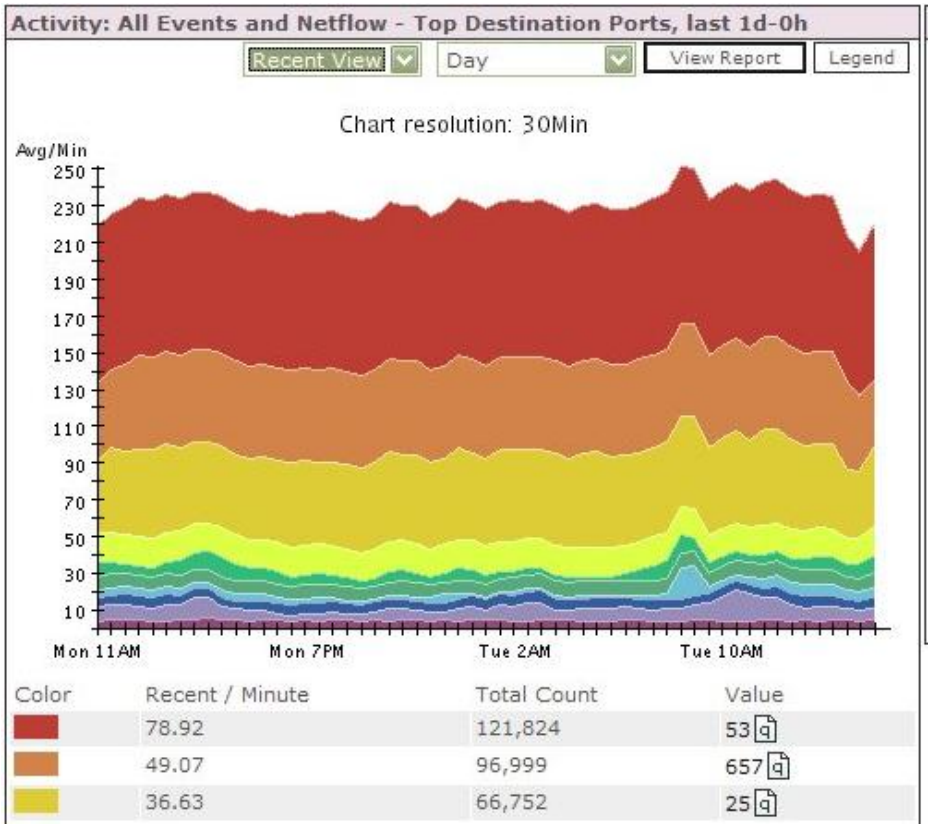
Example 4: Identifying Misconfigured Devices

- Security monitoring can help identify misconfigured devices
- Saves money in reduced bandwidth cost

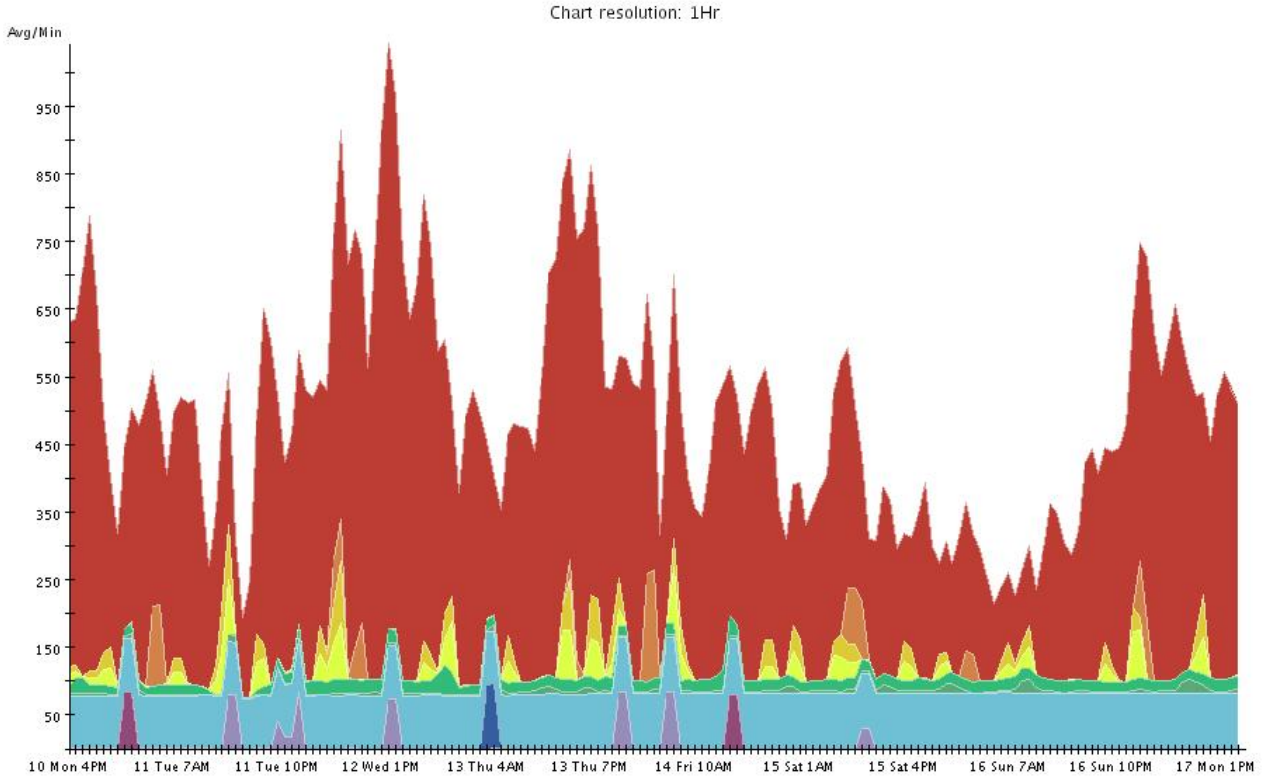
Misconfigured Device 1



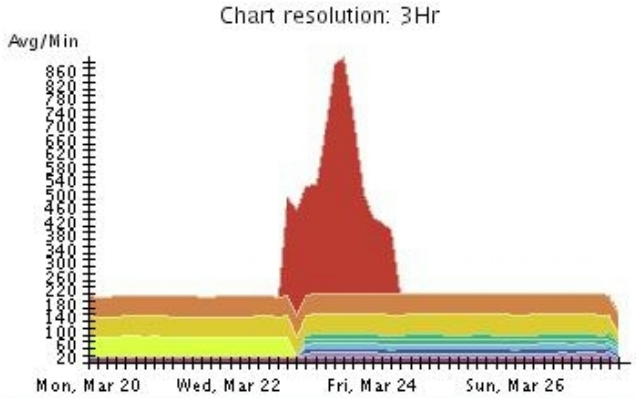
Misconfigured Device 2



Misconfigured Device 3



Example 4: Internal Scanning



Rank		Total Sessions	Average / Minute	Raw Source IP
	1	731,461	72.49	
	2	605,080	59.97	
	3	572,525	56.74	
	4	218,958	21.7	
	5	80,549	7.98	
	6	80,543	7.98	
	7	80,535	7.98	
	8	78,946	7.82	
	9	76,713	7.6	
	10	75,083	7.44	

9. Valuable Assets: People

Team Skills

- Knowledge
- Experience
- Training
- Certifications
- Practice
- Get involved

10. Summary

The Take Home Message

Summary

- Policy and procedure
- Understand the purpose of your network
- Manage risk (simplify, remove what you don't need)
- Logs are important
- Network flow analysis critical
- Collect as much good data as you can
- Develop good data analysis
- Efficient reporting
- Team skills (technical for sure but communication too)
- Be prepared (be prepared)
- Stay in front of management (visibility)
- Future World – physical to virtual (On Demand)