Network Security Infrastructure
Firewall, VPN, IDS/IPS, SIEM

Information Security

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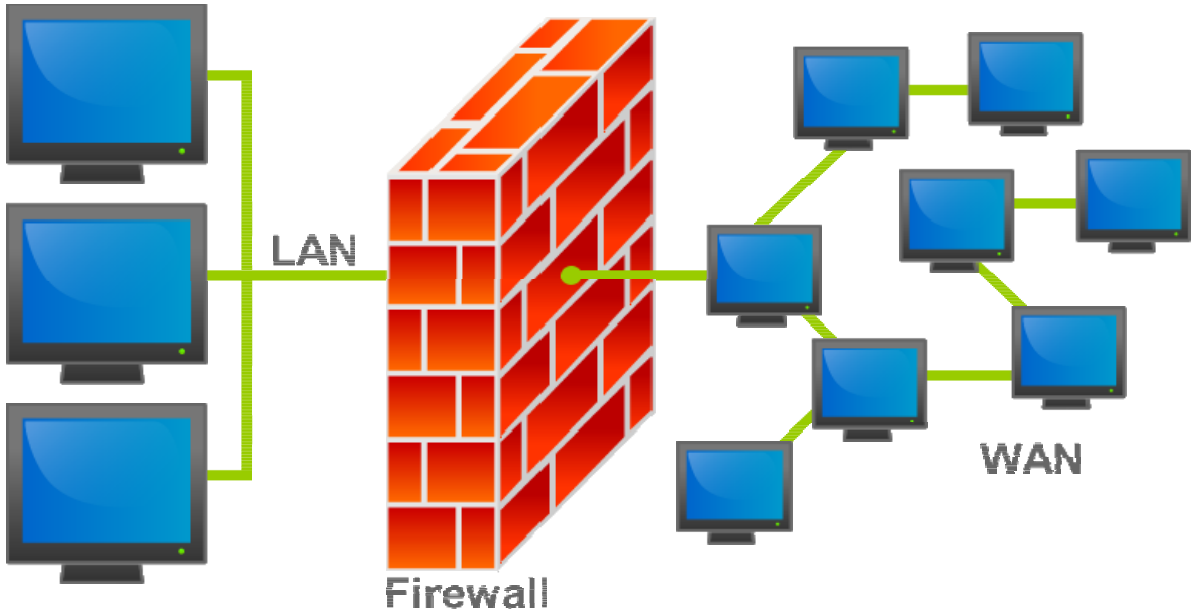
Network Security Infrastructure

- Firewall
  - Hardware vs software
  - Packet Filter
  - Application Gateway/Proxy
  - Stateful Inspection
  - Deployment
- VPN
  - Types of VPNs
- IDS/IPS
  - Components
  - Approach
- SIEM
  - Key Objectives
  - Scenario
  - Process Flow
  - Architecture
  - Features
  - Context
  - Log Correlation

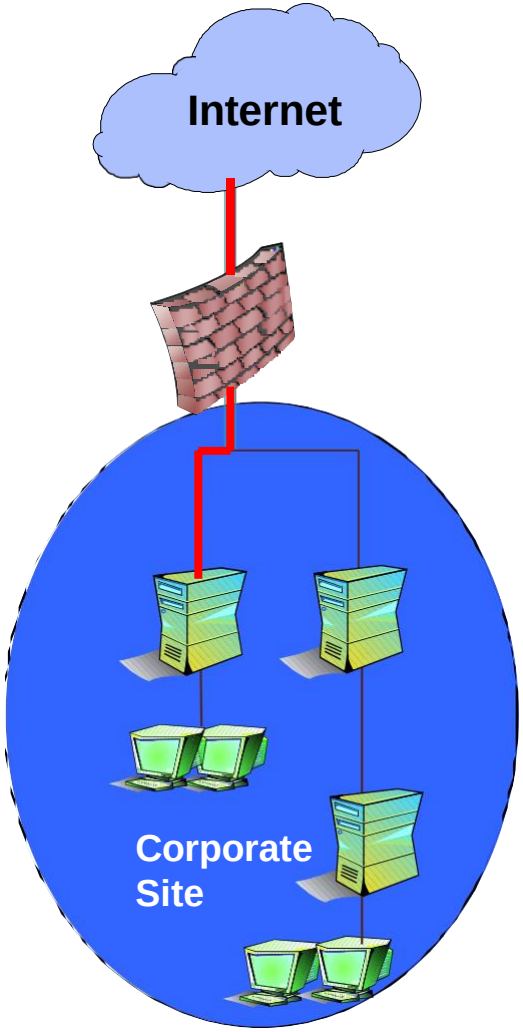
What is a Firewall?

Hardware, software, or a combination of both that is used to prevent unauthorized programs or Internet users from accessing a private network and/or a single computer.



What is a Firewall?

- Acts as a security gateway between two networks
- Tracks and controls network communications
  - Decides whether to pass, reject, encrypt, or log communications (Access Control)



Hardware vs. Software Firewalls

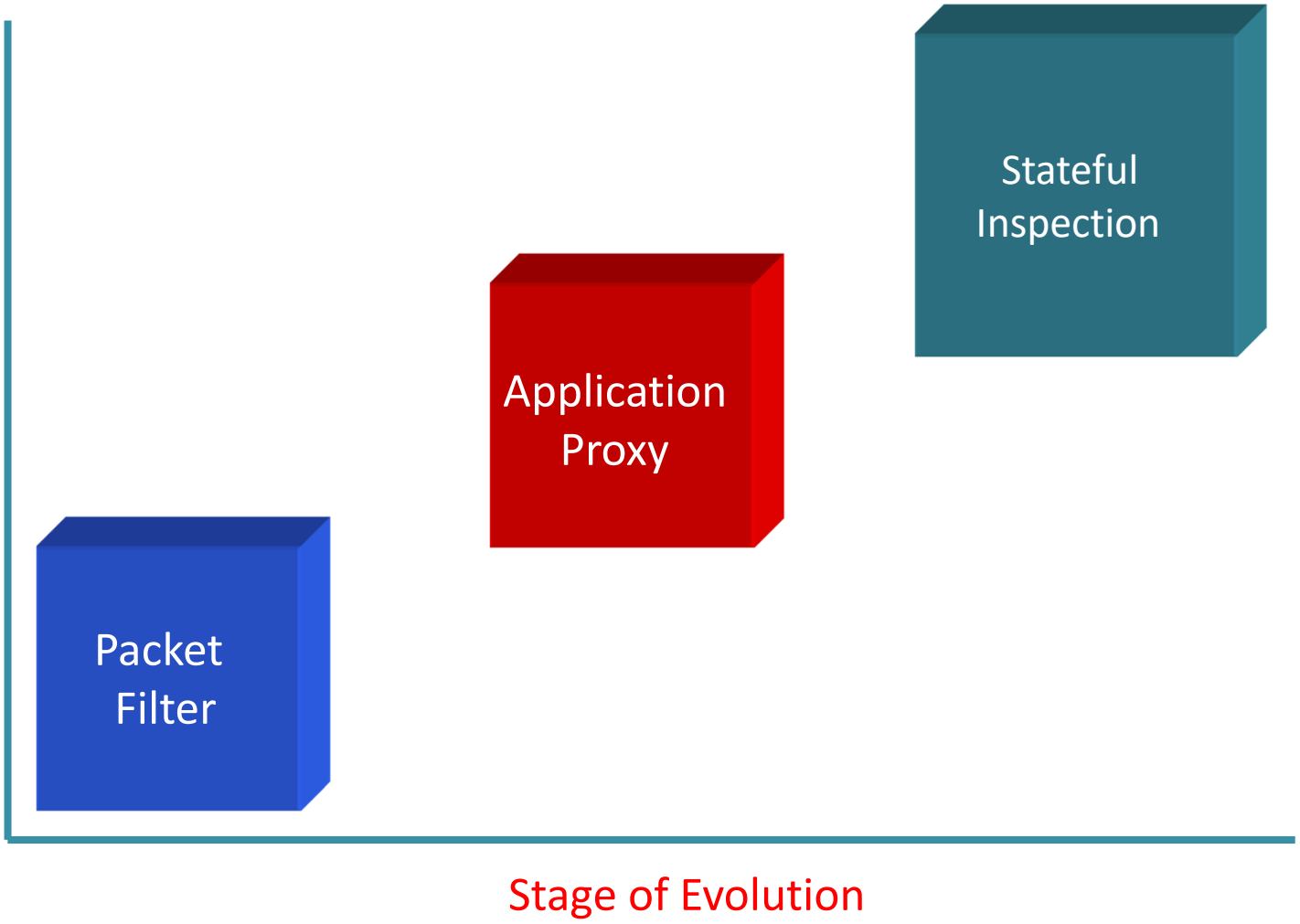
Hardware Firewalls

- Protect an entire network
- Implemented on the router level
- Usually more expensive, harder to configure

Software Firewalls

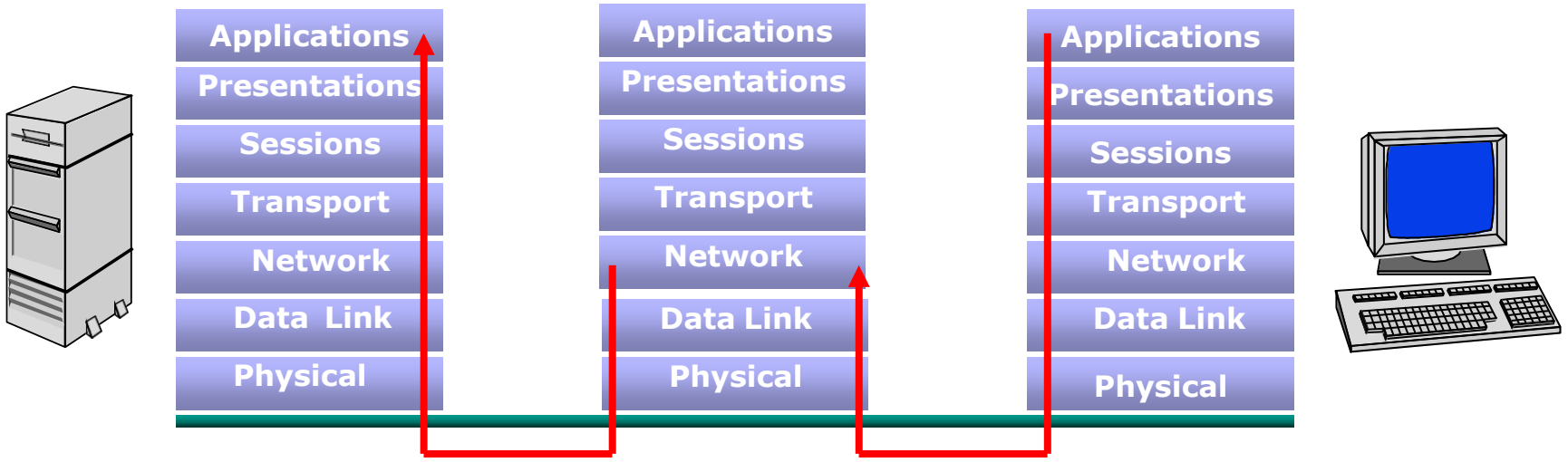
- Protect a single computer
- Usually less expensive, easier to configure

Evolution of Firewalls



Packet Filter

- Packets examined at the network layer
- Useful “first line” of defense - commonly deployed on routers
- Simple accept or reject decision model
- No awareness of higher protocol layers



Packet Filter

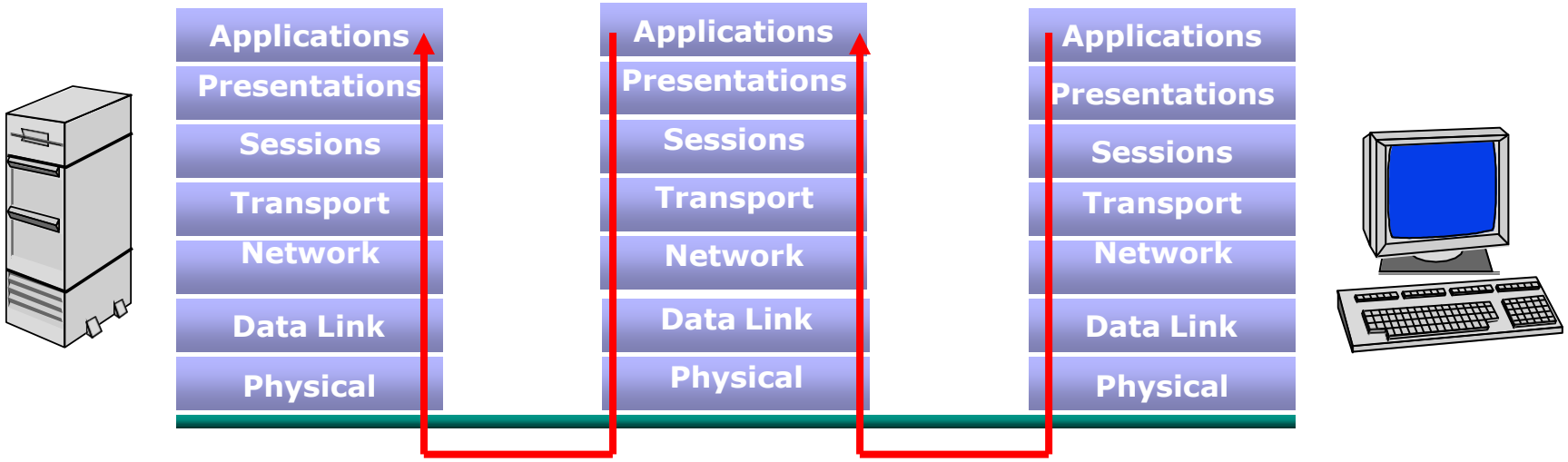
- Simplest of components
- Uses transport-layer information only
  - IP Source Address, Destination Address
  - Protocol/Next Header (TCP, UDP, ICMP, etc)
  - TCP or UDP source & destination ports
  - TCP Flags (SYN, ACK, FIN, RST, PSH, etc)
  - ICMP message type
- Example
  - SSH uses port 22
    - No incoming port 22 packets except known trusted servers

How to Configure a Packet Filter

- Start with a security policy
- Specify allowable packets in terms of logical expressions on packet fields
- Rewrite expressions in syntax supported by your vendor
- General rules - least privilege
  - All that is not expressly permitted is prohibited
  - If you do not need it, eliminate it

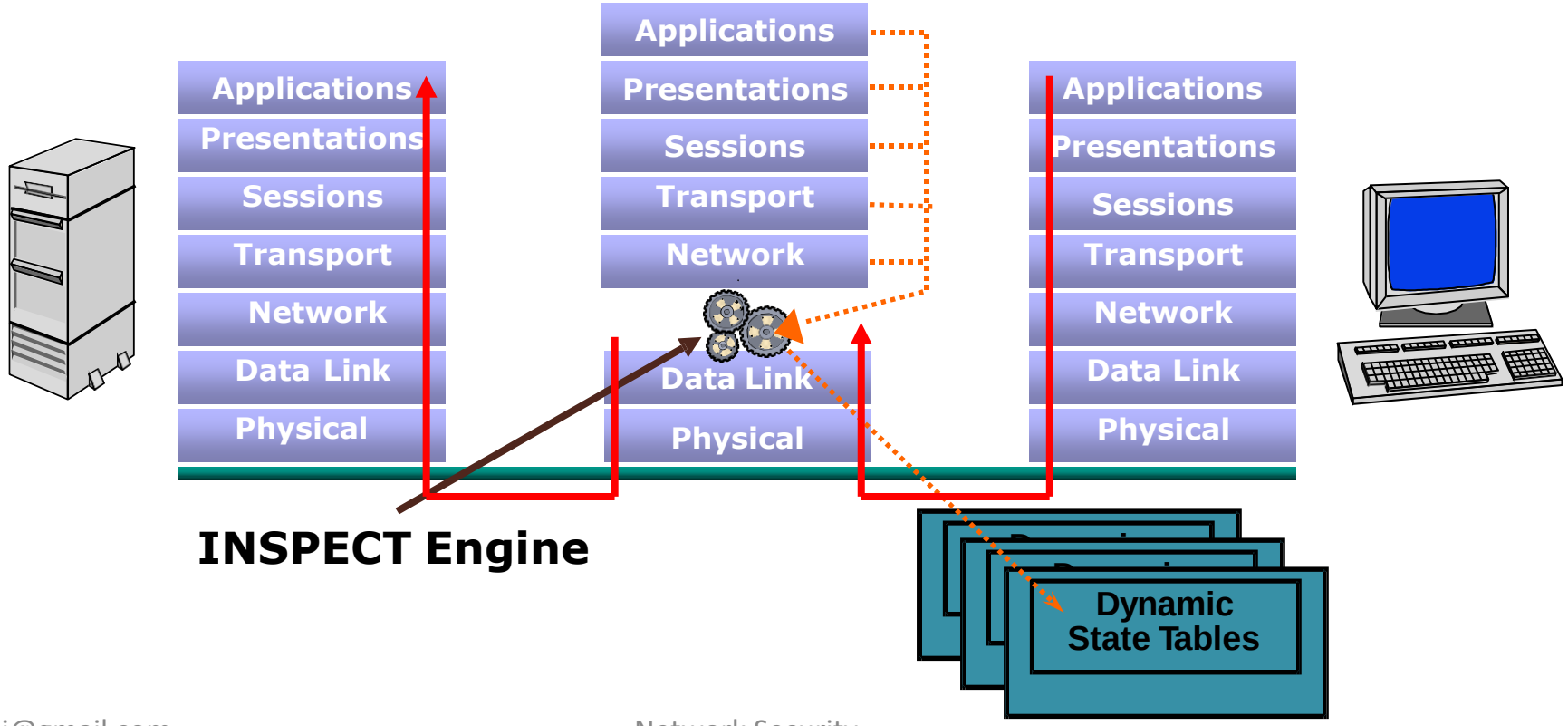
Application Gateway or Proxy

- Packets examined at the application layer
- Application/Content filtering possible
- Scalability and performance limited



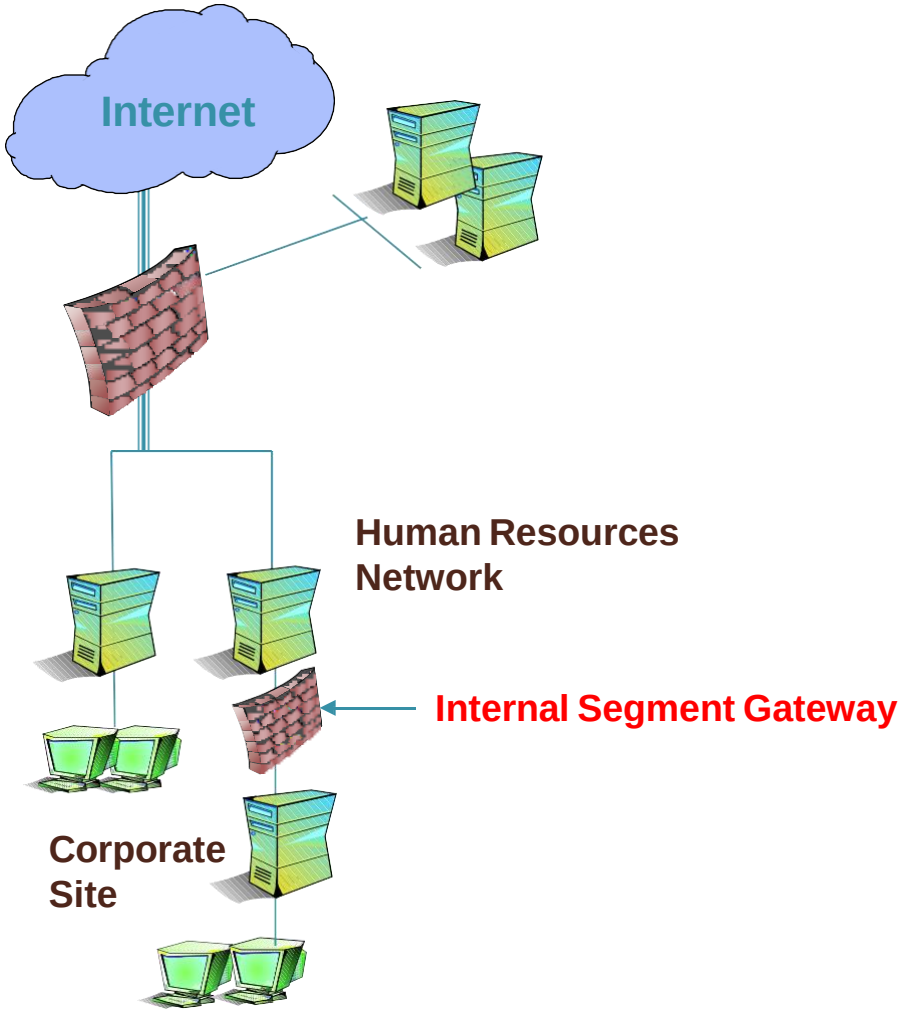
Stateful Inspection

- Packets Inspected between data link layer and network layer in the OS kernel
- State tables are created to maintain connection context



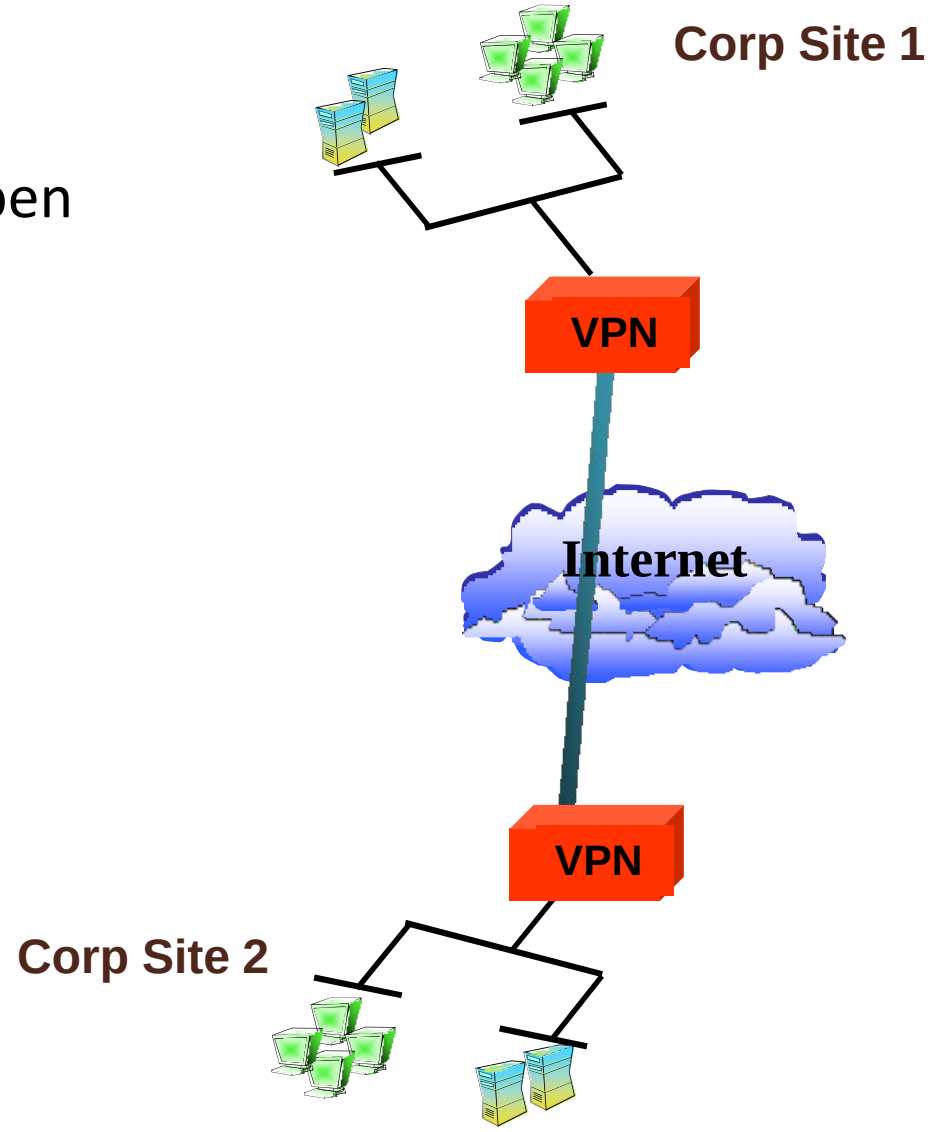
Firewall Deployment

- Corporate Network Gateway
- Internal Segment Gateway
  - Protect sensitive segments (Finance, HR, Product Development)
  - Provide second layer of defense
  - Ensure protection against internal attacks and misuse



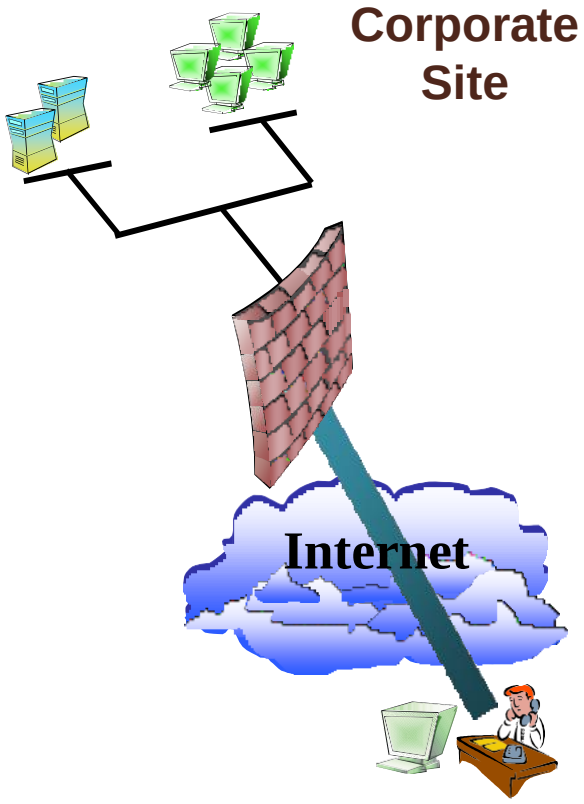
What is a VPN?

- A VPN is a private connection over an open network
- A VPN includes authentication and encryption to protect data integrity and confidentiality



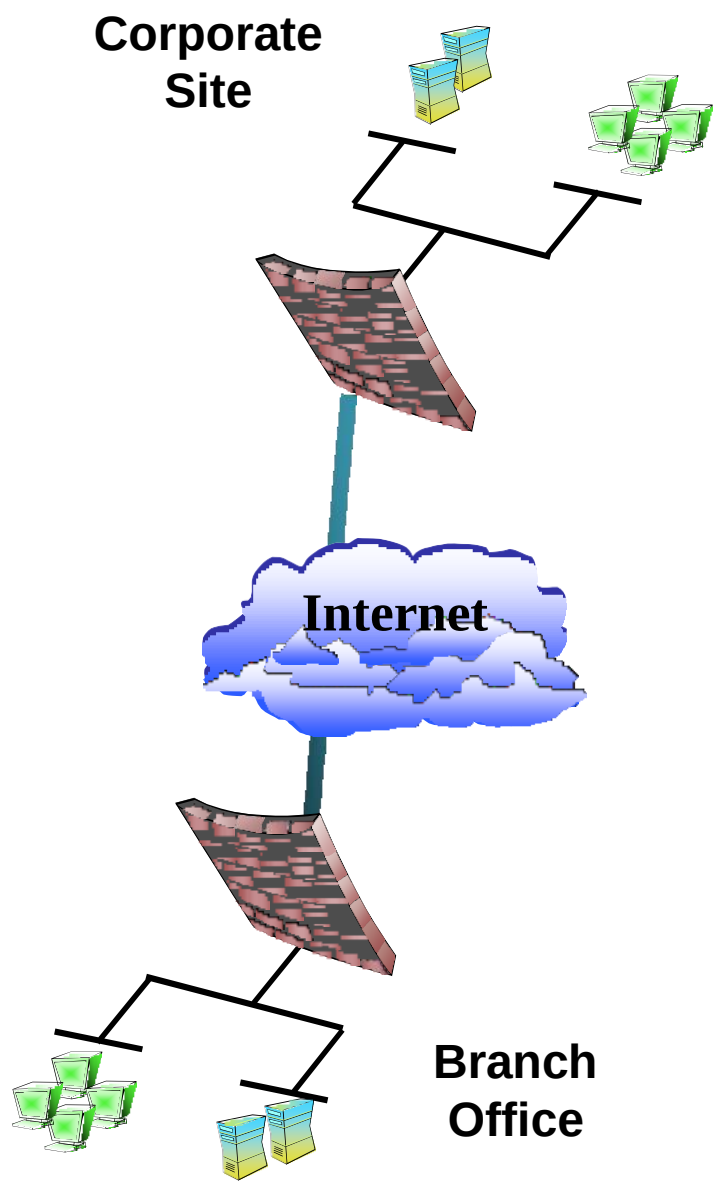
Types of VPNs

- Remote Access VPN
  - Provides access to internal corporate network over the Internet
  - Reduces long distance, modem bank, and technical support costs
  - PAP,CHAP,RADIUS



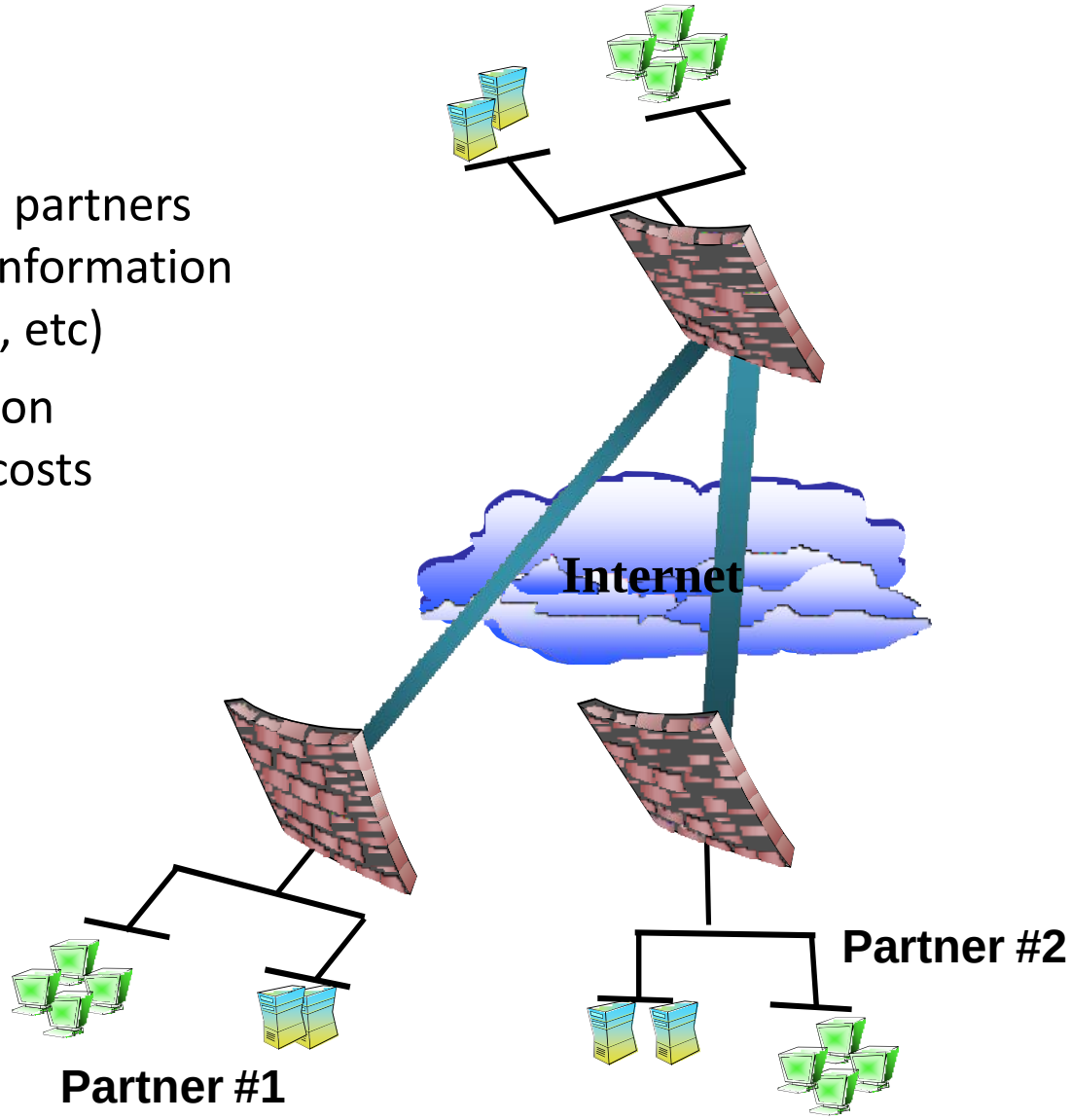
Types of VPNs

- Site-to-Site VPN
  - Connects multiple offices over Internet
  - Reduces dependencies on frame relay and leased lines



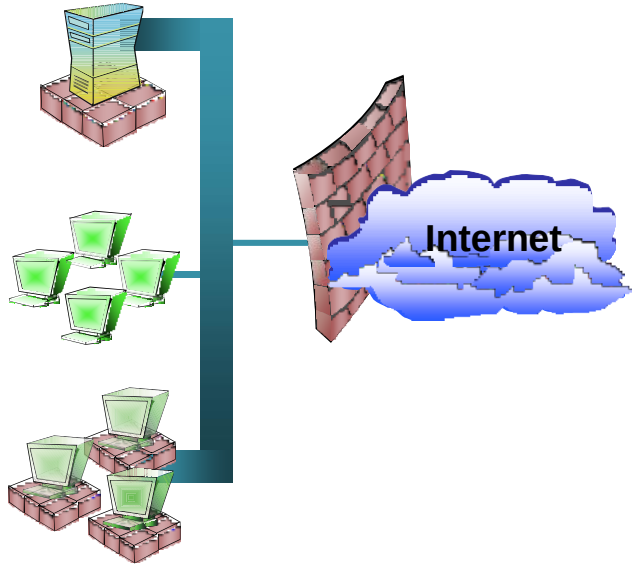
Types of VPNs

- Extranet VPN
  - Provides business partners access to critical information (leads, sales tools, etc)
  - Reduces transaction and operational costs



Types of VPNs

- Client/Server VPN
  - Protects sensitive internal communications



LAN clients with sensitive data

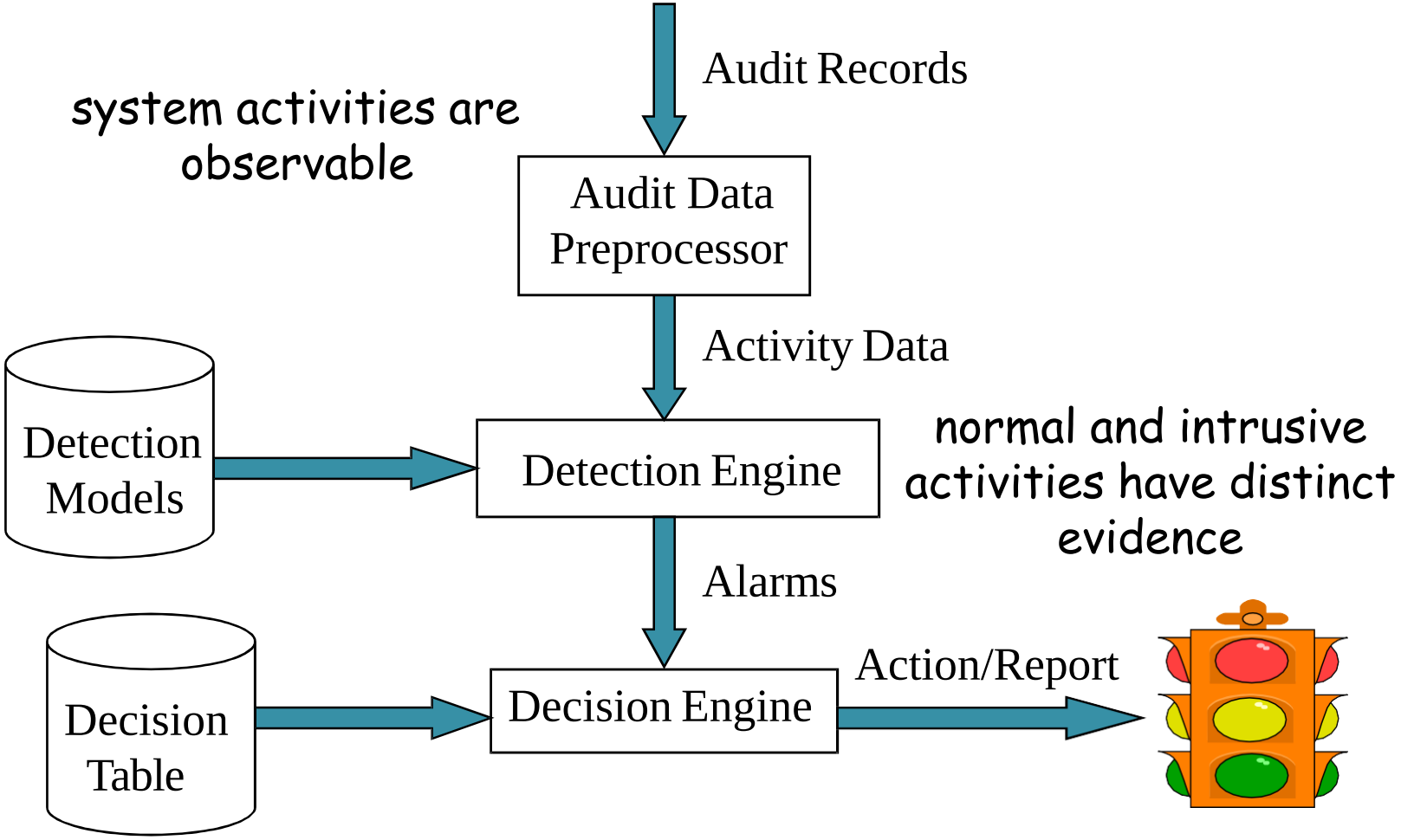
Overview of IDS/IPS

- Intrusion
  - A set of actions aimed at compromising the security goals (confidentiality, integrity, availability of a computing/networking resource)
- Intrusion detection
  - The process of identifying and responding to intrusion activities
- Intrusion prevention
  - The process of both detecting intrusion activities and managing responsive actions throughout the network.

Overview of IDS/IPS

- Intrusion detection system (IDS)
  - A system that performs automatically the process of intrusion detection.
- Intrusion prevention system (IPS)
  - A system that has an ambition to both detect intrusions and manage responsive actions.
  - Technically, an IPS contains an IDS and combines it with preventive measures (firewall, antivirus, vulnerability assessment) that are often implemented in hardware.

Components of Intrusion Detection System



Intrusion Detection Approaches

- Modeling
  - Features: evidences extracted from audit data
  - Analysis approach: piecing the evidences together
    - Misuse detection (a.k.a. signature-based)
    - Anomaly detection (a.k.a. statistical-based)
- Deployment: Network-based or Host-based
  - Network based: monitor network traffic
  - Host based: monitor computer processes

Introduction to SIEM

- The term Security Information Event Management (SIEM), coined by Mark Nicolett and Amrit Williams of Gartner in 2005.
- Describes the product capabilities of gathering, analyzing and presenting information from network and security devices; identity and access management applications; vulnerability management and policy compliance tools; operating system, database and application logs; and external threat data.
- Security Information and Event Management (SIEM) is a term for software and products services combining security information management (SIM) and security event manager (SEM).

Security Information and Event Management (SIEM)

- **LMS - "Log Management System" –** a system that collects and store Log Files (from Operating Systems, Applications, etc) from multiple hosts and systems into a single location, allowing centralized access to logs instead of accessing them from each system individually.
- **SLM /SEM– *"Security Log/Event Management"*** – an LMS, but marketed towards security analysts instead of system administrators. SEM is about highlighting log entries as more significant to security than others.
- **SIM – *"Security Information Management"*** - an Asset Management system, but with features to incorporate security information too. Hosts may have vulnerability reports listed in their summaries, Intrusion Detection and AntiVirus alerts may be shown mapped to the systems involved.
- **SEC - "Security Event Correlation" –** To a particular piece of software, three failed login attempts to the same user account from three different clients, are just three lines in their logfile.To an analyst, that is a peculiar sequence of events worthy of investigation, and Log Correlation (looking for patterns in log files) is a way to raise alerts when these things happen.
- **SIEM – "Security Information and Event Management"** – SIEM is the "All of the Above" option, and as the above technologies become merged into single products, became the generalized term for managing information generated from security controls and infrastructure.We'll use the term SIEM for the rest of this presentation

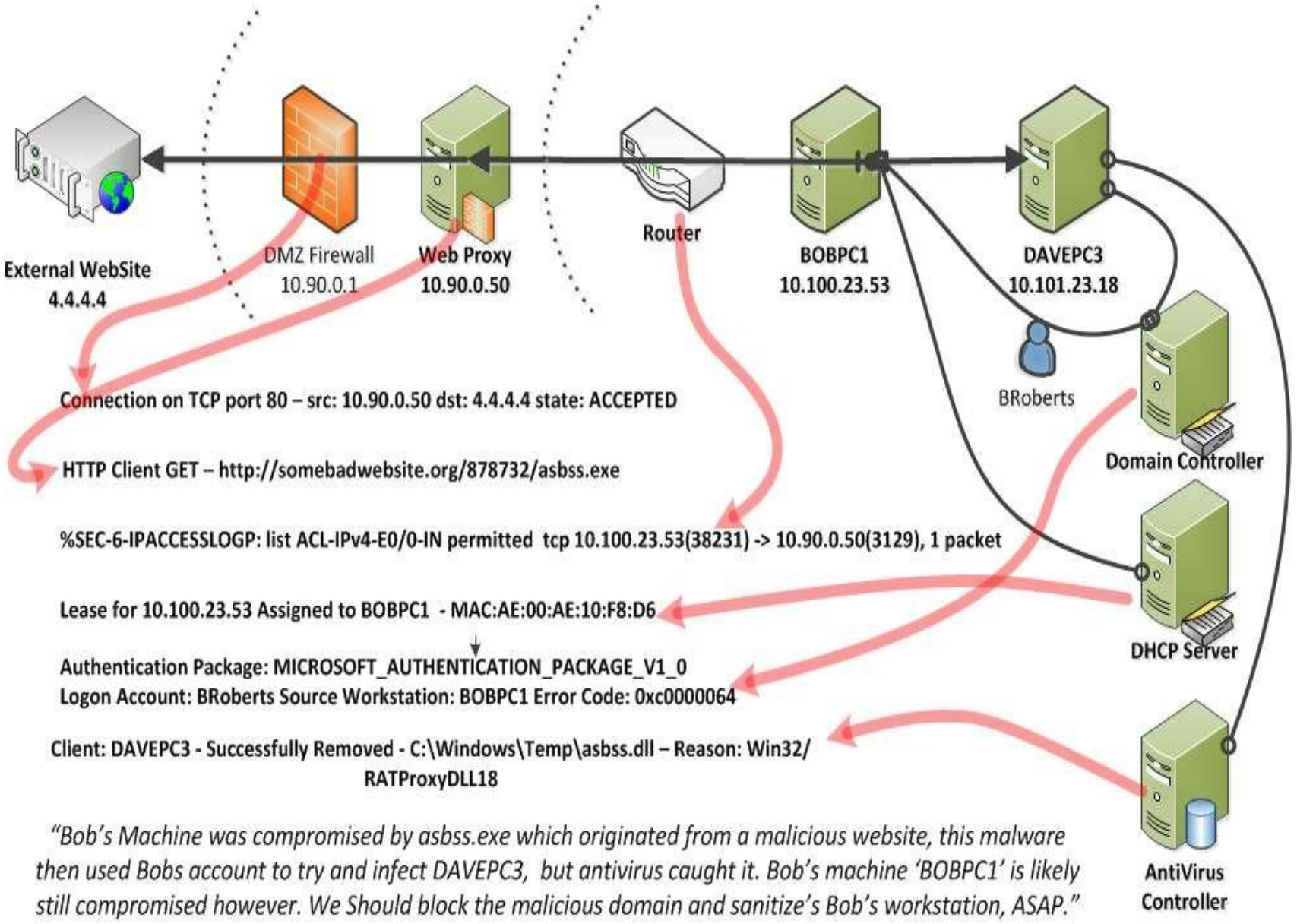
Key Objectives of SIEM

- Identify threats and possible breaches
- Collect audit logs for security and compliance
- Conduct investigations and provide evidence

SIEM vs LM

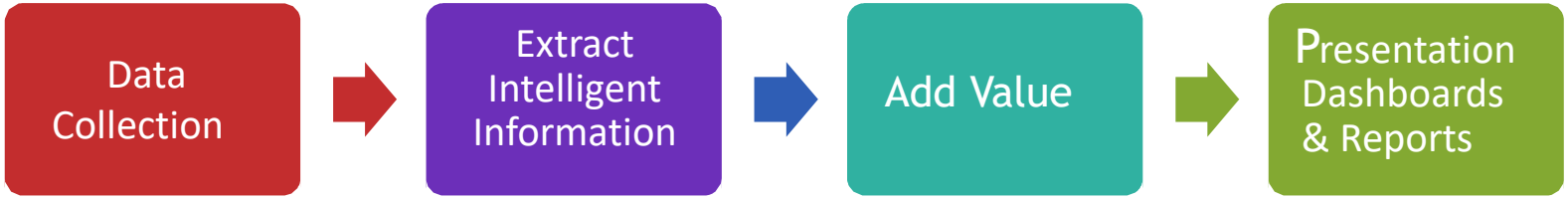
Functionality	Security Information and Event Management (SIEM)	Log Management (LM)
Log collection	Collect security relevant logs + context data	Collect all logs
Log pre-processing	Parsing, normalization, categorization, enrichment	Indexing, parsing or none
Log retention	Retail parsed and normalized data	Retain raw log data
Reporting	Security focused reporting	Broad use reporting
Analysis	Correlation, threat scoring, event prioritization	Full text analysis, tagging
Alerting and notification	Advanced security focused reporting	Simple alerting on all logs
Other features	Incident management, analyst workflow, context analysis, etc.	High scalability of collection and storage

A SIEM Scenario

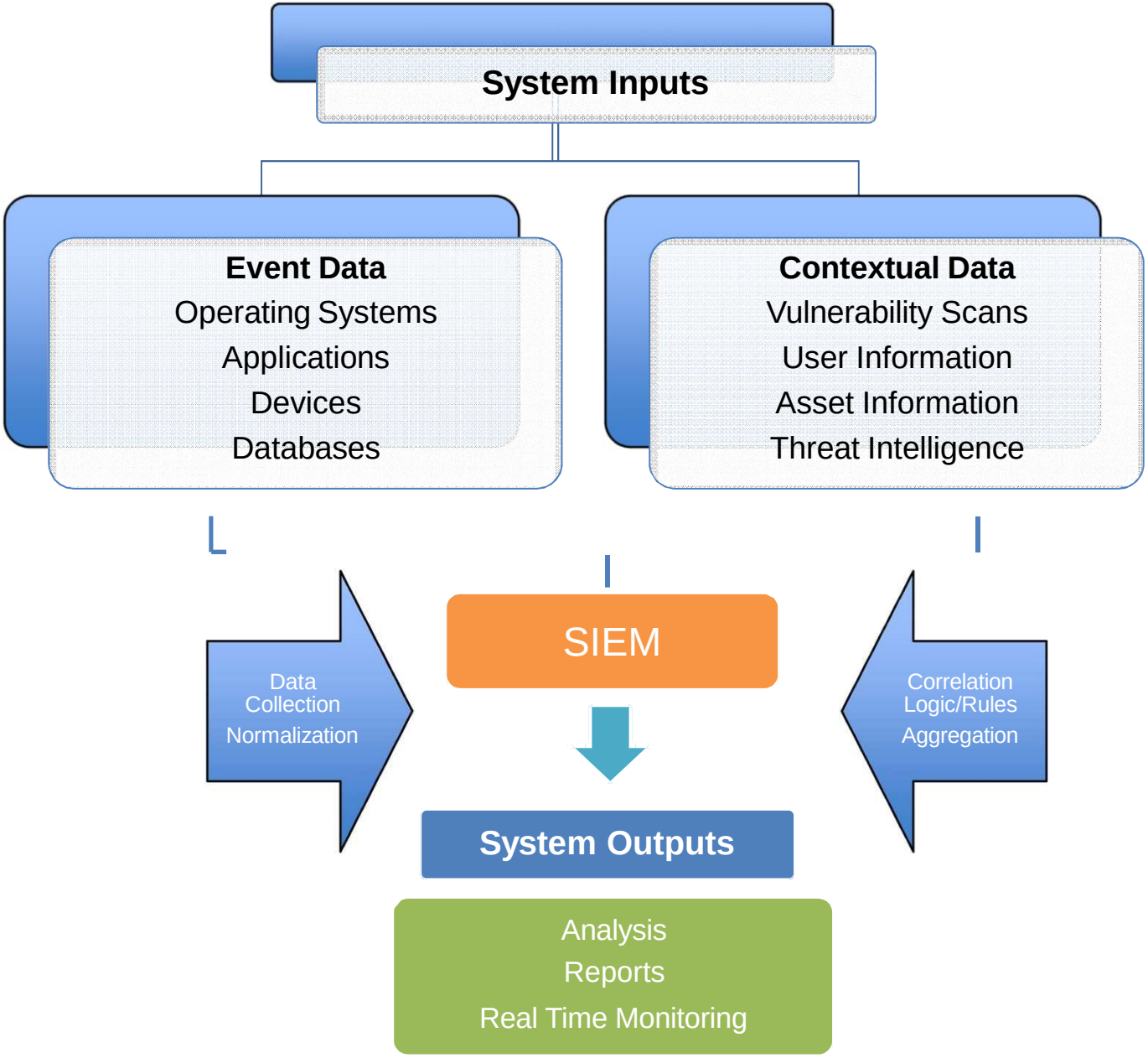


"Bob's Machine was compromised by asbss.exe which originated from a malicious website, this malware then used Bobs account to try and infect DAVEPC3, but antivirus caught it. Bob's machine 'BOBPC1' is likely still compromised however. We Should block the malicious domain and sanitize's Bob's workstation, ASAP."

SIEM Process Flow



SIEM Architecture

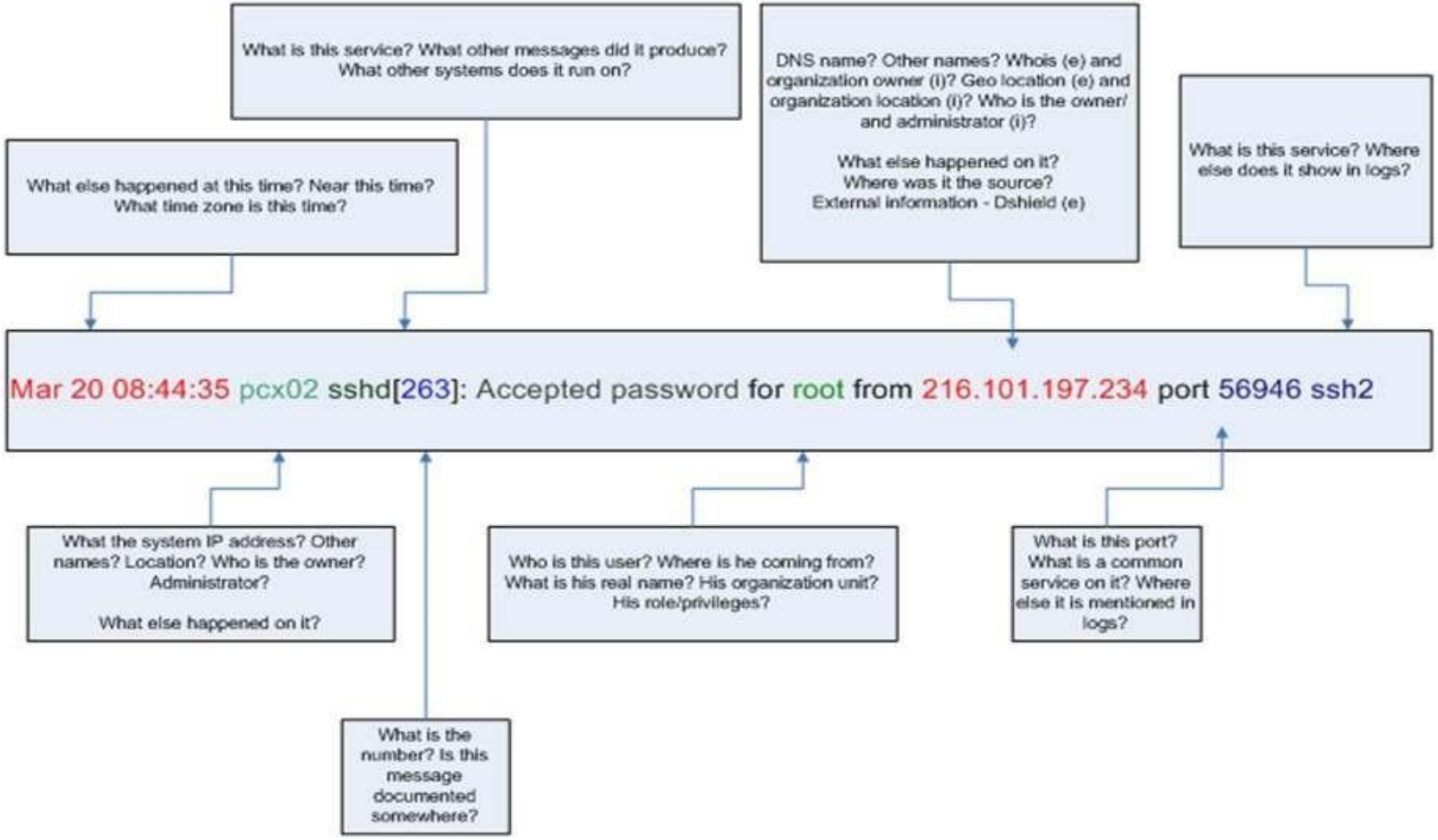


Typical Features of SIEM

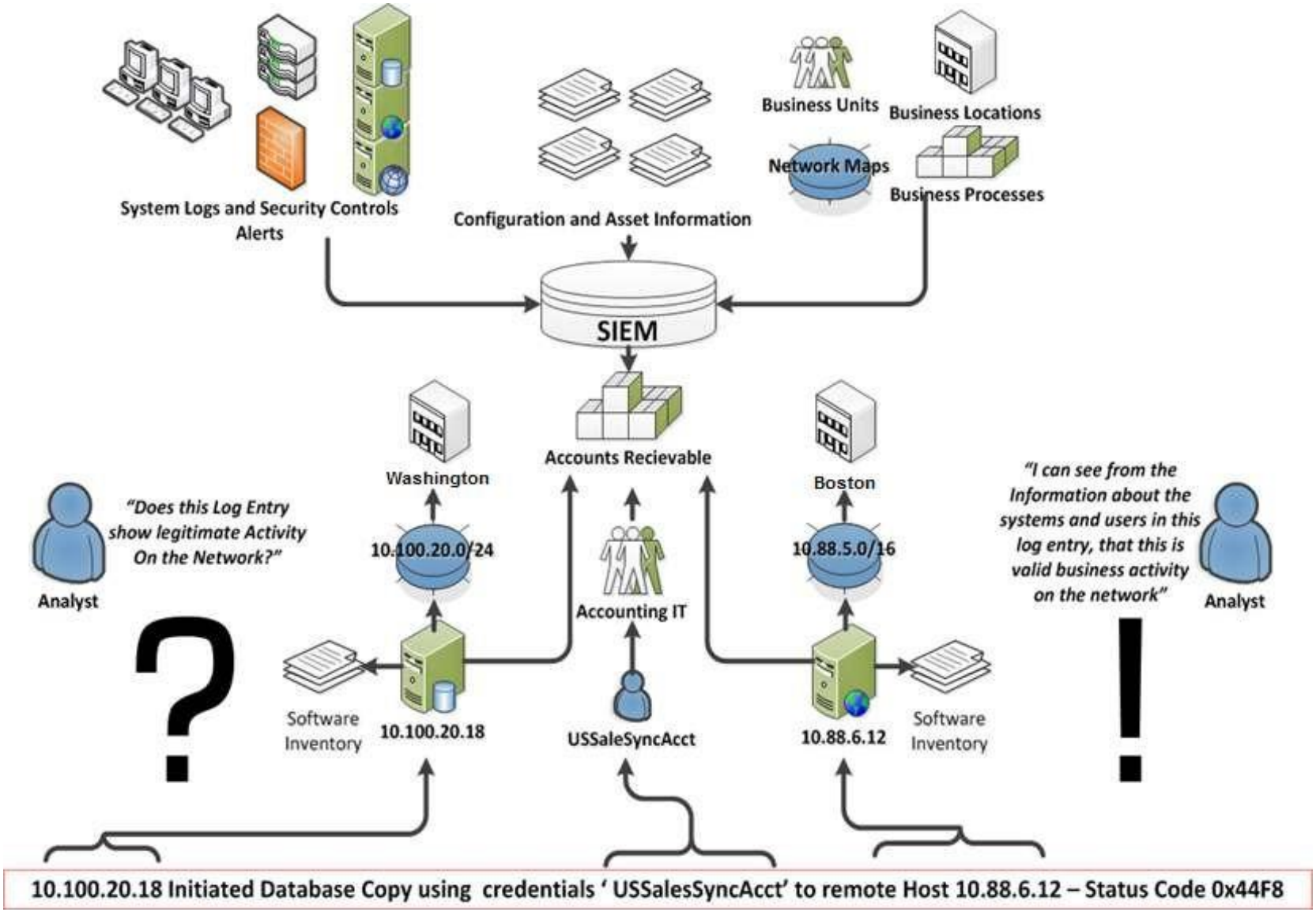
Context

- Examples of context
  - Add geo-location information
  - Get information from DNS servers
  - Get User details (Full Name, Job Title & Description)
- Add context aids in identifying
  - Access from foreign locations
  - Suspect data transfer

Context (Example)



How a Log File is Generated in your Network



Log Correlation

Log Correlation is the difference between:

"14:10 7/4/20110 User E.Smith Successful Auth to 10.100.52.105 from 10.10.8.22"

and…

"An Account belonging to Human Resourses connected to an Engineering System from an office desktop, on a day when nobody should be in the office"

Why is SIEM Necessary?

- Rise in data breaches due to internal and external threats
- Attackers are smart and traditional security tools just don’t suffice
- Mitigate sophisticated cyber-attacks
- Manage increasing volumes of logs from multiple sources
- Meet stringent compliance requirements