insightix

Keep your network in sight

Bypassing NAC v2.0

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What this talk is about?

- Introduction to NAC
  - What is NAC?
  - What problem does NAC aim to solve?
  - A NAC solution's components
- Bypassing NAC
  - Architecture
  - Element Detection
  - Compliance Checks
  - Enforcement
  - Quarantine
  - Etc.
- Product Examples

Ofir Arkin

- CTO and Co-Founder, Insightix
  http://www.insightix.com
- Founder, The Sys-Security Group
  http://www.sys-security.com (Blog)
- Computer Security Researcher
  - Infrastructure Discovery
    - ICMP Usage in Scanning
    - Xprobe2 (The Active OS Fingerprinting Tool)
    - Risks of Passive Network Discovery
  - VoIP Security
  - Information Warfare
  - NAC
- Member
  - VoIPSA (Board member, Chair security research committee)

Introduction

What is NAC?

- Truths about NAC:
  - A hot topic
  - The Next Big Thing in the IT security space
  - A misused term used by some vendors to get visibility
  - A bandwagon a lot of companies wants to jump on
  - Many products available today claiming to offer NAC
  - A misconception created due to lack of standardization and a common definition
- What exactly is NAC?
  - A compliance solution?
  - A security solution?
- What problem does it aim to solve?

The Problem

- An enterprise IT network is a complex and a dynamic environment that is generally described as a black hole by its IT managers
- The lack of knowledge results in lack of control, the inability to manage and secure the enterprise IT network in an appropriate manner
- The stability, integrity (viruses, worms, information theft, etc.) and regular operation of the IT network are in jeopardy due to the lack of knowledge regarding the enterprise network layout (topology), resources (availability and usage), elements residing on the network (devices, applications, their properties and the interdependencies among them) and users accessing the network and their resources (whether locally or remotely)

The Problem

- The threat of viruses, worms, information theft, roaming users, and the lack of control of the IT infrastructure lead companies to seek security solutions which control the access to their internal IT networks
- A new breed of software and hardware solutions from a variety of vendors has recently emerged
- All are tasked with one goal – controlling the access to a network using different methods and solutions

“My” NAC is not “Your” NAC

- Standardization and/or a common criterion for NAC does not exist
  - Cisco **N**etwork **A**dmission **C**ontrol (NAC)
  - Microsoft **N**etwork **A**ccess **P**rotection (NAP)
  - The **T**rusted **C**omputing **G**roup (TCG), **T**rusted **N**etwork **C**onnect (TNC)
  - Etc.
- Therefore the definition of what NAC is, what components a NAC solution should (and/or must) have, and what does a NAC solution needs to adhere to varies from one vendor to another

What NAC Is

- The basic task of NAC is to control access
- The secondary task of NAC is to ensure compliance
- As such NAC is first and foremost a security solution and only then a compliance solution
- My definition of NAC is:
  - **N**etwork **A**ccess **C**ontrol (NAC) is a set of technologies and defined processes, which its aim is to control access to the network allowing only authorized and compliant devices to access and operate on a network

« Security First »
« Contrôle d'accès » avant « Mise en conformité »

Capabilities

The Basics

- The most essential capabilities any NAC solution must have are the ability to detect a new element connecting to the network, and the ability to verify whether or not it complies with a defined security policy
- If the element is not authorized and/or does not comply with the defined security policy, the NAC solution must restrict the element's access to the network

NAC Functions

- The following is a list of functions a NAC solution may, or may not support
  - **Element detection** – The ability to detect new elements as they are introduced to the network
  - **Authentication** – The ability to authenticate each user accessing the network no matter where they are authenticating from and/or which device they are using

NAC Functions

- **End point security assessment** – The ability to assess whether a newly introduced network element complies with a defined security policy. These checks may include the ability to gather knowledge regarding an element's operating system, the list of installed patches, the presence of an A/V software (present, running, and updated), installed applications, etc.

- **Quarantine** – The process of isolating an element from the rest of the network. Quarantine can be triggered when a new element is detected to operate on the network and/or when an element is non-compliant with the defined security policy. When quarantined, the element should be able to access a defined set of remediation servers allowing the user fixing the non-compliant issues

NAC Functions

- **Remediation** – The process of fixing an issue causing an element to be non-compliant with the defined security policy
- **Enforcement** – Is the process of restricting the element's access to the network if found to be non-compliant with the defined security policy
- **Authorization** – The ability to verify access by users to network resources complies with an authorization scheme defined in an existing authorization system (such as Active Directory, RADIUS servers, etc.) allowing enforcing identity-based policies

NAC Functions

- **Post-Admission Protection** – Is the process of continuously monitoring users, elements and their actions for suspicious activity (i.e. spoofing, worms, viruses, malware, etc.). If detected the action taken by a NAC system may vary from isolating the offending system to dropping the session

Attack Vectors

Attack Vectors

- A solution's architecture
  - The placement of the different pieces of a solution
- Technology used
  - Element detection
  - Quarantine abilities
  - Enforcement methods
  - End-point security assessment
  - Etc.
- A solution's components
  - Client-side software
  - Server-side software (and hardware)

La plupart des méthodes de By-Pass des solutions NAC existantes se situent dans l'exploitation de faiblesses inhérentes à la technologie/méthode utilisée, plutôt que dans celle de failles dans les logiciels clients ou serveurs.

Bypassing NAC Background

Element Detection

- Element detection is a core feature that must be supported by any NAC solution
- Way of operation ?
  - Element detection provides the ability to detect a new element operating on the network
  - Or…Element detection must detect, in real-time, a new element as it attempts to attach itself to the network
- ! If a NAC solution cannot perform element detection in real-time then it does not provide a valuable line of defense
- It is simply because you cannot expect a NAC solution to defend against devices it is not aware of !

Questions to Ask

- How does the NAC solution detects the presence of a new element?
- Does element detection performed in real-time?
- How does the information regarding the elements residing on the network stays current?

En moyenne, 25% des éléments connectés sur un réseau local ne sont pas connus, pas détectés ou mal identifiés…

Combien de clients VMWare ? Où sont-ils ?
Combien de PC protégés par un FW personnel ?

Des PC hors domaine ?

Que se cache-t-il derrière une fonction NAT ?

Des éléments sans adresse IP ?

Methods

- DHCP proxy
- Authenticated DHCP (NAC-in-a-Box)
- Broadcast listeners
- Switch integration
- 802.1x
- Agent software
- In-line devices
- Out-of-band devices
- Proprietary methods

Quarantine

- There are a variety of quarantine methods available, each with varying strengths and weaknesses
- The quarantine holds 'soft targets' that can be easily attacked and penetrated into
  - There is a reason why an element is in quarantine…
  - Does not comply with the security policy (patch, A/V, etc.)
  - The level of security of these elements will be the lowest of all elements residing on the network
- ! It is important to understand if a quarantine method a certain NAC solution uses can be bypassed
- ! Another key point is whether a quarantine method a certain NAC solution uses may allow a quarantined element to interact with other quarantined elements

Quarantine

- If the quarantine area is a shared medium (i.e. separate Subnet/VLAN) between the quarantined elements they might be able to infect and/or penetrate each other
- In case it is a shared medium the quarantine area makes the perfect attack vector
  - An attacker connects its machine to the network
  - The attacker's machine will be quarantined
  - The attacker may access any element on the quarantine
  - Infection
  - Control

Analogie avec la prison, dont les jeunes délinquants ressortent aguerris, au contact des « anciens »…

Questions to Ask

- How does the quarantine mechanism operates?
- Is the quarantine area a shared medium?
- Can the quarantine method isolate an element as soon as it tries to attach itself to the network?
  - Blocking possible interaction with other elements on the network until the state of the questionable element is determined
  - Does this mandates using the switch?
- Does the quarantine method rely on specialized hardware or software?
- Does the quarantine method rely on switch integration?
  - Separate VLAN: Where is the VLAN termination?
- Can the quarantine mechanism quarantine virtual machines
  - Virtualization becomes an integral part of the data center (as well as QA and R&D environments)

Needed Solution

- Use a quarantine method able to provide with a private quarantine
  - Shielding the quarantined element from the network and from other quarantined elements
- Quarantine a device into a private VLAN (PVLAN) with no access to other elements on the network (except for remediation servers)

Enforcement

- How is enforcement performed?
- Is the enforcement performed at L2 or at L3?
  - L3: Bypassable, creates isolated shared islands (subnets)
  - L2: Most powerful, usually done with manipulating ARP tables. In many situations bypassable. Its power depends on the technique used.
- Does the enforcement involves the networking gear?
  - I.E. Cisco, Extreme, Juniper, etc.
  - Must be one vendor shop
- Does the enforcement depends on specialized software?
  - I.E. Agent software
- Does the enforcement depends on specialized hardware?
- Is the NAC solution capable of enforcing the NAC policy against individual virtual machines?

Methods

- Switch integration
  - 802.1x
  - Shutting down switch ports
  - Assigning separate VLANs
- DHCP
  - Separate subnet
- IPS style shootem' up
- Layer 2
  - Manipulating ARP tables

Exige d'avoir une connaissance exhaustive et en temps réel de la topologie de son réseau, sinon…

End-point Compliance Assessment

- What are the parameters that can be checked when an element is being admitted to the network?
- Agent Vs. Agent less
- End point compliance checks are designed for risk reduction (and compliance)
- Managed Vs. Unmanaged elements

« Unmanaged elements » : AS400, Mainframe, Imprimantes, ToIP, etc.

Agent-based

- Strengths
  - Provides a wealth of information regarding a host and its known* security state (OS, patches, A/V Signatures)
  - May detect changes
- Weaknesses
  - Where to install the clients?
  - Usually available for Microsoft Windows operating systems only
  - Management can be a nightmare
  - No awareness of the entire network, not everything is covered
  - The information which needs to be extracted from the elements may be *easily* spoofed (For example, Windows OS version, Service Pack version installed, patches installed, etc.)
  - Unmanaged elements

* What the general public is aware of

Agent-less

- Strengths
  - No need to install additional software
  - Fast deployment
- Weaknesses
  - Information regarding a certain element might not always be available (i.e. service not available, unmanaged device, device property which cannot be reported through a management service, etc.)
  - Less granular information
  - The information which needs to be extracted from the elements may be *easily* spoofed (For example, Windows OS version, Service Pack version installed, patches installed, etc.)

The Real Risk

- It all breaks down to what is being checked, and does the information is helpful or not
  - Patches
    - Security related patches (and other patches) are not enrolled into the enterprise as soon as they are available
    - It may take months to enroll a major security update of an operating system (i.e. Microsoft Windows XP SP2)
  - Zero day is not blocked
    - The checks performed may be useless. Zero day viruses, worms, and vulnerabilities may not be detected, and remediation will not be available
  - Understanding the real risk
    - The risk from an element does not only rely on the version of the A/V signature file it may be running (I.e. information theft, unauthorized access, etc.)
- End point compliance checks are designed for risk reduction (and compliance)

Bypassing NAC Examples

Examples

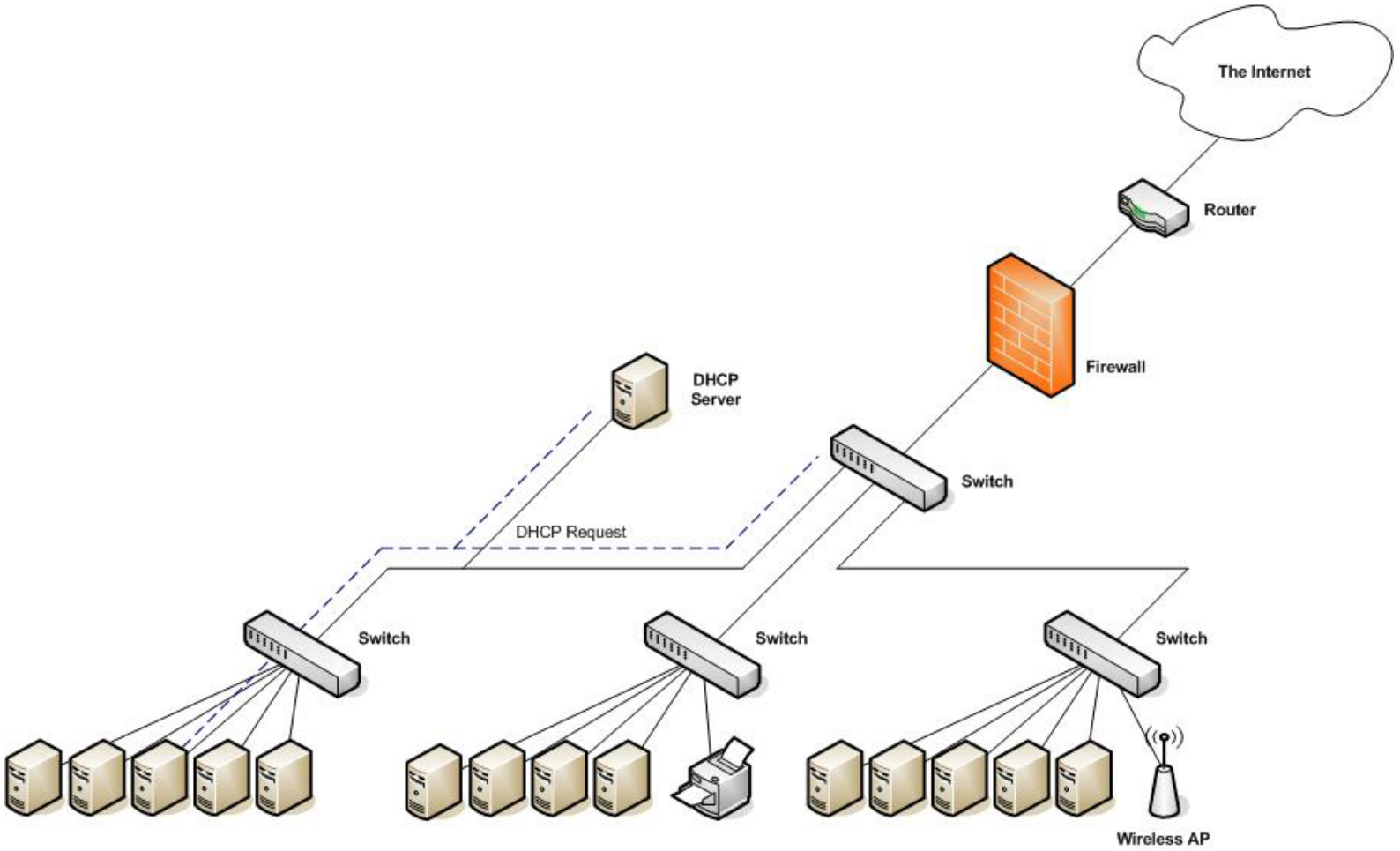
- DHCP Proxy
- Authenticated DHCP / DHCP in-a-box
- Broadcast Listeners
- Switch Integration
- 802.1x
- Cisco NAC Framework
- In-Line devices
- Out-of-Band devices

Examples

- The examples following were taken from different vendor offerings
- There may be other combinations/offerings which are not covered in this presentation
- The information provided would allow to figure out their issues

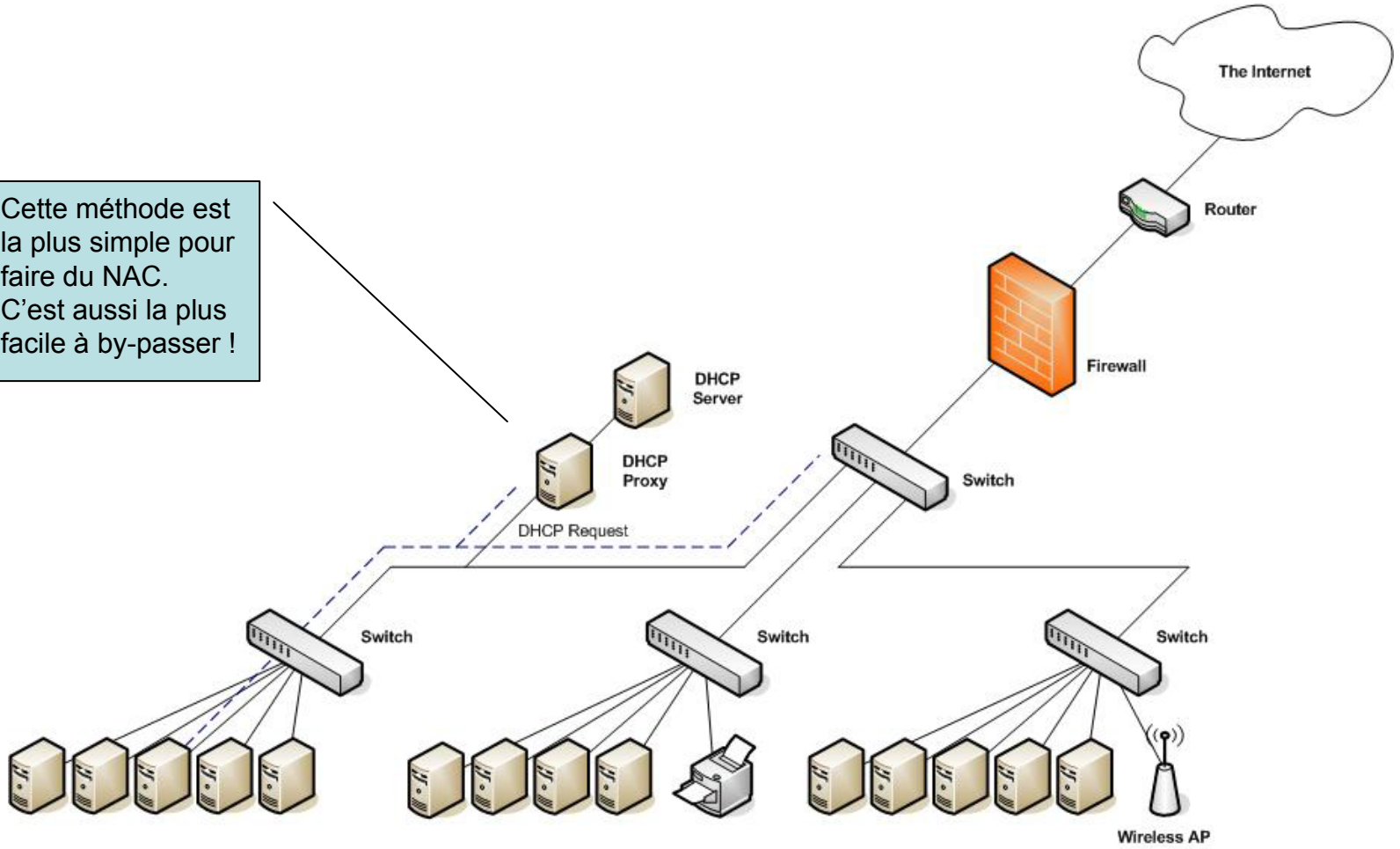
DHCP Proxy

Architecture

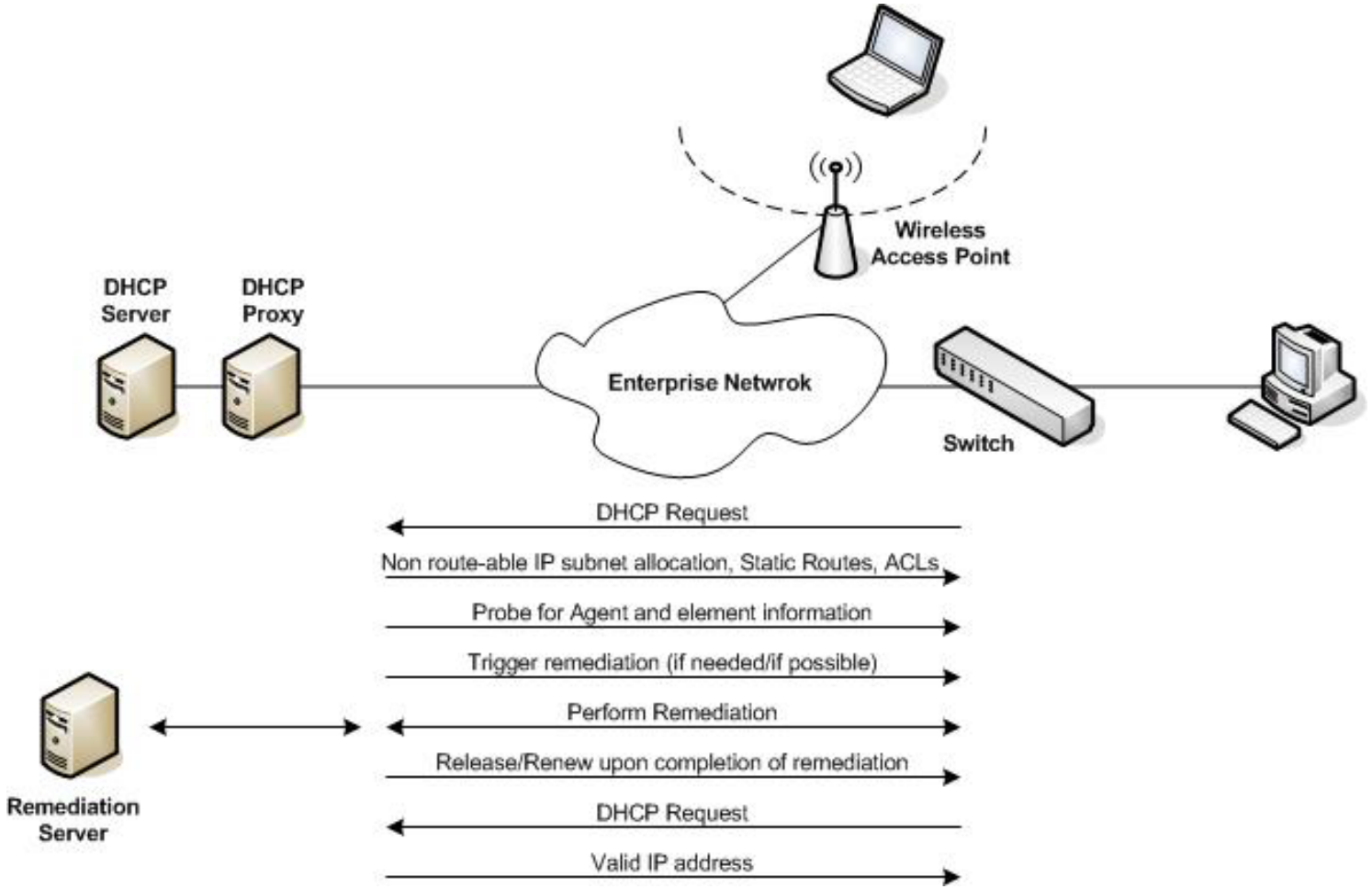


Architecture

Cette méthode est la plus simple pour faire du NAC.
C'est aussi la plus facile à by-passer !



Information Exchange



Strengths

- Most organizations use DHCP
- Easy to deploy
- Fast to deploy

Weaknesses

- Detected elements are only those using DHCP
  - Not all of the elements residing on the enterprise network will be using DHCP (I.e. Servers, Printers, etc.)
  - Incomplete detection of elements operating on the network. Other elements may exist and operate on the network
  - Bypassing DHCP Proxy NAC by simply assigning a static IP address for an element
- Elements must use agent software with this type of solution
  - Usually available for Microsoft Windows-based OSs only
  - Without the usage of agent-based software there is an inability to determine whether an element comply, or not, with the enterprise security policy
- Detection of elements is done at Layer 3 only
  - An element can connect to the network without being detected
  - Access to at least the local subnet will not be restricted

Weaknesses

- Enforcement is performed at Layer 3 only
  - The local subnet is a shared medium
  - Elements can infect and/or penetrate other elements on their subnet, and cannot be stopped
  - Bypassing enforcement by attacking a system on the local subnet using it as an 'access proxy' to other parts of the enterprise network
- Quarantine of an element is done using non-routable IP addresses and ACLs on routers (Layer 3 only)
  - Bypassing the quarantine by assigning an element a static IP address
  - The local subnet is a shared medium
- No actual knowledge regarding the enterprise network
  - No actual knowledge of what is on the network
  - No knowledge on the actual network topology may lead the existence of other, uncovered venues to access the network

Weaknesses

- Not able to detect masquerading elements hiding behind an allowed elements (i.e. NAT)
  - Virtualization as a major issue (i.e. Freebee virtualization software such as Virtual PC, Vmware, etc.)
- Exceptions needs to be manually inputted (i.e. printers)
  - There is no knowledge about the exception element (i.e. OS, exact location, and other properties)
  - It is possible to spoof the MAC address and/or the IP address of an exception is order to receive full access to the enterprise network
- Cannot be extended to include remote users
- There is no form of user authentication (i.e. theoretically, install an appropriate client, be compliant with the security policy, access is granted)

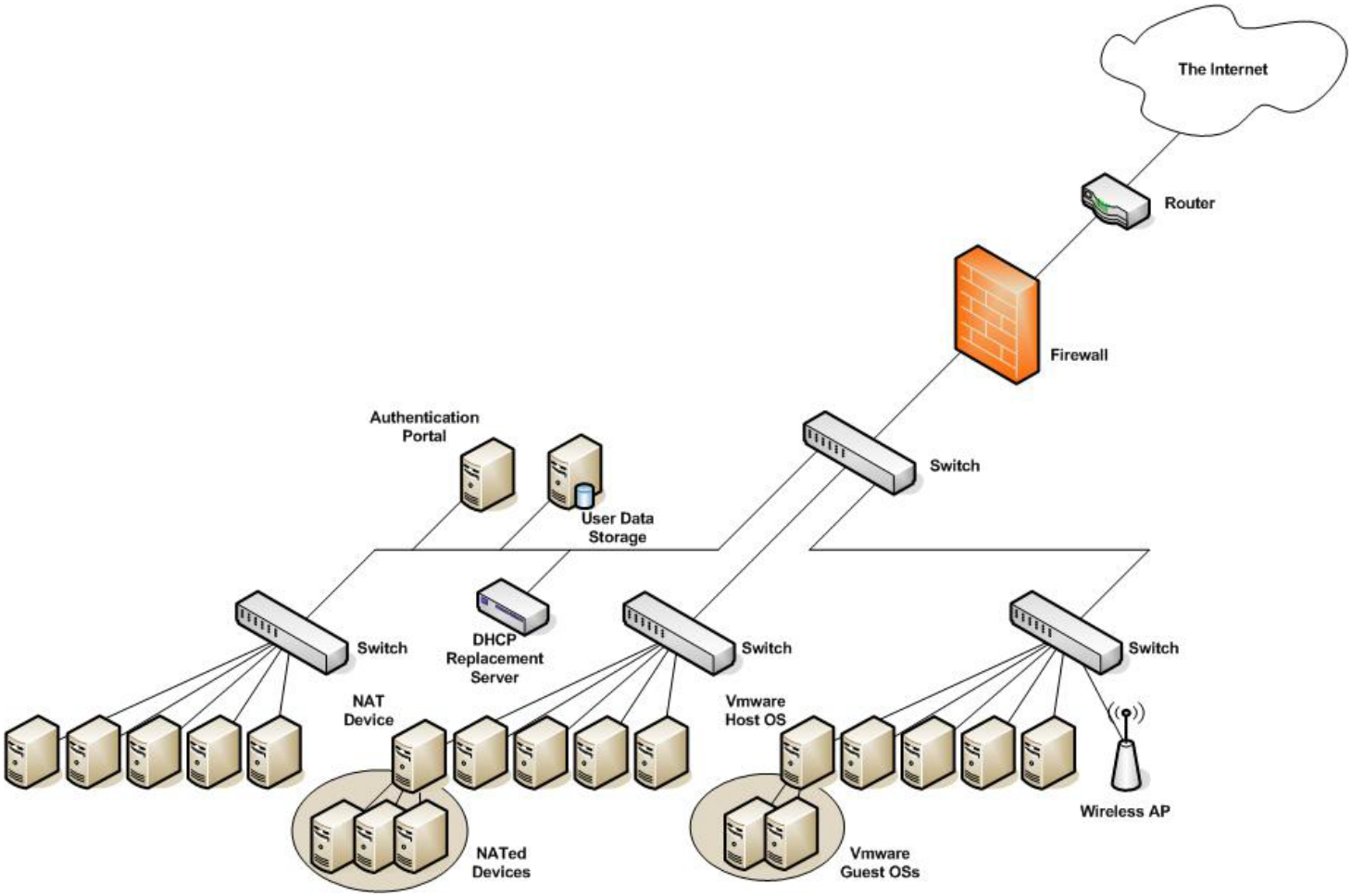
Weaknesses

- The problem of unmanaged elements
  - "Systems without agents can be granted network access two ways. First, a non-windows exception can be made that exempts non-windows clients from the NAC process. Second, a MAC address-based exemption list can be built. This MAC address list accepts wildcards, allowing the exemption of whole classes of systems such as IP phones using their Organizationally Unique Identifiers."
  - There is no knowledge about the exception element (i.e. OS, exact location, and other properties)
  - It is possible to spoof the MAC address and the IP address of an exception is order to receive full access to the enterprise network

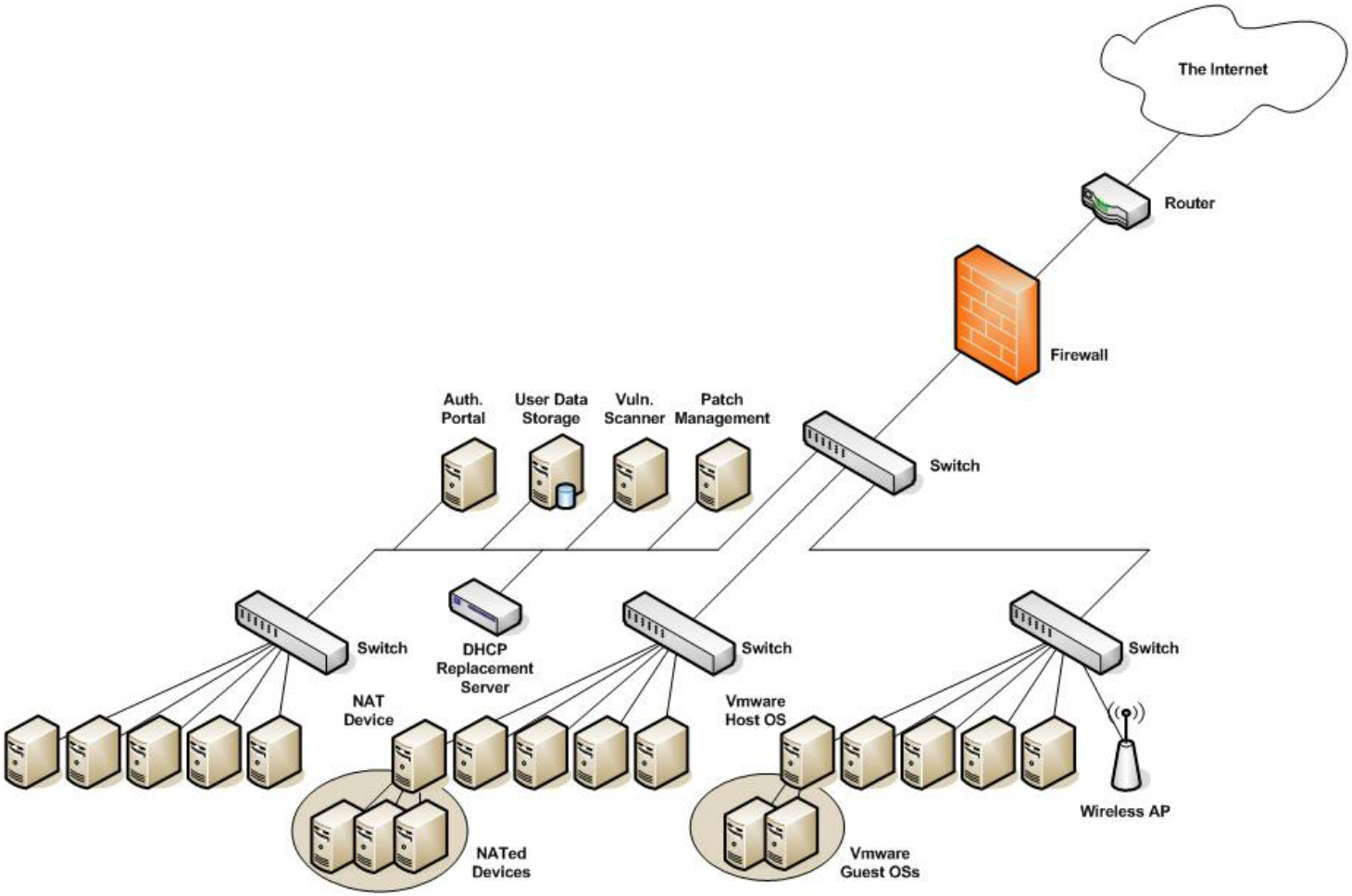
Source: "Network Access Control Technologies and Sygate Compliance on Contact", Sygate/Symantec

Authenticated DHCP
or
DHCP In-a-Box

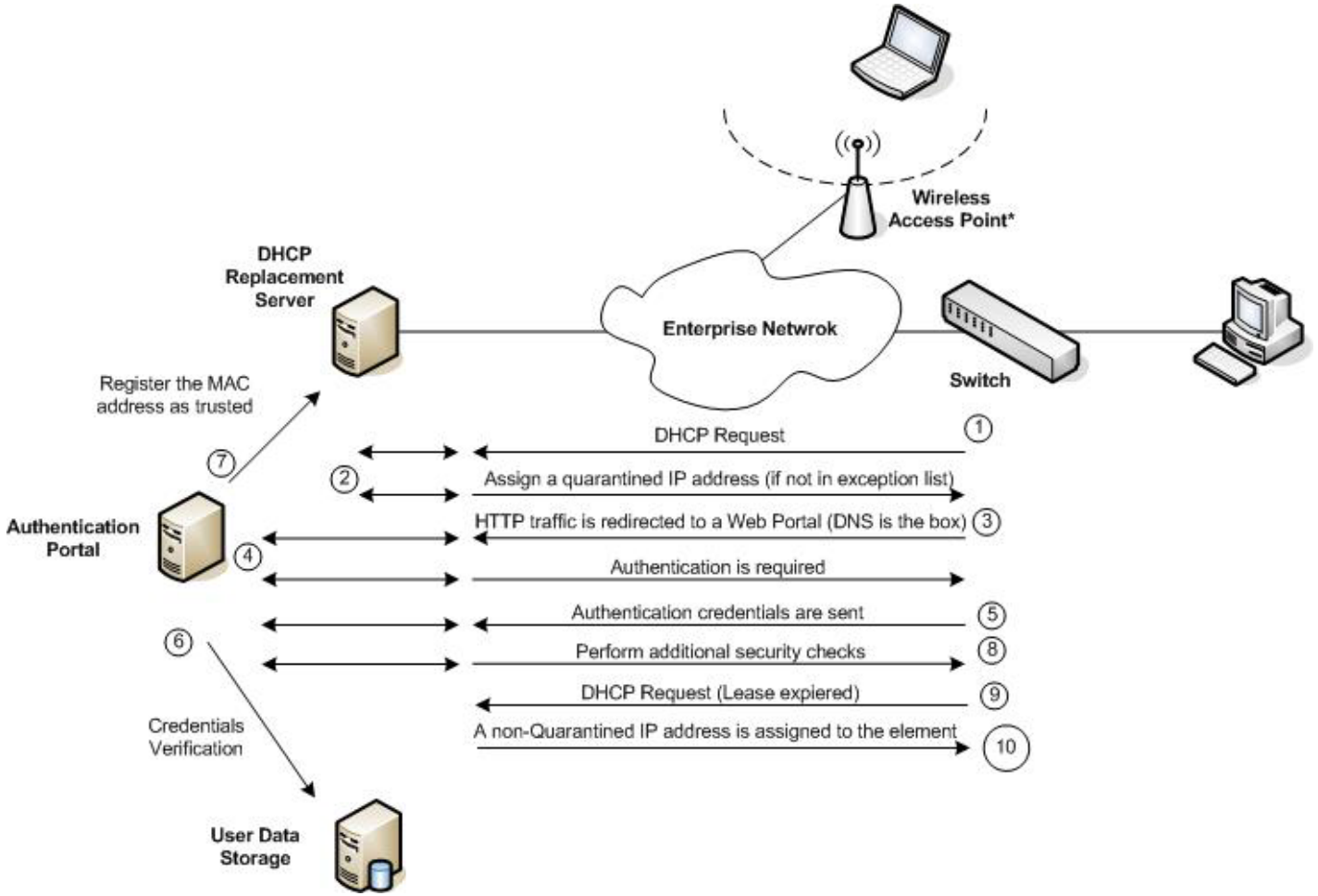
Architecture



Architecture



Information Exchange



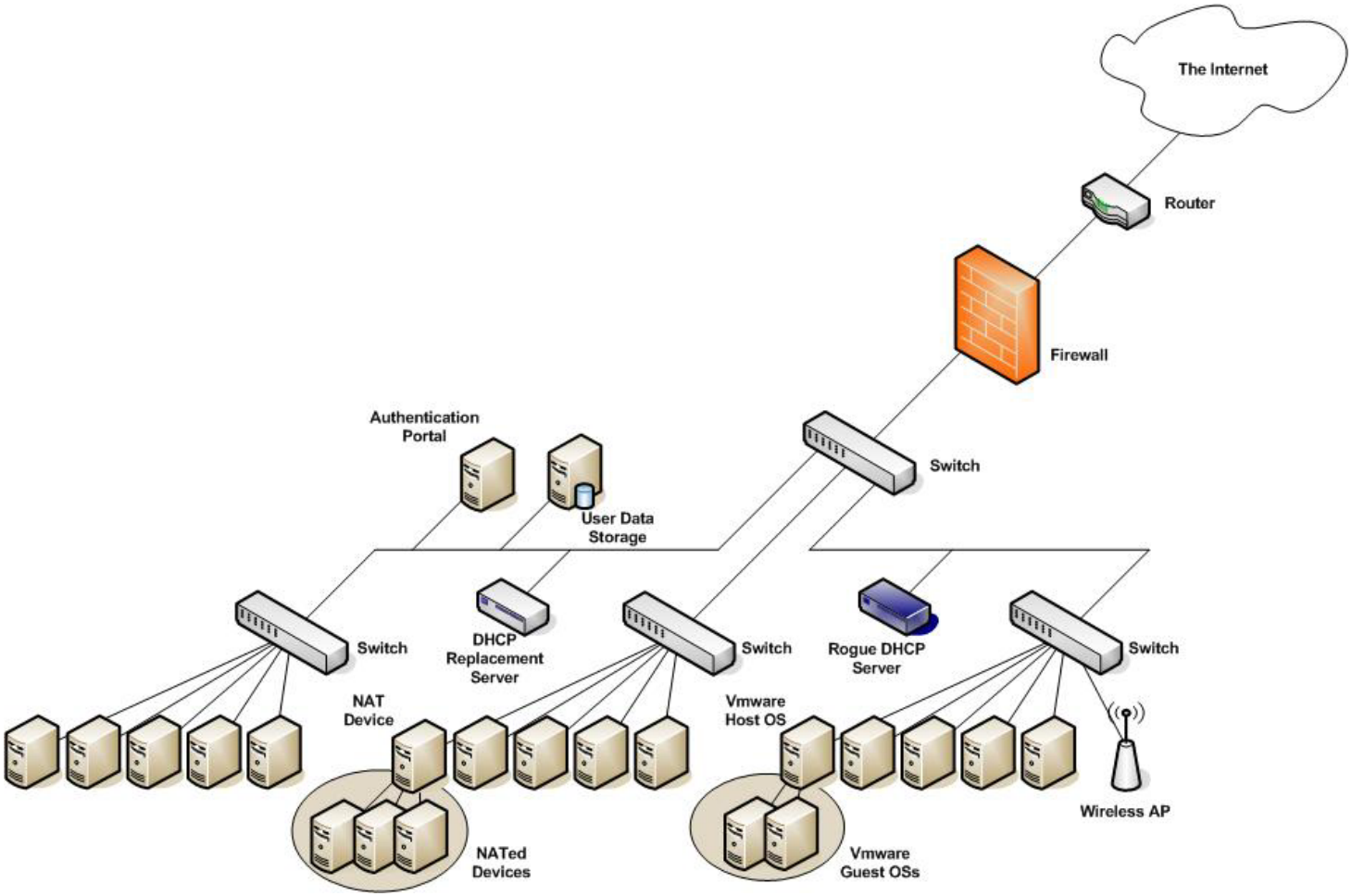
Strengths

- Theoretically, may authenticate any user trying to access the network
- Theoretically, operating system independent
- Most organizations use DHCP
- Easy to deploy
- Fast to deploy

Weaknesses (Highlights)

- Detected elements are only those using DHCP
- Detection of elements at Layer 3 only
- Enforcement is performed at Layer 3 only
- No knowledge of the who is on the network
- There is no knowledge about the exception elements
- Uses 3rd party products to asset the security of elements
  - No real-time assessment
  - In some cases, these checks would prove useless (I.e. FWed elements, etc.)
- All other DHCP Proxy weaknesses apply

Rogue DHCP Server

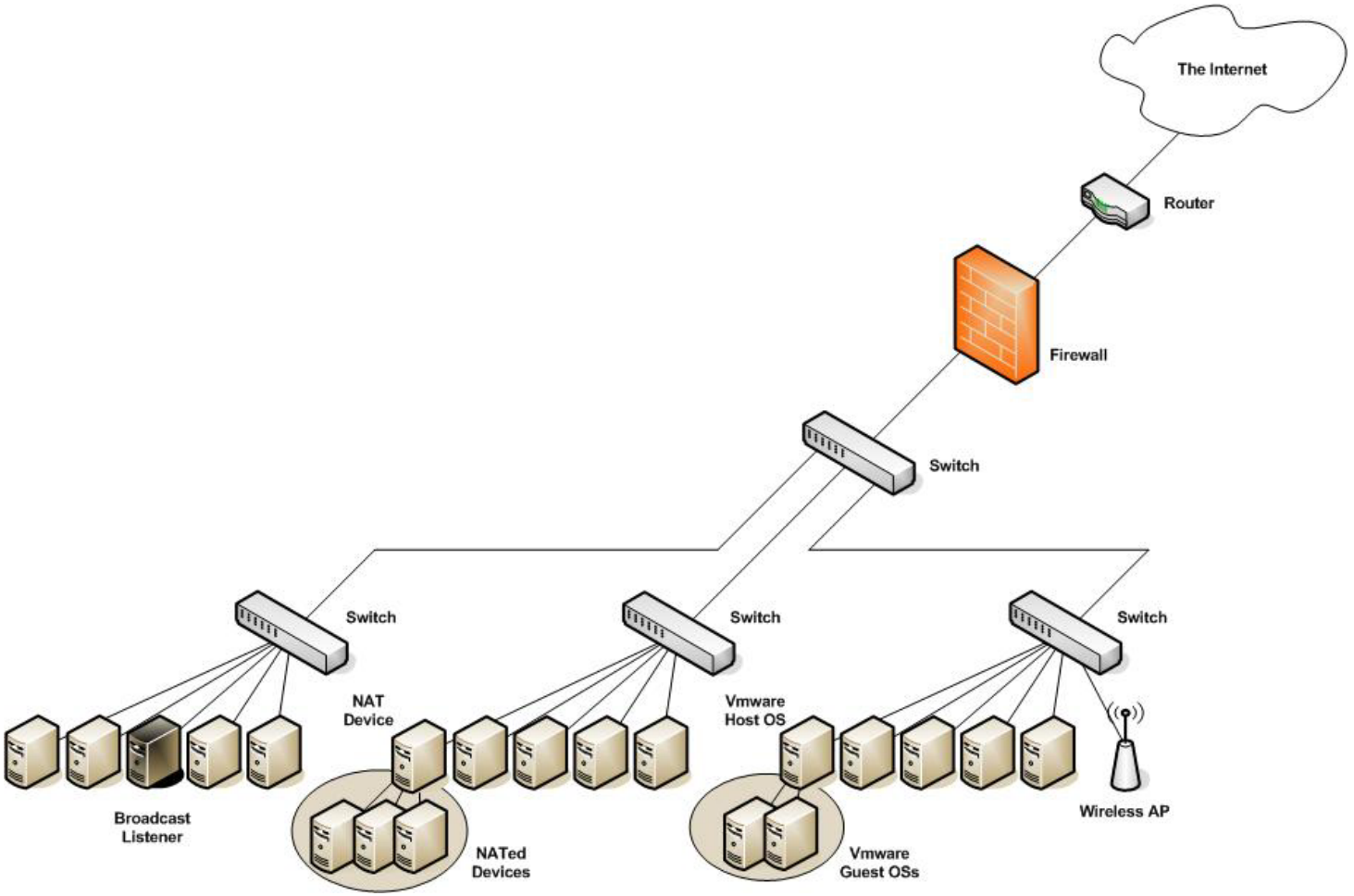


Rogue DHCP Server

- The first DHCP server's reply to reach a host sending a DHCP request would assign the DHCP server responding to be used by the element
  - Assign the element a "quarantined" IP address
  - Direct DNS traffic to the rogue DHCP Server by assigning the DNS server's IP address with the DHCP reply to the rogue DHCP server
  - Present the user with a look-a-like authentication page (using HTTPS, preferred)
  - Abuse the credentials collected
    - For example, wait for the disconnection of the element and abuse its credentials
    - Etc.

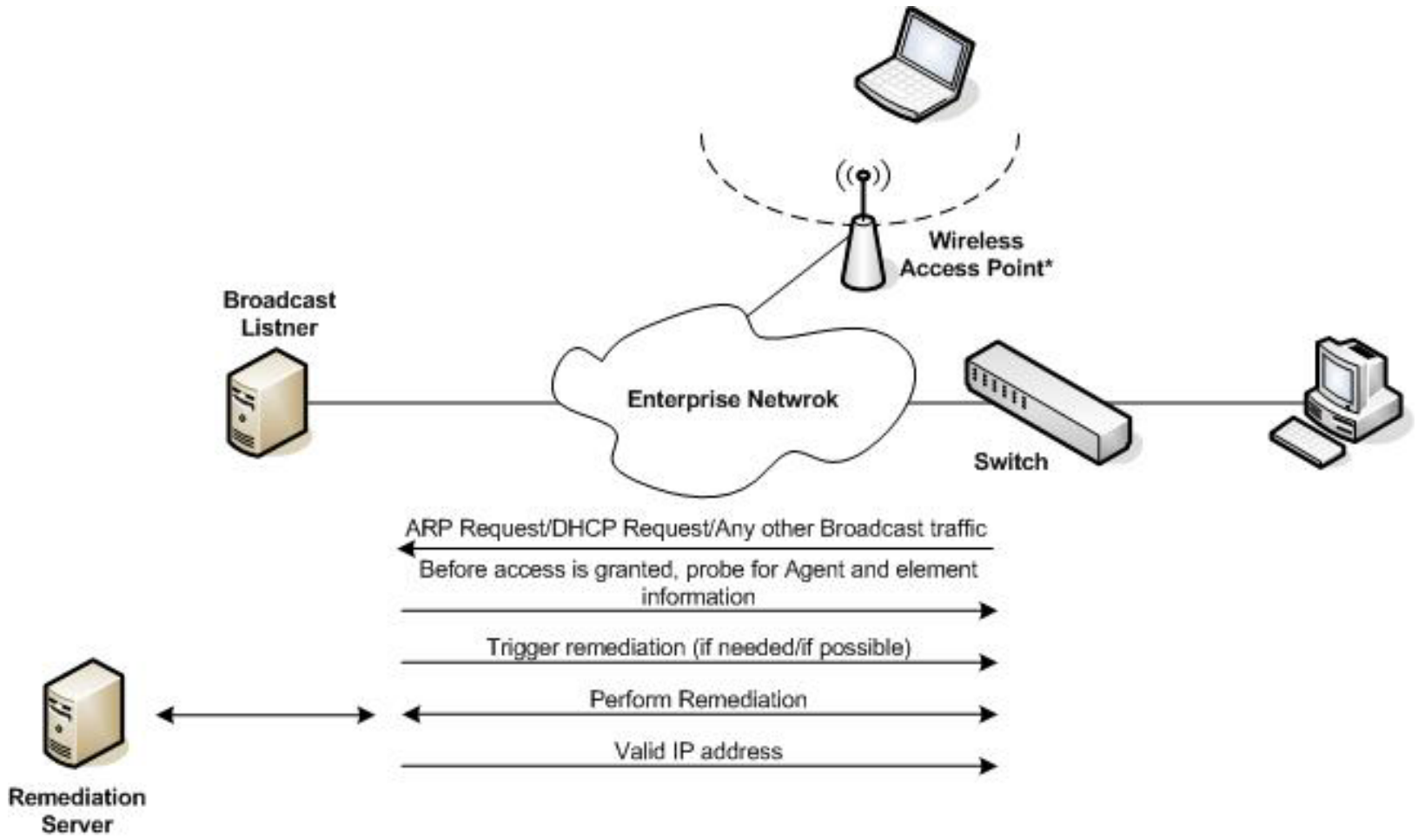
Broadcast Listeners

Architecture



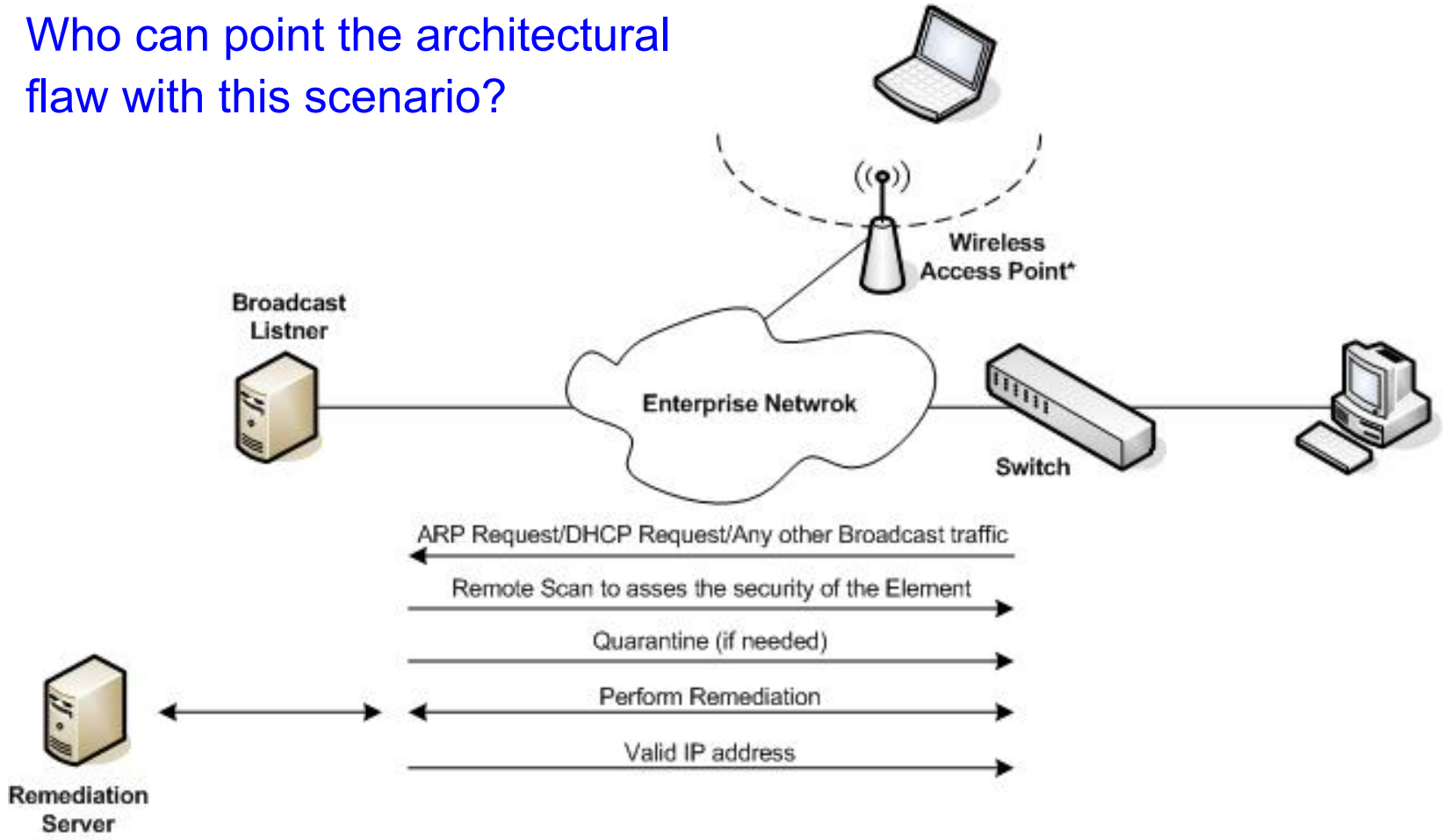
Broadcast Listeners

Architecture: Managed Elements



Architecture: Unmanaged Elements

Who can point the architectural flaw with this scenario?



Weaknesses

- Software must be deployed on each and every subnet
  - A lot of moving parts
- Prior knowledge regarding the enterprise network must be obtained prior to deployment
  - What are the enterprise subnets?
  - Where are the locations to be deployed?
  - The approach of “the client tells us where to install the software” simply does not work
- Must integrate with switches in order to perform quarantine
  - No knowledge who these switches are
  - In most cases this might be a manual process
  - Switches may reside on their own VLAN/Subnet
  - Switches serving a certain subnet may reside on different subnets
  - In many cases switches can be accessed only from a management network (a sever deployment issue)

Weaknesses

- No knowledge on actual network topology lead existence of other, uncovered venues to access the network
  - Other subnets which may not be monitored
  - Forgotten switches
- Not able to detect masquerading elements hiding behind an allowed elements (i.e. NAT)
  - Virtualization as a major issue (i.e. Freebee virtualization software such as Virtual PC, Vmware, etc.)
- Exceptions needs to be manually inputted
  - There is no knowledge about the exception element (i.e. OS, exact location, and other properties)
  - It is possible to spoof the MAC address and/or the IP address of an exception is order to receive its access to the enterprise network
- Cannot be extended to include remote users

Weaknesses

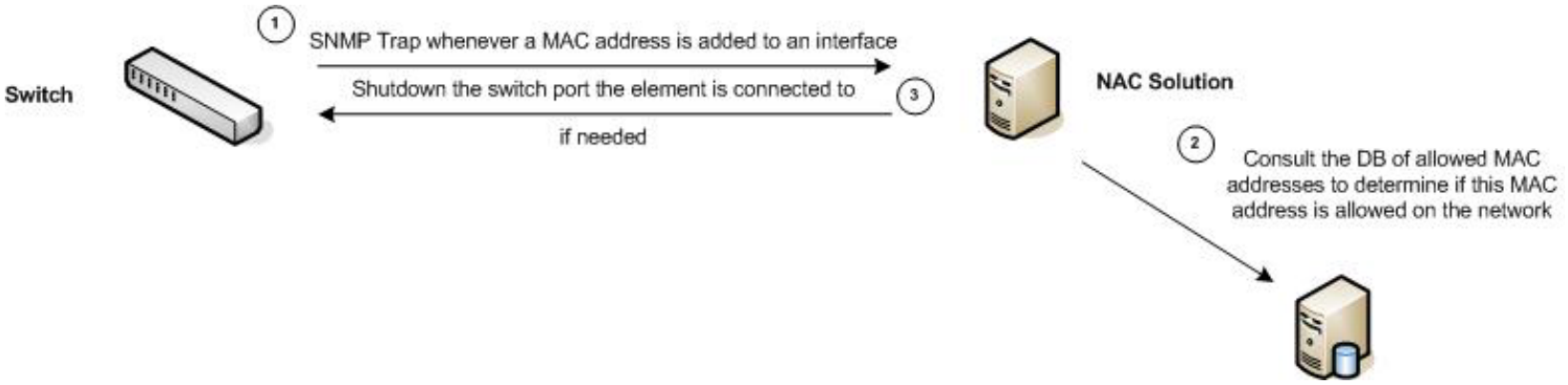
- Unmanaged Elements
  - No Client-software for non-Windows operating systems
  - Non-Windows operating systems cannot be scanned for compliance (i.e. using a portal, client, active-X, etc.)
  - External vulnerability scans takes time to complete
  - An increasing number of operating systems will be using a personal firewall. Remote scanning will not reveal information regarding the scanned elements
  - The number of exceptions would be high

Weaknesses

- Some elements may not generate broadcast traffic
- ! Configuring static ARP entries bypasses the detection of broadcast traffic
- ! Abusing manipulated ARP requests bypasses the detection of broadcast traffic
  - Instead of aiming the request to the broadcast address, aim it directly to the MAC address you wish to communicate with

Switch Integration
SNMP Traps

Architecture



Weaknesses

- Must rely on prior knowledge regarding the IT infrastructure
  - A list of switches which needs to be configured to send SNMP traps
  - Incomplete information leads to discrete access venues
- Total dependency on switches
  - The switch ability to provide with information through the usage of SNMP traps
    - Not all switches supports this type of SNMP traps and notifications
  - The ability to quarantine an element to a certain VLAN
- When an element is detected to operate on the network, the real location of the element is unknown
  - Multiple SNMP traps regarding the registration of the element's MAC address may be received
  - No classification is made regarding the interface alerting about the added MAC address (i.e. direct connect, multiple elements, etc.)
  - Solutions that may shutdown a switch port may lead to the disconnection of other, allowed elements
  - Quarantine may not be trivial

Weaknesses

- Must integrate with switches
  - No knowledge who the switches are
  - Always a manual configuration process
- Not able to detect masquerading elements hiding behind allowed elements (i.e. NAT)
  - Virtualization as a major issue (i.e. Freebee virtualization software such as Virtual PC, Vmware, etc.)
- Any reference to an element is done using its MAC address
  - There is no knowledge about the exception element (i.e. OS, exact location, and other properties)
  - It is possible to spoof the MAC address of an exception in order to receive its access to the enterprise network
- Cannot be extended to include remote users

802.1x

802.1x

- A username password based protocol (only ?!)
- For compliance checks must use an agent software
- Difficult manageability
  - All elements on the network must be configured to use 802.1x
  - Legacy networking gear must be upgraded to support 802.1x (or replaced)
- Not all of the networking elements can support 802.1x
- Not all of the elements residing on the network are 802.1x capable (i.e. legacy equipment, AS-400, printers, etc.)
- The cost for implementing a solution which is based on 802.1x is currently high (time, resources, infrastructure upgrade, etc.)

802.1x

- Exceptions
  - Hosts that do not support 802.1x can be granted access to the network using manually configured exceptions by MAC address
  - There is no knowledge about the exception element (i.e. OS, exact location, and other properties)
  - It is possible to spoof the MAC address of an exception element is order to receive the same access that element has to the enterprise network
- Not able to detect masquerading elements hiding behind an allowed elements (i.e. NAT)
  - Virtualization as a major issue (i.e. Freebee virtualization software such as Virtual PC, Vmware, etc.)
- No knowledge on actual network topology may lead existence of other, uncovered venues to access the network
  - The network might be composed from other networking equipment which does not support 802.1x
  - Used as an access venue to the network

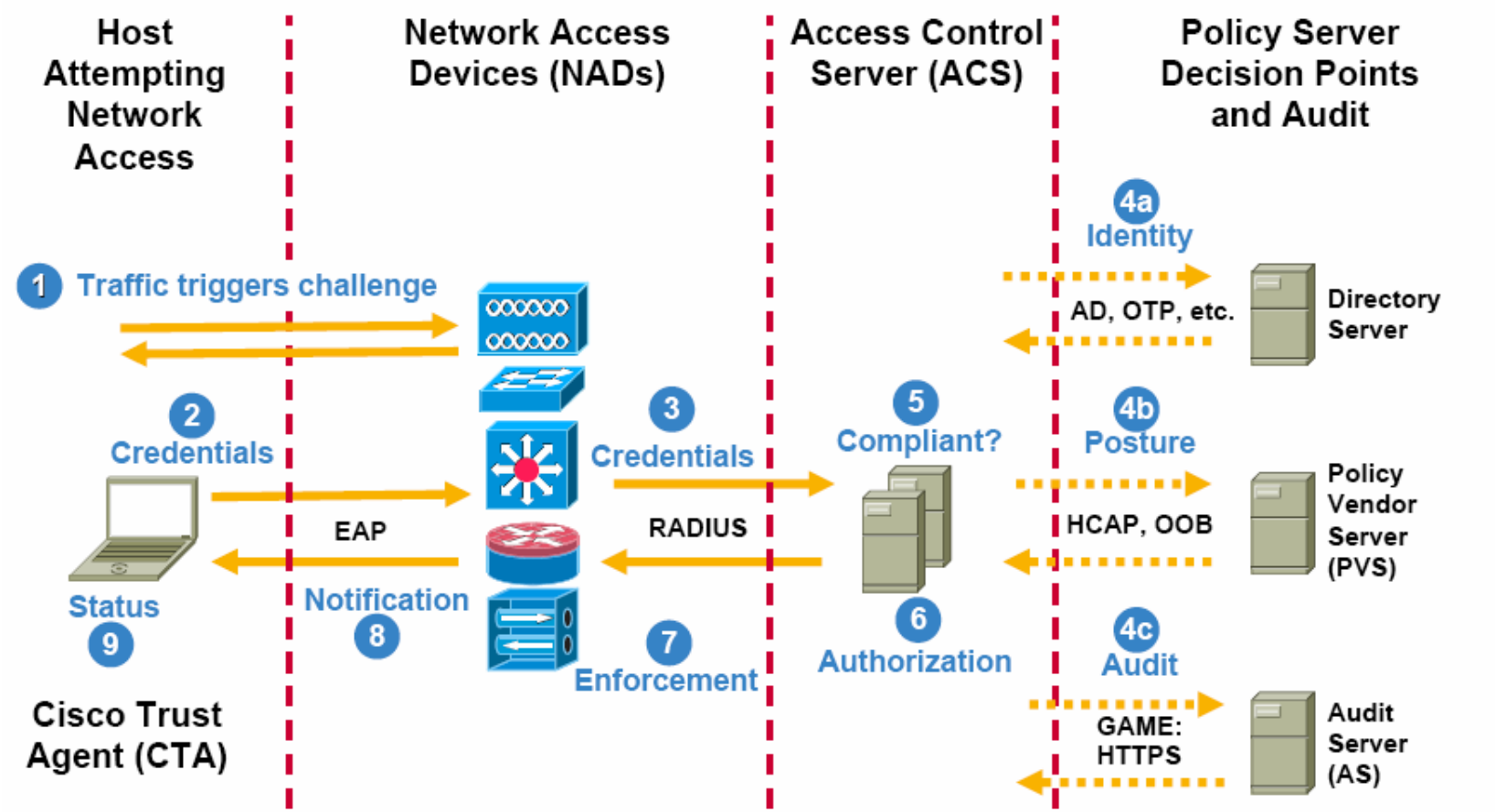
Cisco NAC Framework

Architecture

- Components
  - **C**isco **T**rust **A**gent (CTA)
  - Cisco **n**etwork **a**ccess **d**evice (NAD) with NAC enabled on one or more interfaces for network access enforcement
  - Cisco Secure **A**ccess **C**ontrol **S**erver (ACS) for endpoint compliance validation
- Enforcement strategies
  - NAC L3 IP
    - Deployed using Routers
    - Triggered by an IP packet
  - NAC L2 IP
    - Deployed using switches/routers
    - Apply per interface
    - Triggered by either a DHCP packet or an ARP request
  - NAC L2 802.1x
    - Triggered by any data-link packet

Cisco NAC Framework

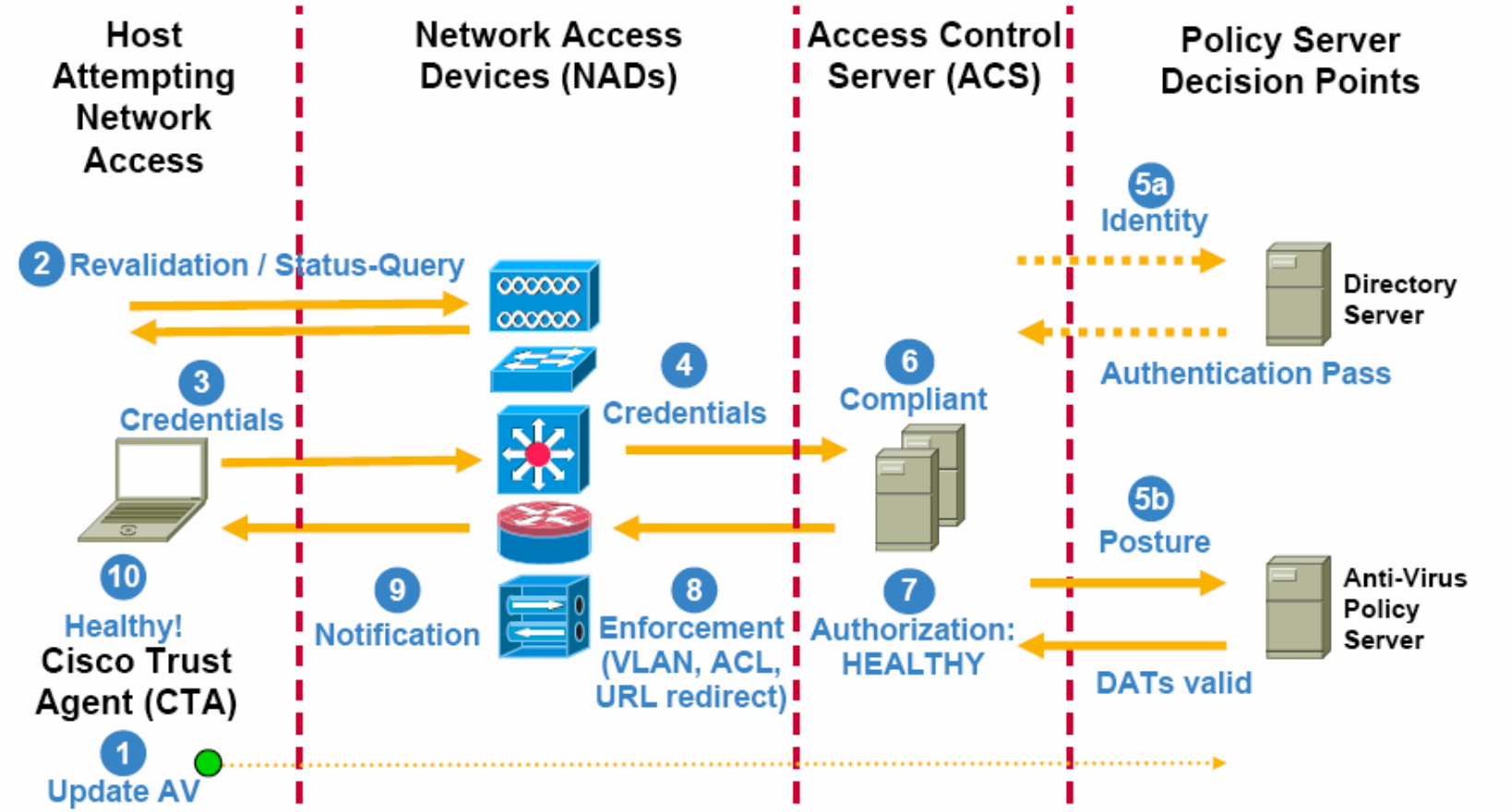
Information Exchange



Source: Cisco

Cisco NAC Framework

Information Exchange



Source: Cisco

Strengths

- NAC L2 802.1x
  - Can prevent elements to connect to the network even before assigned an IP address (when implemented on switches)
  - Embedded with the underlying networking gear

Weaknesses

- Works only with Cisco equipment
  - Only Cisco devices support the EAPoUDP protocol
- Difficult manageability
  - All elements on the network must be configured to use 802.1x
  - Al the network elements on the network must be Cisco's
  - Legacy networking elements must be upgraded to support 802.1x
- Not all of the networking elements can support 802.1x
- Not all of the elements residing on the network are 802.1x capable (i.e. legacy equipment, AS-400, printers, etc.)
- The cost for implementing a solution which is based on 802.1x is currently high (time, resources, infrastructure upgrade, etc.)

Weaknesses

- Not all of the enforcement strategies are bullet proof
  - NAC L3 IP
    - Deployed using Routers
    - Triggered by an IP packet
    - Local network is vulnerable to viruses, worms, and local compromises
  - NAC L2 IP
    - Apply per interface
    - Triggered by either a DHCP packet or an ARP request
    - Information might be tunneled through
    - Also applies when a hub is connected to the interface

Weaknesses
Unmanaged Elements

- Static Exceptions
  - “Hosts that cannot run the CTA (Cisco Trust Agent) can be granted access to the network using manually configured exceptions by MAC or IP address on the router or ACS. Exceptions by device types such as Cisco IP phones can also be permitted using CDP on the router. “ - Cisco NAC FAQ
  - There is no knowledge about the exception element (i.e. OS, exact location, and other properties)
  - It is possible to spoof the MAC address and/or the IP address of an exception is order to receive the same access that element has to the enterprise network

Weaknesses
Unmanaged Elements

- Dynamic Audit
  - "The newest component in the NAC solution is the audit server, which applies vulnerability assessment (VA) technologies to determine the level of compliance or risk of a host prior to network admission. "
    - The level of response from various elements is questionable
    - Many elements uses a personal firewall by default (even if the element is responsive, closing all "hatches" may still grant access to the network)

Weaknesses

- Not able to detect masquerading elements hiding behind an allowed elements (i.e. NAT)
  - Virtualization as a major issue (i.e. Freebee virtualization software such as Virtual PC, Vmware, etc.)
- No knowledge on actual network topology may lead existence of other, uncovered venues to access the network
  - The network might be composed from different networking equipment from different companies other then Cisco

Weaknesses

Example: Default Quarantine ACL

EAPoUDP, DNS et DHCP sont autorisés !

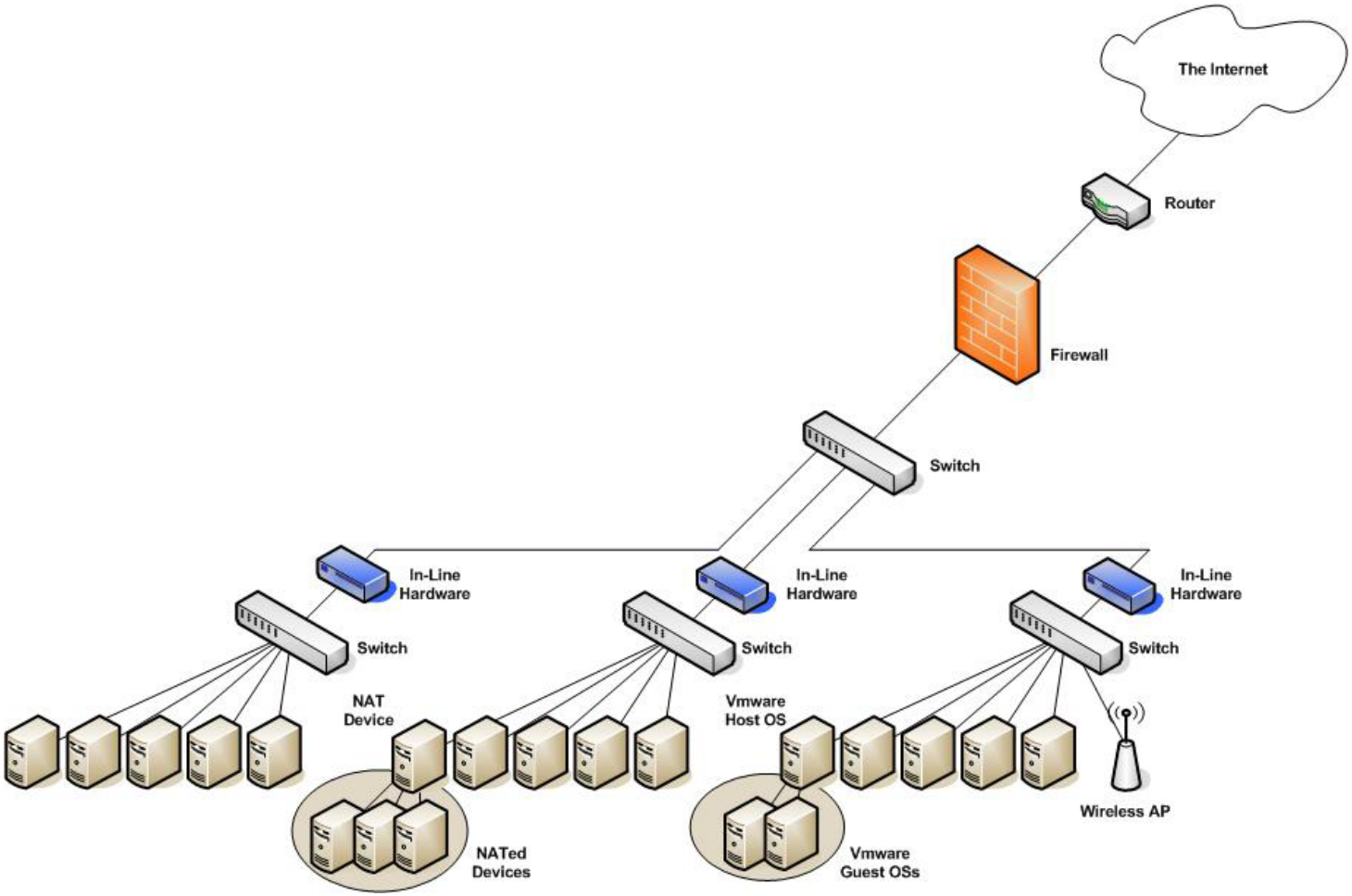
Name	NAF	ACL Definition
healthy_acl	(All-AAA-Client)	`permit ip any any`

quarantine_acl	(All-AAA-Client)	`remark Allow DHCP`
		`permit udp any eq bootpc any eq bootps`
		`remark Allow EAPoUDP`
		`permit udp any any eq 21862`
		`remark Allow DNS`
		`permit udp any any eq 53`
		`remark Allow HTTP to UpdateServer`
		`permit tcp any host 10.0.200.30 eq www`
		`remark allow client access to qualys`
		`permit ip any host 10.0.200.106`

Source: Network Admission Control (NAC) Framework Configuration Guide, Cisco

In-Line Devices

Architecture



Weaknesses

- No knowledge on actual network topology may lead existence of other, uncovered venues to access the network
  - Where to install the in-line devices
- Deployment must involve a network re-architecture
- Deployment must be as close as possible to the access layer to be efficient and productive
- A possible point of failure
- Deployment is time consuming (the networking people in IT would fiercely resist it)
- The infection/compromise of other elements on the local subnet and/or switch is possible
- Some elements may only generate Layer 2 traffic
- Cost

Weaknesses

- Element detection is performed at Layer 3 only
  - Elements can infect and/or penetrate other elements on their local subnet, and cannot be stopped
  - If elements are detected due to their IP traffic (rather then according to their Layer 2 traffic) there would be many different venues to bypass the in-line device
  - If elements are detected due to their broadcast traffic, it is still possible to bypass the in-line device's element detection capabilities (see: Broadcast Listeners)
  - Bypassing enforcement by attacking a system on the local subnet using it as an 'access proxy' to other parts of the enterprise network
    - With many IT networks servers will share the same subnet with desktops
- Encryption

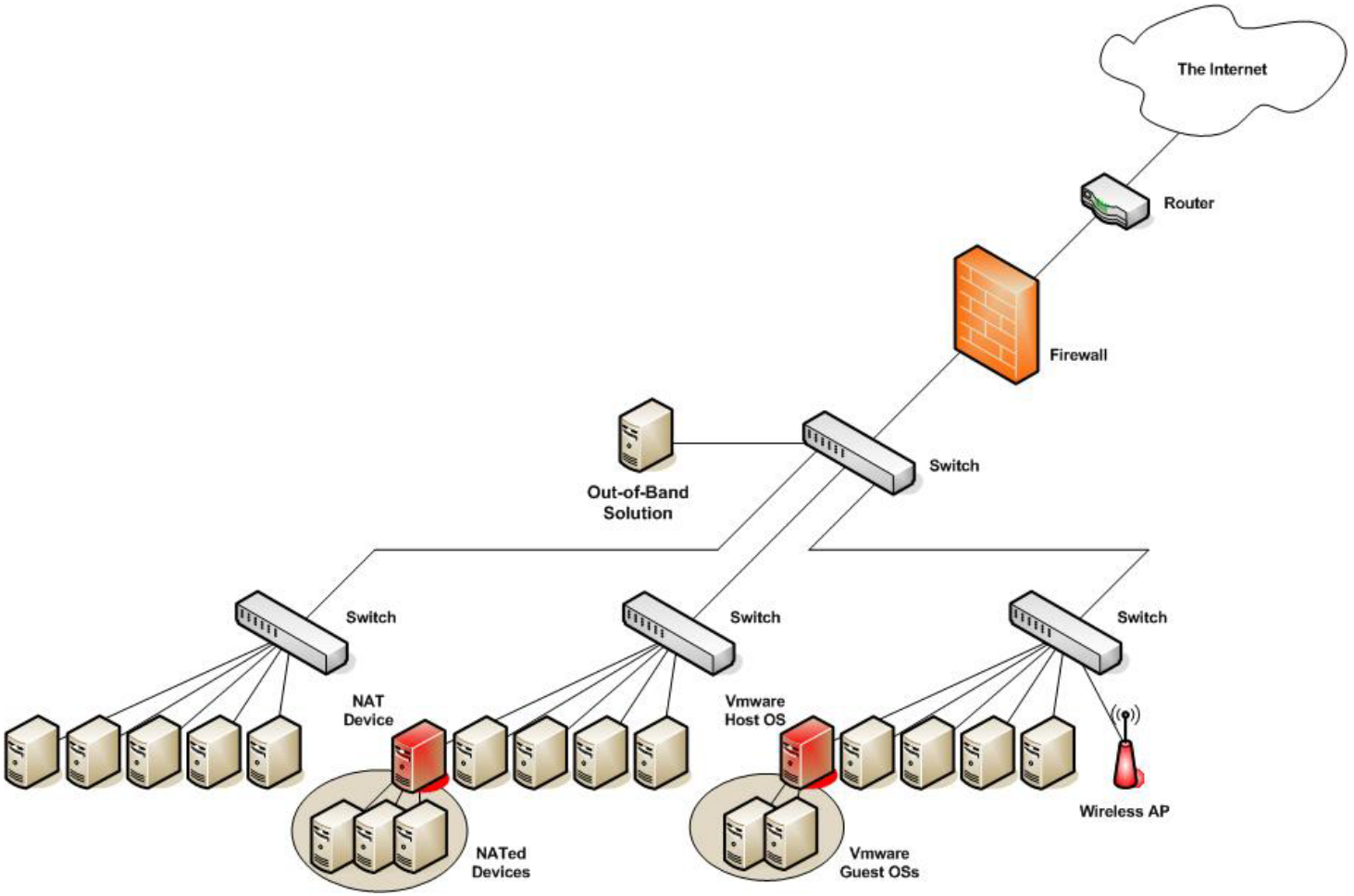
Weaknesses

- Not able to detect smart masquerading
  - Using the same underlying operating system as the NAT service provider will completely hide the NATed element (i.e. using random ID numbers, etc.)
- Exceptions needs to be manually inputted (i.e. printers)
  - There is no knowledge about the exception element (i.e. OS, exact location, functionality, and other properties)*
  - It is possible to spoof the MAC address and/or the IP address of an exception is order to receive its access to the enterprise network

* If the operating system of the element is being tracked, mimicking the OS responses would yield the same access rights to the network

Out-of-Band Devices

Architecture



Strengths

- Fast to implement
- Less moving parts
- Real-time
- Detection at L2 (if deployed close enough to the access layer)

Weaknesses

- Incomplete discovery
  - Inactive elements will not be detected
- As long as the traffic generated is not broadcast traffic and does not pass through the monitoring point of the out-of-band solution, the element would not be detected
- May suffer from the different issues as Broadcast Listeners
- For more issues please see: Risks of Passive Network Discovery Systems (PNDS), Ofir Arkin, 2005. Available from: http://www.insightix.com/resources/whitepapers.html

The End Result

The End-Result

- A (very) confused market place
- Solutions are being bought without proper verification and checking
- Most of the available NAC solutions on the market today can be bypassed
- We are starting to see a more serious attitude towards the pitfalls of various NAC solutions outlined in the ‘bypassing NAC’ presentation

Questions?

Resources

- Microsoft NAP
  http://www.microsoft.com/technet/itsolutions/network/nap/default.mspx
- Cisco NAC
  http://www.cisco.com/en/US/netsol/ns466/networking_solutions_package.html
- TCG https://www.trustedcomputinggroup.org/home
- Insightix http://www.insightix.com
- The Sys-Security Group http://www.sys-security.com

Thank You

A votre disposition :

- **Brochure "*Découverte exhaustive et en continu des éléments connectés sur un réseau LAN*"**
- **Licence d'évaluation de l'outil DID (Dynamic Infrastructure Discovery)**
- **Licence d'évaluation de l'outil InsightiX NAC**
- **Brochure "*Projet NAC : Les bonnes questions à se poser*"**

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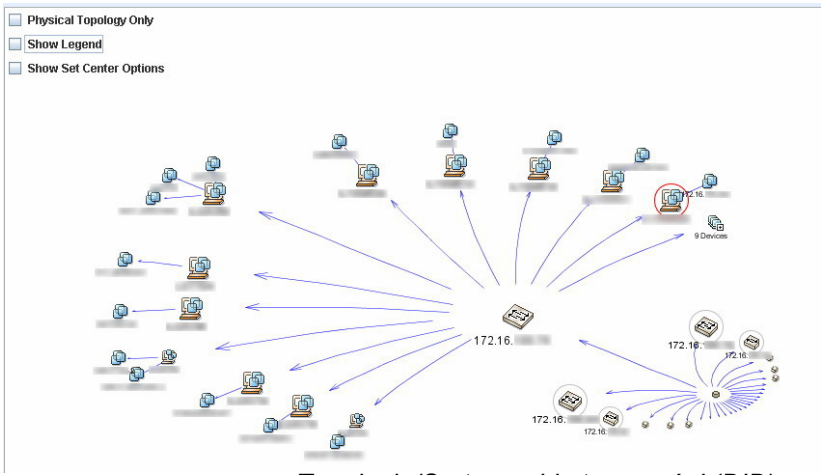

Topologie/Cartographie temps réel (DID)