Disruption

Baseline, Monitor, Detect, Analyze, Respond, & Recover

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Overview

- Disruption
  - Concepts, Examples, Motivations
- Hands-on Cyber Attack
  - Concept
  - Establishing a Baseline
  - Demonstration of the Attack
  - Monitoring & Detection
  - Analyzing the Attack
  - Response & Recovery
  - Enacting Mitigation Actions

Router Re-config
DoS via DNS Queries

Disruption

- Disruption is the act of denying, degrading, or otherwise limiting the availability of services provided by a system or application

Disruption

Some Examples:

- Network Denial of Service – using the network protocols against themselves to saturate or overwhelm services or the links required to access them (e.g. SYN flood, DNS query flood)

- Hardware Denial of Service – making a change to the hardware which prevents the device from operating correctly (e.g. BIOS flashing)

- Service Reconfiguration – changing configurations or operating requirements such that the service, application or system no longer functions as intended (e.g. changing sshd_config to an unexpected port, disabling Windows services, overwriting system boot files)

Disruption

- Disruption can be done without any access to the systems affected
  - DoS, DDoS, Traffic Floods, Amplification Attacks, …
- Disruption is also possible (and easier) with access to the system
  - Rebooting hosts, router configuration changes, …

Disruption

- Network disruption attacks are a battle between attacker's and defender's provisioning capabilities.
  - The one with more bandwidth, servers, capability, etc wins.
- They are typically done with BotNets since they offer an easy method of provisioning more than the defender can muster
- They take many, many forms – bandwidth saturation, malformed packets, server overload, etc

A Brief Aside – BotNets

BotNet – "A collection of software robots, or bots, which run autonomously and automatically"

- Compromised Hosts (Zombies) are Centrally Controlled by a Single Entity (a Bot Herder)
- Typically Used for Malicious Purposes
  - DDoS, spam, Non-attribution Attacks

A Brief Aside – BotNets

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Bot Herder Establishes a Presence
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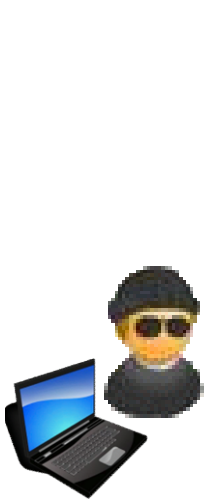
A Brief Aside – BotNets

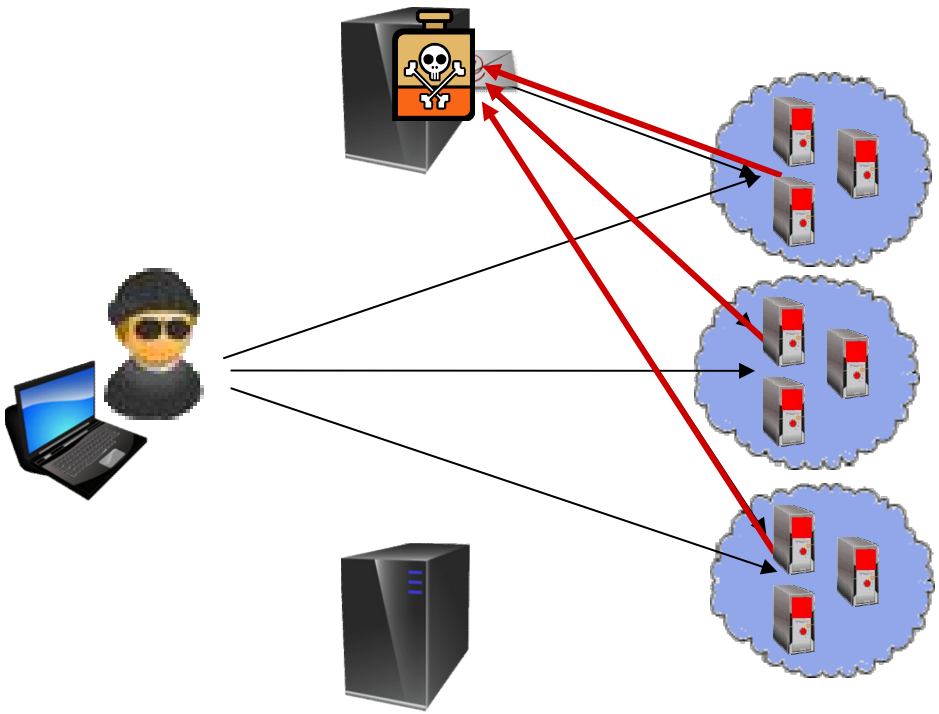
Bot Herder Creates a Delivery System
- Delivers "BotNet" Payload to Hosts

A Brief Aside – BotNets



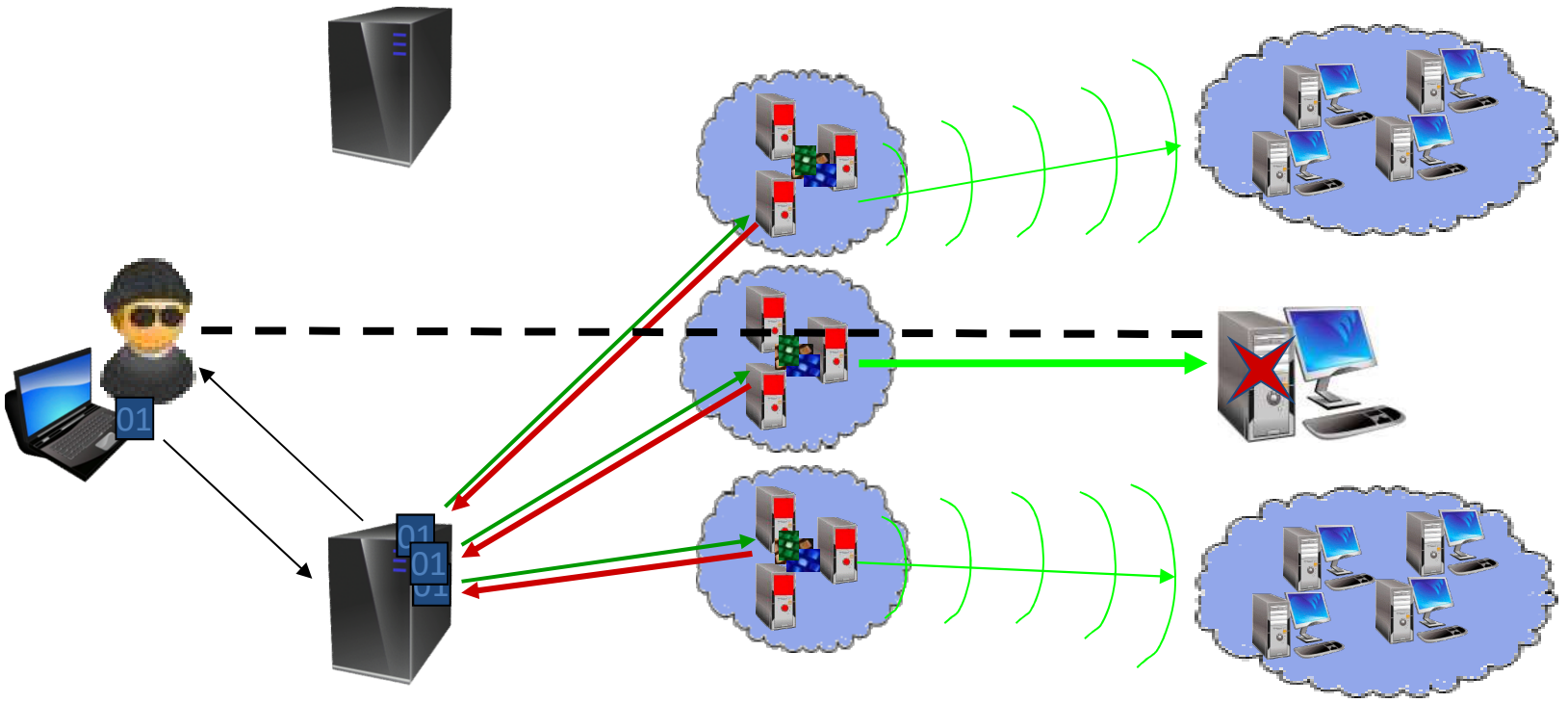
Bot Herder Creates DNS Control Server
- Issues Commands to Bots
- Receives Data From Bots

A Brief Aside – BotNets



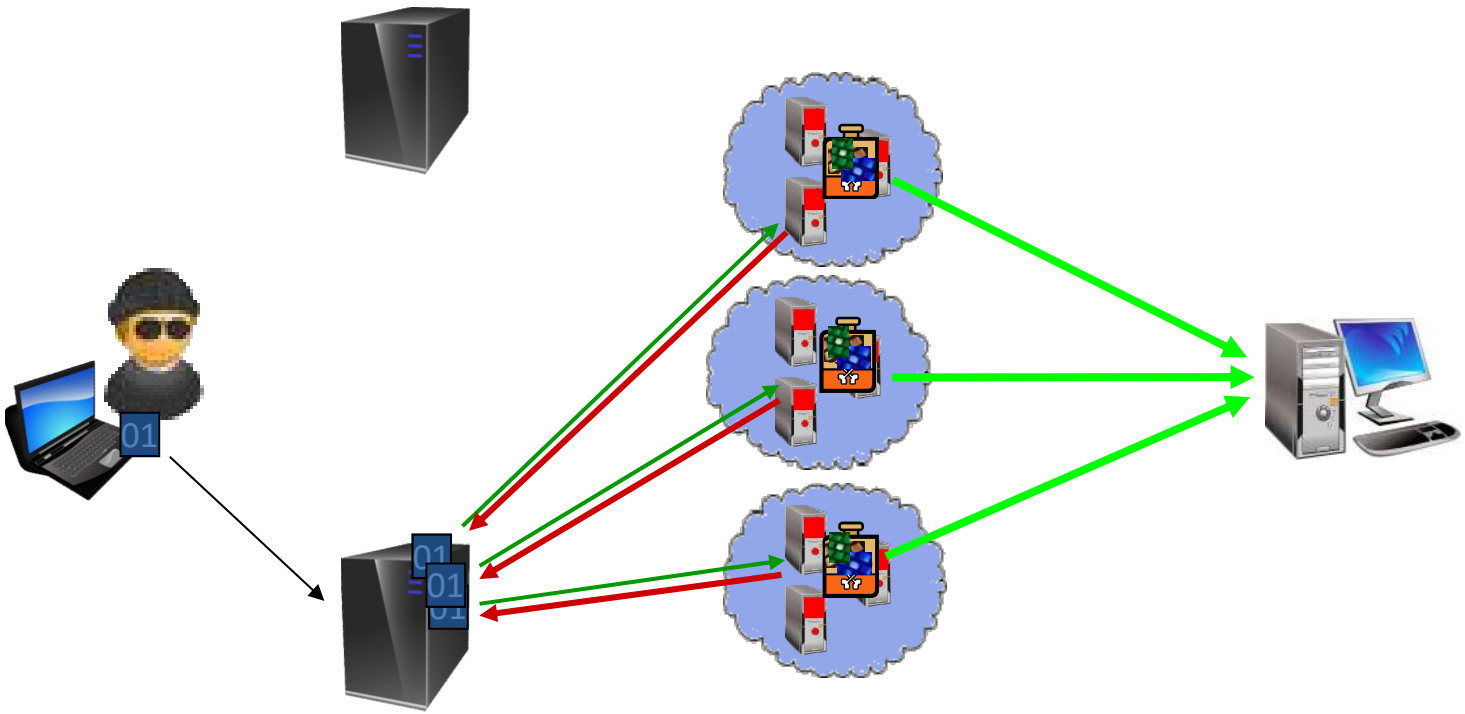
Bot Herder Identifies Candidate Hosts
- Sends Baited E-Mail to Hosts
- Hosts Download Bot Malware from Server
- Hosts Become Zombies

A Brief Aside – BotNets



Bot Herder Identifies Target
- Issues Command via Control Server
- Zombies Receive Command from Server
- Zombies Locate Target
- Zombies Report Back to Server

A Brief Aside – BotNets



Bot Herder Launches Attack at Target
- Issues Command via Control Server
- Zombies Attack Target
- Bot Herder Issues Stop Command

Disruption

- Hardware disruption attacks can be done remotely, but are easier to pull off with physical access
  - Ease of system administration = vectors for attack
  - Some hardware manufacturers allow remote flashing of system BIOS
  - Physical access = complete control
  - Don’t forget the obvious hammer to the PC trick

Disruption

- Service reconfiguration attacks can be done remotely or locally, but almost always require some sort of access (recall privilege escalation)
  - Overwrite boot files
  - Delete critical OS files
  - Modify or create a hosts file
  - Modify application configuration files
  - Stop or disable MS Windows services
- System administration tasks can turn into service reconfiguration attacks in the blink of an eye
  - This could be malicious or accidental!

Disruption

- Why are these attacks important to you?
  - They keep you from offering services to your customers
  - Potentially tarnish your reputation as a service provider
- These attacks may coincide with other attacks
  - The “loudest” attack usually receives administrator attention
  - Be sure to watch the bigger picture - this may be a smoke screen
- These attacks will definitely affect your network
  - The intent of the attack is to disrupt your operations

Disruption

Cyber Attack
- Router Re-Configuration -

Disruption Cyber Attack – Router Re-Config

- Your routers perform a critical service to your operation
  - If they don't work – you can't provide service to your customers
- We will assume that you have a malicious user (an administrator) operating on the inside of your network who wants to disrupt the gateway router
  - They have the credentials to conduct this attack

Disruption Cyber Attack – Router Re-Config

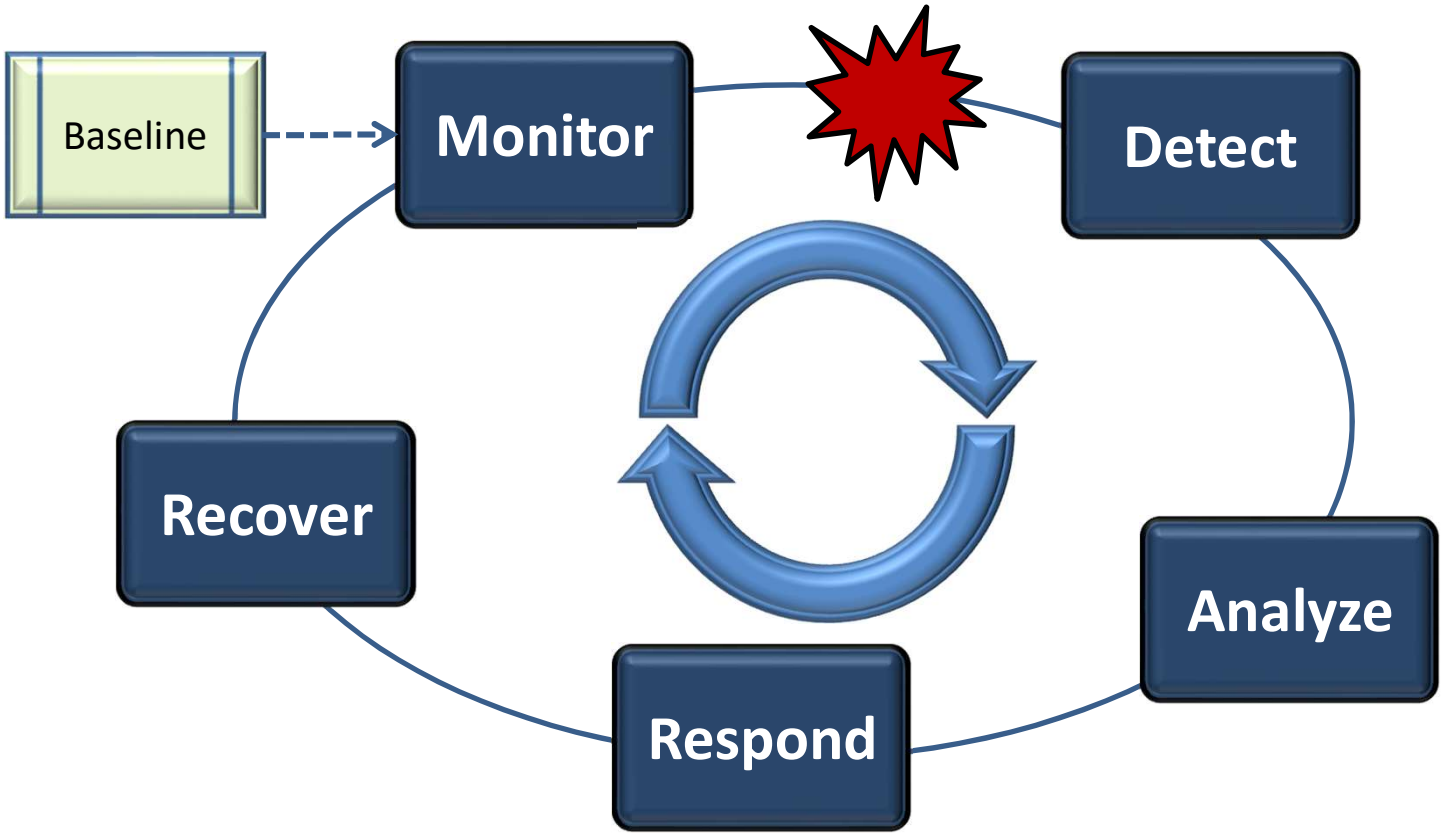
- Malicious actors might target your gateway routers:
  - Because they are central points in the network
  - Affecting one usually has broader effects
- Why?
  - The obvious one: deny service
  - Political statements
  - Demonstrations of “power”
  - Cyber “Riot”

Disruption Cyber Attack – Router Re-Config

- The components needed for this attack
  - Target IP address, credentials

Disruption Cyber Attack – Router Re-Config

- Recall Our Secure Operations Framework



Disruption Cyber Attack – Router Re-Config

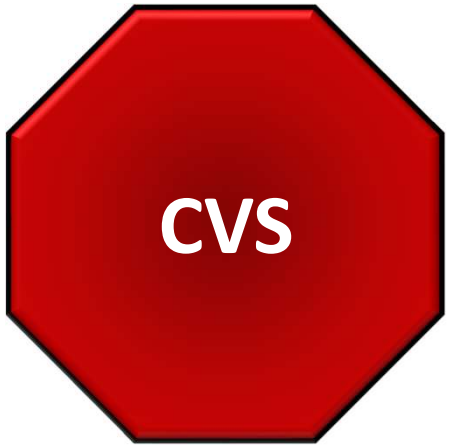
- Establish a Baseline for What's Normal for Your Network:
  - What are your current router configurations?
  - Are your external links up? (silly question – but you may have authorized outages from your provider)
  - Do you see fluctuations in your links over time? (e.g. poor service quality, satellite link outages, rainstorms, etc)
- Use this baseline to compare what you currently see to what you expect
  - The key is expectation, if you aren't expecting it, analyze it!

Disruption Cyber Attack – Router Re-Config

Attack Demonstration

Disruption Cyber Attack – Router Re-Config

- Monitoring & Detection
  - External Service Availability
  - Router Configuration Monitoring



Disruption Cyber Attack – Router Re-Config

- Monitoring & Detection
  - Configure your network to monitor service availability and router configuration changes
  - Monitor your detection tool(s)
  - Establish a Baseline

Disruption Cyber Attack – Router Re-Config

Attack Demonstration

(This time you can see how your network views the attack)

Disruption Cyber Attack – Router Re-Config

- Analysis - what did your detection tools report? Is this really an attack?
  - External service availability
  - Router configuration changes
- Where is the attack coming from?
- Was your external service availability affected?

Disruption Cyber Attack – Router Re-Config

- Response Actions
  - aka “I’m Under Attack – What Do I Do Now?!”
  1) Prioritize – is anything else happening?
  2) Reload configuration from known good copy

- The actions you take:
  - Should focus on restoring service – punish the guilty afterwards!

Disruption Cyber Attack – Router Re-Config

- BUT WAIT – Dr. Evil has changed your router again – what has he done??

Attack Demonstration

Disruption Cyber Attack – Router Re-Config

- Analysis - what did your detection tools report?
  - External service availability
  - Router configuration changes
- Where is the attack coming from?
- Was your external service availability affected?
- Are there other indications of what occurred?
  - Multi-Source Analysis – what else occurred about the same time as the configuration change?

Disruption Cyber Attack – Router Re-Config

- Response Actions
  – aka “I’m Under Attack – What Do I Do Now?!”
  1) Prioritize – is anything else happening?
  2) Reload configuration from known good copy
  3) Make changes by hand?!

Disruption Cyber Attack – Router Re-Config

- Recovery Actions
  - The attack is over – how do I prevent this again?
  1) Ask yourself “What _*could*_ have happened here?”
  2) Use your analysis tools to determine where attack originated from and who may have done it
  3) Consider use of a management VLAN or otherwise restrict infrastructure administration to certain IPs
  4) Setup automatic alerts for service availability and configuration changes

Disruption Cyber Attack – Router Re-Config

- What Other Mitigation Steps Would You Take?
  - What is appropriate for your network & resources?

Disruption Cyber Attack – Router Re-Config

- Attack Discussion
  - Everyone hopes their employees are trustworthy
    - but history tells us otherwise

Trust But Verify

- Other Thoughts Before We Move On?

Disruption

Cyber Attack
- DoS via DNS Queries -

- Full Disclosure – we do not (yet) have traffic generation capabilities to saturate all 8 student group 100 Mbps links – so we will throttle your upstream router connections to demonstrate this attack

- Your backchannel connection will not be affected by the throttling (or the DoS) so you should be able to see the attack as it happens

Disruption Cyber Attack – DoS via DNS

- Your authoritative DNS servers are open to the world and remotely accessible
  - They _***have***_ to be, otherwise, what's the point?
- We will generate large numbers of DNS queries to saturate your upstream link
  - Note that we are NOT targeting your DNS server!
- The effect is that external users will not be able to resolve DNS queries to your domain

Disruption Cyber Attack – DoS via DNS

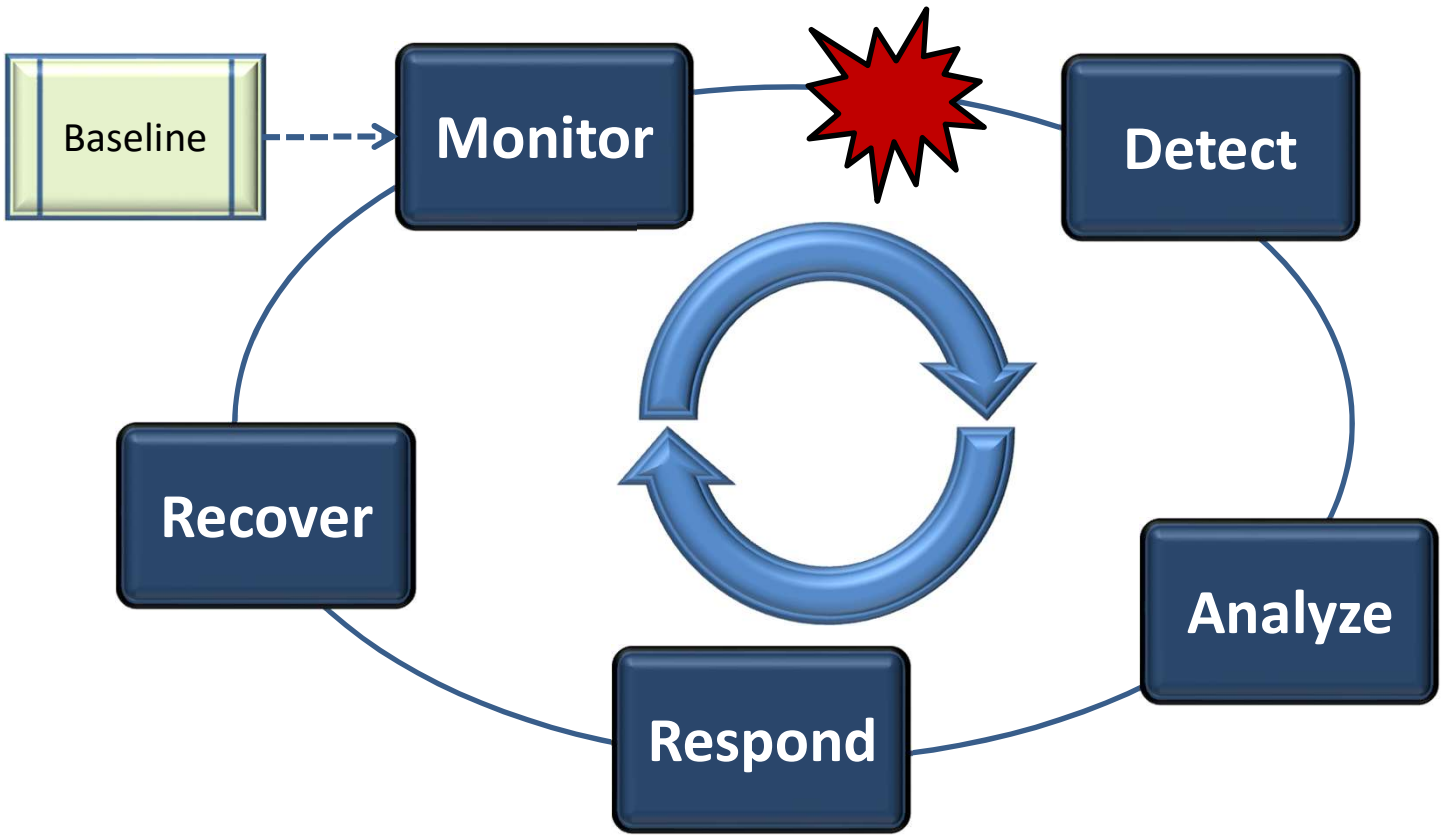
- Malicious actors might target your DNS servers:
  - Because they are remotely accessible
  - You are guaranteed to have them
  - DNS queries are easy to generate
- Why?
  - The obvious one: deny service
  - Political statements
  - Demonstrations of “power”
  - Cyber “Riot”

Disruption Cyber Attack – DoS via DNS

- The components needed for this attack
  - Target IP address, DNS query generation

Disruption Cyber Attack – DoS via DNS

- Recall Our Secure Operations Framework



Disruption Cyber Attack – DoS via DNS

- Establish a Baseline for What's Normal for Your Network:
  - What is your current bandwidth?
  - How much of your bandwidth is normally in use?
  - How many queries do you normally see?
  - Do you see fluctuations over time? (e.g. more queries in the morning than in the evening)

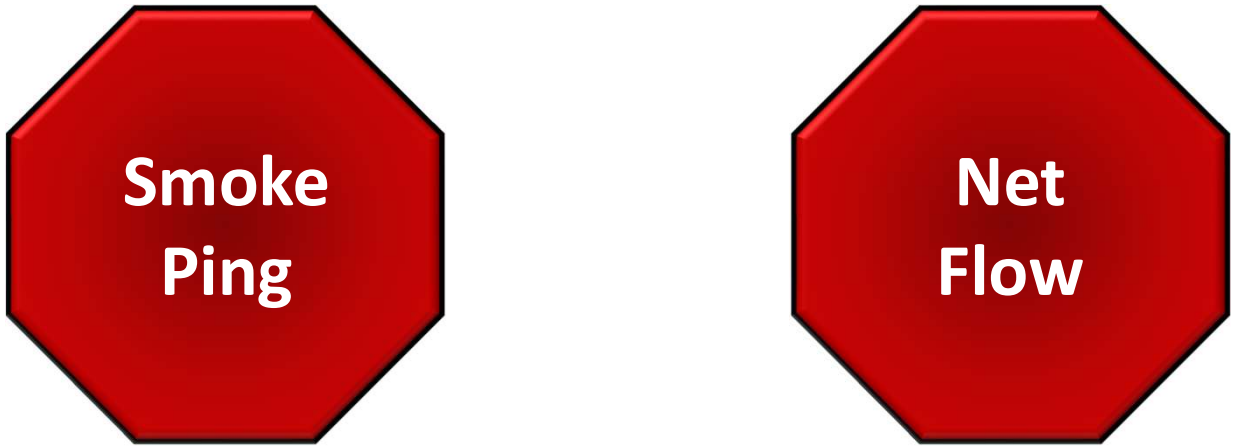
- Use this baseline to compare what you currently see to what you expect
  - A spike in queries might indicate undue "interest" in you!
  - You don't want your first indication of an attack to be a customer calling you!

Disruption Cyber Attack – DoS via DNS

Attack Demonstration

Disruption Cyber Attack – DoS via DNS

- Monitoring & Detection
  - Bandwidth Monitoring Tools
  - External Service Availability



Disruption Cyber Attack – DoS via DNS

- Monitoring & Detection
  - Configure your network to monitor bandwidth and DNS queries
  - Monitor your detection tool(s)
  - Establish a Baseline

Disruption Cyber Attack – DoS via DNS

Attack Demonstration

(This time you can see how your network views the attack)

Disruption Cyber Attack – DoS via DNS

- Analysis - what did your detection tools report? Is this really an attack?
  - Bandwidth Usage
  - Queries per second
- Where is the attack coming from?
- Was your external service availability affected?

Disruption Cyber Attack – DoS via DNS

- Response Actions
  - aka “I’m Under Attack – What Do I Do Now?!”
  1) Prioritize – is anything else happening?
  2) Filter at your gateways based on the attack traffic
  3) Contact your upstream providers to filter
  4) Provision more services (bandwidth, secondaries, etc)

- The actions you take:
  - Should focus on restoring service to your customers
  - Depend on the extent of attack and where its originating from
  - Depend on your connectivity and where your customers are located
    - Recall establishing an architecture baseline – you don’t want to figure our where your links are while you are being attacked
    - You may determine that you can mitigate the attack by closing your servers to queries from outside your country – your in-country customers are OK

Disruption Cyber Attack – DoS via DNS

- Recovery Actions
  - The attack is over – how do I prevent this again?
  1) Ask yourself “What _*could*_ have happened here?”
  2) Provision additional bandwidth over separate links
  3) Provision geographically separated secondaries
  4) Anycasting
  5) Mutual Aid Agreements with other ccTLDs
  6) Response procedures for contacting upstream providers
  7) Procedures for determining customer priority

Disruption Cyber Attack – DoS via DNS

- What Other Mitigation Steps Would You Take?
  - What is appropriate for your network & resources?

Disruption Cyber Attack – DoS via DNS

- Attack Discussion
  - DoS attacks can take many forms; effective monitoring is the only way to detect them
  - External service monitoring (e.g. what does your network look like from the outside) can help too!
- Other Thoughts Before We Move On?

QUESTIONS?

- Do you have any questions about …
  - Disruption Attacks
  - Detecting This Type of Attack
  - Responding & Recovering From This Type of Attack