Operational Security Current Practices

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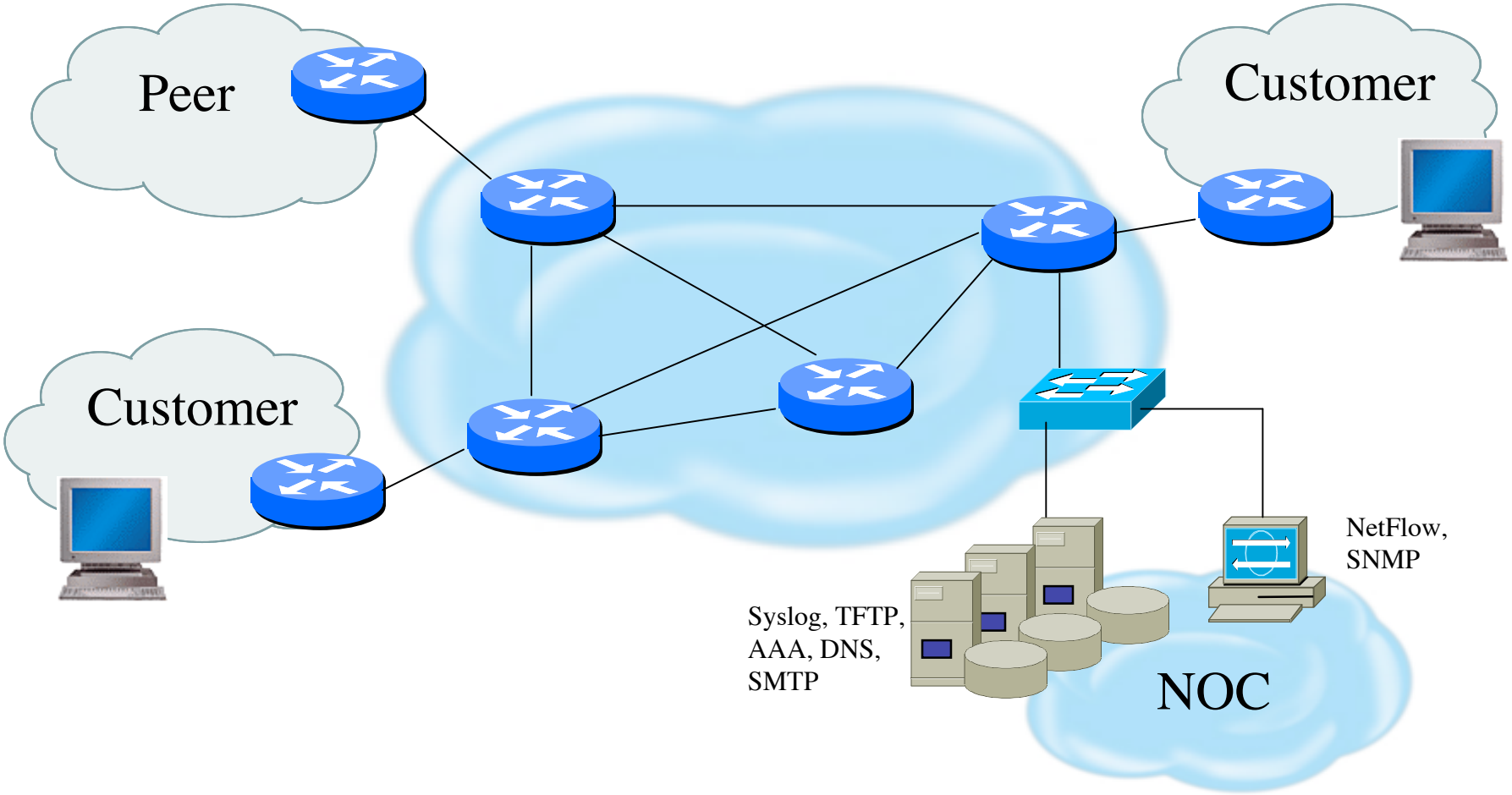
Infrastructure Security



How Do Large ISPs Protect Their Infrastructures ?

- Understand the Problem
- Establish an Effective Security Policy
  - physical security
  - logical security
  - control/management plane
  - routing plane
  - data plane
- Have Procedures In Place For Incident Response
  - procedures for assessing software vulnerability risk
  - auditing configuration modifications

Attack Sources

- Passive vs Active
  - Writing and/or reading data on the network
- On-Path vs Off-Path
  - How easy is it to subvert network topology?
- Insider or Outsider
  - What is definition of perimeter?
- Deliberate Attack vs Unintentional Event
  - Configuration errors and software bugs are as harmful as a deliberate malicious network attack

Operational Security Impact

- Unauthorized Disclosure
  - circumstance or event whereby entity gains access to data for which it is not authorized
- Deception
  - circumstance or event that may result in an authorized entity receiving false data and believing it to be true
- Disruption
  - circumstance or event that interrupts or prevents the correct operation of system services and functions
- Usurpation
  - circumstance or event that results in control of system services or functions by an unauthorized entity

Security Services

- User Authentication
- User Authorization
- Data Origin Authentication
- Access Control
- Data Integrity
- Data Confidentiality
- Auditing / Logging
- DoS Mitigation

Functional Considerations

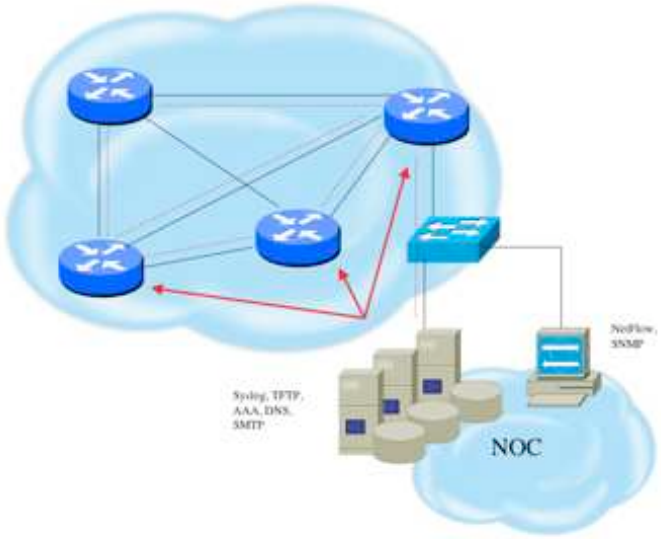
- Device Physical Access
- Device In-Band Management
- Device OOB Management
- Data Path
- Routing Control Plane
- Software Upgrade / Configuration Integrity

- Logging
- Filtering
- DoS Tracking /Tracing
  - Sink Hole Routing
  - Black-Hole Triggered Routing
  - Unicast Reverse Path Forwarding (uRPF)
  - Rate Limiting

Device Physical Access

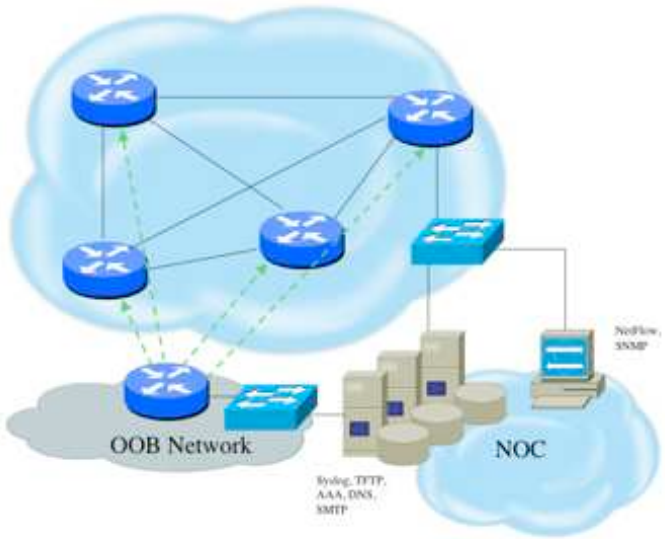
- Equipment kept in highly restrictive environments
- Console access
  - password protected
  - access via OOB management
- Individual users authenticated
- Social engineering training and awareness

Device In-Band Management



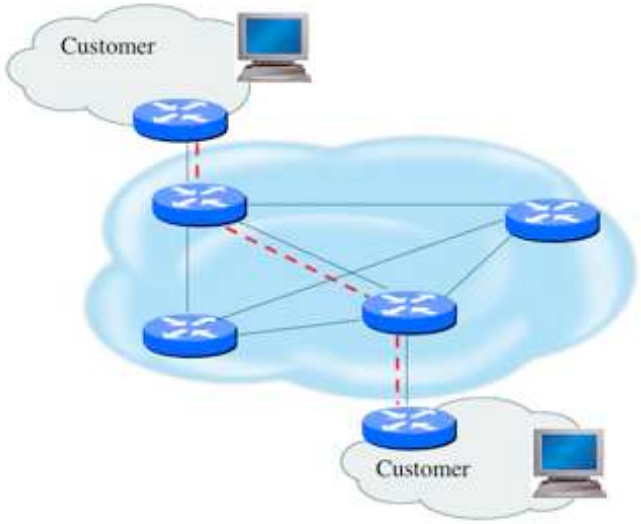
- SSH primarily used; Telnet only from jumphosts
- All access authenticated
  - Varying password mechanisms
  - AAA usually used
  - Single local database entry for backup
- Each individual has specific authorization
- Strict access control via filtering
- Access is audited with triggered pager/email notifications
- SNMP is read-only
  - community strings updated every 30-90 days

Device OOB Management



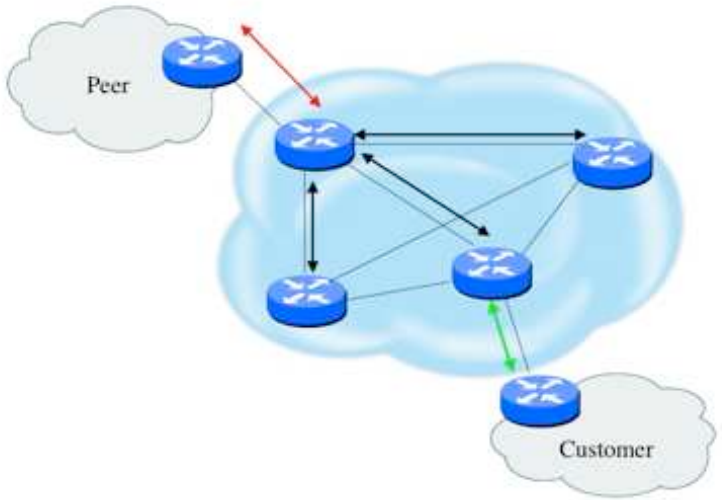
- SSH primarily used; Telnet only from jumphosts
- All access authenticated
  - Varying password mechanisms
  - AAA usually used (server typically different for in-band vs OOB)
  - Single local database entry for backup
- Each individual has specific authorization
- Strict access control via filtering
- Access is audited with triggered pager/email notifications
- SNMP is read-only
  - community strings updated every 30-90 days

Data Path



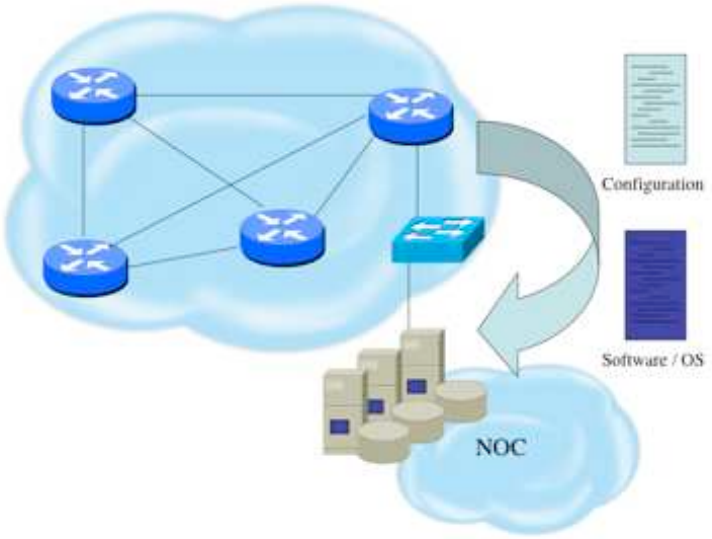
- Filtering and rate limiting are primary mitigation techniques
- BCP-38 guidelines for ingress filtering
- Null-route and black-hole any detected malicious traffic
- Netflow is primary method used for tracking traffic flows
- Unicast Reverse Path Forwarding is not consistently implemented
- Logging of Exceptions

Routing Control Plane



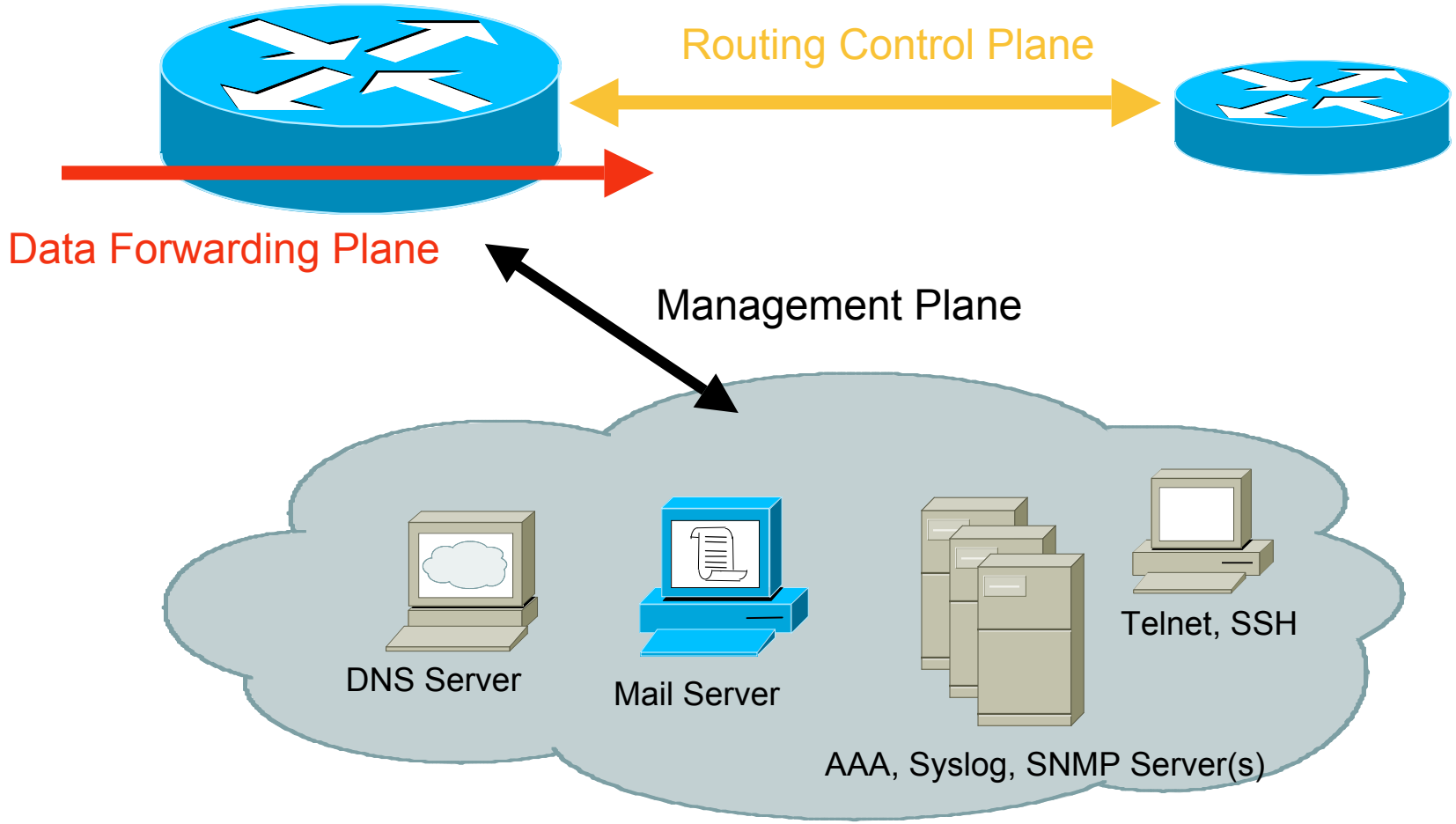
- MD-5 authentication
  - Some only deploy this at customer's request
- Route filters limit what routes are believed from a valid peer
- Packet filters limit which systems can appear as a valid peer
- Limiting propagation of invalid routing information
  - Prefix filters
  - AS-PATH filters (trend is leaning towards this)
  - Route dampening (latest consensus is that it causes more harm than good)
- Not yet possible to validate whether legitimate peer has authority to send routing update

Software Upgrade / Integrity



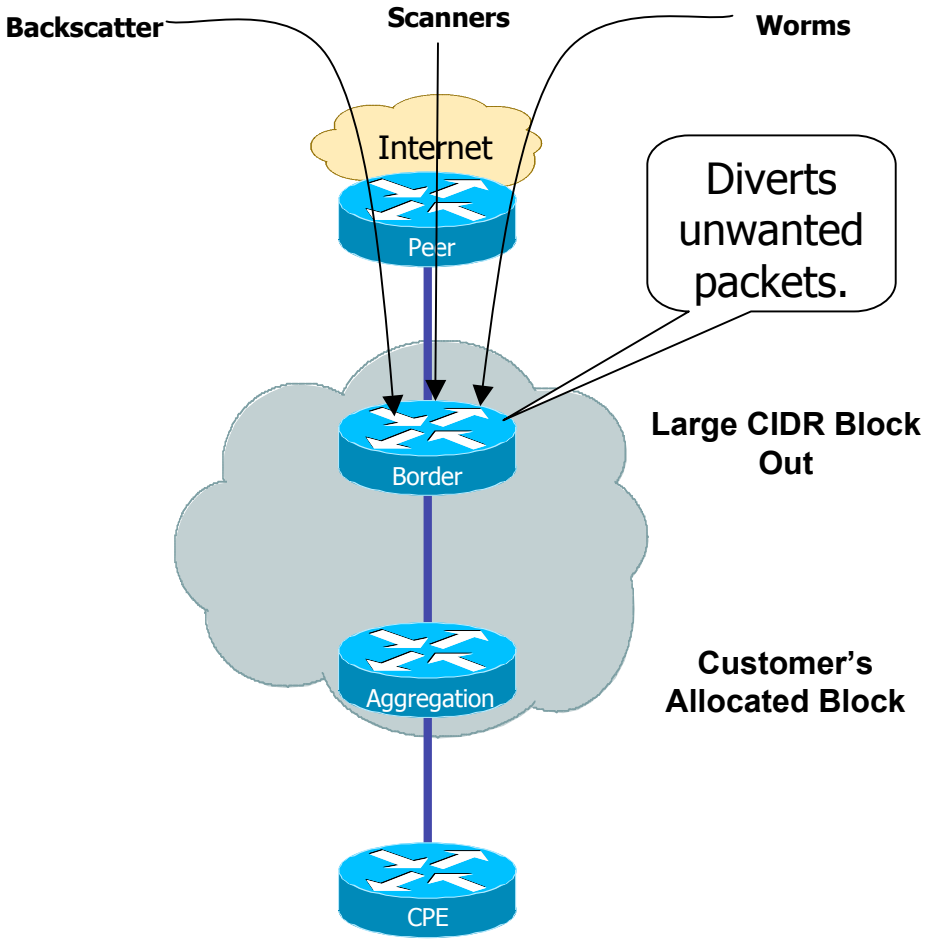
- Files stored on specific systems with limited access
- All access to these systems are authenticated and audited
- SCP is used where possible and FTP is NEVER used
- Configuration files are polled and compared on an hourly basis
- Filters limit uploading / downloading of files to specific systems
- Many system binaries use MD-5 checks for integrity
- Configuration files are stored with obfuscated passwords

Filtering Considerations



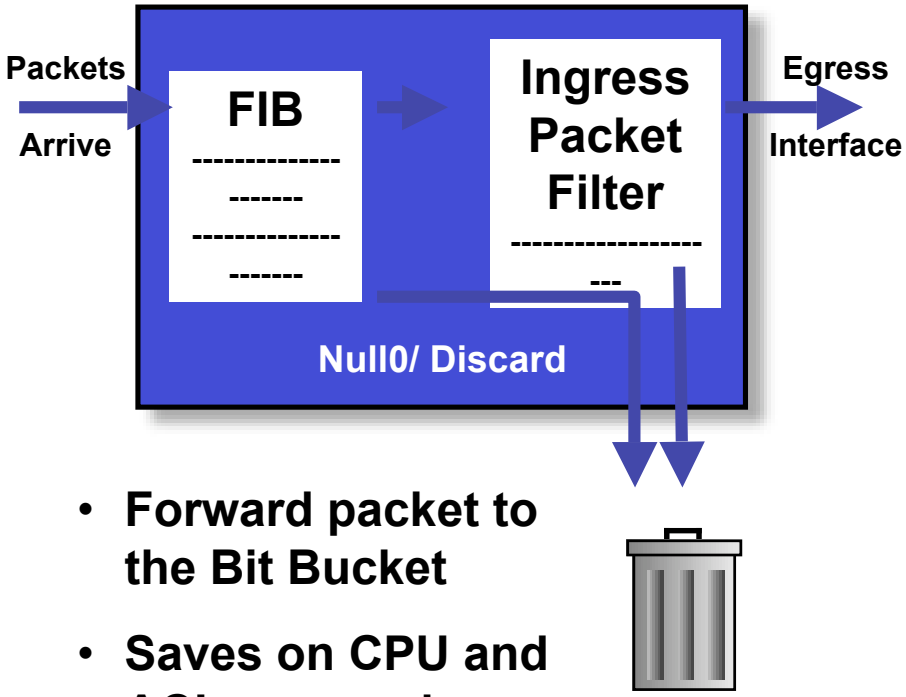
DoS Tracking / Mitigation (Sink Hole)

- Router or workstation built to *divert traffic* and assist in analyzing attacks and determine the source.
- Used to redirect attacks away from the customer – working the attack on a router built to withstand the attack.
- Used to monitor *attack noise*, *scans*, *data from mis-configuration* and other activity (via the advertisement of default or unused IP space)



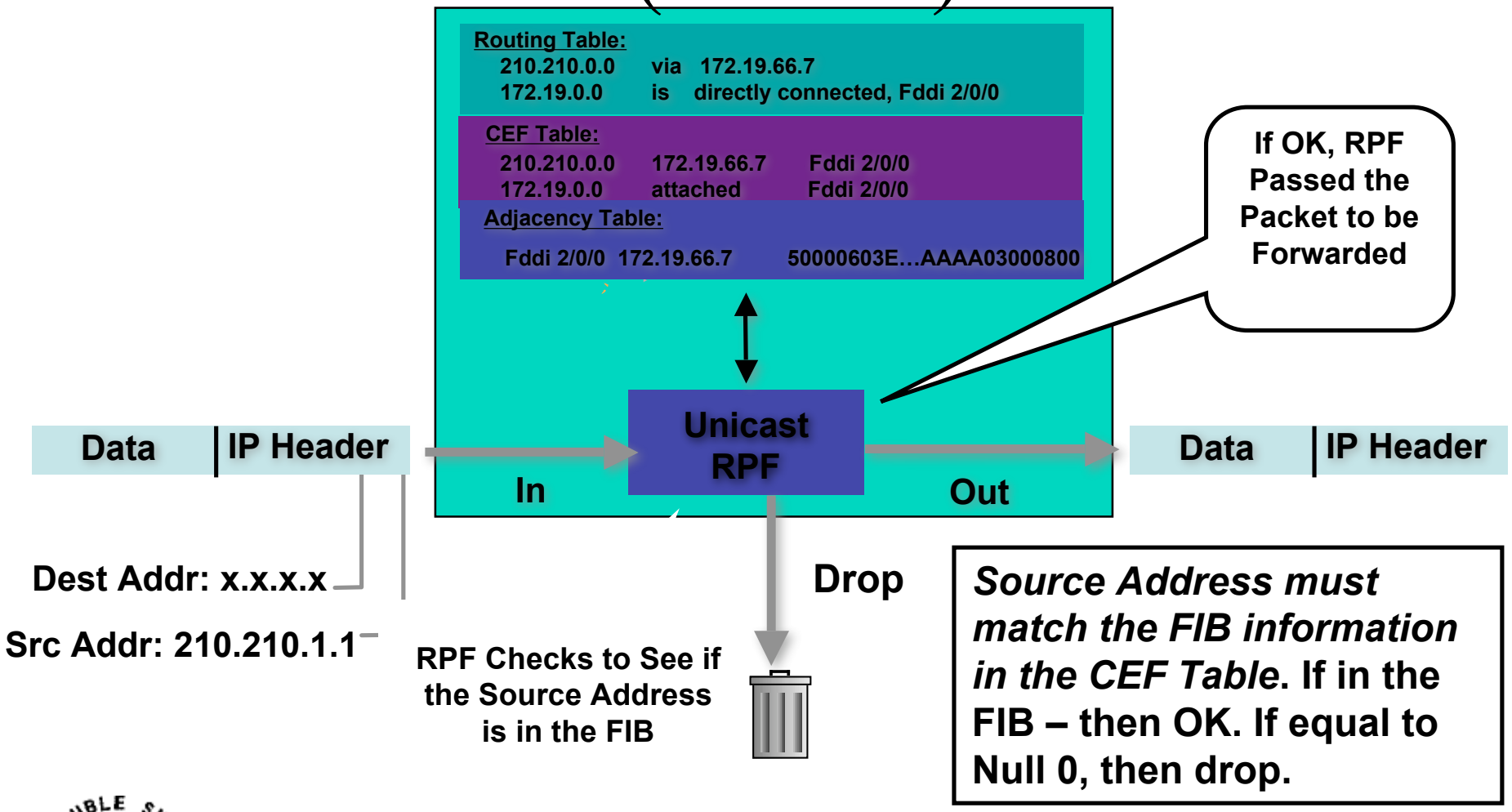
DoS Tracking / Mitigation (Black-Hole Triggered Routing)

- Several Techniques:
  - Destination-based BGP Blackhole Routing
  - Source-based BGP Blackhole Routing (coupling uRPF)
  - Customer-triggered
- Exploits router's forwarding logic which typically results in desired packets being dropped with minimal or no performance impact



- **Forward packet to the Bit Bucket**
- **Saves on CPU and ACL processing**

DoS Tracking / Mitigation (uRPF)



IPv4 vs IPv6

- Same considerations exist for IPv6 networks although the same tools are not yet there for IPv6 transports
- IPv6 / IPv4 tunnels used to hide malicious traffic from filtering rules is a concern
- Flow collection tools are not yet capable of detecting much malicious traffic

Operational Practices Summary

- Risk mitigation techniques similar yet different
  - Similar conceptual safeguards
  - Differences based on performance issues and operational complexity
- Infrastructure products need standardized capabilities for more effective security deployments

THANK YOU!

(draft-ietf-opsec-current-practices-06.txt)