IP Spoofing
CS 239
Advanced Topics in Network Security
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The Problem

- Existing Internet protocols and infrastructure allow forgery of some IP packet header fields
- In particular, the source address field can often be forged
- If packet causes trouble, can't determine its true source
- Particularly important for distributed denial of service attacks
  - But relevant for other situations

Limitations of the Problem

- If attacker forges source address in packet, probably won't see the response
- So spoofing only useful when attacker doesn't care about response
  - Usually denial of service attacks
- This point is not universally true

Types of Spoofing

- General spoofing
  - Attacker chooses a random IP address for source address
- Subnet spoofing
  - Attacker chooses an address from the subnet his real machine is on
  - With suitable sniffing, can see responses
  - Harder for some types of filtering

Combating Spoofing

- Basic approaches:
  1. Authenticate address
  2. Prevent delivery of packets with spoofed addresses
  3. Trace packets with spoofed addresses to their true source
  4. Deduce bogosity from other packet header information
  5. Deduce bogosity of entire data streams with shared IP addresses

Authenticate Address

- Probably requires cryptography
- Can be done with IPSec
- Incurs cryptographic costs
- Only feasible when crypto authentication is feasible
- Could we afford to do this for all packets?

Preventing Delivery of Spoofed Packets

- Somehow recognize that address is spoofed
  - Usually based on information about network topology and addresses
- Simple version is ingress filtering
- More sophisticated methods are possible

Ingress Filtering Example

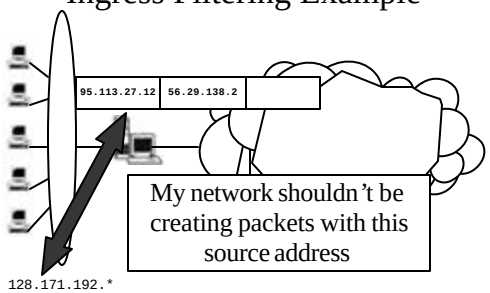
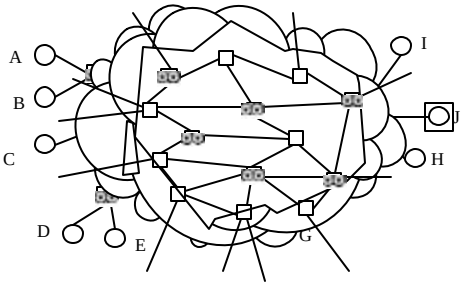


Diagram for Detection Approaches



Potential Problems With Approaches Requiring Infrastructure Support

- Issues of speed and cost
- Issues of trustworthiness
- Issues of deployment
  - Why will it be deployed at all?
  - How will it work partially deployed?

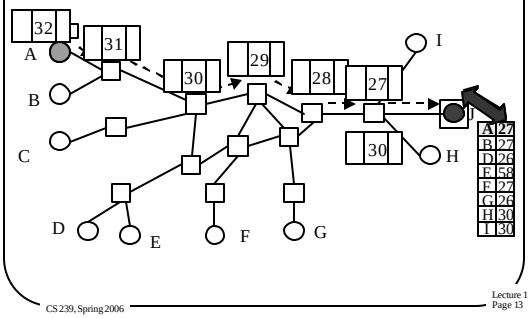
Packet Tracing

- Figure out where the packet really came from
- Generally only feasible if there is a continuing stream of packets
- Will be discussed in more detail in later class
- Challenges when there are multiple sources of spoofed addresses

Using Other Packet Header Info

- Packets from a particular source IP address have stereotypical header info
  - E.g., for given destination, TTL probably is fairly steady
- Look for implausible info in such fields
- Could help against really random spoofing
- Attacker can probably deduce many plausible values
- There aren't that many possible values

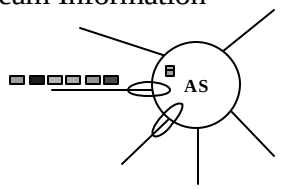
Diagram for Using TTL



Deducing Spoofing From Data Stream Information

- Streams of packets are expected to have certain behaviors
  - Especially TCP
- Observe streams for proper behavior
  - Maybe even fiddle with them a little to see what happens
- Obvious example:
  - Drop some packets from TCP stream with suspect address
  - Do they get retransmitted?

Diagram for Deducing From Data Stream Information



Packets from 131.179.192.* have been coming in on one interface
Now packets from those addresses show up on another
Route change or spoofing?
Drop a few and see what happens

Open Questions

- Are there entirely different families of approaches?
- How can you actually build tables for detection approaches?
- Can detection approaches work in practical deployments?
- Are crypto approaches actually feasible?