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MIDDLE EAST TECHNICAL UNIVERSITY

.tr DDoS Attack

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A Summary of a 3 weeks long experience …

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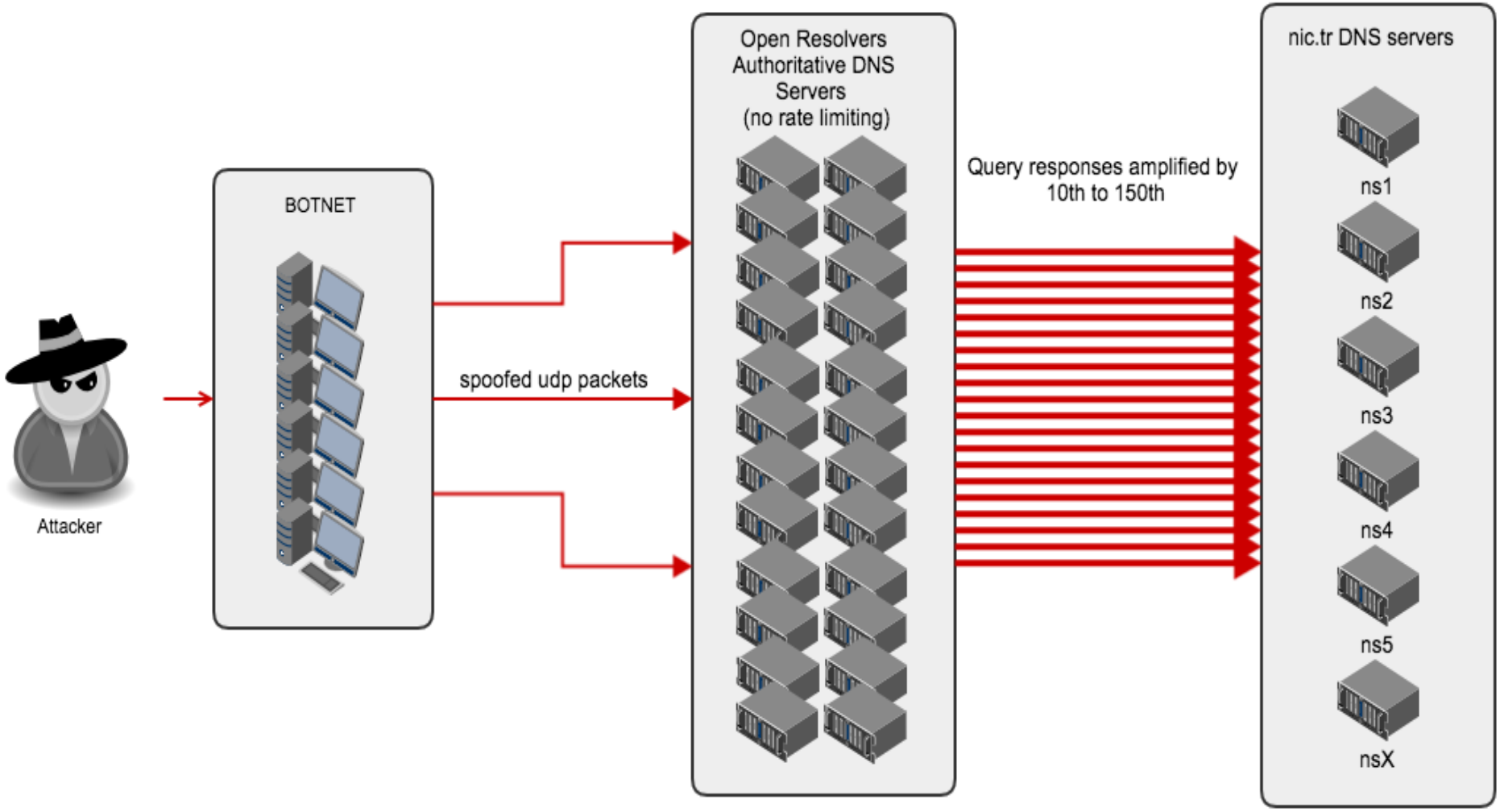
Before DDoS

- Infrequent Small scale DoS and DDos Attacks
  - Few times every year
  - 5-30 mins. each
  - Mostly to our registry services
    - www.nic.tr
- 6 NS at 5 different locations
  - All open source
    - Linux, Bind, NSD
  - Average Bandwidth: 1.5 Mbps per server
  - 1.250 QPS per server

DDoS Attack

- Started at 14 December 2015 10:20
  - Went on nearly for 3 weeks
  - Towards the end, changed its target to Finance and Government sectors
- Basically a *"DNS Amplification Attack"*
  - Botnets sending spoofed query packets to
    - ✧ Open DNS resolvers
    - ✧ Authoritative DNS servers (no rate limiting)
  - Amplified by 10-150 times by victims
  - %25 victims from TR IPs
  - Targets 6 NS Servers
  - Secondary target was our registry services (Web)

Anatomy of the DDoS



Communication Infrastructure

- 3 major ISPs serving TR Internet
  - Each connected to Tier-1 at various locations
    - ✧ No topology info on our side
  - Abstraction: 3 major pipes to TR
- 4 NSs downstream of ISP-A
- 1 NS downstream of ISP-B
- 1 NS @Europe

During the Attack …

- Mainly between 09:00-17:00
  - Working hours! (1st shift)
  - 185.000 QPS per server
- Reduced rate and different nature of attack during 2nd and 3rd shift
- All NSs were almost always up
  - Reachability and delay problems due to overloaded pipes
- Volume
  - Max. 220 Gbps attack bandwidth at one pipe at one time
  - No synchronized picture of attack history
- Might be one of the largest DDoS observed so far

Basic Defense Mechanisms

- Make the surface of the attack wider
  - Increasing the # of NSs
    - 6 to 11
    - 2 of 11 are ANYCAST (DynDNS)
    - Effectively 6 to 60
- Analyze traffic
  - Figure out drop rules to be used
- Adaptively react by reconfiguring mitigation services and devices
  - Attackers were highly adaptive to our defence

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Currently

- Infrequent, relatively light, 5-10 minutes DDoS Attacks are still coming in
- Administrative measures
  - List of critical domain names (Gov, Banks, etc.) expanded
    - ✧ 100 → 600 → 1.000+
- Temporarily
  - Zone Updates are done 3 times per day
  - Manual inspection of zone updates

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Observations

- Major attack classes
  - UDP flooding
  - Spoofed packets
    - Source Port 53, Destination Port 53
    - …
    - Almost all known attack patterns
- Other attacks
  - Application attacks
    - TCP based
- No Ingress/Egress filtering in subnets
- 8% of registered NSs in our registry DB are “Open Resolvers”

Observations and Lessons

- Importance of quick RZM mechanisms
  - Updates were not quick enough
    - ✧ DOC Checks
- Effective communication mechanisms
  - Within the registry tech team
    - ✧ Use of Near Real Time technologies (Chat, etc.)
  - Between Registry and Upstream Operator
    - ✧ Tech team correspondance
  - Critical communication should be in written form
    - ✧ Rules to be coded
  - All critical communication should be tolerant to DNS failures

Observations and Lessons

- Effective (and concurrent) communication with
  - IANA/ICANN
  - Other organizations within the country
    - ✧ Cybersecurity
  - Press (Media)
  - Upstream operators

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Questions?