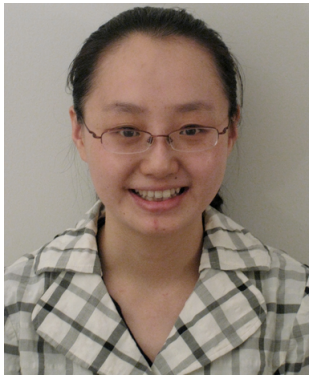
USC University of Southern California

SENSS

Security Service for the Internet

Jelena Mirkovic (USC/ISI), Minlan Yu (USC), Ying Zhang (HP Labs), Sivaram Ramanathan (USC)

Attack Mitigation Today

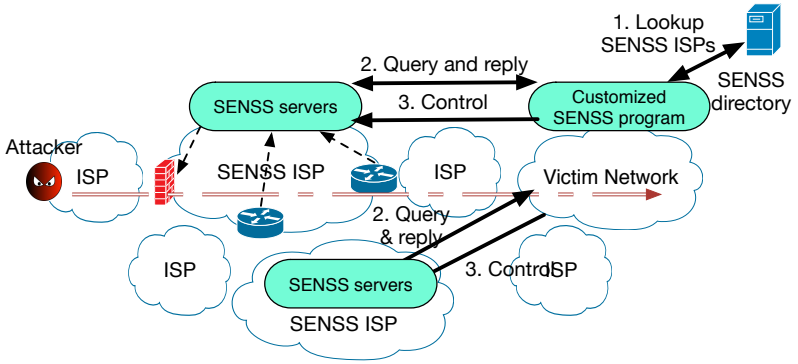
- DDoS
  - Local device does traffic analysis, sometimes DPI (low-volume and application attacks; cannot handle high-volume or reflected traffic)
  - Cloud-based defense, traffic goes to cloud for scrubbing (high-volume attacks; takes time to set up, expensive, redirects traffic, special handling for encrypted traffic)
- BGP prefix hijacking
  - BGP anycast (distributes prefix presence; takes time to set up, expensive, needs content replication too)
- Most solutions focus on resource replication and withstand attacks

Our solution - SENSS

- Collaborative between victim and ISPs
- Enables victim to query its own ISP or remote ISPs about:
  - Its inbound traffic
  - Routes to its prefixes
- Enables victim to ask ISPs to:
  - Filter some of its inbound traffic (victim specifies header signature)
  - Demote a route that may contain a hijacker
- Secure, robust to misbehavior
- Works with existing ISP infrastructure

Operation

- ISPs run SENSS servers
- Victim identifies ISPs to interact with using public SENSS directory
  - Sends to each a query
  - ISPs authenticate prefix ownership, process query, charge the victim and return replies
- Victim decides which control actions to apply and where
  - Sends messages about this to chosen ISPs
  - ISPs authenticate prefix ownership, charge the victim, implement requested actions



SENSS APIs at ISPs

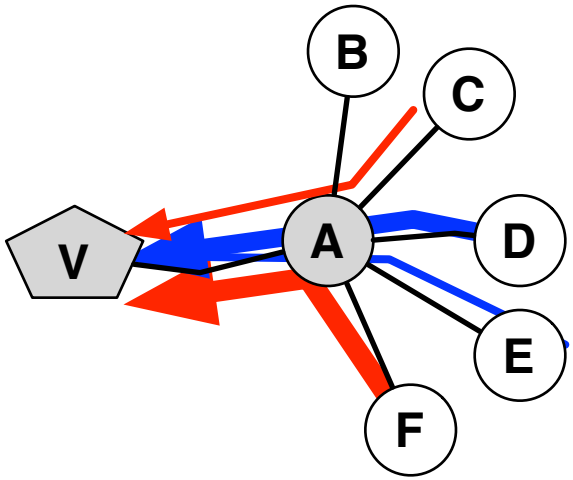
neighbor's AS number (+ geolocation)

- Exposed as Web services
  - Leverage existing functionalities for robustness (replication), security (HTTPS), charging (e-commerce)

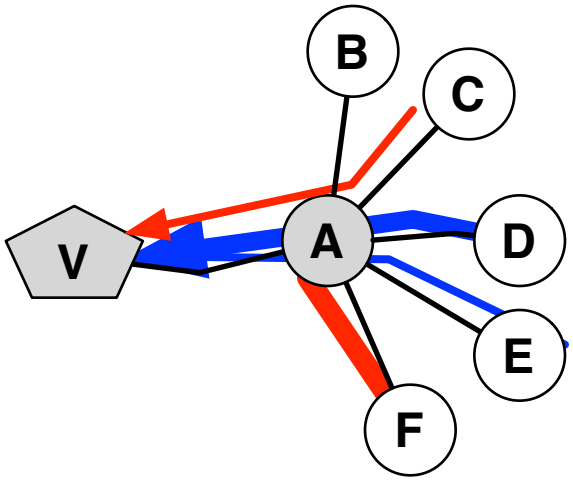
Type	Fields	Action/Reply
Traffic query	Flow, dir, obs_time	List of <tag, dir, volume>
Traffic filter/allow	Flow, dir, tag, duration	Deploy filter/allow actions
Route query	Prefix	List of best paths to prefix
Route demote	Prefix, segment, duration	Demote routes with given segment

- Message authentication: Proof of authority for a prefix
  - Signed proof that owner of a given public key is authorized to speak for a set of prefixes in the SENSS messages
  - RPKI, extension of SSL certs, …
  - … or manually populate a DB of known customers and prefixes
- TLS for communication security
- Victim can delegate a proxy if it cannot communicate itself

Example: Isolated Deployment

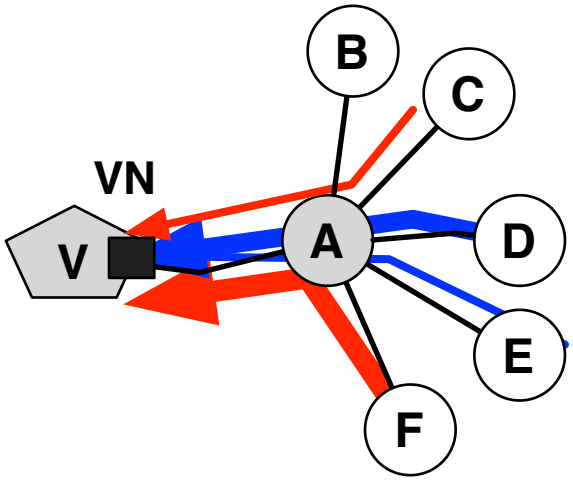


V ➔ A: traffic_query
A ➔ V: 1 (D-A), 0.5 (E-A), 5 (F-A), 0.5 (C-A)

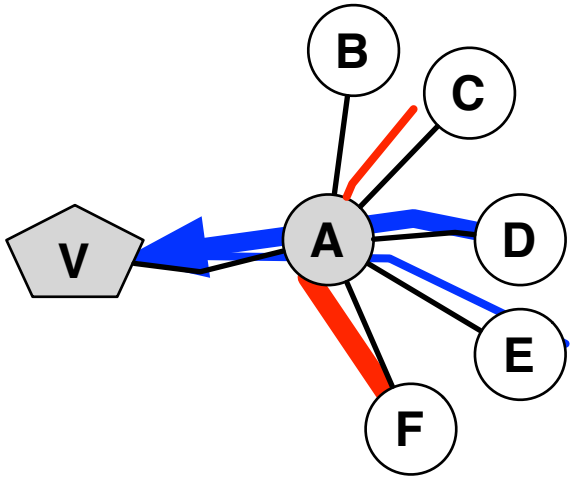


V ➔ A: traffic_filter(tag=F-A, dest=V)

Direct flood



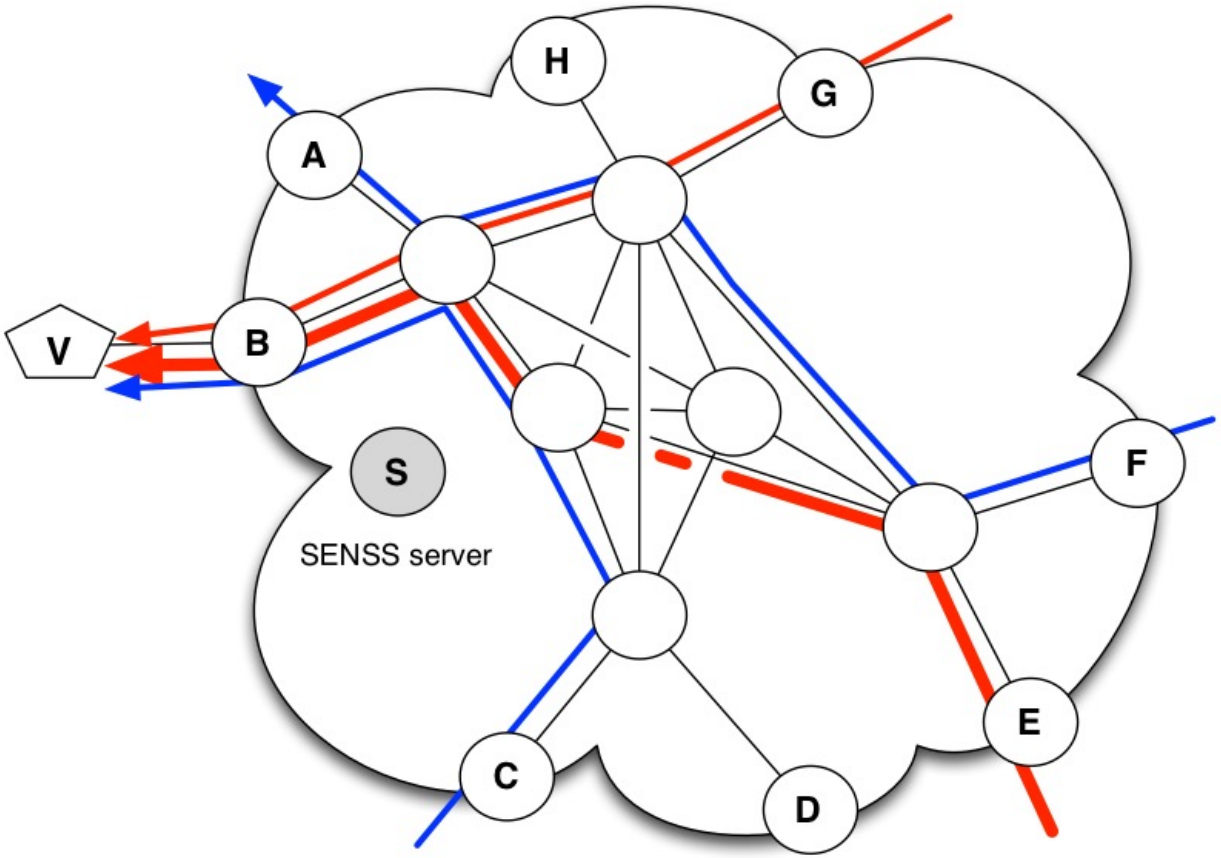
V NATs all DNS traffic through VN, ports 1000-2000



V ➔ A: traffic_allow(dest=VN, sport=53, dport=(1000,2000))
V ➔ A: traffic_filter(dest=V, sport=53)

Reflector

Example: ISP-Only Deployment



S periodically collects traffic reports from A,B,C,D,E,F,G,H
Analyzes traffic
Detects attack on V
Identifies E as ingress router, which sends most of the attack to V
Deploys blackholing at E for destination V

SENSS Components

- @ISP: SENSS server – Web application + scripts, which communicate with routers
- @Victim or @ISP: SENSS client – application, which sends messages to SENSS server, analyzes responses, decides on mitigation strategy
- @Victim or @ISP: Attack detection module – works on Netflow records to detect attacks, suggest filter rules to SENSS client

What SENSS Can Do For ISPs?

- Help you defend your customers from DDoS with existing infrastructure
- Automate DDoS handling within your ISP
- Help detect and diagnose attacks (separate module)

Integrating SENSS With ISP

- SENSS is a Web application, which can be ran on any Web server within your ISP:
  - Admin account requires 2-factor authentication
  - Use RPKI or set up DB for proof of authority for a prefix
  - Supply IP addresses of switches
- SENSS needs traffic/route observation and filtering:
  - For traffic observation: SDN or SNMP
  - For traffic filtering: SDN or Flowspec or ACLs
  - For route observation/filtering: interact with router software (Quagga)

Expected Performance

- SENSS should help mitigate most direct floods and 100% of reflector attacks
- SENSS server performance scales with # border routers and # concurrent requests from clients
  - Irrespective of attack volume or # attackers
  - Message processing under ¼ sec under heavy load
- One rule per SENSS message:
  - Modest consumption of TCAM space
- Fast-path packet handling
- Easy deployment: no separate hardware

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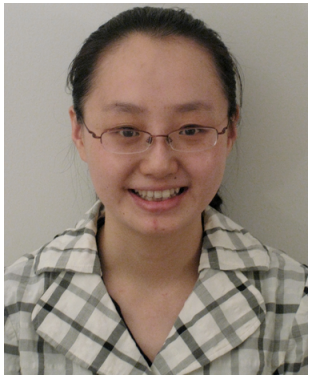
Test drive SENSS in your network

Reach out

sunshine@isi.edu

http://steel.isi.edu/Projects/SENSS/

Jelena Mirkovic



Minlan Yu

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