BGP attack scenarios

Discussing BGP weaknesses

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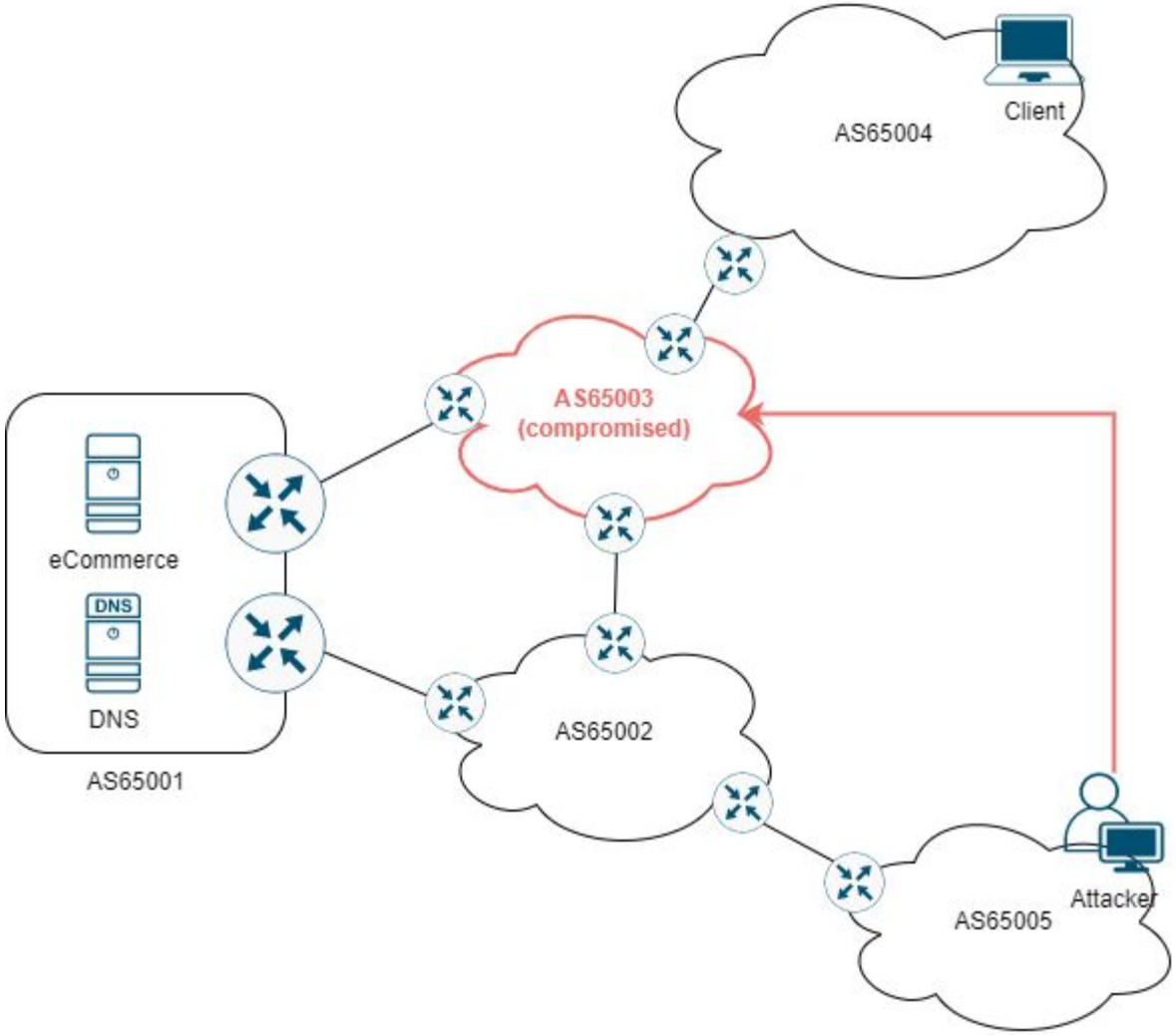
- Senior Network & Security Architect with 15+ years' experience in securing complex IT and OT infrastructures
- Focused on cyber security strategies, GDPR/ISO27001 compliance and Automation
- Incident Response Team
- Cisco (CCIE), VMware, Red Hat… certified
- Father of Unified Networking Lab (UNetLab)
- Privacy and digital security evangelist – expert counselor-mediator in Cyberbullying

https://adainese.it


TRAFFIC INTERCEPTION

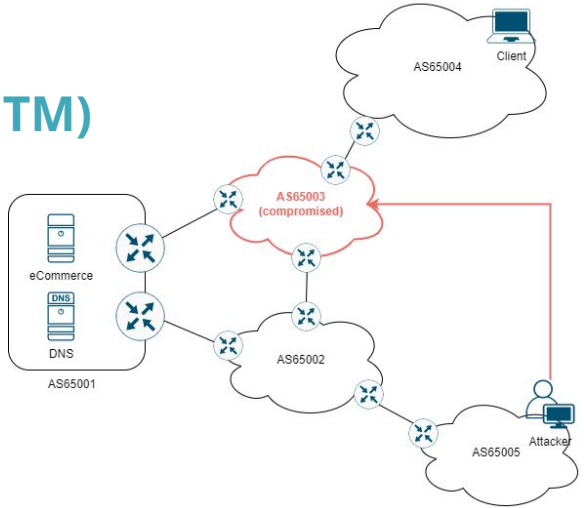
TRAFFIC INTERCEPTION



TRAFFIC INTERCEPTION

Traffic Interception / Man In The Middle (MITM)

Attacker can announce black-holed prefixes or add flapping creating routing instability.



Impacts

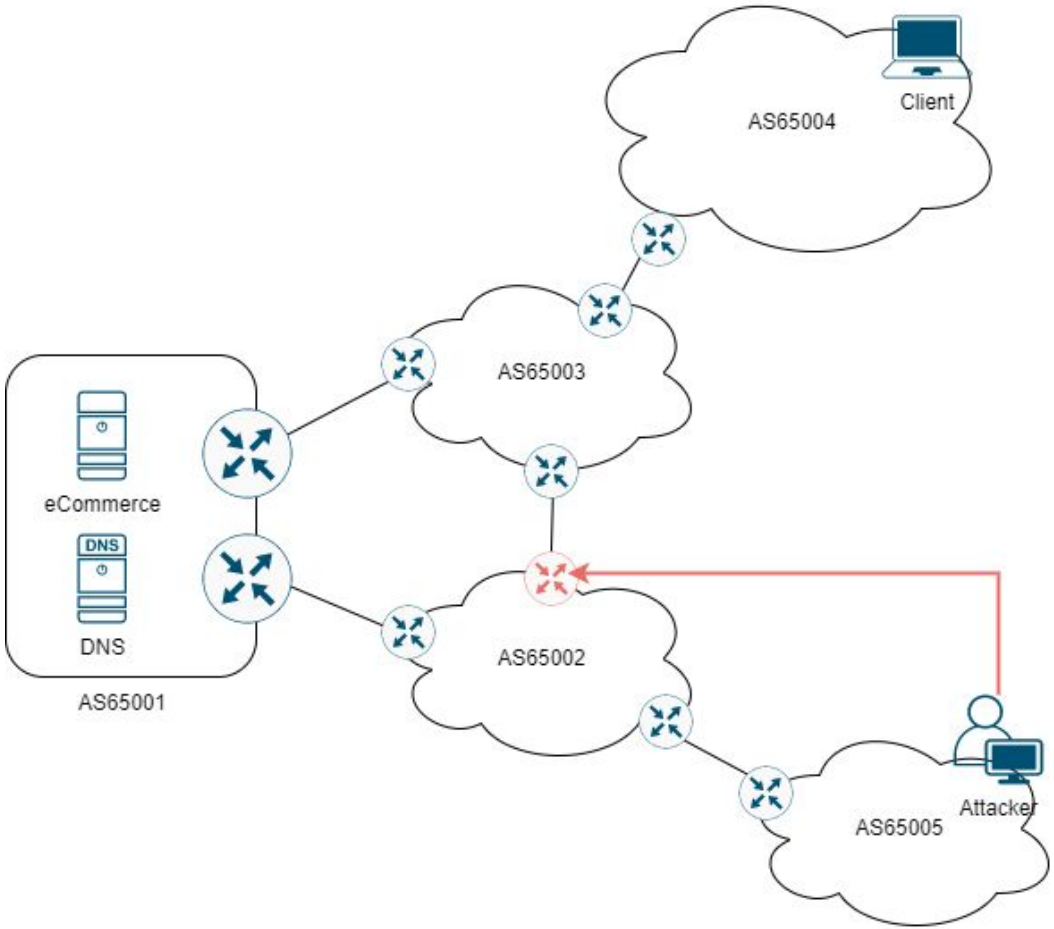
- Unencrypt traffic intercept

Mitigations

- Hardening, auditing, certificate pinning (discouraged)
- DNS security (marginally implemented <10%)

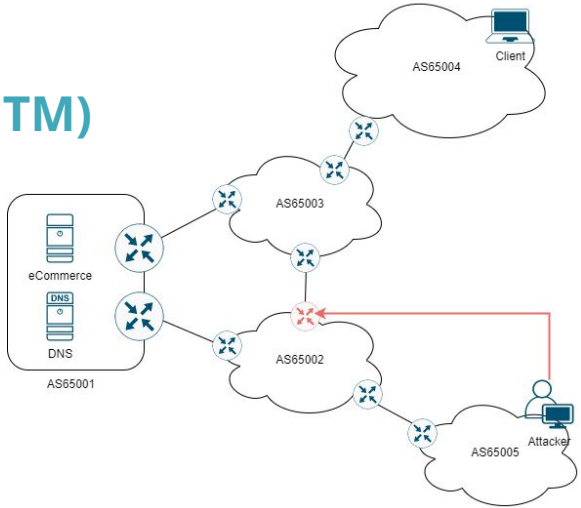

ROUTING INSTABILITY

ROUTING INSTABILITY



Traffic Interception / Man In The Middle (MITM)

Attacker can intercept client-to-server traffic (via compromised router, compromised AS, bribery). Attack could compromise any router (server-side, transit-AS, any AS).



Impacts

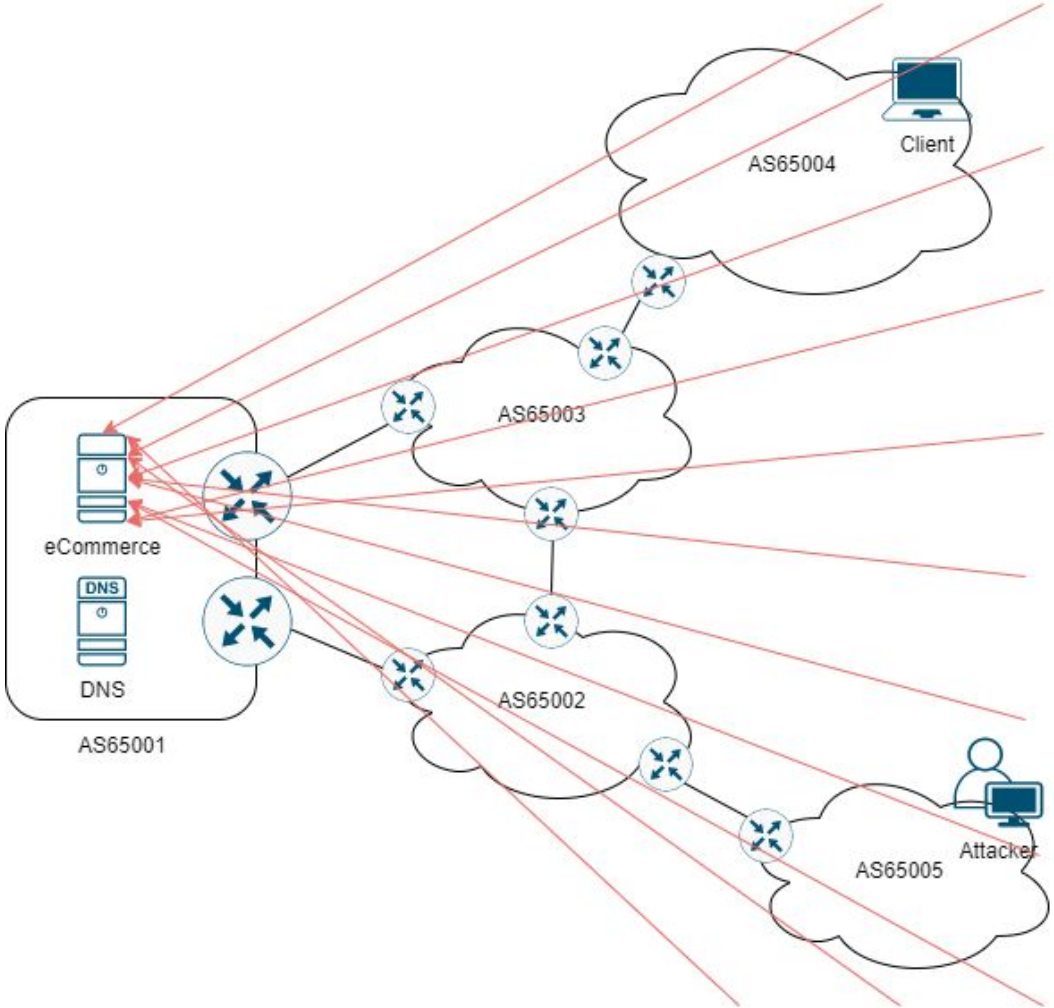
- Flapping network connections
- Outage

Mitigations

- RPKI, hardening, auditing

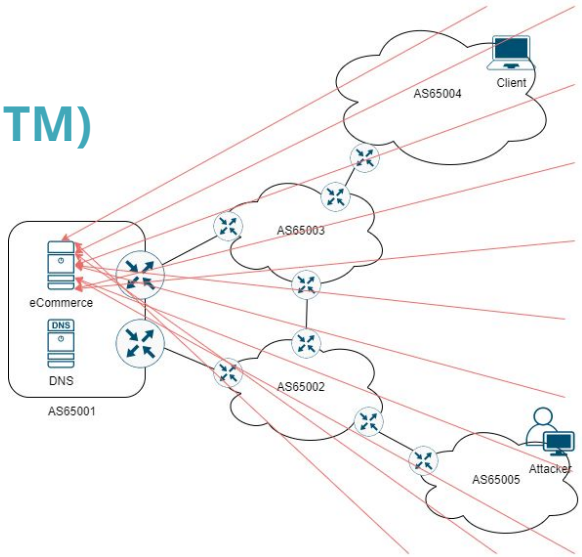

DDOS / SOURCE DDOS

DDOS


AS65004
Client
AS65003
eCommerce
DNS
DNS
AS65001
AS65002
Attacker
AS65005

Traffic Interception / Man In The Middle (MITM)

Attacker can orchestrate compromised clients to send data to a specific web service, consuming resources (CPU, memory, bandwidth).



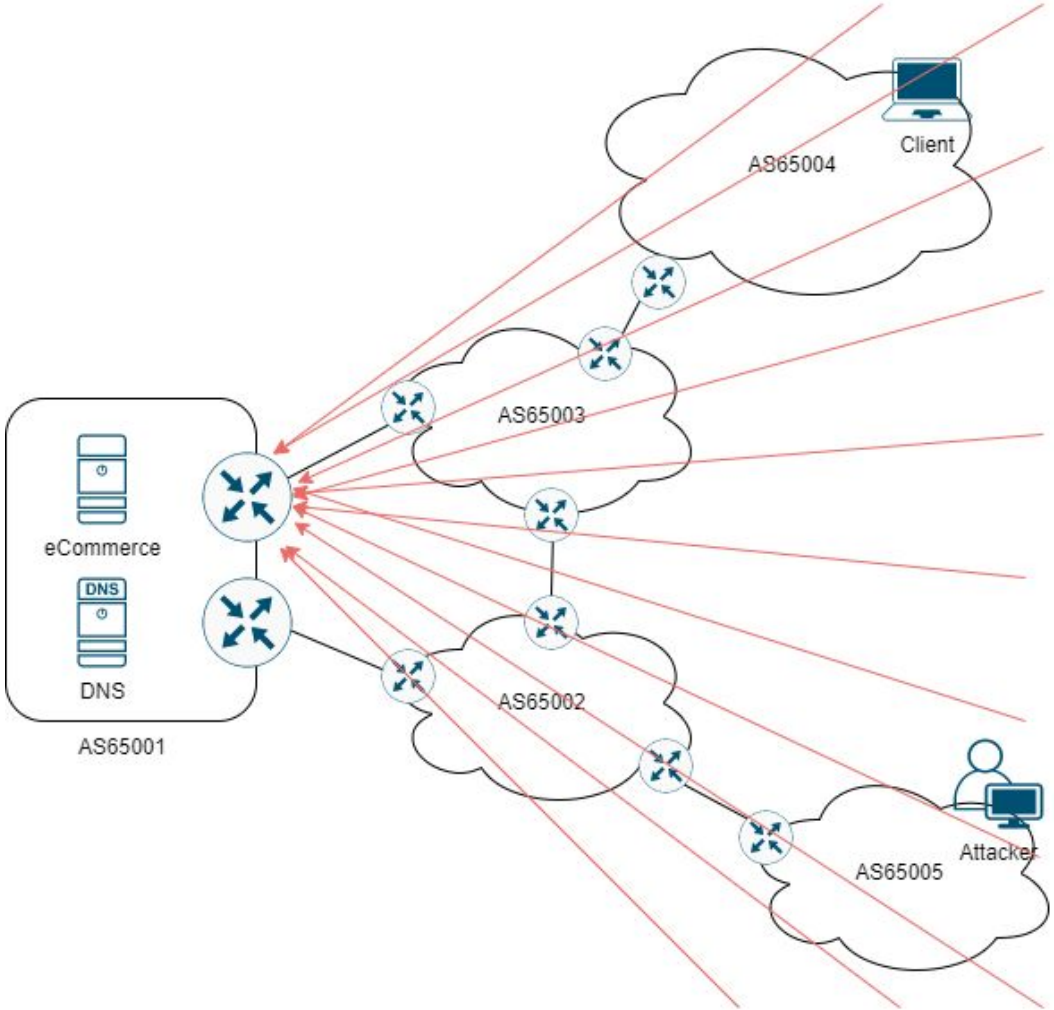
Impacts

- Outage

Mitigations

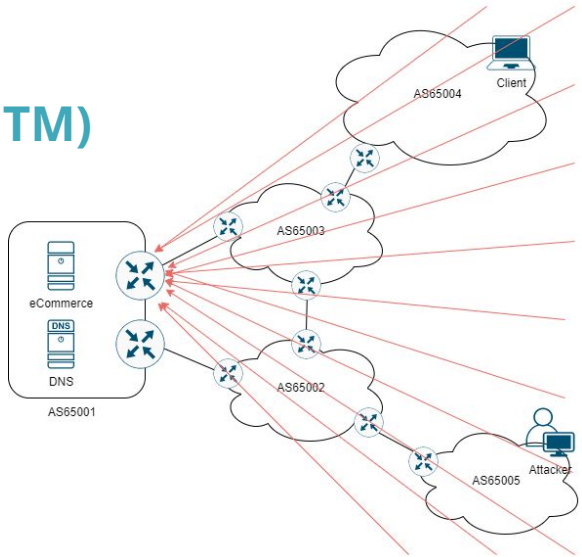
- Anti DDOS (cloud-based)

DDOS


AS65004
Client
AS65003
eCommerce
DNS
DNS
AS65001
AS65002
Attacker
AS65005

Traffic Interception / Man In The Middle (MITM)

Attacker can orchestrate compromised clients to send data to a border router consuming resources (CPU, memory, bandwidth).



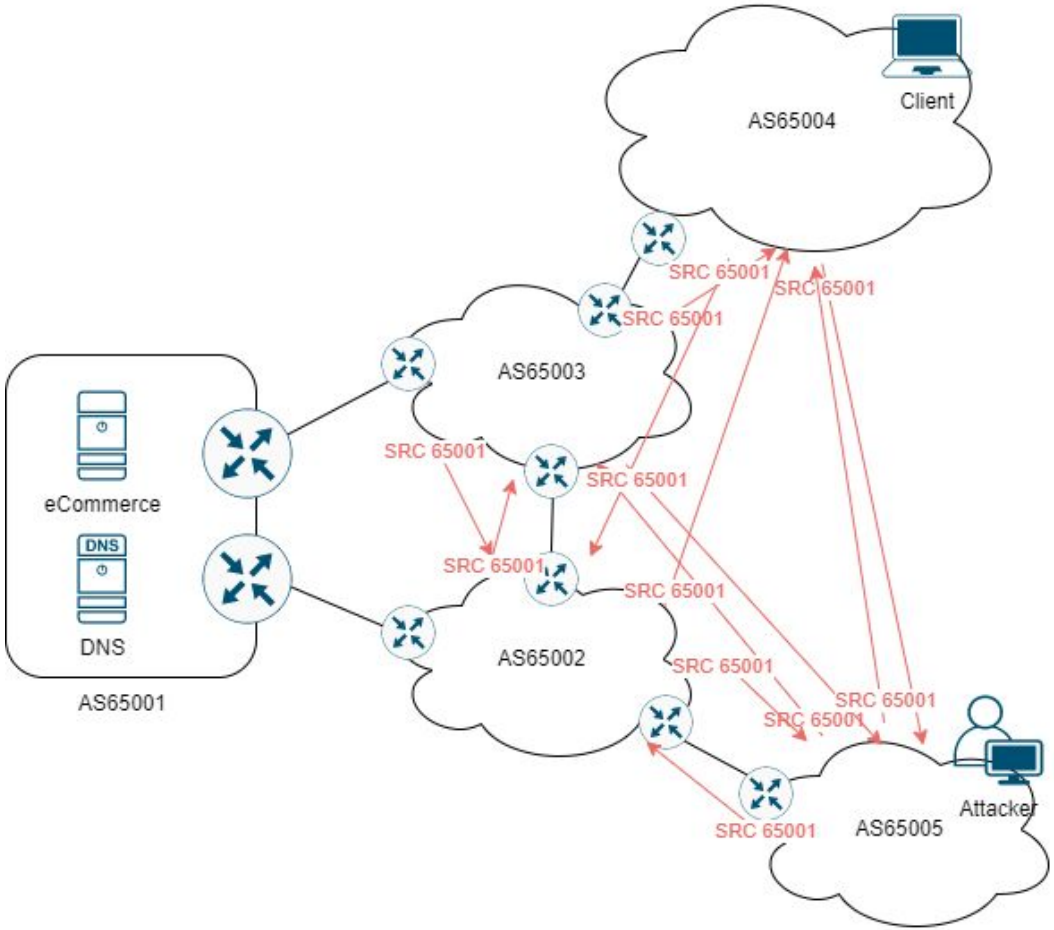
Impacts

- Outage

Mitigations

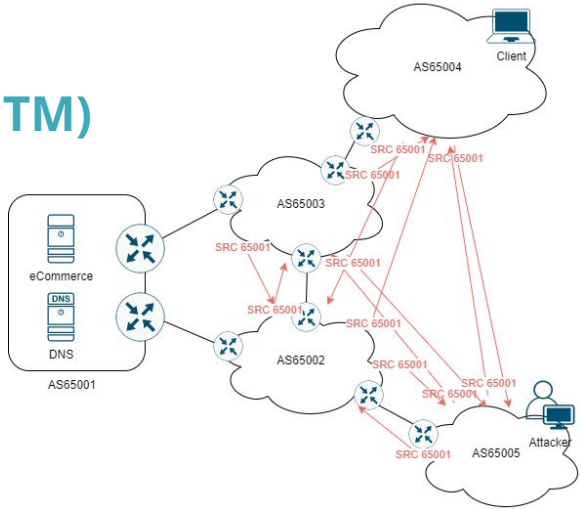
- Anti-DDOS (ISP)

Indirect DDOS



Traffic Interception / Man In The Middle (MITM)

Attacker can orchestrate compromised clients to send spoofed data to a specific web service, consuming resources (CPU, memory, bandwidth).



Impacts

- Outage caused by blacklists

Mitigations

- Traffic filtering (on customers' traffic)
- RPF (Reverse Path Forwarding)


BGP HIJACKING

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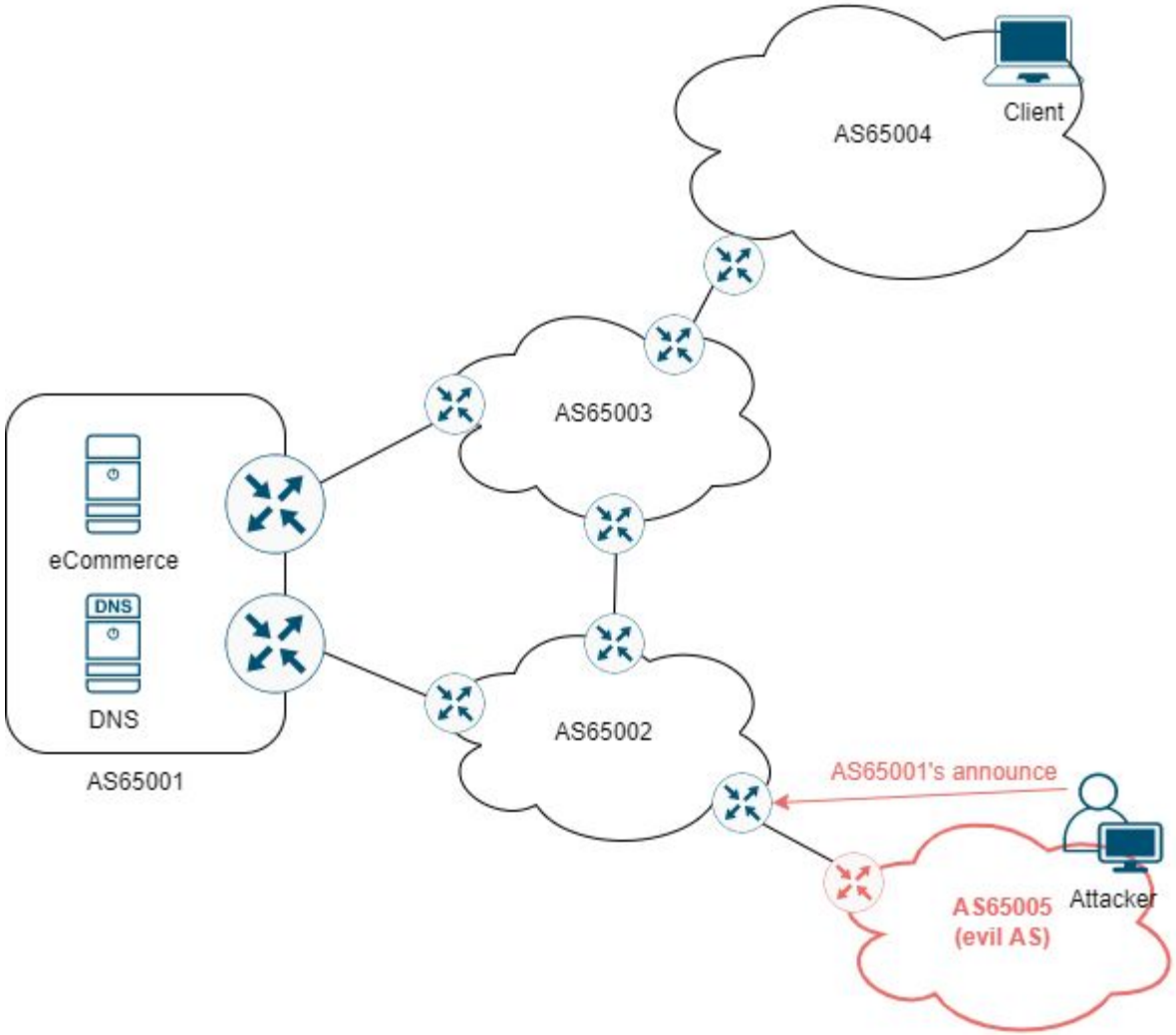
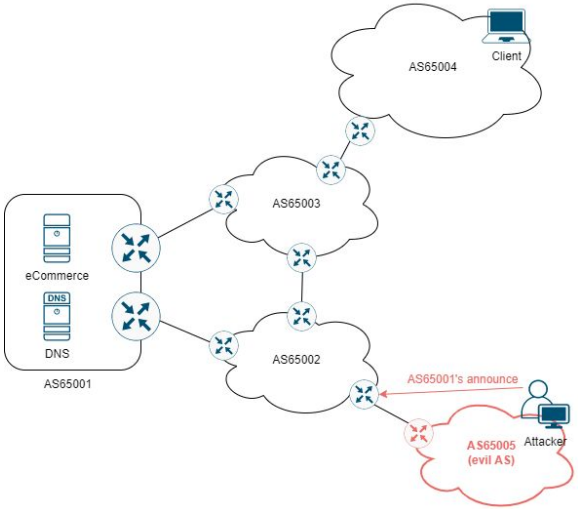


BGP hijacking

Attacker can announce AS65001's prefixes causing blackholes or fake services.



Impacts

- Outage
- PSK based VPNs are unaffected
- TLS traffic authenticated via certificates can be affected (using Let's Encrypt services)

Mitigations

- RPKI


RPKI VALIDATORS

Relying Party Software (as per 16/09/2022)

Name	Maintainer	Language	Last Commit	Version	Contributors
FORT Validator	NIC.mx	C	4 months ago	1.5.3 (11/2021)	12
OctoRPKI	Cloudflare*	Go	5 months ago	1.4.3 (02/2022)	16
rcynic	Dragon Research Labs	Python 2	9 months ago	?	4
Routinator	NLnet Labs	Rust	This month	0.11.3 (09/2022)	14
rpki-client	OpenBSD*	C	This month	7.8 (04/2022)	7
rpki-prover	Misha Puzanov	Haskell	1 month ago	0.3.3 (02/2022)	4
RPSTIR2	ZDNS	Go	3 month ago	?	3

https://rpki.readthedocs.io/en/latest/ops/tools.html#doc-tools

RTR Server Software (as per 16/09/2022)

OctoRPKI and rpki-client do not implement the RPKI-to-router (RTR) protocol, an external software is required.

Name	Maintainer	Language	Last Commit	Version	Contributors
GoRTR	Cloudflare	Go	22 months ago	0.14.7 (09/2020)	14
StayRTR	bgp	Go	2 months ago	?	18
RTRTR	NLnet Labs	Rust	This month	0.2.2 (06/2022)	4
rpkirtr	Darren O'Connor	Go	9 months ago	?	1

https://rpki.readthedocs.io/en/latest/ops/tools.html#rtr-server-software

Security issues

- repositories are vulnerable to Denial of Service (DoS) attacks
- all implementations must make system calls to an rsync binary
- RPKI does not guarantee that the data is up to date

Recommendations

- RPKI Repository Delta Protocol or RRDP (RFC 8182)

https://www.manrs.org/2021/04/2-security-issues-with-rpki-and-how-to-fix-them/

rsync based security…

- It seems a little strange to build routing security on top of a protocol which we have demonstrated is inefficient, insecure and dangerous to run as server or client

https://www.ietf.org/proceedings/89/slides/slides-89-sidr-6.pdf


NETWORK EXPERTS
ARE NOT
SOFTWARE DEVELOPERS

Recommendations

- Routinator and one of FORT Validator or rpki-client + stayrtr
- Prefer software included by default in Linux distributions
- Be sure RPLI machines are included in asset/vulnerability/patch/lifecycle management processes
- Force RRDP
- Include it in your DR plan
- Monitor them!!!

Mind that

- Things rapidly change
- Bugs (memory leak) also in “stable” versions
- Reloading means re-validation (it’s a long process)
- Managing Linux software is a system administration tasks


Q & A


END