WHOLESALE FT Winery Tour

Routing Security for lazy kids

RS4LK

Ud'A
Università degli Studi "G. d'Annunzio"

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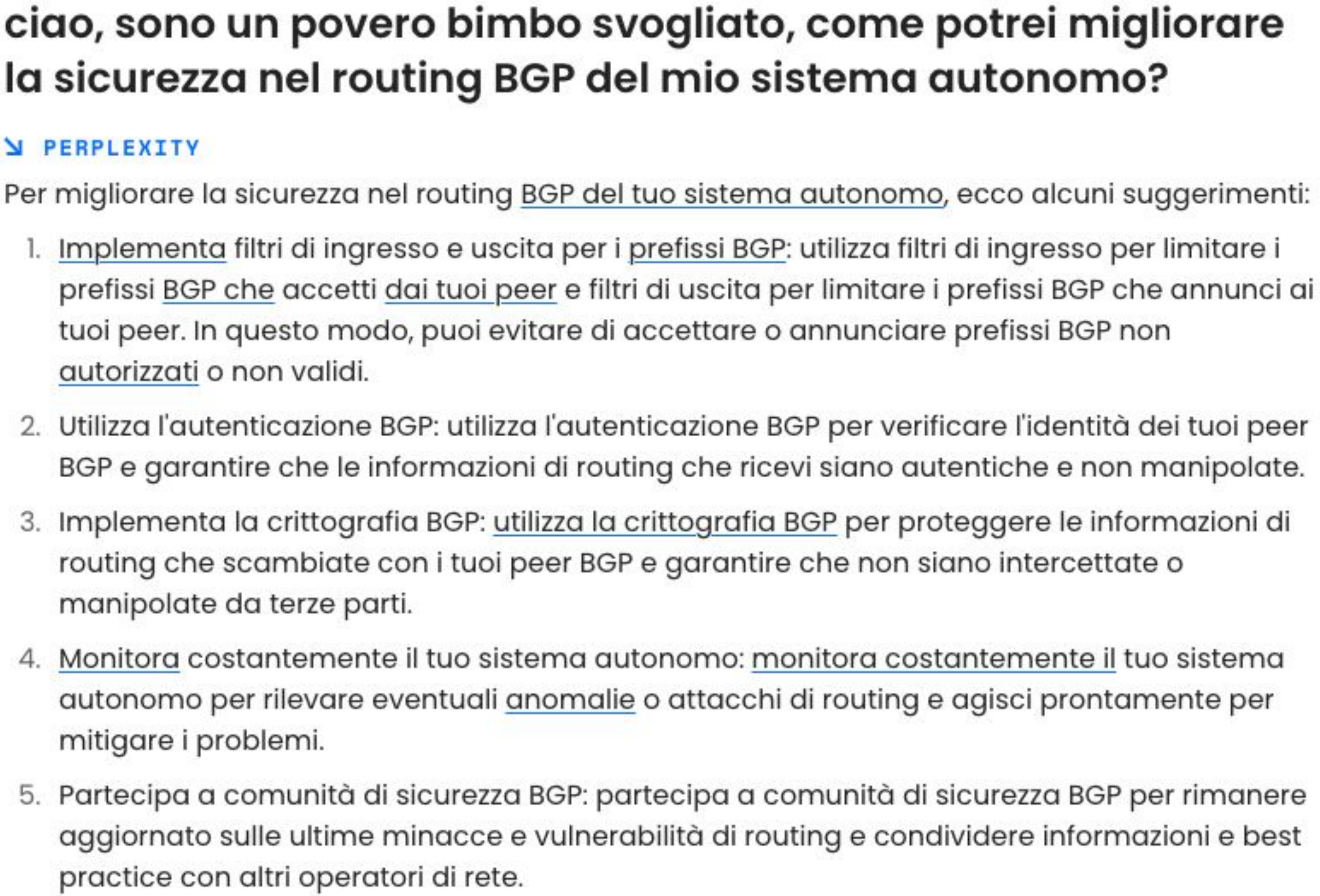
fermi tutti, sentiamo l’Oracolo

BY NC SA

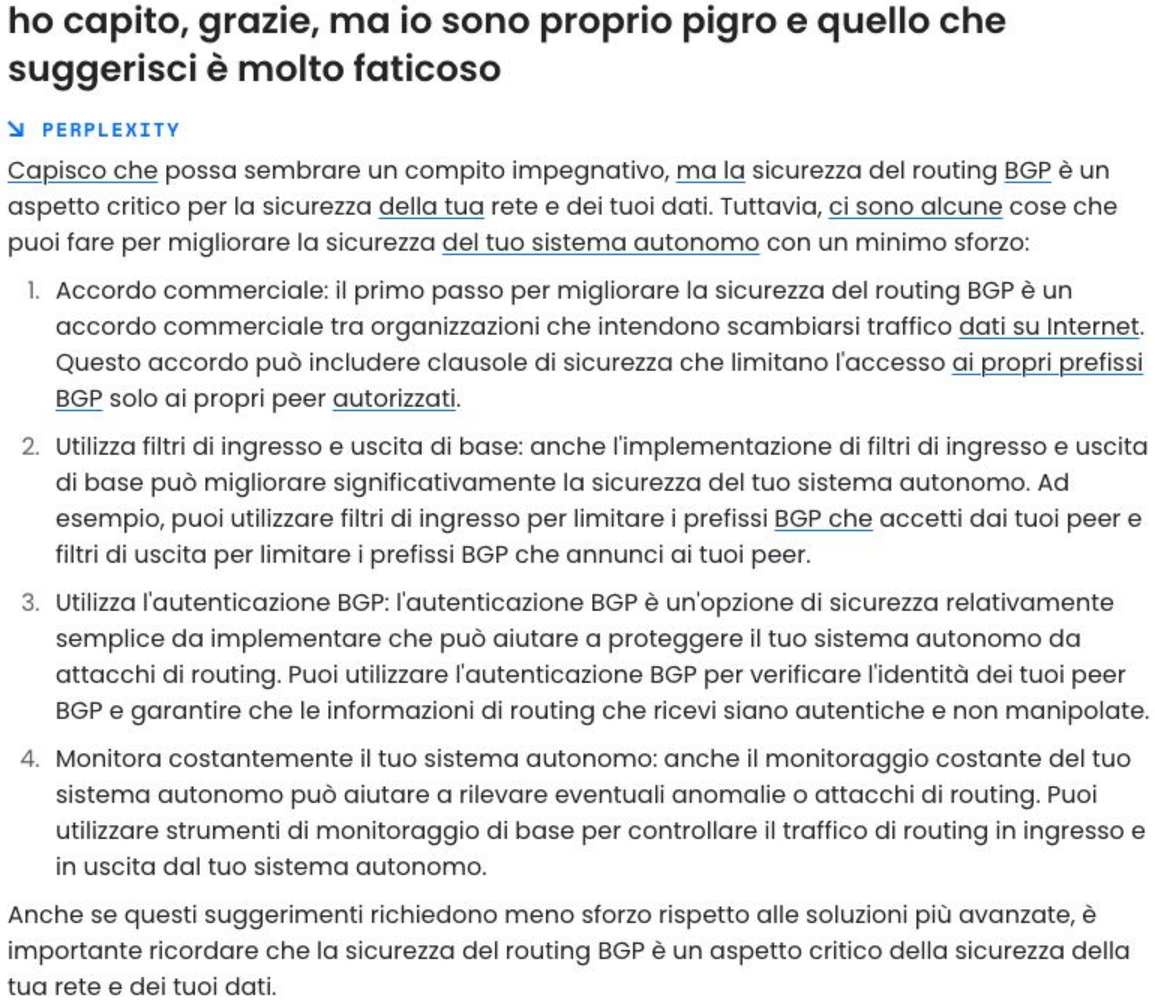


ciao, sono un povero bimbo svogliato, come potrei migliorare la sicurezza nel routing BGP del mio sistema autonomo?

↘ PERPLEXITY

Per migliorare la sicurezza nel routing BGP del tuo sistema autonomo, ecco alcuni suggerimenti:

1. Implementa filtri di ingresso e uscita per i prefissi BGP: utilizza filtri di ingresso per limitare i prefissi BGP che accetti dai tuoi peer e filtri di uscita per limitare i prefissi BGP che annunci ai tuoi peer. In questo modo, puoi evitare di accettare o annunciare prefissi BGP non autorizzati o non validi.
2. Utilizza l'autenticazione BGP: utilizza l'autenticazione BGP per verificare l'identità dei tuoi peer BGP e garantire che le informazioni di routing che ricevi siano autentiche e non manipolate.
3. Implementa la crittografia BGP: utilizza la crittografia BGP per proteggere le informazioni di routing che scambiate con i tuoi peer BGP e garantire che non siano intercettate o manipolate da terze parti.
4. Monitora costantemente il tuo sistema autonomo: monitora costantemente il tuo sistema autonomo per rilevare eventuali anomalie o attacchi di routing e agisci prontamente per mitigare i problemi.
5. Partecipa a comunità di sicurezza BGP: partecipa a comunità di sicurezza BGP per rimanere aggiornato sulle ultime minacce e vulnerabilità di routing e condividere informazioni e best practice con altri operatori di rete.



ho capito, grazie, ma io sono proprio pigro e quello che suggerisci è molto faticoso

↘ PERPLEXITY

Capisco che possa sembrare un compito impegnativo, ma la sicurezza del routing BGP è un aspetto critico per la sicurezza della tua rete e dei tuoi dati. Tuttavia, ci sono alcune cose che puoi fare per migliorare la sicurezza del tuo sistema autonomo con un minimo sforzo:

1. Accordo commerciale: il primo passo per migliorare la sicurezza del routing BGP è un accordo commerciale tra organizzazioni che intendono scambiarsi traffico dati su Internet. Questo accordo può includere clausole di sicurezza che limitano l'accesso ai propri prefissi BGP solo ai propri peer autorizzati.
2. Utilizza filtri di ingresso e uscita di base: anche l'implementazione di filtri di ingresso e uscita di base può migliorare significativamente la sicurezza del tuo sistema autonomo. Ad esempio, puoi utilizzare filtri di ingresso per limitare i prefissi BGP che accetti dai tuoi peer e filtri di uscita per limitare i prefissi BGP che annunci ai tuoi peer.
3. Utilizza l'autenticazione BGP: l'autenticazione BGP è un'opzione di sicurezza relativamente semplice da implementare che può aiutare a proteggere il tuo sistema autonomo da attacchi di routing. Puoi utilizzare l'autenticazione BGP per verificare l'identità dei tuoi peer BGP e garantire che le informazioni di routing che ricevi siano autentiche e non manipolate.
4. Monitora costantemente il tuo sistema autonomo: anche il monitoraggio costante del tuo sistema autonomo può aiutare a rilevare eventuali anomalie o attacchi di routing. Puoi utilizzare strumenti di monitoraggio di base per controllare il traffico di routing in ingresso e in uscita dal tuo sistema autonomo.

Anche se questi suggerimenti richiedono meno sforzo rispetto alle soluzioni più avanzate, è importante ricordare che la sicurezza del routing BGP è un aspetto critico della sicurezza della tua rete e dei tuoi dati.

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se lo dice lui…

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Fortunatamente abbiamo il conforto anche di altre fonti

MANRS

Mutually Agreed Norms for Routing Security

by ISOC

BCP38, BCP84, BCP194, BCP211

by IETF

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Quindi, come lazy kid, qual è la mia necessità?

Io ti faccio vedere la mia configurazione

→

Tu mi dici se è conforme a MANRS

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Occorre allora uno strumento che:

Riceva la configurazione di un border router (BGP speaking)

Analizzi la configurazione così da comprendere: vendor, transit, peer, customer

Confronti i dati pubblicati sugli IRR con quanto presente nella configurazione

Restituisca segnali di OK, KO, WARNING, INFO

Costruisca automaticamente un ambiente emulato

Esegua molteplici test per provare la conformità alle azioni MANRS (anti-spoofing e BGP filtering)

Verificabilità delle configurazioni, lo stato dell’arte

Batfish: "finds errors and guarantees the correctness of planned or current network configurations. It enables safe and rapid network evolution, without the fear of outages or security breaches."

Bagpipe: ”enables an ISP to express its BGP policy in a domain-specific specification language and verify that its router configurations implement this policy.”

BGPVerif: ”a formal analysis toolkit that enables networking researchers to study and analyze large BGP systems in a sound and automatic fashion.”

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Cosa non va generalmente in quegli strumenti?

Incompletezza

Perlopiù ricerche abbandonate allo stato embrionale che mancano di alcuni requisiti: non contemplano specifiche caratteristiche del BGP

Incomprensione

I vendor sono molteplici e ciascuno impiega una sintassi (o più di una) che evolve nel tempo

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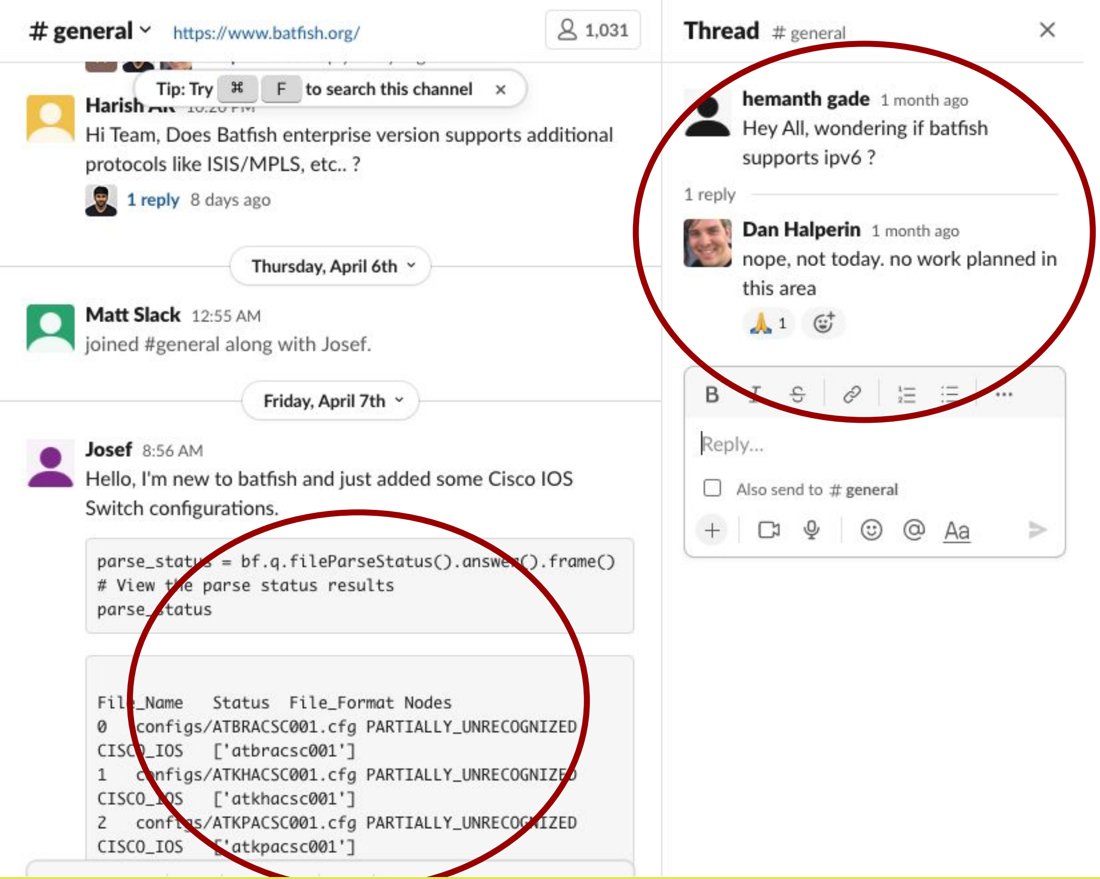
Discussione su Batfish



# general https://www.batfish.org/ 1,031

Tip: Try ⌘ F to search this channel ×

Harish AR

Hi Team, Does Batfish enterprise version supports additional protocols like ISIS/MPLS, etc.. ?

1 reply 8 days ago

Thursday, April 6th

Matt Slack 12:55 AM

joined #general along with Josef.

Friday, April 7th

Josef 8:56 AM

Hello, I'm new to batfish and just added some Cisco IOS Switch configurations.

```
parse_status = bf.q.fileParseStatus().answer().frame()
# View the parse status results
parse_status
```

```
File_Name   Status  File_Format Nodes
0   configs/ATBRACSC001.cfg PARTIALLY_UNRECOGNIZED
CISCO_IOS   ['atbracsc001']
1   configs/ATKHACSC001.cfg PARTIALLY_UNRECOGNIZED
CISCO_IOS   ['atkhacsc001']
2   configs/ATKPACSC001.cfg PARTIALLY_UNRECOGNIZED
CISCO_IOS   ['atkpacsc001']
```

Thread # general

hemanth gade 1 month ago

Hey All, wondering if batfish supports ipv6 ?

1 reply

Dan Halperin 1 month ago

nope, not today. no work planned in this area

🙏 1

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Una riflessione sul metodo

1 Massima astrazione: prendi una routing policy (in RPSLng) e verifica se è conforme alle azioni MANRS

2 Astrazione: prendi una configurazione, leggi le parole, studia la sintassi, comprendi il senso e verifica se è conforme alle azioni MANRS

3 Emulazione: prendi una configurazione, applicala a un router e verifica se è conforme alle azioni MANRS

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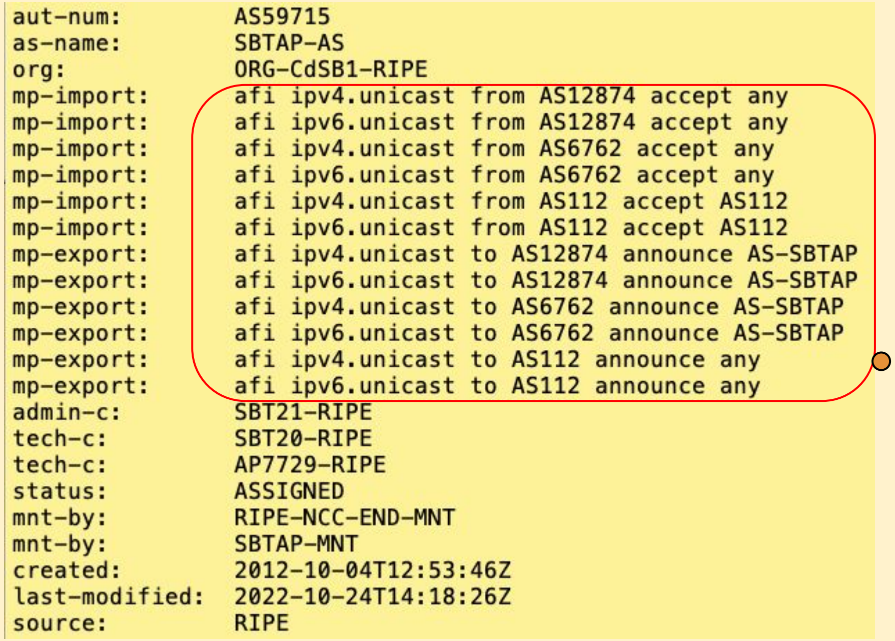
1 Massima astrazione



```
aut-num:        AS59715
as-name:        SBTAP-AS
org:            ORG-CdSB1-RIPE
mp-import:      afi ipv4.unicast from AS12874 accept any
mp-import:      afi ipv6.unicast from AS12874 accept any
mp-import:      afi ipv4.unicast from AS6762 accept any
mp-import:      afi ipv6.unicast from AS6762 accept any
mp-import:      afi ipv4.unicast from AS112 accept AS112
mp-import:      afi ipv6.unicast from AS112 accept AS112
mp-export:      afi ipv4.unicast to AS12874 announce AS-SBTAP
mp-export:      afi ipv6.unicast to AS12874 announce AS-SBTAP
mp-export:      afi ipv4.unicast to AS6762 announce AS-SBTAP
mp-export:      afi ipv6.unicast to AS6762 announce AS-SBTAP
mp-export:      afi ipv4.unicast to AS112 announce any
mp-export:      afi ipv6.unicast to AS112 announce any
admin-c:        SBT21-RIPE
tech-c:         SBT20-RIPE
tech-c:         AP7729-RIPE
status:         ASSIGNED
mnt-by:         RIPE-NCC-END-MNT
mnt-by:         SBTAP-MNT
created:        2012-10-04T12:53:46Z
last-modified:  2022-10-24T14:18:26Z
source:         RIPE
```

sarà vero?

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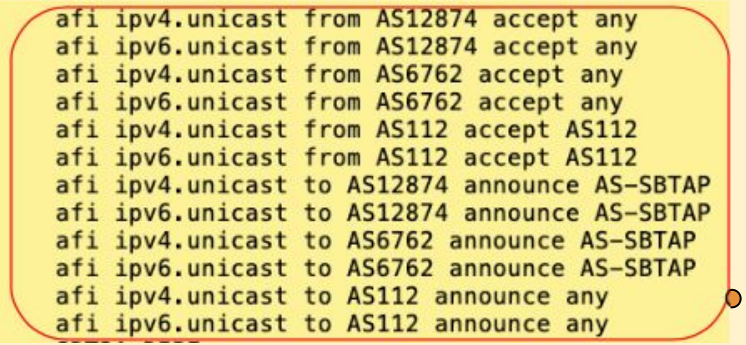
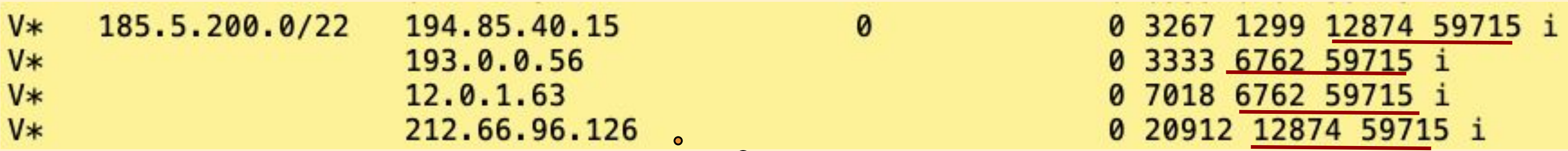
1 Massima astrazione



```
afi ipv4.unicast from AS12874 accept any
afi ipv6.unicast from AS12874 accept any
afi ipv4.unicast from AS6762 accept any
afi ipv6.unicast from AS6762 accept any
afi ipv4.unicast from AS112 accept AS112
afi ipv6.unicast from AS112 accept AS112
afi ipv4.unicast to AS12874 announce AS-SBTAP
afi ipv6.unicast to AS12874 announce AS-SBTAP
afi ipv4.unicast to AS6762 announce AS-SBTAP
afi ipv6.unicast to AS6762 announce AS-SBTAP
afi ipv4.unicast to AS112 announce any
afi ipv6.unicast to AS112 announce any
```

è vero! ma...

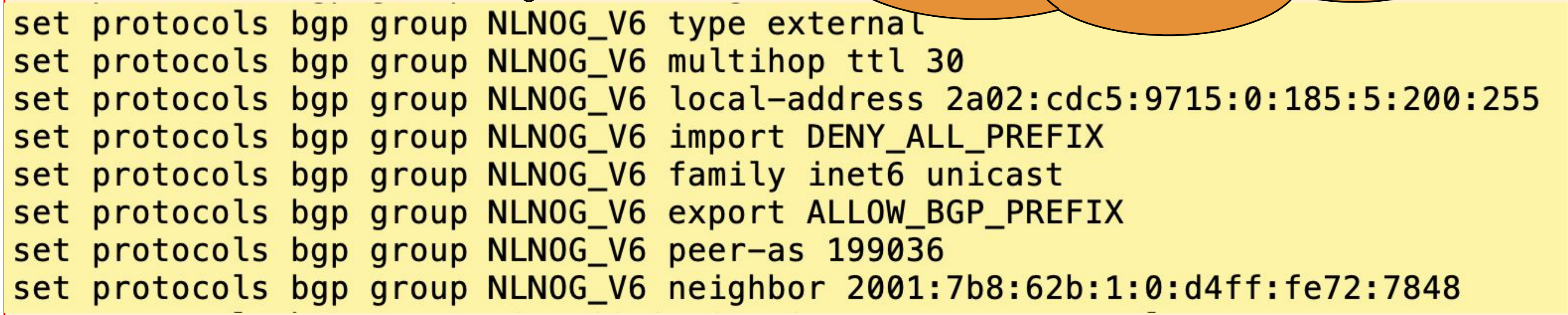


```
V*    185.5.200.0/22    194.85.40.15          0          0 3267 1299 12874 59715 i
V*                      193.0.0.56                       0 3333 6762 59715 i
V*                      12.0.1.63                        0 7018 6762 59715 i
V*                      212.66.96.126                    0 20912 12874 59715 i
```

dov'è l'AS112?

2 Astrazione

Batfish capisce mpBGP?



```
set protocols bgp group NLNOG_V6 type external
set protocols bgp group NLNOG_V6 multihop ttl 30
set protocols bgp group NLNOG_V6 local-address 2a02:cdc5:9715:0:185:5:200:255
set protocols bgp group NLNOG_V6 import DENY_ALL_PREFIX
set protocols bgp group NLNOG_V6 family inet6 unicast
set protocols bgp group NLNOG_V6 export ALLOW_BGP_PREFIX
set protocols bgp group NLNOG_V6 peer-as 199036
set protocols bgp group NLNOG_V6 neighbor 2001:7b8:62b:1:0:d4ff:fe72:7848
```

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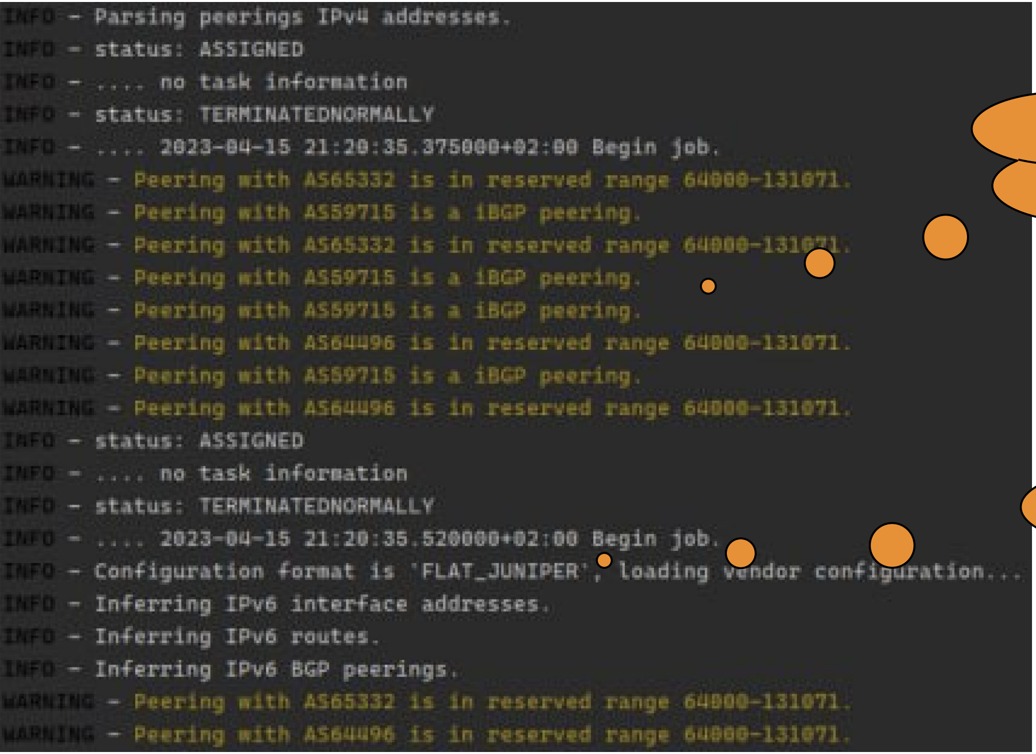
2 Astrazione



```
INFO - Parsing peerings IPv4 addresses.
INFO - status: ASSIGNED
INFO - .... no task information
INFO - status: TERMINATEDNORMALLY
INFO - .... 2023-04-15 21:20:35.375000+02:00 Begin job.
WARNING - Peering with AS65332 is in reserved range 64000-131071.
WARNING - Peering with AS59715 is a iBGP peering.
WARNING - Peering with AS65332 is in reserved range 64000-131071.
WARNING - Peering with AS59715 is a iBGP peering.
WARNING - Peering with AS59715 is a iBGP peering.
WARNING - Peering with AS64496 is in reserved range 64000-131071.
WARNING - Peering with AS59715 is a iBGP peering.
WARNING - Peering with AS64496 is in reserved range 64000-131071.
INFO - status: ASSIGNED
INFO - .... no task information
INFO - status: TERMINATEDNORMALLY
INFO - .... 2023-04-15 21:20:35.520000+02:00 Begin job.
INFO - Configuration format is 'FLAT_JUNIPER', loading vendor configuration...
INFO - Inferring IPv6 interface addresses.
INFO - Inferring IPv6 routes.
INFO - Inferring IPv6 BGP peerings.
WARNING - Peering with AS65332 is in reserved range 64000-131071.
WARNING - Peering with AS64496 is in reserved range 64000-131071.
```

capisce sessioni BGP

capisce Juniper

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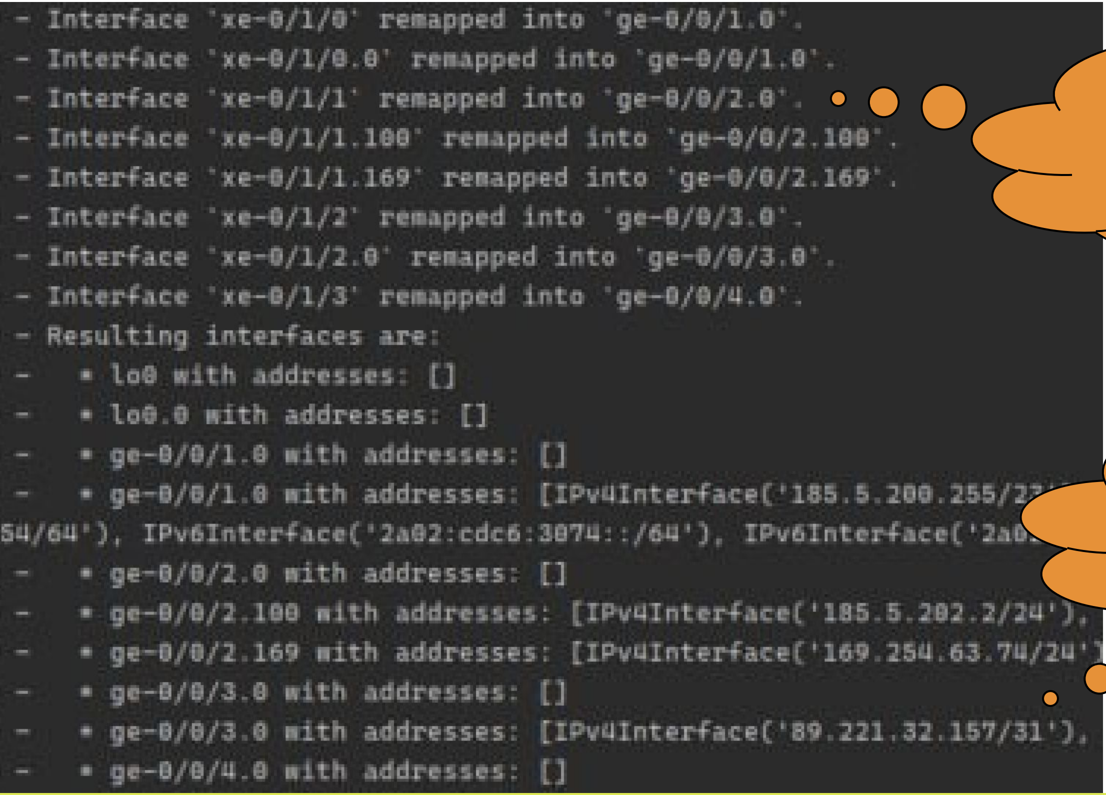
2 Astrazione



```
- Interface 'xe-0/1/0' remapped into 'ge-0/0/1.0'.
- Interface 'xe-0/1/0.0' remapped into 'ge-0/0/1.0'.
- Interface 'xe-0/1/1' remapped into 'ge-0/0/2.0'.
- Interface 'xe-0/1/1.100' remapped into 'ge-0/0/2.100'.
- Interface 'xe-0/1/1.169' remapped into 'ge-0/0/2.169'.
- Interface 'xe-0/1/2' remapped into 'ge-0/0/3.0'.
- Interface 'xe-0/1/2.0' remapped into 'ge-0/0/3.0'.
- Interface 'xe-0/1/3' remapped into 'ge-0/0/4.0'.
- Resulting interfaces are:
-    * lo0 with addresses: []
-    * lo0.0 with addresses: []
-    * ge-0/0/1.0 with addresses: []
-    * ge-0/0/1.0 with addresses: [IPv4Interface('185.5.200.255/22
54/64'), IPv6Interface('2a02:cdc6:3074::/64'), IPv6Interface('2a0
-    * ge-0/0/2.0 with addresses: []
-    * ge-0/0/2.100 with addresses: [IPv4Interface('185.5.202.2/24'),
-    * ge-0/0/2.169 with addresses: [IPv4Interface('169.254.63.74/24'
-    * ge-0/0/3.0 with addresses: []
-    * ge-0/0/3.0 with addresses: [IPv4Interface('89.221.32.157/31'),
-    * ge-0/0/4.0 with addresses: []
```

capisce le interfacce

e le mappa con IP

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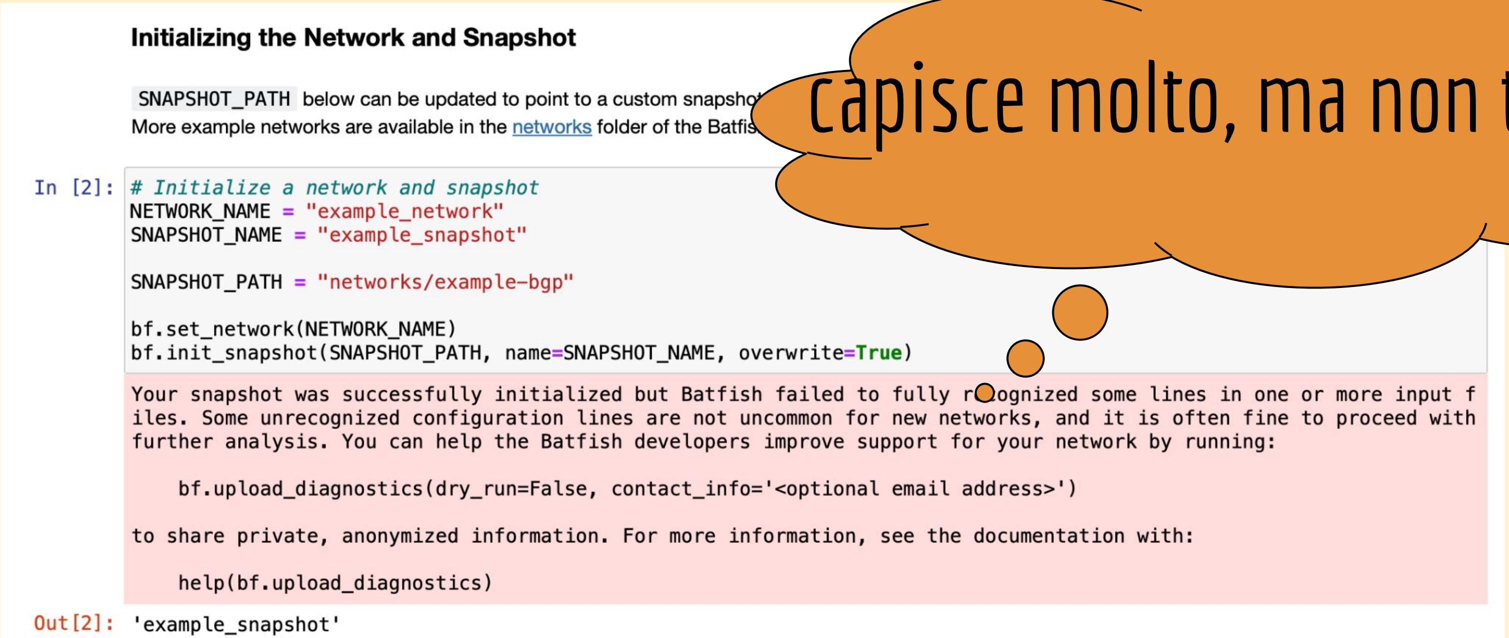
2 Astrazione



Initializing the Network and Snapshot

`SNAPSHOT_PATH` below can be updated to point to a custom snapsho
More example networks are available in the networks folder of the Batfis

In [2]:
```
# Initialize a network and snapshot
NETWORK_NAME = "example_network"
SNAPSHOT_NAME = "example_snapshot"

SNAPSHOT_PATH = "networks/example-bgp"

bf.set_network(NETWORK_NAME)
bf.init_snapshot(SNAPSHOT_PATH, name=SNAPSHOT_NAME, overwrite=True)
```

```
Your snapshot was successfully initialized but Batfish failed to fully recognized some lines in one or more input f
iles. Some unrecognized configuration lines are not uncommon for new networks, and it is often fine to proceed with
further analysis. You can help the Batfish developers improve support for your network by running:

    bf.upload_diagnostics(dry_run=False, contact_info='<optional email address>')

to share private, anonymized information. For more information, see the documentation with:

    help(bf.upload_diagnostics)
```

Out[2]:
```
'example_snapshot'
```

capisce molto, ma non tutto IPv6!

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3 Emulazione

Studi scientifici hanno dimostrato che

Kathará

allevia il mal di testa!

Kathará is an open source container-based network emulation system for showing interactive demos/lessons, testing production networks in a sandbox environment, or developing new network protocols.

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3 Emulazione

Kathará

Chiediamo a kathara di prendere tutto ciò che viene digerito da Batfish e di creare uno scenario, cioè una piccola Internet con tutti gli elementi essenziali della configurazione:

- **peer** ($\forall p \in AS1\_SET : \exists\, rp,2 \in T2; \forall q \in AS2\_SET : \exists\, rq,1 \in T1$)
- **transit** ($\forall p \in FIRT : \exists\, rp,1 \in T1 \land \exists\, rp,2 \in T2$)
- **customer** ($\forall p \in AS2\_SET : \exists\, rp,2 \in T2 \land \exists\, rp,1 \in T1$)

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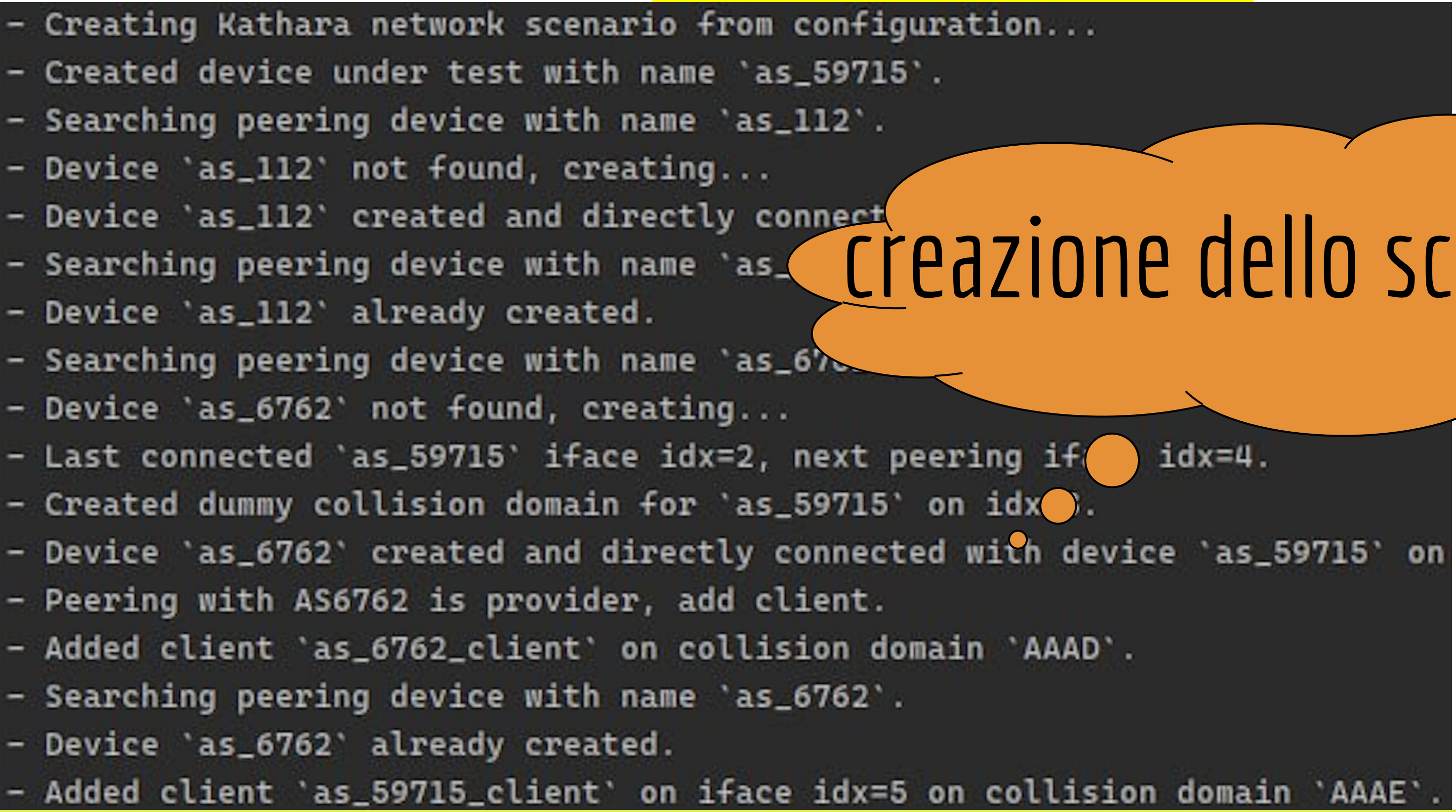
peer ($\forall p \in AS1\_SET : \exists r_{p,2} \in T2; \forall q \in AS2\_SET : \exists r_{q,1} \in T1$)
transit ($\forall p \in FIRT : \exists r_{p,1} \in T1 \land \exists r_{p,2} \in T2$)
customer ($\forall p \in AS2\_SET : \exists r_{p,2} \in T2 \land \exists r_{p,1} \in T1$)
Non ci son problemi: tu mi dici quello che devo fare e io lo faccio!
Kathará

BY NC SA

3 Emulazione

Kathará



```
- Creating Kathara network scenario from configuration...
- Created device under test with name `as_59715`.
- Searching peering device with name `as_112`.
- Device `as_112` not found, creating...
- Device `as_112` created and directly connect
- Searching peering device with name `as_
- Device `as_112` already created.
- Searching peering device with name `as_67
- Device `as_6762` not found, creating...
- Last connected `as_59715` iface idx=2, next peering if   idx=4.
- Created dummy collision domain for `as_59715` on idx  .
- Device `as_6762` created and directly connected with device `as_59715` on
- Peering with AS6762 is provider, add client.
- Added client `as_6762_client` on collision domain `AAAD`.
- Searching peering device with name `as_6762`.
- Device `as_6762` already created.
- Added client `as_59715_client` on iface idx=5 on collision domain `AAAE`.
```

creazione dello scenario

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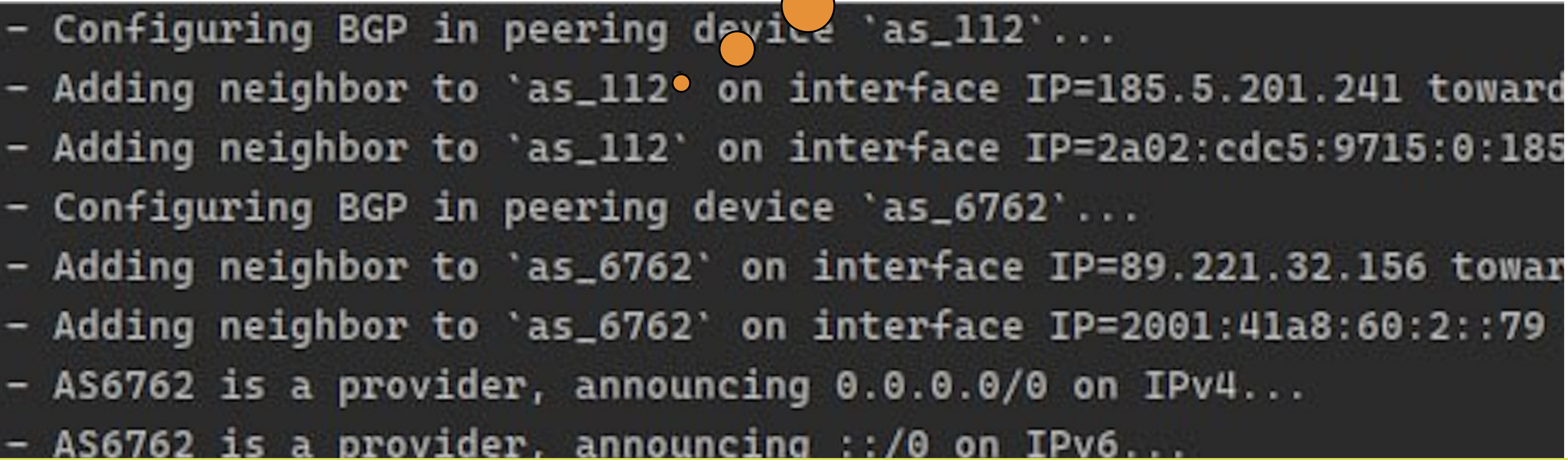
3 Emulazione

Kathará

configurazione delle sessioni BGP



```
- Configuring BGP in peering device `as_112`...
- Adding neighbor to `as_112` on interface IP=185.5.201.241 toward
- Adding neighbor to `as_112` on interface IP=2a02:cdc5:9715:0:185
- Configuring BGP in peering device `as_6762`...
- Adding neighbor to `as_6762` on interface IP=89.221.32.156 towar
- Adding neighbor to `as_6762` on interface IP=2001:41a8:60:2::79
- AS6762 is a provider, announcing 0.0.0.0/0 on IPv4...
- AS6762 is a provider, announcing ::/0 on IPv6...
```

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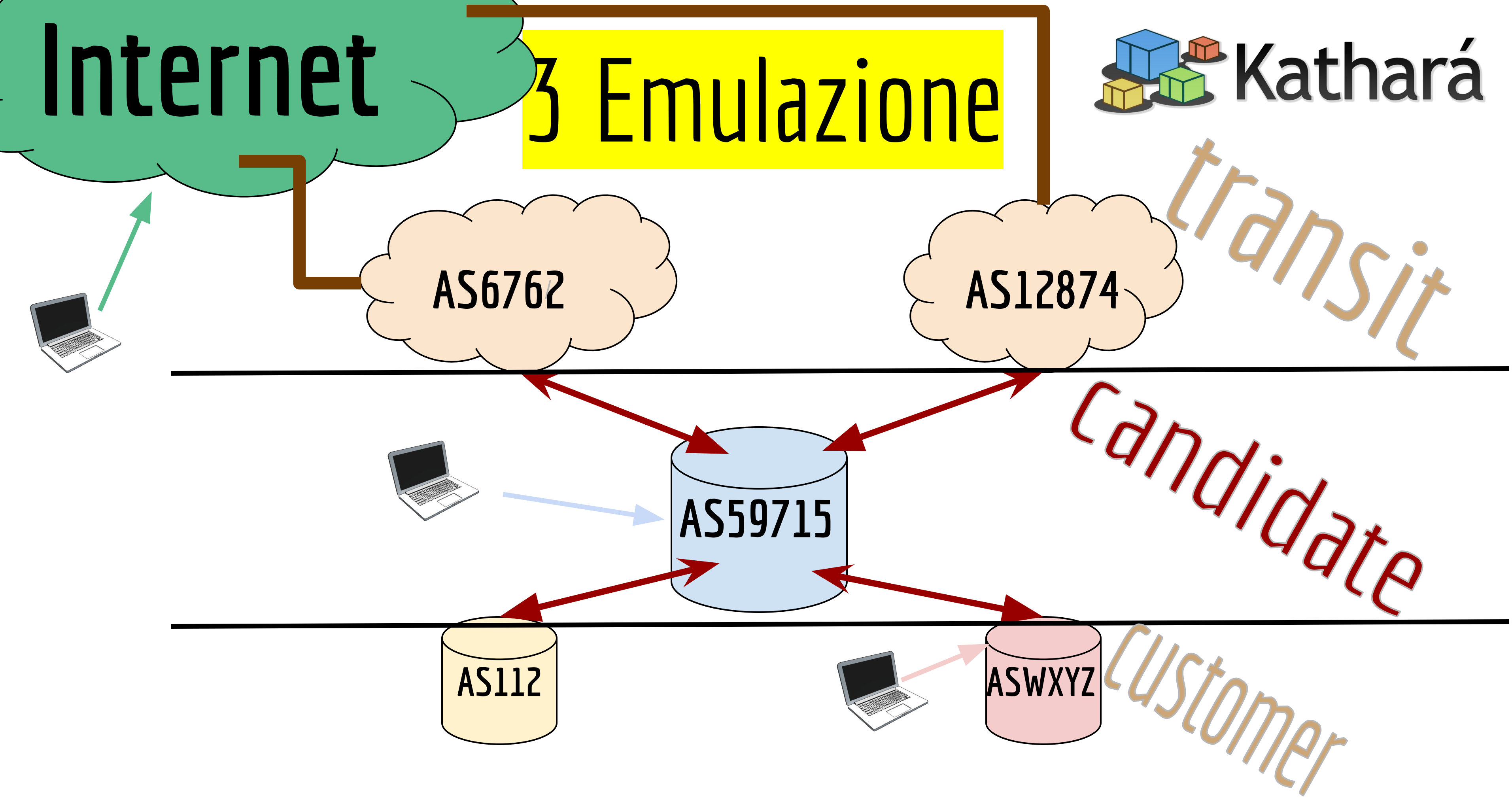
3 Emulazione

Kathará



Internet

AS6762

AS12874

transit

AS59715

Candidate

AS112

ASWXYZ

Customer

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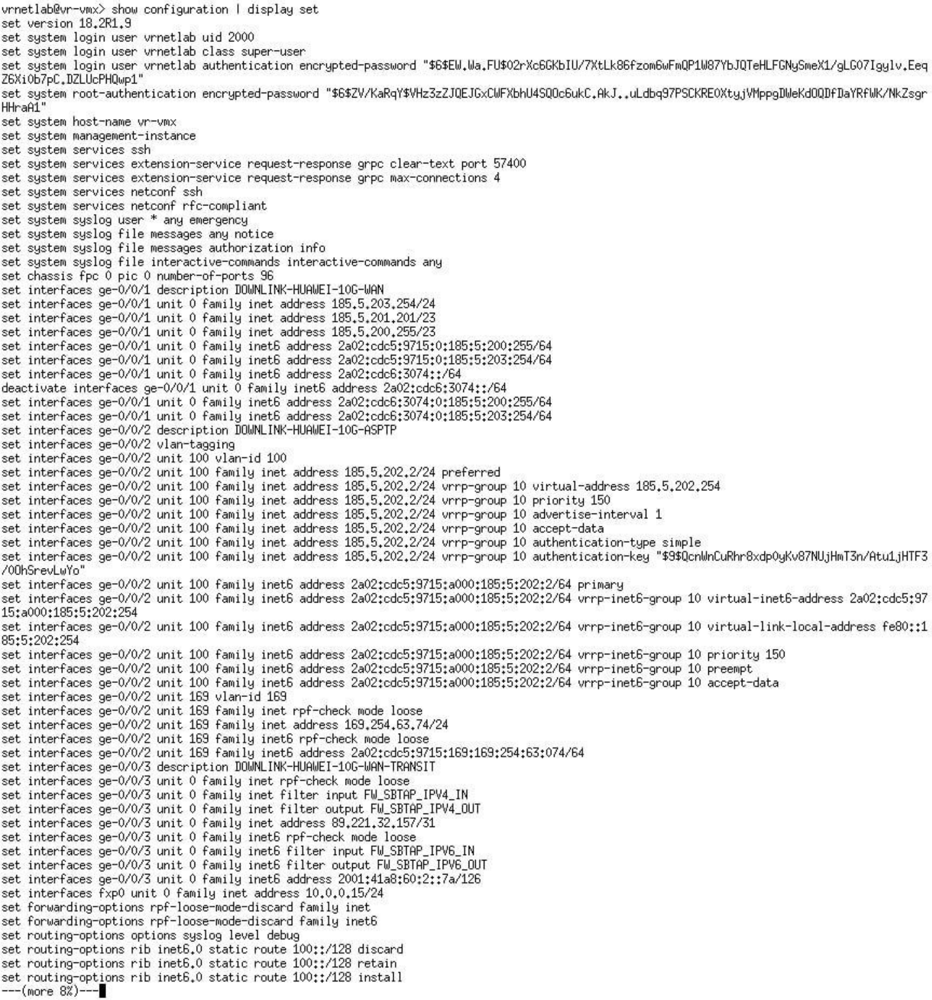
configurazione del candidato caricata nel JunOS su kathara

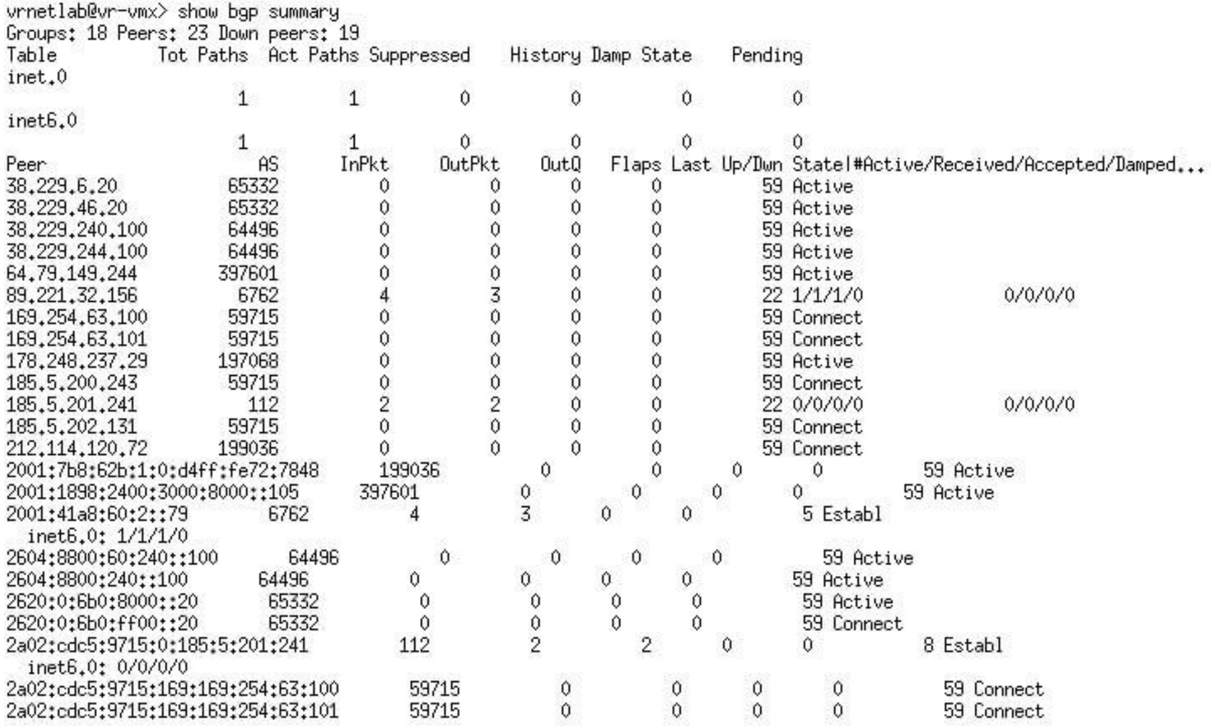


```
vrnetlab@vr-vmx> show configuration | display set
set version 18.2R1.9
set system login user vrnetlab uid 2000
set system login user vrnetlab class super-user
set system login user vrnetlab authentication encrypted-password "$6$EW.Wa.FU$02rXc6GKbIU/7XtLk86fzom6wFmQP1W87YbJQTeHLFGNySmeX1/gLG07Igylv.Eeq
Z6Xi0b7pC.DZLUcPHQwp1"
set system root-authentication encrypted-password "$6$ZV/KaRqY$VHz3zZJQEJGxCWFXbhU4SQOc6ukC.AkJ..uLdbq97PSCKREOXtyjVMppgDWeKdOQDfDaYRfWK/NkZsgr
HHraA1"
set system host-name vr-vmx
set system management-instance
set system services ssh
set system services extension-service request-response grpc clear-text port 57400
set system services extension-service request-response grpc max-connections 4
set system services netconf ssh
set system services netconf rfc-compliant
set system syslog user * any emergency
set system syslog file messages any notice
set system syslog file messages authorization info
set system syslog file interactive-commands interactive-commands any
set chassis fpc 0 pic 0 number-of-ports 96
set interfaces ge-0/0/1 description DOWNLINK-HUAWEI-10G-WAN
set interfaces ge-0/0/1 unit 0 family inet address 185.5.203.254/24
set interfaces ge-0/0/1 unit 0 family inet address 185.5.201.201/23
set interfaces ge-0/0/1 unit 0 family inet address 185.5.200.255/23
set interfaces ge-0/0/1 unit 0 family inet6 address 2a02:cdc5:9715:0:185:5:200:255/64
set interfaces ge-0/0/1 unit 0 family inet6 address 2a02:cdc5:9715:0:185:5:203:254/64
set interfaces ge-0/0/1 unit 0 family inet6 address 2a02:cdc6:3074::/64
deactivate interfaces ge-0/0/1 unit 0 family inet6 address 2a02:cdc6:3074::/64
set interfaces ge-0/0/1 unit 0 family inet6 address 2a02:cdc6:3074:0:185:5:200:255/64
set interfaces ge-0/0/1 unit 0 family inet6 address 2a02:cdc6:3074:0:185:5:203:254/64
set interfaces ge-0/0/2 description DOWNLINK-HUAWEI-10G-ASPTP
set interfaces ge-0/0/2 vlan-tagging
set interfaces ge-0/0/2 unit 100 vlan-id 100
set interfaces ge-0/0/2 unit 100 family inet address 185.5.202.2/24 preferred
set interfaces ge-0/0/2 unit 100 family inet address 185.5.202.2/24 vrrp-group 10 virtual-address 185.5.202.254
set interfaces ge-0/0/2 unit 100 family inet address 185.5.202.2/24 vrrp-group 10 priority 150
set interfaces ge-0/0/2 unit 100 family inet address 185.5.202.2/24 vrrp-group 10 advertise-interval 1
set interfaces ge-0/0/2 unit 100 family inet address 185.5.202.2/24 vrrp-group 10 accept-data
set interfaces ge-0/0/2 unit 100 family inet address 185.5.202.2/24 vrrp-group 10 authentication-type simple
set interfaces ge-0/0/2 unit 100 family inet address 185.5.202.2/24 vrrp-group 10 authentication-key "$9$QcnWnCuRhr8xdp0yKv87NUjHmT3n/Atu1jHTF3
/OOhSrevLwYo"
set interfaces ge-0/0/2 unit 100 family inet6 address 2a02:cdc5:9715:a000:185:5:202:2/64 primary
set interfaces ge-0/0/2 unit 100 family inet6 address 2a02:cdc5:9715:a000:185:5:202:2/64 vrrp-inet6-group 10 virtual-inet6-address 2a02:cdc5:97
15:a000:185:5:202:254
set interfaces ge-0/0/2 unit 100 family inet6 address 2a02:cdc5:9715:a000:185:5:202:2/64 vrrp-inet6-group 10 virtual-link-local-address fe80::1
85:5:202:254
set interfaces ge-0/0/2 unit 100 family inet6 address 2a02:cdc5:9715:a000:185:5:202:2/64 vrrp-inet6-group 10 priority 150
set interfaces ge-0/0/2 unit 100 family inet6 address 2a02:cdc5:9715:a000:185:5:202:2/64 vrrp-inet6-group 10 preempt
set interfaces ge-0/0/2 unit 100 family inet6 address 2a02:cdc5:9715:a000:185:5:202:2/64 vrrp-inet6-group 10 accept-data
set interfaces ge-0/0/2 unit 169 vlan-id 169
set interfaces ge-0/0/2 unit 169 family inet rpf-check mode loose
set interfaces ge-0/0/2 unit 169 family inet address 169.254.63.74/24
set interfaces ge-0/0/2 unit 169 family inet6 rpf-check mode loose
set interfaces ge-0/0/2 unit 169 family inet6 address 2a02:cdc5:9715:169:169:254:63:074/64
set interfaces ge-0/0/3 description DOWNLINK-HUAWEI-10G-WAN-TRANSIT
set interfaces ge-0/0/3 unit 0 family inet rpf-check mode loose
set interfaces ge-0/0/3 unit 0 family inet filter input FW_SBTAP_IPV4_IN
set interfaces ge-0/0/3 unit 0 family inet filter output FW_SBTAP_IPV4_OUT
set interfaces ge-0/0/3 unit 0 family inet address 89.221.32.157/31
set interfaces ge-0/0/3 unit 0 family inet6 rpf-check mode loose
set interfaces ge-0/0/3 unit 0 family inet6 filter input FW_SBTAP_IPV6_IN
set interfaces ge-0/0/3 unit 0 family inet6 filter output FW_SBTAP_IPV6_OUT
set interfaces ge-0/0/3 unit 0 family inet6 address 2001:41a8:60:2::7a/126
set interfaces fxp0 unit 0 family inet address 10.0.0.15/24
set forwarding-options rpf-loose-mode-discard family inet
set forwarding-options rpf-loose-mode-discard family inet6
set routing-options options syslog level debug
set routing-options rib inet6.0 static route 100::/128 discard
set routing-options rib inet6.0 static route 100::/128 retain
set routing-options rib inet6.0 static route 100::/128 install
---(more 8%)---▌
```

BY NC SA

3 Emulazione

sessioni BGP del JunOS su kathara

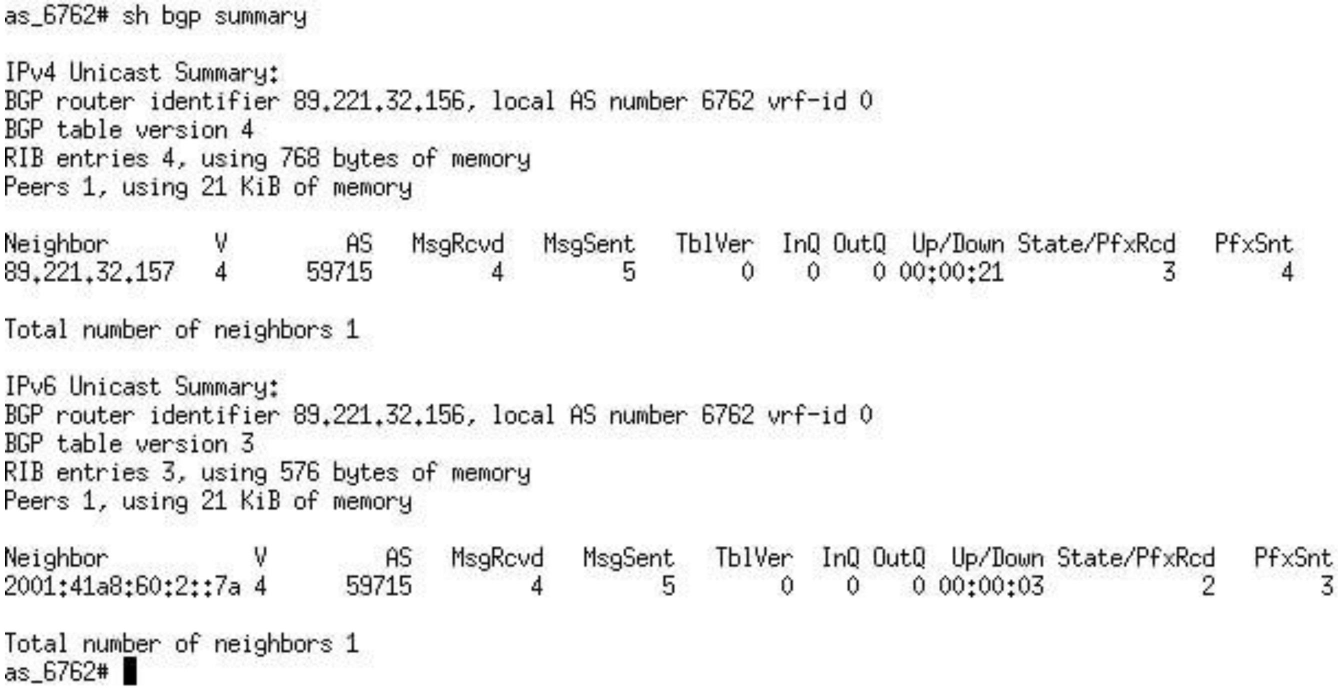


```
vrnetlab@vr-vmx> show bgp summary
Groups: 18 Peers: 23 Down peers: 19
Table          Tot Paths  Act Paths Suppressed    History Damp State    Pending
inet.0
                       1          1          0          0          0          0
inet6.0
                       1          1          0          0          0          0
Peer                     AS      InPkt     OutPkt    OutQ   Flaps Last Up/Dwn State|#Active/Received/Accepted/Damped...
38.229.6.20           65332          0          0       0       0          59 Active
38.229.46.20          65332          0          0       0       0          59 Active
38.229.240.100        64496          0          0       0       0          59 Active
38.229.244.100        64496          0          0       0       0          59 Active
64.79.149.244        397601          0          0       0       0          59 Active
89.221.32.156          6762          4          3       0       0          22 1/1/1/0              0/0/0/0
169.254.63.100        59715          0          0       0       0          59 Connect
169.254.63.101        59715          0          0       0       0          59 Connect
178.248.237.29       197068          0          0       0       0          59 Active
185.5.200.243         59715          0          0       0       0          59 Connect
185.5.201.241           112          2          2       0       0          22 0/0/0/0              0/0/0/0
185.5.202.131         59715          0          0       0       0          59 Connect
212.114.120.72       199036          0          0       0       0          59 Connect
2001:7b8:62b:1:0:d4ff:fe72:7848      199036          0          0       0       0          59 Active
2001:1898:2400:3000:8000::105      397601          0          0       0       0          59 Active
2001:41a8:60:2::79        6762          4          3       0       0           5 Establ
  inet6.0: 1/1/1/0
2604:8800:60:240::100       64496          0          0       0       0          59 Active
2604:8800:240::100       64496          0          0       0       0          59 Active
2620:0:6b0:8000::20       65332          0          0       0       0          59 Active
2620:0:6b0:ff00::20       65332          0          0       0       0          59 Connect
2a02:cdc5:9715:0:185:5:201:241         112          2          2       0       0           8 Establ
  inet6.0: 0/0/0/0
2a02:cdc5:9715:169:169:254:63:100       59715          0          0       0       0          59 Connect
2a02:cdc5:9715:169:169:254:63:101       59715          0          0       0       0          59 Connect
```

3 Emulazione

Kathará

router FRR su kathara per emulazione transit



```
as_6762# sh bgp summary

IPv4 Unicast Summary:
BGP router identifier 89.221.32.156, local AS number 6762 vrf-id 0
BGP table version 4
RIB entries 4, using 768 bytes of memory
Peers 1, using 21 KiB of memory

Neighbor        V         AS   MsgRcvd   MsgSent   TblVer  InQ OutQ  Up/Down State/PfxRcd   PfxSnt
89.221.32.157   4      59715         4         5        0    0    0 00:00:21            3        4

Total number of neighbors 1

IPv6 Unicast Summary:
BGP router identifier 89.221.32.156, local AS number 6762 vrf-id 0
BGP table version 3
RIB entries 3, using 576 bytes of memory
Peers 1, using 21 KiB of memory

Neighbor           V         AS   MsgRcvd   MsgSent   TblVer  InQ OutQ  Up/Down State/PfxRcd   PfxSnt
2001:41a8:60:2::7a 4      59715         4         5        0    0    0 00:00:03            2        3

Total number of neighbors 1
as_6762# █
```

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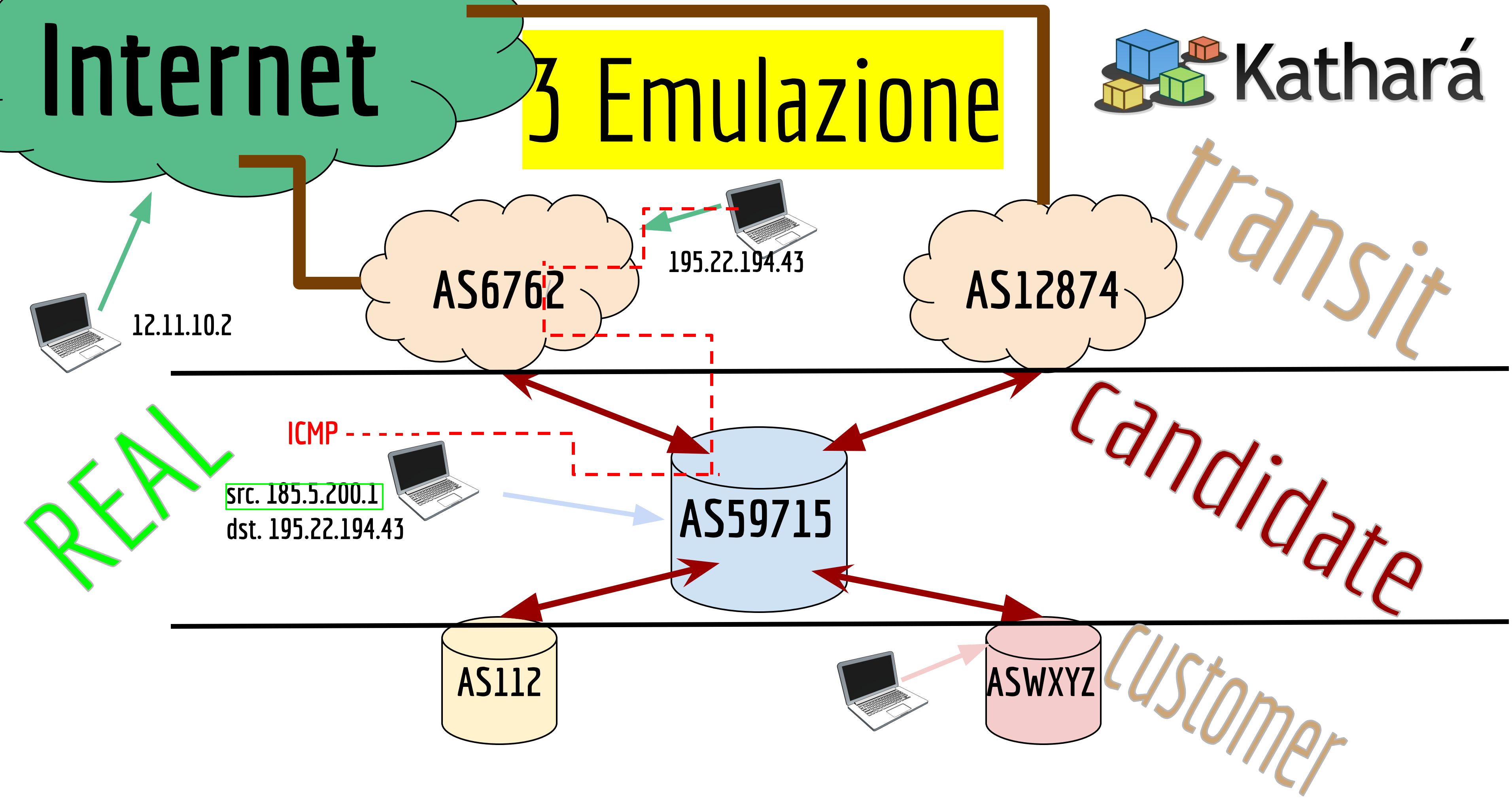
MANRS

ACTION 3 for network operators

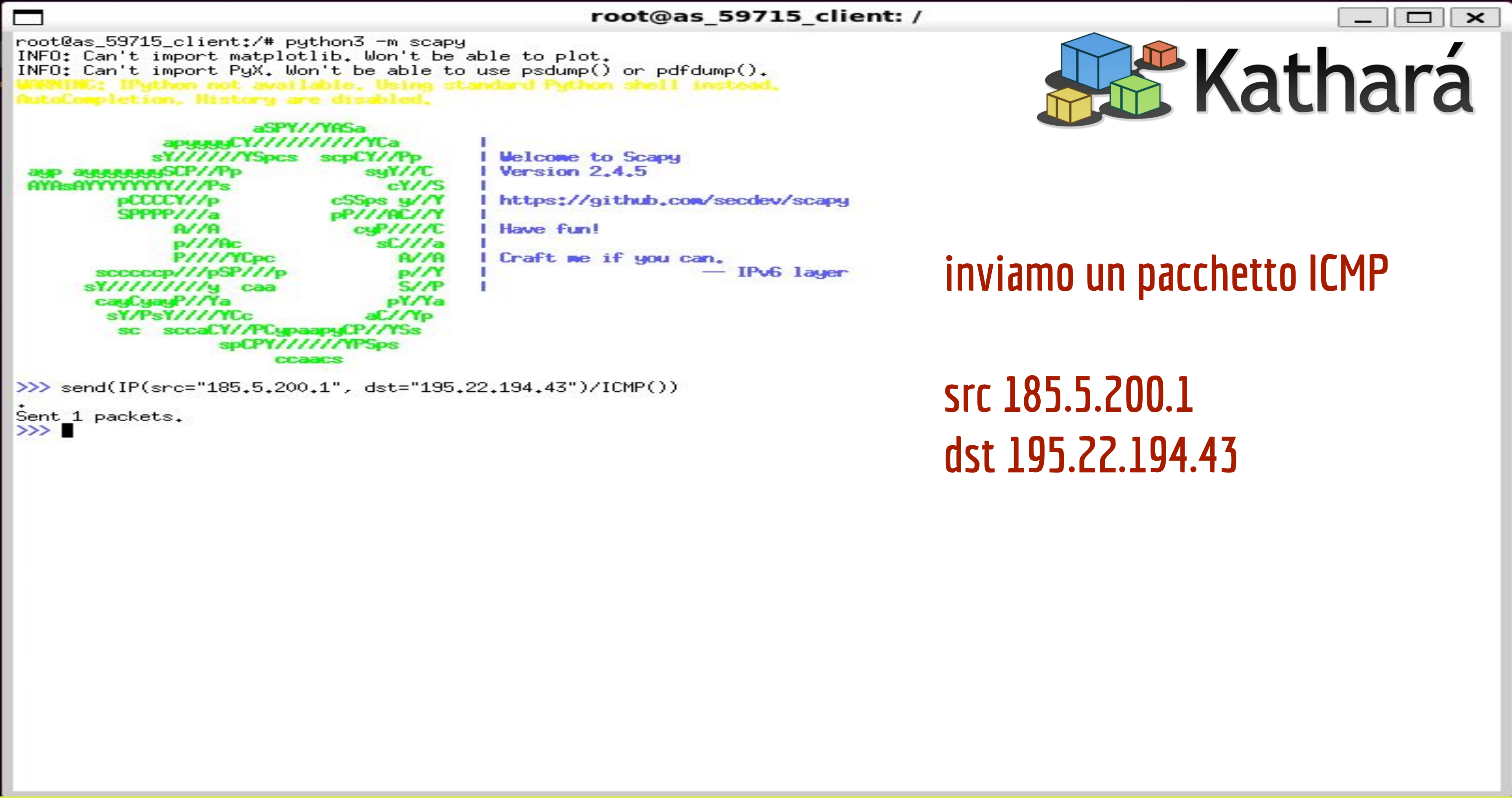
Blocking traffic from spoofed IP addresses: an operator should implement a system that enables Source Address Validation for its own network and its customers. It is then necessary to include anti-spoofing filters to prevent packets with an incorrect source IP address from entering or leaving the network.

cc BY NC SA

3 Emulazione



cc BY NC SA



```
root@as_59715_client:/# python3 -m scapy
INFO: Can't import matplotlib. Won't be able to plot.
INFO: Can't import PyX. Won't be able to use psdump() or pdfdump().
WARNING: IPython not available. Using standard Python shell instead.
AutoCompletion, History are disabled.

                     aSPY//YASa
             apyyyyCY//////////YCa       |
            sY//////YSpcs  scpCY//Pp     | Welcome to Scapy
 ayp ayyyyyyySCP//Pp           syY//C    | Version 2.4.5
 AYAsAYYYYYYYY///Ps              cY//S   |
         pCCCCY//p          cSSps y//Y   | https://github.com/secdev/scapy
         SPPPP///a          pP///AC//Y   |
              A//A            cyP////C   | Have fun!
              p///Ac            sC///a   |
              P////YCpc           A//A   | Craft me if you can.
       scccccp///pSP///p          p//Y   |                   -- IPv6 layer
      sY/////////y  caa           S//P   |
       cayCyayP//Ya              pY/Ya
        sY/PsY////YCc          aC//Yp
         sc  sccaCY//PCypaapyCP//YSs
                  spCPY//////YPSps
                       ccaacs

>>> send(IP(src="185.5.200.1", dst="195.22.194.43")/ICMP())
.
Sent 1 packets.
>>> 
```

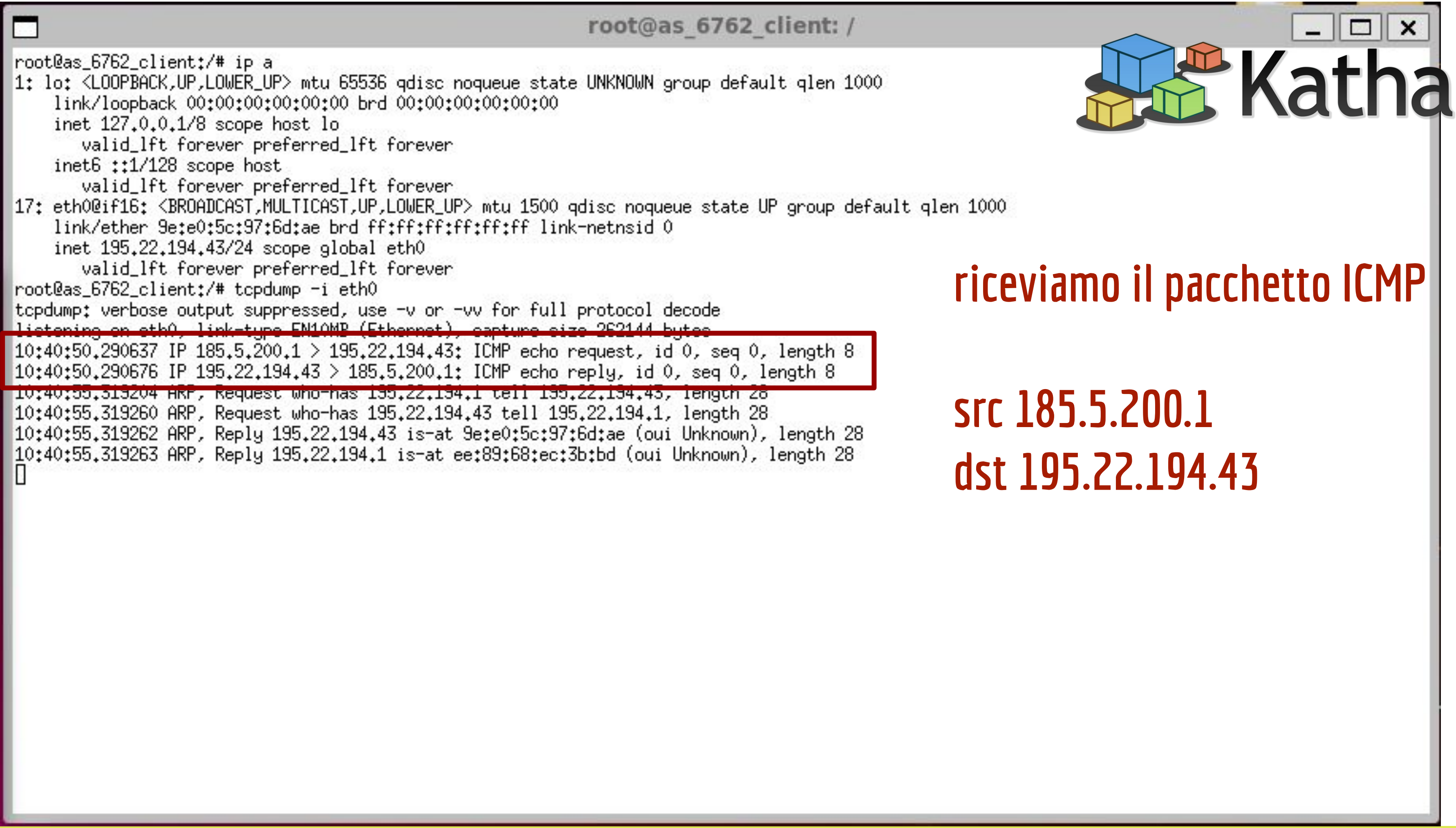
Kathará

inviamo un pacchetto ICMP

src 185.5.200.1

dst 195.22.194.43

cc BY NC SA



```
root@as_6762_client:/# ip a
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group default qlen 1000
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
    inet 127.0.0.1/8 scope host lo
       valid_lft forever preferred_lft forever
    inet6 ::1/128 scope host
       valid_lft forever preferred_lft forever
17: eth0@if16: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc noqueue state UP group default qlen 1000
    link/ether 9e:e0:5c:97:6d:ae brd ff:ff:ff:ff:ff:ff link-netnsid 0
    inet 195.22.194.43/24 scope global eth0
       valid_lft forever preferred_lft forever
root@as_6762_client:/# tcpdump -i eth0
tcpdump: verbose output suppressed, use -v or -vv for full protocol decode
listening on eth0, link-type EN10MB (Ethernet), capture size 262144 bytes
10:40:50.290637 IP 185.5.200.1 > 195.22.194.43: ICMP echo request, id 0, seq 0, length 8
10:40:50.290676 IP 195.22.194.43 > 185.5.200.1: ICMP echo reply, id 0, seq 0, length 8
10:40:55.319204 ARP, Request who-has 195.22.194.1 tell 195.22.194.43, length 28
10:40:55.319260 ARP, Request who-has 195.22.194.43 tell 195.22.194.1, length 28
10:40:55.319262 ARP, Reply 195.22.194.43 is-at 9e:e0:5c:97:6d:ae (oui Unknown), length 28
10:40:55.319263 ARP, Reply 195.22.194.1 is-at ee:89:68:ec:3b:bd (oui Unknown), length 28
▯
```

riceviamo il pacchetto ICMP

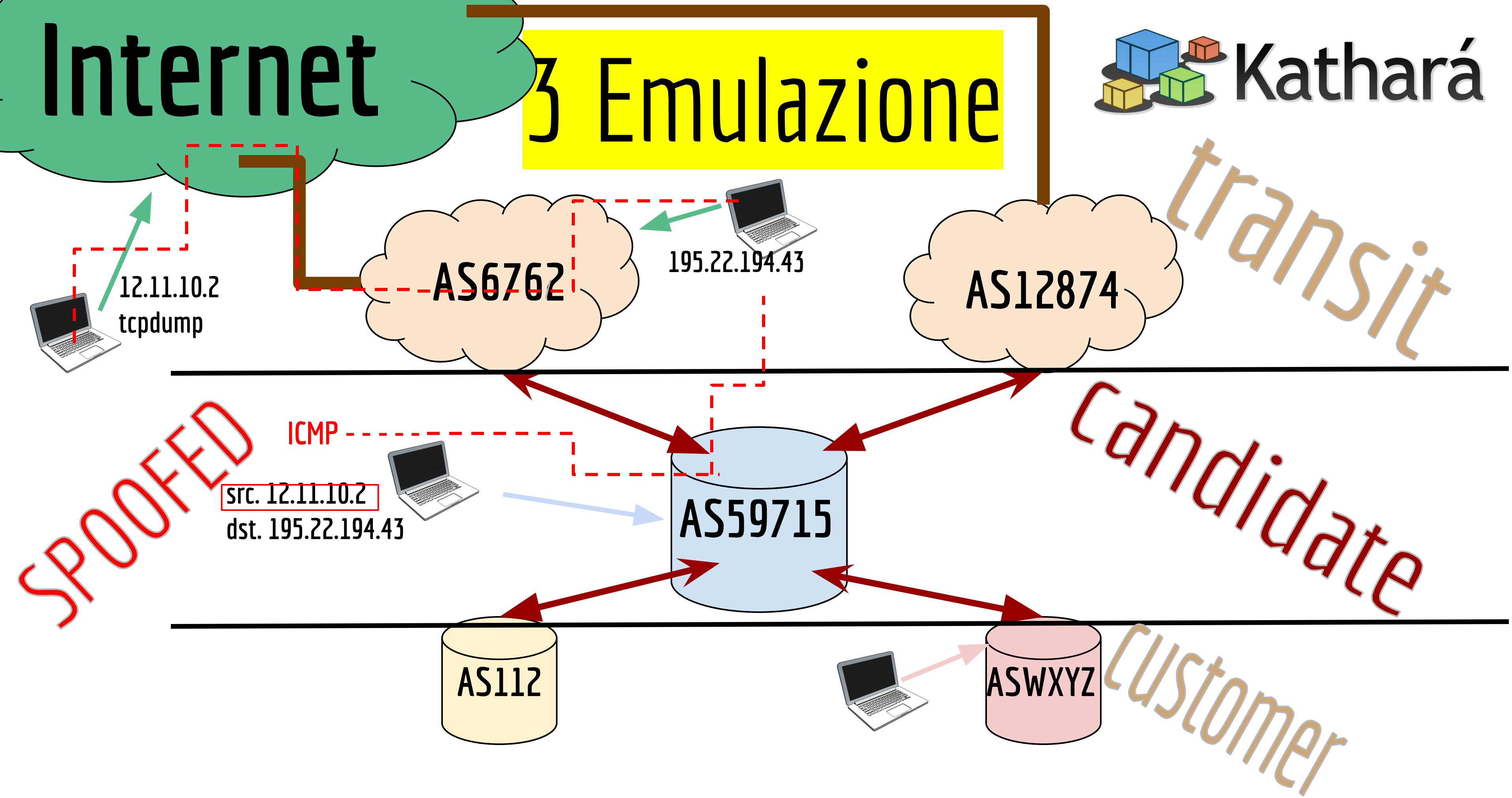
src 185.5.200.1

dst 195.22.194.43

cc BY NC SA

3 Emulazione

Kathará



Internet

12.11.10.2
tcpdump

AS6762

195.22.194.43

AS12874

transit

ICMP

SPOOFED

src. 12.11.10.2
dst. 195.22.194.43

AS59715

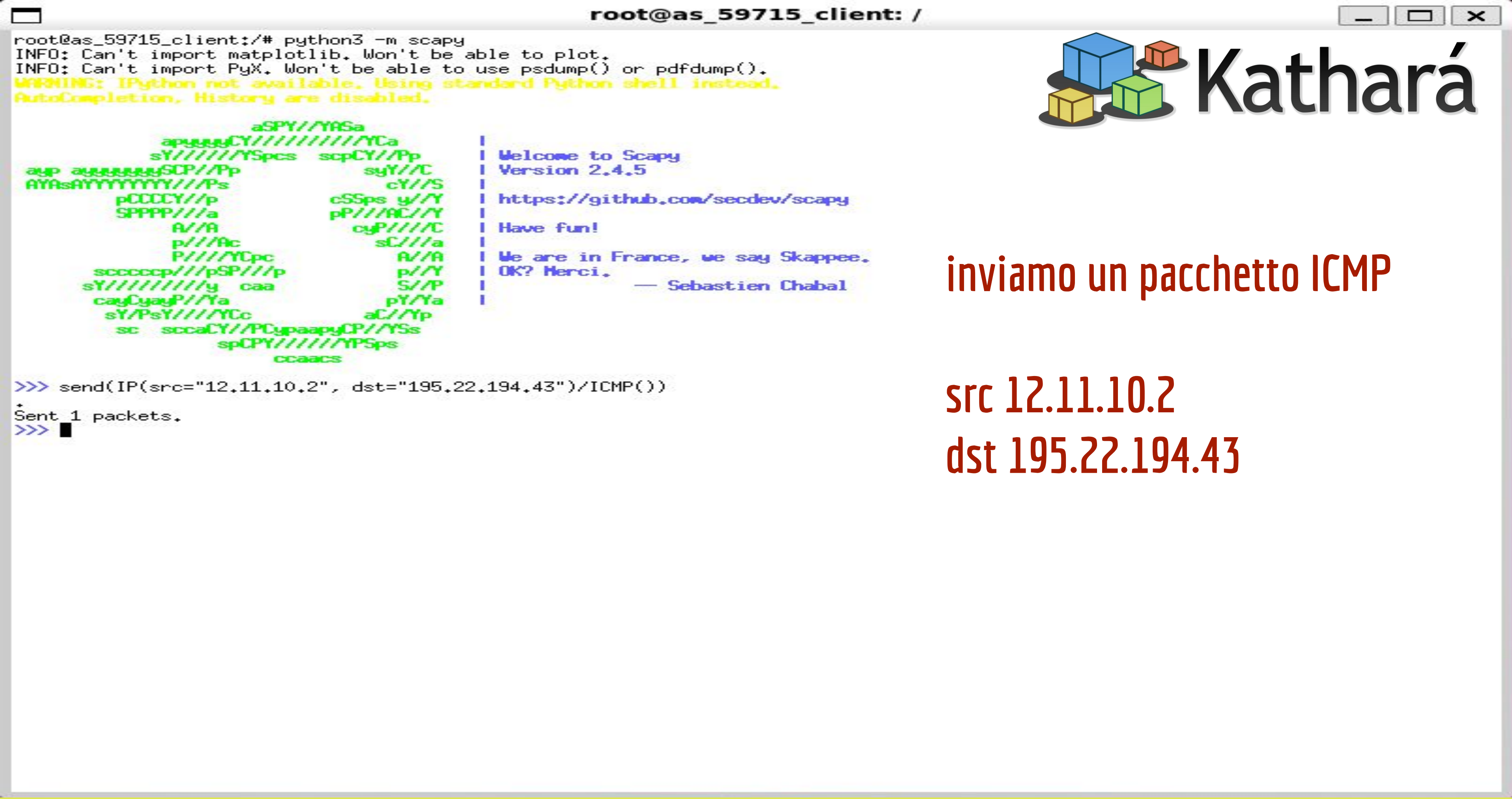
candidate

AS112

ASWXYZ

customer

BY NC SA



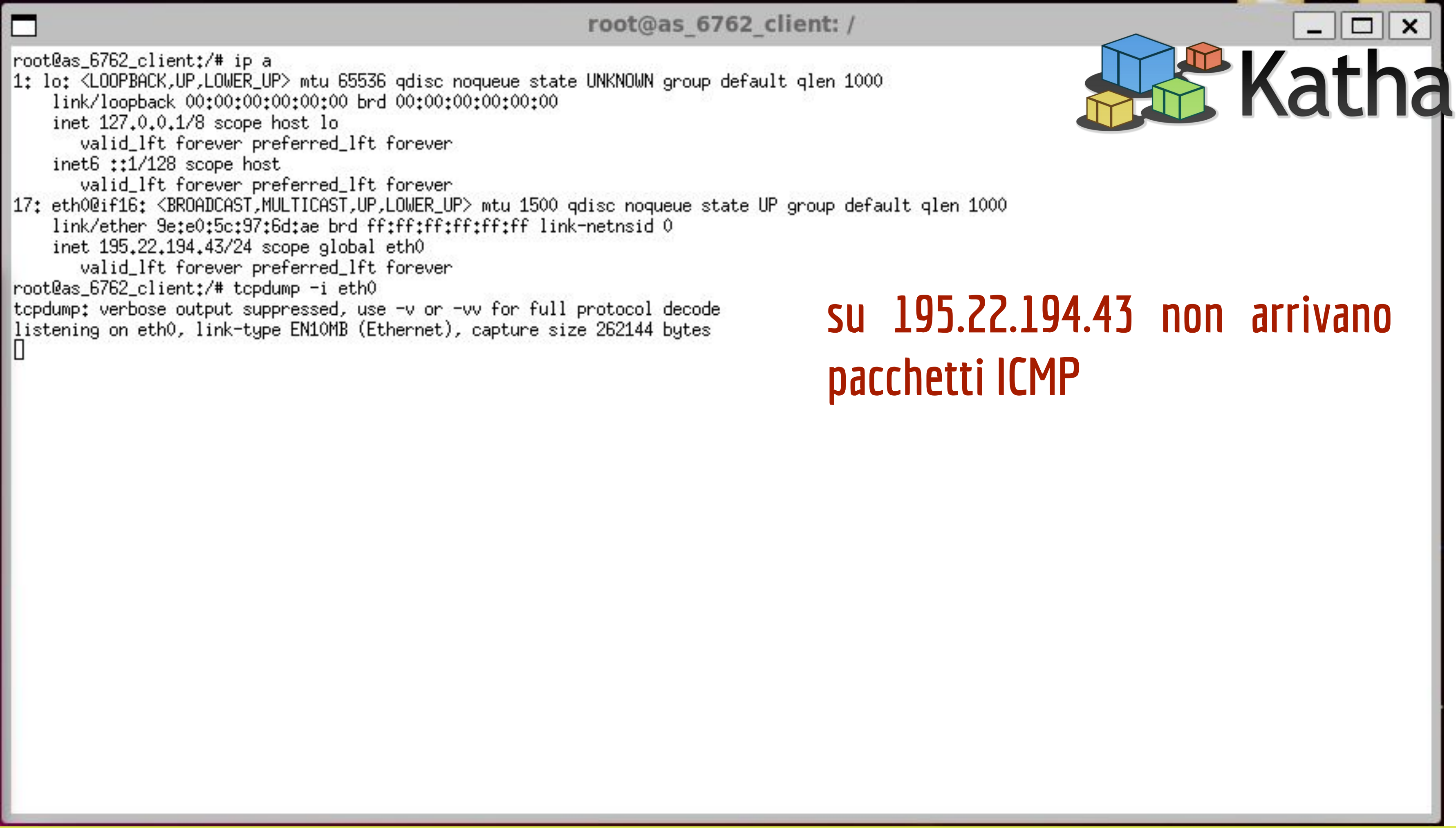
```
root@as_59715_client:/# python3 -m scapy
INFO: Can't import matplotlib. Won't be able to plot.
INFO: Can't import PyX. Won't be able to use psdump() or pdfdump().
WARNING: IPython not available. Using standard Python shell instead.
AutoCompletion, History are disabled.

                     aSPY//YASa
             apyyyyCY//////////YCa       |
            sY//////YSpcs  scpCY//Pp     | Welcome to Scapy
 ayp ayyyyyyySCP//Pp           syY//C    | Version 2.4.5
 AYAsAYYYYYYYY///Ps              cY//S   |
         pCCCCY//p          cSSps y//Y   | https://github.com/secdev/scapy
         SPPPP///a          pP///AC//Y   |
              A//A            cyP////C   | Have fun!
              p///Ac            sC///a   |
              P////YCpc           A//A   | We are in France, we say Skappee.
       scccccp///pSP///p          p//Y   | OK? Merci.
      sY/////////y  caa           S//P   |             -- Sebastien Chabal
       cayCyayP//Ya              pY/Ya   |
        sY/PsY////YCc          aC//Yp
         sc  sccaCY//PCypaapyCP//YSs
                  spCPY//////YPSps
                       ccaacs

>>> send(IP(src="12.11.10.2", dst="195.22.194.43")/ICMP())
.
Sent 1 packets.
>>> 
```

inviamo un pacchetto ICMP

src 12.11.10.2

dst 195.22.194.43

cc BY NC SA

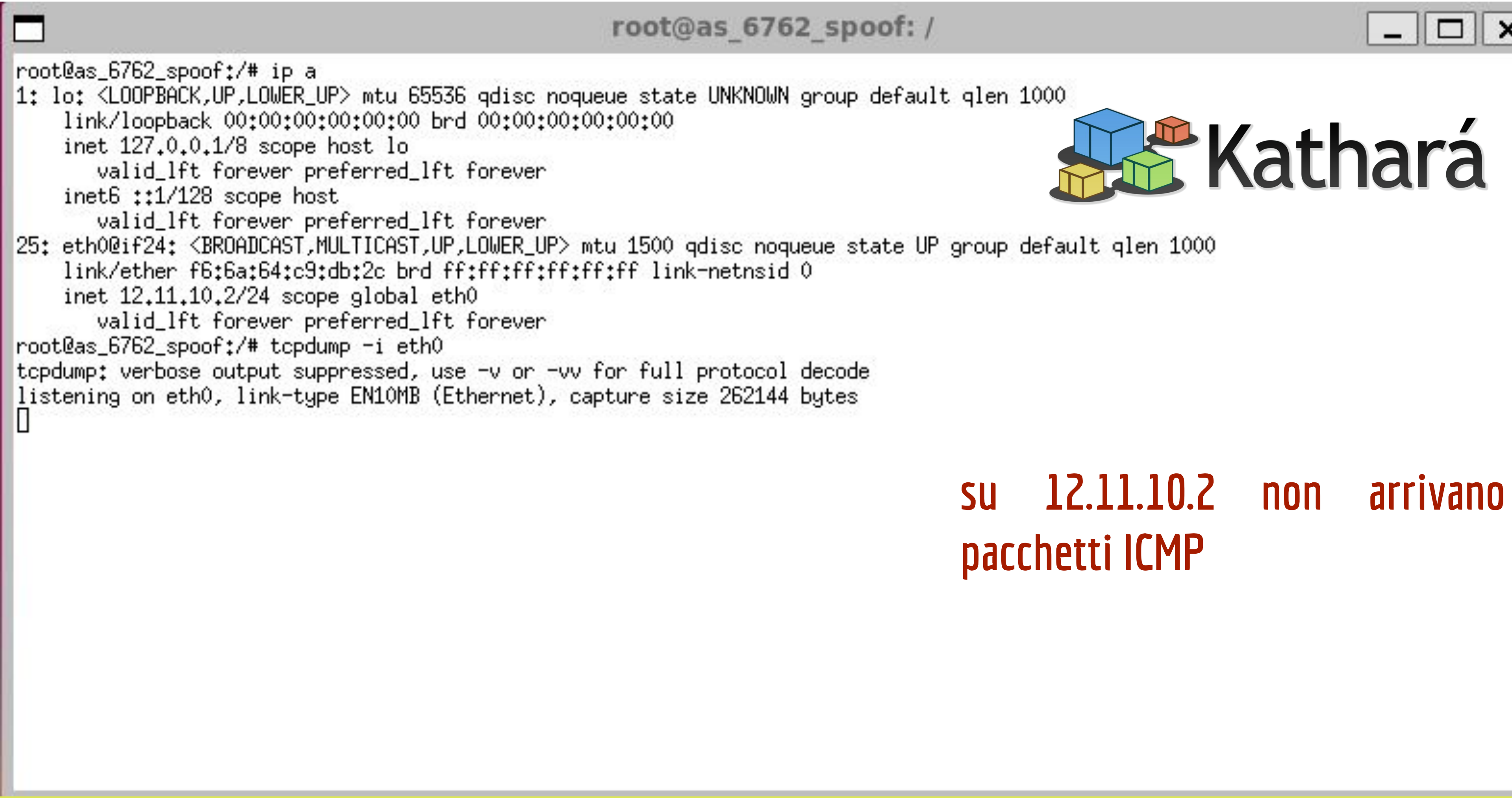


```
root@as_6762_client:/# ip a
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group default qlen 1000
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
    inet 127.0.0.1/8 scope host lo
       valid_lft forever preferred_lft forever
    inet6 ::1/128 scope host
       valid_lft forever preferred_lft forever
17: eth0@if16: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc noqueue state UP group default qlen 1000
    link/ether 9e:e0:5c:97:6d:ae brd ff:ff:ff:ff:ff:ff link-netnsid 0
    inet 195.22.194.43/24 scope global eth0
       valid_lft forever preferred_lft forever
root@as_6762_client:/# tcpdump -i eth0
tcpdump: verbose output suppressed, use -v or -vv for full protocol decode
listening on eth0, link-type EN10MB (Ethernet), capture size 262144 bytes
▯
```

su 195.22.194.43 non arrivano pacchetti ICMP

Kathará

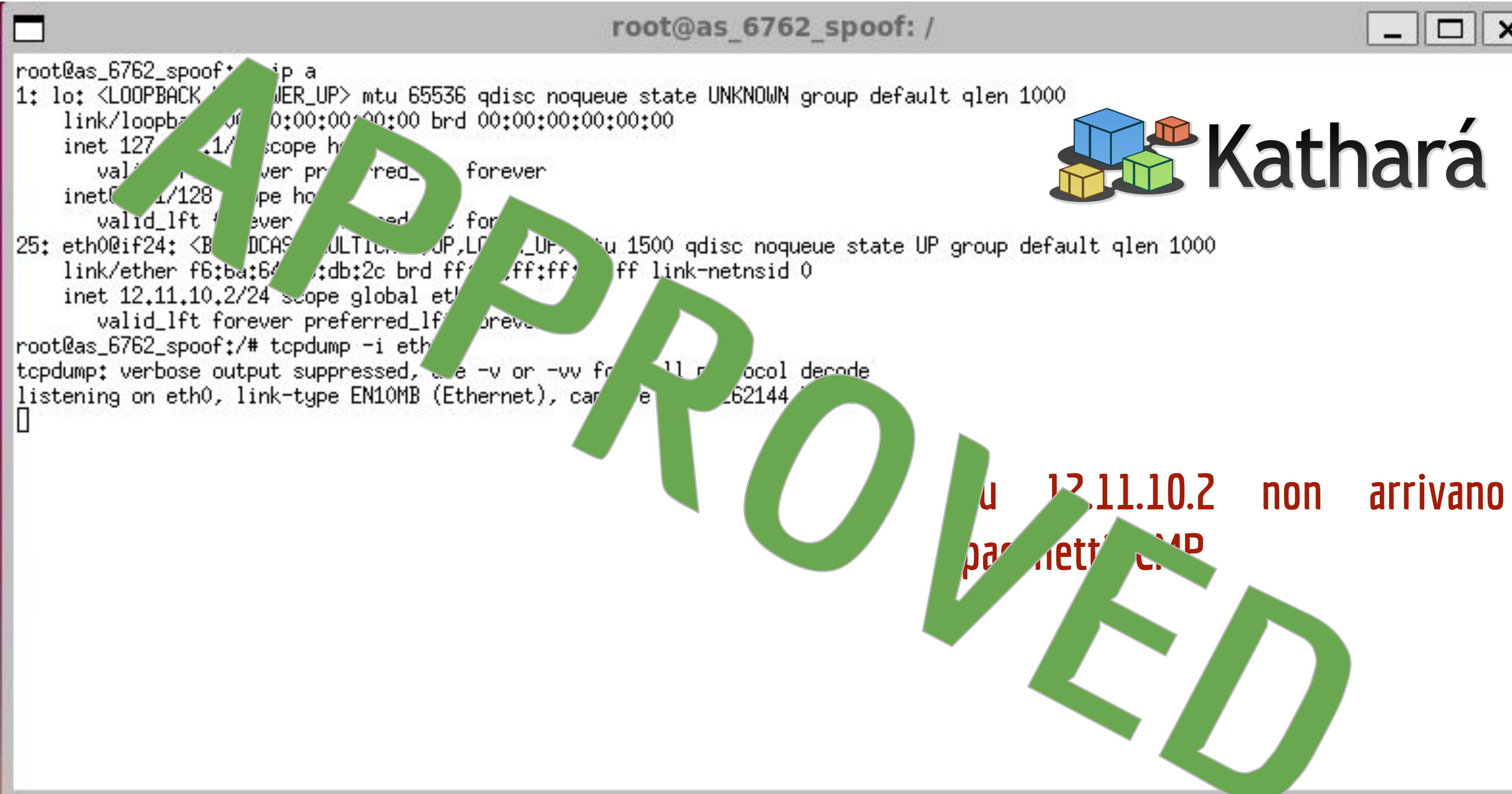
BY NC SA



```
root@as_6762_spoof:/# ip a
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group default qlen 1000
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
    inet 127.0.0.1/8 scope host lo
       valid_lft forever preferred_lft forever
    inet6 ::1/128 scope host
       valid_lft forever preferred_lft forever
25: eth0@if24: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc noqueue state UP group default qlen 1000
    link/ether f6:6a:64:c9:db:2c brd ff:ff:ff:ff:ff:ff link-netnsid 0
    inet 12.11.10.2/24 scope global eth0
       valid_lft forever preferred_lft forever
root@as_6762_spoof:/# tcpdump -i eth0
tcpdump: verbose output suppressed, use -v or -vv for full protocol decode
listening on eth0, link-type EN10MB (Ethernet), capture size 262144 bytes
```

su 12.11.10.2 non arrivano pacchetti ICMP

cc BY NC SA



```
root@as_6762_spoof:[illegible]ip a
1: lo: <LOOPBACK,[illegible]WER_UP> mtu 65536 qdisc noqueue state UNKNOWN group default qlen 1000
    link/loopb[illegible]0:00:00:[illegible]0:00 brd 00:00:00:00:00:00
    inet 127[illegible].1/[illegible]scope h[illegible]
       val[illegible]ver pr[illegible]red_[illegible] forever
    inet[illegible]1/128 [illegible]pe ho[illegible]
       valid_lft [illegible]ever [illegible]red[illegible] for[illegible]
25: eth0@if24: <B[illegible]DCAS[illegible]ULTIC[illegible]UP,L[illegible]_UP>[illegible]u 1500 qdisc noqueue state UP group default qlen 1000
    link/ether f6:ba:6[illegible]:db:2c brd ff[illegible]ff:ff[illegible]ff link-netnsid 0
    inet 12.11.10.2/24 scope global et[illegible]
       valid_lft forever preferred_lf[illegible]reve[illegible]
root@as_6762_spoof:/# tcpdump -i eth[illegible]
tcpdump: verbose output suppressed, [illegible]e -v or -vv f[illegible]ll [illegible]ocol decode
listening on eth0, link-type EN10MB (Ethernet), ca[illegible]e[illegible]62144[illegible]
```

Kathará

[illegible]u 12.11.10.2 non arrivano
pa[illegible]etti [illegible]MP

APPROVED

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MANRS

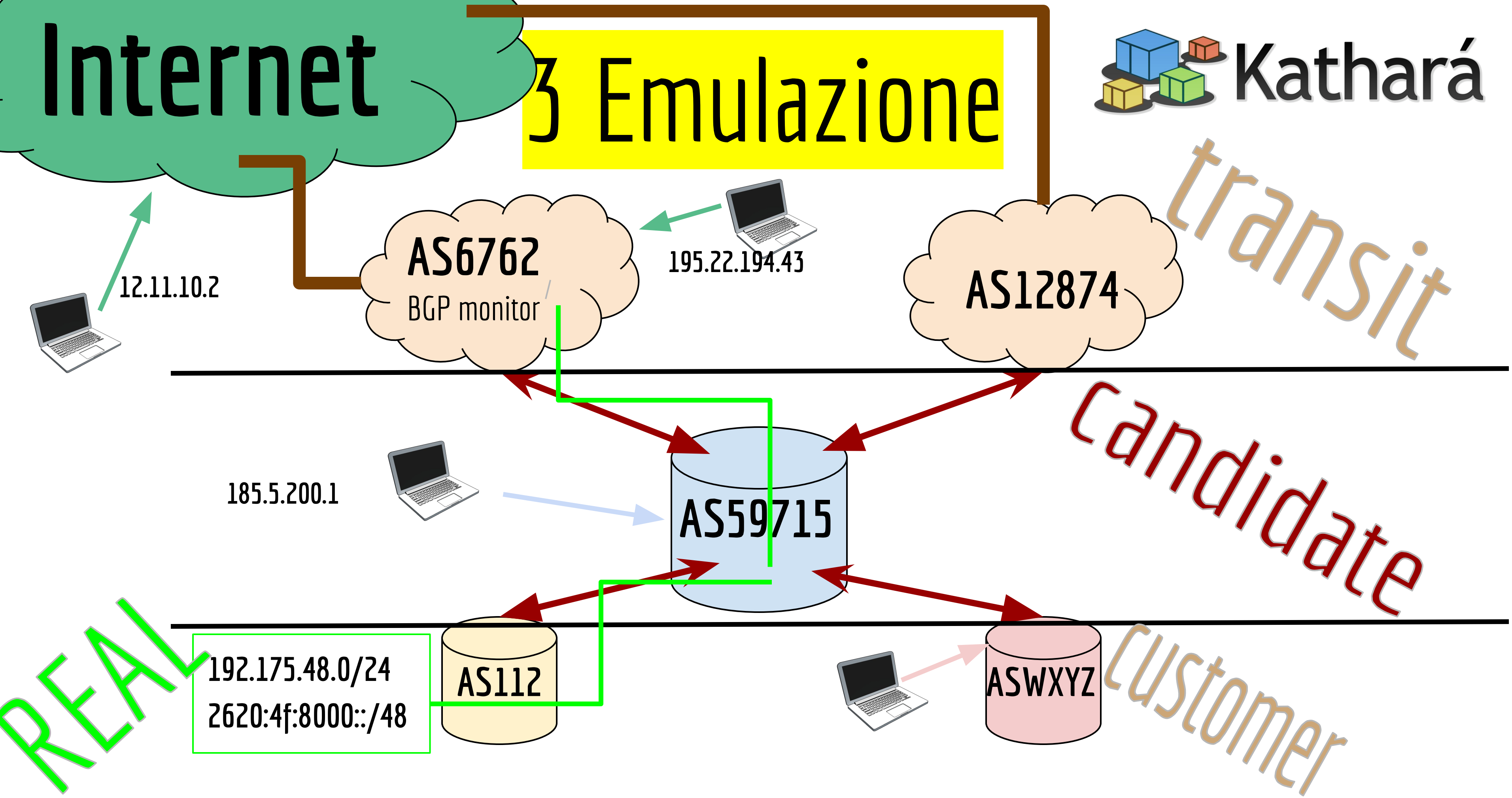
ACTION 4 for network operators

Preventing the propagation of incorrect routing information: it is necessary to implement a system on the basis of which an operator announces to adjacent networks only and exclusively its own prefixes and those of its customers. Likewise, the operator must verify that the prefixes announced by its customers are really their own.

cc BY NC SA

3 Emulazione

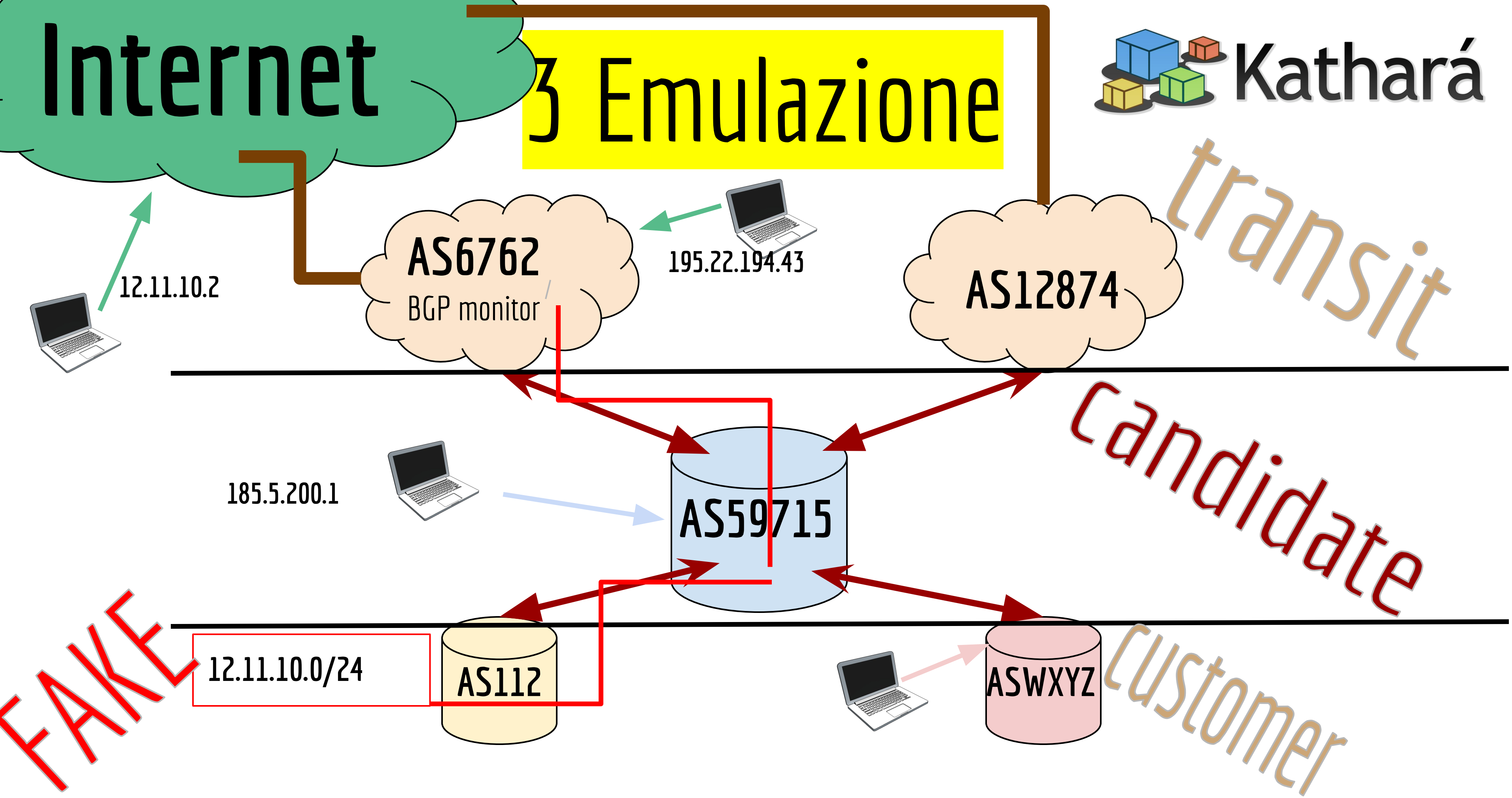
Kathará



cc BY NC SA

3 Emulazione

Kathará


Internet

AS6762

BGP monitor

195.22.194.43

AS12874

transit

12.11.10.2

185.5.200.1

AS59715

candidate

FAKE

12.11.10.0/24

AS112

ASWXYZ

customer

CC BY NC SA

Su GitHUB il progetto in fieri:

https://github.com/Skazza94/rs4lk

Aiutaci, cerchiamo volontari!

cc BY NC SA

Speciali ringraziamenti vanno:

- al professore **Fabio Fioravanti** per la fiaccola che mantiene sempre accesa durante il mio cammino;
- all'Università degli studi "G. d'Annunzio" di Chieti-Pescara per il sostegno a questa ricerca attraverso la messa a disposizione di amplissima capacità di calcolo;
- al professore **Gianluca Amato** per il prezioso supporto;
- al collega **Mariano Scazzariello** per l'entusiasmo, la professionalità e la continua collaborazione.

BY NC SA

Domande?