LINGI2142 Computer Networks
Project 3

Group 2

Université Catholique de Louvain - INGI

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1. Gateway Protocol
   - IGP
   - Reveal eBGP peerings involving Internet2
   - Examples
2. MPLS
   - Configuration
   - Ingress, Egress, Transit
3. Paths and performances provided by Internet2 routers
   - First approach
   - Analysing that results

Introduction

What we have done first :

- IPV4 ? IPV6 ?
- Search for the addresses of the backbones routers to uses traceroutes,
- Play with the tools on the website by trying traceroute between each destination,
- List the differents backbones to begin a map of the network,
- Put the cost (metrics) of each link to check if the path that we have found before are normal,
- Tried to find the configuration of the firewall, but obviously, it was not visible,
- Search for strange things, like: *spf-delay 200*; Warning: spf-delay is deprecated

Introduction

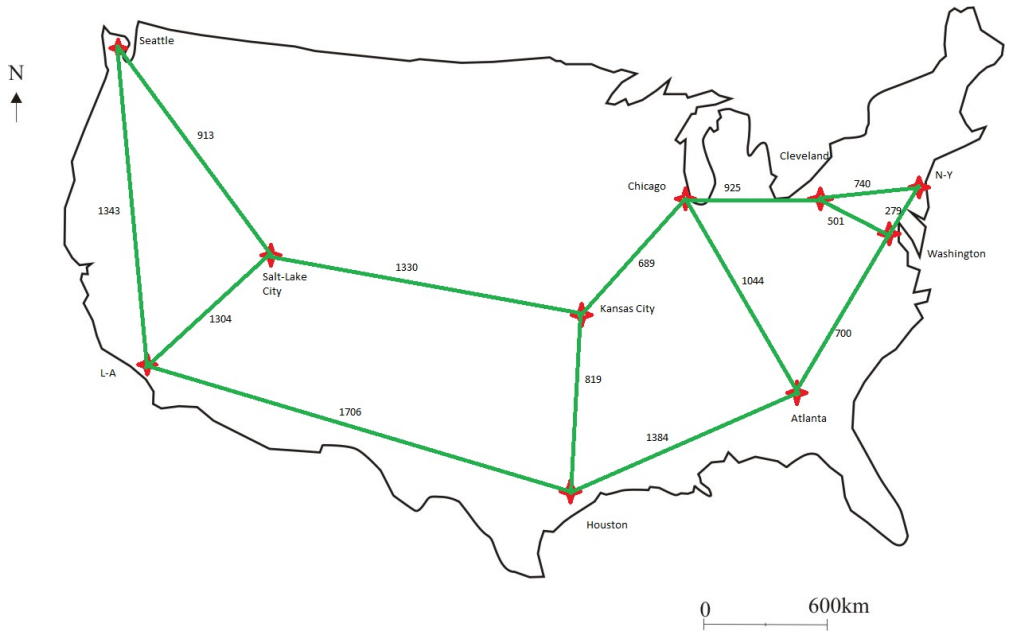
```
bgp {
group INTERNET2 {
      type internal;
      local-address 64.57.28.241;
export NEXT-HOP-SELF;
         peer-as 11537;
         inactive: neighbor 198.32.8.200 {
             description STTLng;
         }
         neighbor 64.57.28.243 {
             description ATLA;
         }
         neighbor 64.57.28.242 {
             description NEWY;
         }
         neighbor 64.57.28.244 {
             description HOUS;
         }
         neighbor 64.57.28.245 {
             description KANS;
         }
         neighbor 64.57.28.248 {
             description LOSA;
         }
         neighbor 64.57.28.246 {
             description SALT;
         }
         neighbor 64.57.28.247 {
             description SEAT;
         }
         neighbor 64.57.28.249 {
             description WASH;
         }
         neighbor 64.57.28.250 {
             description CLEV;
         }
}
}
```

Introduction

Protocols found in the configuration

Protocols	**Utility**
IS-IS	Used to help the backbone routers to determine the best path to reach each other.
BGP	Exchange accessibility's informations between Autonomous Systems (AS).
SNMP	Simple Network Management Protocol, used by administrator to manage network remotely.
MPLS	MultiProtocol Label Switching, mechanism to the transport of data, based on the commutation of labels that are added on the entry of the MPLS and remove at the exit.
IGMP	Internet Group Management Protocol, permit to IP's routers to dynamically determin the multicast's groups who dispose of clients in a subnetwork.
PIM	Protocol-Independent Multicast, permit the difussion toward a group of host.
MLD	Multicast Listener Discovery, used by a router to identify the client of a multicast group on a segment directly attached.
RSVP	Permit to dynamically allocate bandwith to application oriented network.
MSDP	mechanism to connect multiple IP Version 4 Protocol Independent Multicast Sparse-Mode (PIM-SM) domains together.

Introduction

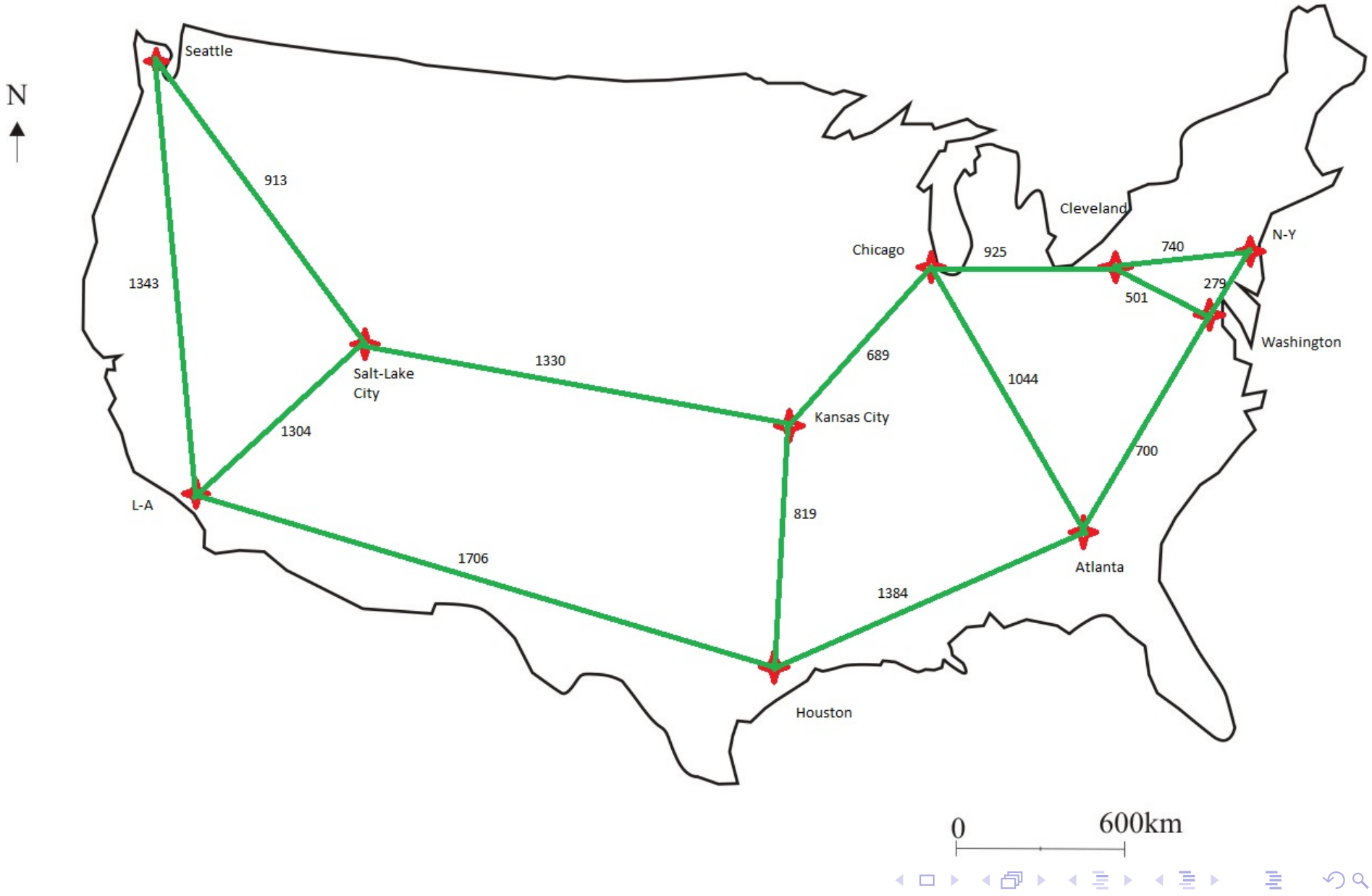


This is a map of the different backbones and routers that we deduced from the configuration.

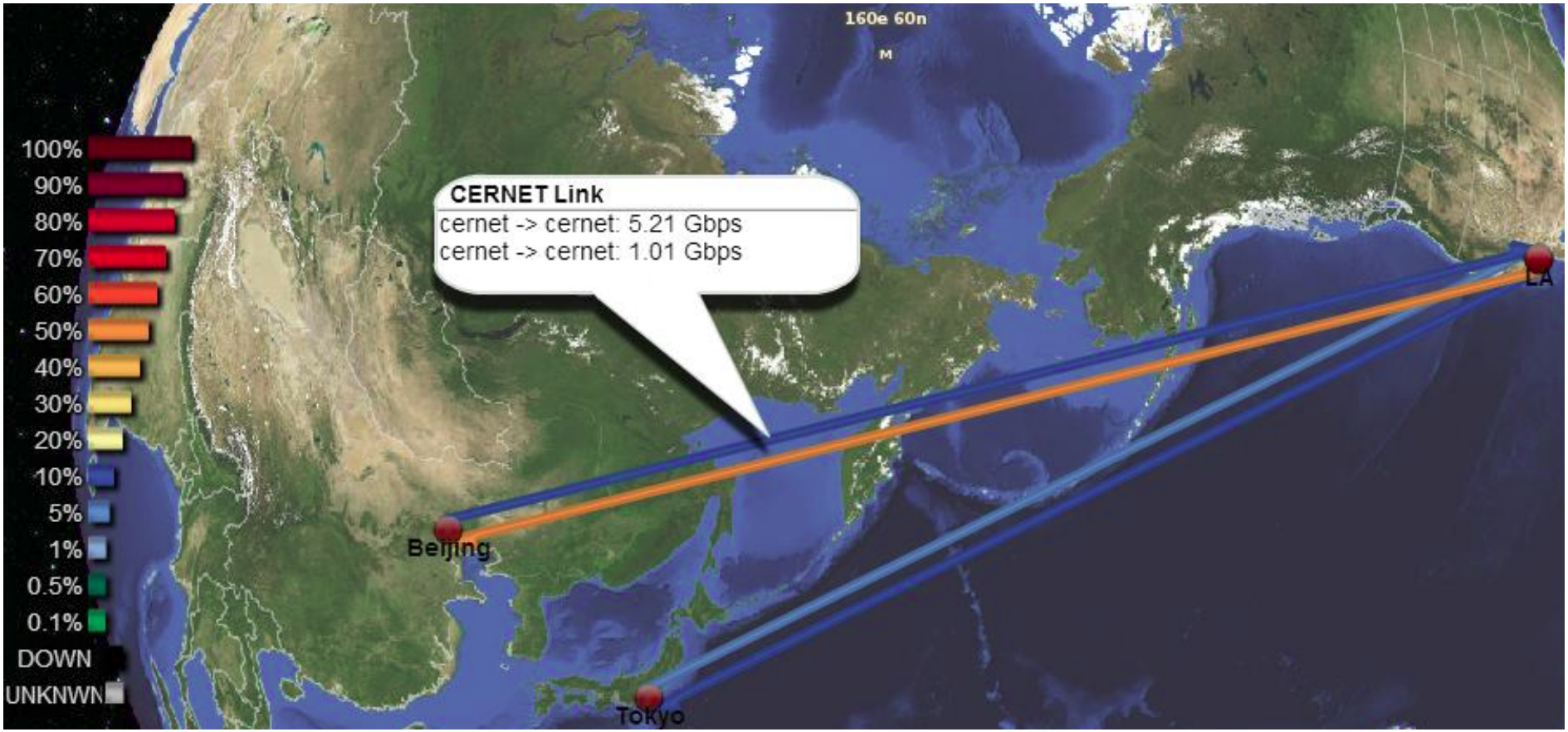
- In green, the backbones links
- In red, the backboones routers
- In black, the "cost" of using the link to go from a router to another.

These costs are deduced thanks to the IS-IS protocol.

Introduction

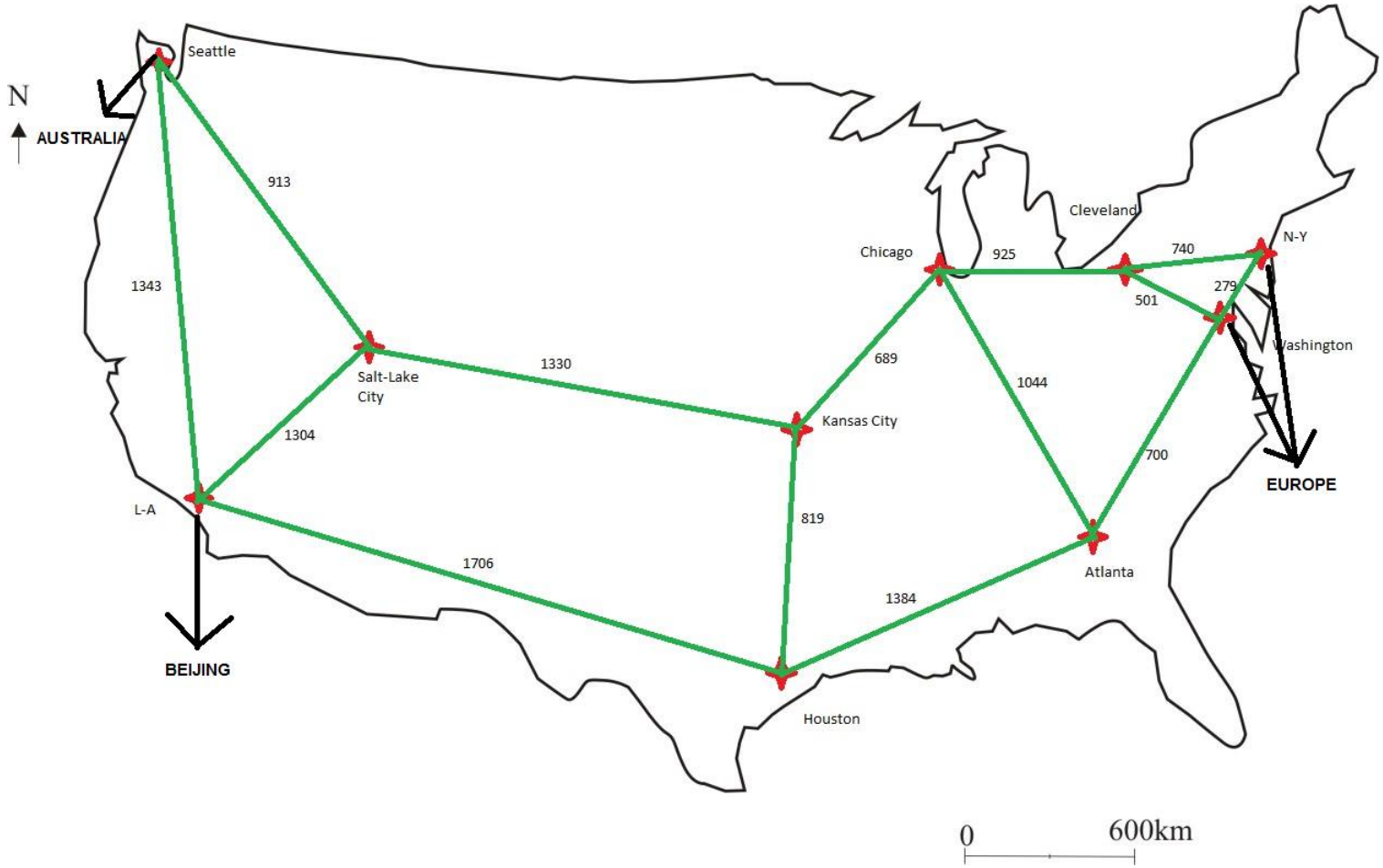


Introduction



On this picture, you can see that Internet2 is linked to other location in the world. We have found that when you want to access Beijing, you quit the US by L-A, for the Europa you quit the US by N-Y or Washington.We will study that later.

Introduction



On this map, you can see where the data will quit the US to reach Beijing (TransPac), Australia and Europe. Again, we have found that by using some traceroute.

IGP

- IS-IS protocol
- Find best path (Run SPF)
- Adjacencies - Redundancy
- Use ISO addresses as ID
- Only on Level 2 (for Backbones)

Example of IS-IS configuration

```
isis {
        export V6-IGP-AGG; /* Policy */
        no-authentication-check; /* don't reject not authenticated */
        rib-group {
            inet isis-rg;
            inet6 isis6-rg;
        }
        spf-options delay 200; /* run SPF algorithm after a network topology change */
        level 2 wide-metrics-only; /* generate metric values greater than 63 */
        /* AL2S: CLEV-NEWY R&E */
        interface et-5/0/0.102 {
            bfd-liveness-detection { /* bidirectional failure detection */
                minimum-interval 200; /* minimum intervals at which the local routing
    device transmits Hello packets */
                multiplier 3; /* number of hello packets not received to set int down */
                no-adaptation; /* not to adapt to changing network conditions */
            }
            level 1 disable;
            level 2 metric 740;
        }
}
```

Reveal eBGP peerings involving Internet2

http://vn.grnoc.iu.edu/Internet2/bgp/bgp-summary.html
How can we reconstruct the BGP sessions data presented at this page ?

BGP Dump from Atlanta router from the RIB

```
TIME: 05/10/14 01:13:01
TYPE: TABLE_DUMP/INET
VIEW: 0
SEQUENCE: 557
PREFIX: 64.215.152.0/24
FROM:64.57.16.65 AS11537
ORIGINATED: 05/09/14 13:13:06
ORIGIN: IGP
ASPATH: 18541
NEXT_HOP: 64.57.28.248
LOCAL_PREF: 200
AGGREGATOR: AS18541 64.215.152.254
COMMUNITY: 11537:248 11537:3500 11537:5000 11537:5002 11537:5005
STATUS: 0x1
```

Conclusion : AS18541 is connected to internet2 by router 64.57.28.248 (LOSA)

Let's check this

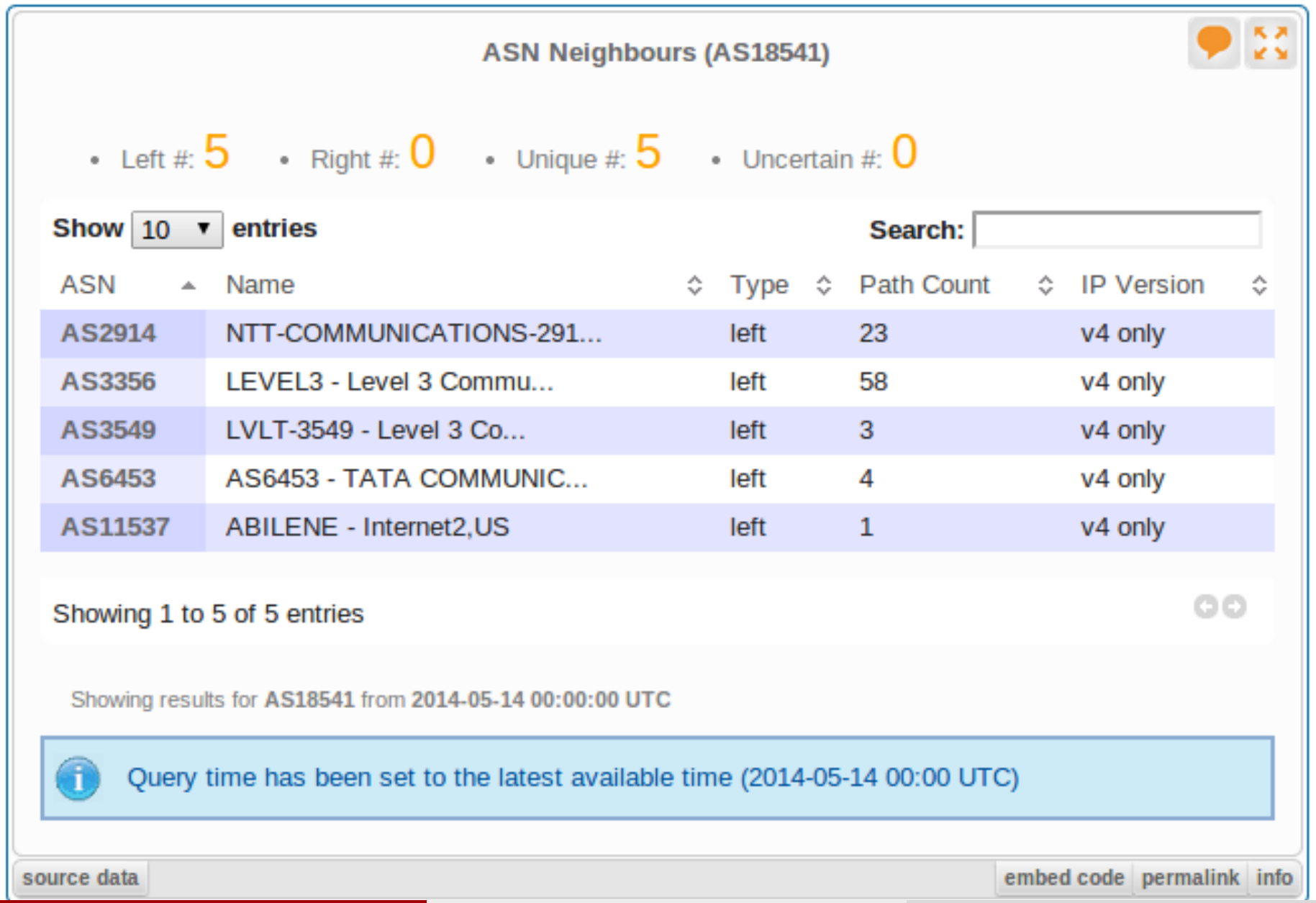
In the LOSA router configuration :

```
neighbor 64.57.30.53 {
                description "[NETPLUS] I2-S10323 Blue Jeans Network";
                import [ SANITY-IN SET-PREF NETPLUS-BLUEJEANS-IN NETPLUS-CLOUD-IN ];
                export [ SANITY-OUT REMOVE-COMMS-OUT ORIGINATE4 NETPLUS-BLUEJEANS-OUT
    NETPLUS-CLOUD-OUT ];
                peer-as 18541;
            }
```

Additionnal verifications

losa	TR-CPS, multicast-only	11164	64.57.20.193	N/A	N/A	176	272
losa	[AL2S-WSC-MGMT] oob2.sunn	65532	64.57.25.180	1	1	N/A	N/A
losa	[AL2S-WSC-MGMT] oob.port	65532	64.57.25.181	1	1	N/A	N/A
losa	[AL2S-WSC-MGMT] oob.phoe	65532	64.57.25.188	1	1	N/A	N/A
losa	[AL2S-WSC-MGMT] oob.elpa	65532	64.57.25.189	1	1	N/A	N/A
losa	[AL2S-WSC-MGMT] oob.tucs	65532	64.57.25.190	1	1	N/A	N/A
losa	[NETPLUS] I2-S06178 Box.net Cloud Service	33011	64.57.28.197	0	7	N/A	N/A
losa	[NETPLUS] I2-S10323 Blue Jeans Network	18541	64.57.30.53	2	2	N/A	N/A
losa	[LHCONE] Connector CALTECH via CENIC via AL2S I2-S06812 [NO-NOTIFY]	32361	64.57.30.150	N/A	N/A	N/A	N/A
losa	CalREN-HPR	2153	137.164.26.133	665	784	188	206
losa	[LHCONE] Connector CALTECH I2-S06812 [NO-NOTIFY]	2153	137.164.26.136	N/A	N/A	N/A	N/A
losa	I2-S09149 CENIC (CalREN-HPR) via AL2S	2153	137.164.26.200	1	1	1	1
losa	[CPS] Customer TransitRail [PENDING]	11164	137.164.131.89	253110	253111	N/A	N/A
losa	[RE] UEN via AL2S/SALT	210	140.197.253.143	70	74	N/A	N/A
losa	SINET via PacWave South	2907	150.99.199.93	815	1611	N/A	N/A
losa	[R&E] Oregon Gigapop via Internet DWS |I2-LOSA-PORT-I2-00109	4600	198.32.165.65	22	23	22	22
losa	WIDE-operated DNS M-root [NO-MONITOR]	7500	198.32.176.179	Not Established			
losa	Commercial NTT via PAIX (Multicast Only)	2914	198.32.177.14	N/A	N/A	609	696
losa	I2-S09355 Sun Corridor, Phoenix, IP v4	62600	198.71.45.198	29	33	N/A	N/A
losa	[NETPLUS] I2-S11605 Box.net Cloud Service 10G PNI	33011	198.71.46.45	7	7	N/A	N/A
losa	[RE]Connector Sun Corridor via AL2S/TUCS v4 | I2-S12126 [NO-MONITOR]	62600	198.71.46.73	0	0	N/A	N/A
losa	ESnet Sunnyvale via AL2s	293	198.129.48.1	120	141	19	19
losa	zebra.jp.apan.net	65432	203.181.248.35	0	0	N/A	N/A
losa	APAN via PacWave	7660	203.181.248.142	20	2784	1	685
losa	[R&E] Layer 2 Participant U of Hawaii | I2-S06201	6360	205.166.205.12	12	12	7	7
losa	TWAREN via PacWave jumbo vlan 702	7539	207.231.240.133	53	55	0	0
losa	TransPAC | AS22388	22388	207.231.240.136	1132	2901	683	709
losa	redCLARA via PacWave	27750	207.231.240.138	Not Established			
losa	CUDI via PacWave	18592	207.231.240.142	9	27	N/A	N/A
losa	AARnet 1Gbps backup via PacWave and Equinix	7575	207.231.240.149	46	220	0	70

Verification from RIPE



ASN Neighbours (AS18541)

- Left #: 5
- Right #: 0
- Unique #: 5
- Uncertain #: 0

Show 10 entries Search:

ASN	Name	Type	Path Count	IP Version
AS2914	NTT-COMMUNICATIONS-291...	left	23	v4 only
AS3356	LEVEL3 - Level 3 Commu...	left	58	v4 only
AS3549	LVLT-3549 - Level 3 Co...	left	3	v4 only
AS6453	AS6453 - TATA COMMUNIC...	left	4	v4 only
AS11537	ABILENE - Internet2,US	left	1	v4 only

Showing 1 to 5 of 5 entries

Showing results for **AS18541** from **2014-05-14 00:00:00 UTC**

Query time has been set to the latest available time (2014-05-14 00:00 UTC)

source data embed code permalink info

Another Example

```
TIME: 05/10/14 01:13:01
TYPE: TABLE_DUMP/INET
VIEW: 0
SEQUENCE: 9482
PREFIX: 198.71.45.80/28
FROM:64.57.16.65 AS11537
ORIGINATED: 05/09/14 13:13:07
ORIGIN: IGP
ASPATH: 65532
NEXT_HOP: 64.57.25.165
MULTI_EXIT_DISC: 0
LOCAL_PREF: 100
COMMUNITY: no-export
STATUS: 0x1
```

Conclusion : AS 65532 is peer with router 64.57.25.165, which is not in the backbone, and thus corresponds to a directly connected AS.
Hence, Atlanta is peered with AS 65532.

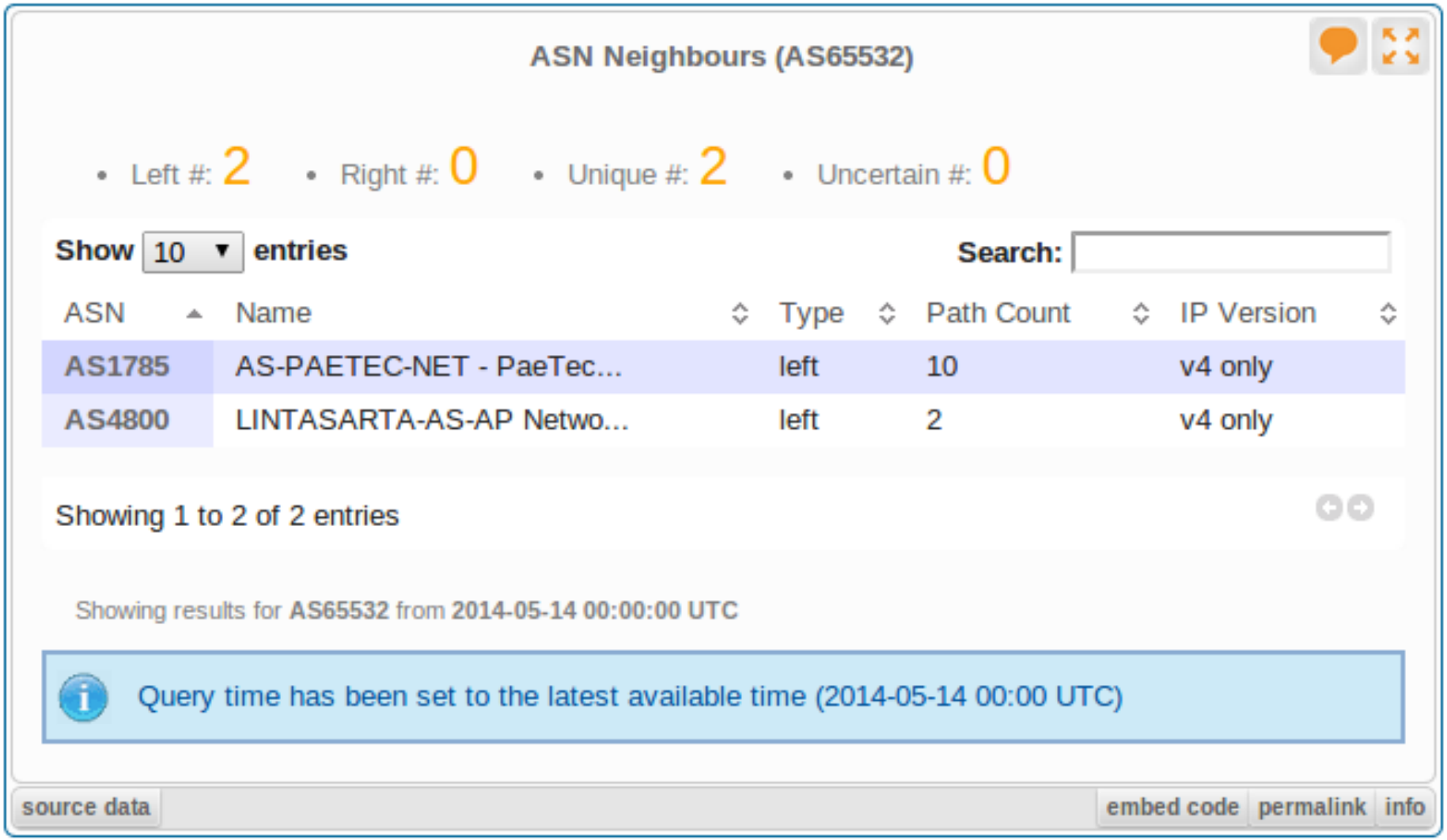
Let's check this

```
group AL2S_MGMT {
            type external;
            metric-out igp;
            log-updown;
            import REJECT-ALL;
            family inet {
                unicast {
                    prefix-limit {
                        maximum 20;
                        teardown;
                    }
                }
            }
            export REJECT-ALL;
            remove-private;
            peer-as 65532;
            inactive: bfd-liveness-detection {
                minimum-interval 1000;
            }
            neighbor 64.57.24.204 {
                description "[AL2S-WSC-MGMT] oob.ashb";
                local-preference 300;
                hold-time 12;
                import AL2S_MGMT-IN;
            }
            ...
}
```

Peering exists...

atla	[AL2S-WSC-MGMT] oob.jack	65532	64.57.24.196	1	1	N/A	N/A
atla	[AL2S-WSC-MGMT] oob.bato	65532	64.57.24.197	1	1	N/A	N/A
atla	[AL2S-WSC-MGMT] oob.jcsn	65532	64.57.24.217	1	1	N/A	N/A
atla	[AL2S-WSC-MGMT] oob.houh	65532	64.57.25.116	1	1	N/A	N/A
atla	[AL2S-WSC-MGMT] oob.rale	65532	64.57.25.164	1	1	N/A	N/A
atla	[AL2S-WSC-MGMT] oob.char	65532	64.57.25.165	1	1	N/A	N/A
atla	[LHCONE] Connector FLR I2-S12108 [NO-NOTIFY][NO-MONITOR]	6356	64.57.30.153	N/A	N/A	N/A	N/A
atla	[RE] LEARN IPv4 via AL2S/HOUH	14085	74.200.187.18	142	251	26	44
atla	[RE] FLR via AL2S/JACK	11096	108.59.25.20	117	856	9	49
atla	[RE] SoX via AL2S/ATLA	10490	143.215.193.3	164	232	44	104
atla	Indiana Gigapop	19782	149.165.254.20	1	109	0	50
atla	ANSP (Brazil) (via AMPATH)	1251	198.32.252.230	74	74	N/A	N/A
atla	AMPATH/FIU via SOX | I2-S09216	20080	198.32.252.237	209	1062	45	45
atla	MCNC via Internet2 DWS I2-ATLA-RALE-I2-00126	81	198.86.17.65	81	89	0	0
atla	RedCLARA via AtlanticWave/AL2S	27750	200.0.207.9	651	775	8	8
atla	Connector MissiON | I2-S06927	54234	205.233.255.36	19	19	5	5
atla	KyRON NEW	30700	216.249.136.197	39	41	1	1
atla	Connector MissiON | I2-S06927	54234	2001:468:ff:140::2	1	1	N/A	N/A
atla	Indiana Gigapop	19782	2001:468:ff:144::2	1	4	0	0
atla	SFGP/AMPATH	20080	2001:468:ff:e47::2	7	66	N/A	N/A
atla	[CPS] Customer6 Indiana GigaPoP TEST [NO-MONITOR]	19782	2001:468:ffff:144::2	N/A	N/A		
atla	[CPS] Customer6 MCNC/NCREN	81	2001:468:ffff:155::2	N/A	N/A		
atla	[CPS] Customer6 USF/FLR	11096	2001:468:ffff:1c1::2	N/A	N/A		
atla	[CPS] Customer6 SFGP/AMPATH	20080	2001:468:ffff:e47::2	N/A	N/A		
atla	RedCLARA via AtlanticWave/AL2S	27750	2001:1348:4:3::1	0	83	N/A	N/A
atla	[RE] FLR via AL2S/JACK	11096	2607:f5d8:2:d100::1	4	7	N/A	N/A
atla	[CPS] Customer6 SoX via AL2S/ATLA	10490	2607:f7b8:1d00:a000::2	N/A	N/A		
atla	[RE] SoX via AL2S/ATLA	10490	2607:f7b8:1f02:c102::2	6	63	1	38
atla	[RE] LEARN IPv6 via AL2S/HOUH	14085	2607:f928:2:8::2	12	16	0	0
atla	MCNC via Internet2 DWS | ATLA-RALE-I2-00126	81	2610:28:10e:1::1	0	7	N/A	N/A
atla	[CPS] Customer6 KyRON [NO-MONITOR]	30700	2610:1e0:1000:4010::1	N/A	N/A		
atla	KyRON NEW	30700	2610:1e0:1000:6010::1	4	4	0	0

... but doesn't appear on RIPE



ASN Neighbours (AS65532)

- Left #: 2
- Right #: 0
- Unique #: 2
- Uncertain #: 0

Show 10 entries Search:

ASN	Name	Type	Path Count	IP Version
AS1785	AS-PAETEC-NET - PaeTec...	left	10	v4 only
AS4800	LINTASARTA-AS-AP Netwo...	left	2	v4 only

Showing 1 to 2 of 2 entries

Showing results for AS65532 from 2014-05-14 00:00:00 UTC

Query time has been set to the latest available time (2014-05-14 00:00 UTC)

source data embed code permalink info

Why ?

```
policy-statement AL2S_MGMT-IN {
        term accept {
            from {
                prefix-list-filter ATLA-AL2S-RACKLAN exact;
            }
            then {
                community add NO-EXPORT;
                accept;
            }
        }
        term reject {
            then reject;
        }
    }
```

MPLS

MPLS labels:

- Not visible when using MyTraceRoute (`mtr`) from outside and inside the network.
- But it's used according to the configuration.

Configuration: MPLS

```
admin-groups { /* Used to include or exclude an LSP and a path's primary and secondary
    paths */
    r_and_e 0; /* Research and Education */
    ion 1; /* A virtual circuit network service to provide dedicated bandwidth for the
    most demanding apps */
}
```

```
label-switched-path CHIC->SALT {
    to 64.57.28.246;
    admin-group exclude [ ion r_and_e ]; /* Exclude all members of the group */
    fast-reroute; /* Mechanism for automatically rerouting traffic on an LSP if a node
    or link in an LSP fails */
}
```

```
label-switched-path oscars_ion_internet2_edu-11936 {
    from 64.57.28.241;
    to 64.57.28.24; /* ae-0.30.rtr.salt.net.internet2.edu: Salt-Lake */
    metric 65535; /* Compared against another LSP or against an IGP route instead of
    using a dynamic and automatically tracks underlying IGP metrics. */
    bandwidth 200m; /* Allocated bandwidth for the reroute path */
    priority 4 4; /* Configure the setup priority [0] and reservation priority [1] */
    primary oscars_ion_internet2_edu-11936; /* Primary path to use for an LSP */
    policing filter oscars_ion_internet2_edu-11936_policing; /* policing filter */
}
```

```
path oscars_ion_internet2_edu-11936 {
    64.57.28.120 strict; /* Kans */
    64.57.28.24 strict; /* Salt */
}
```

Configuration: Misc.

We can see this previous path `oscars_ion_internet2_edu-11936` in other parts of Chicago and Seattle routers:

- Forwarding table (in the export section)
- BGP's community (example here above from Chicago configuration)
- Policy options (accept what come from this path and define the community)

```
        neighbor 64.57.28.246 { /* Salt-Lake */
2           interface xe-0/2/0.1517 {
                psn-tunnel-endpoint 64.57.28.24; /* Salt-Lake */
4               virtual-circuit-id 10201517;
                description oscars_ion_internet2_edu-11936;
6               community oscars_ion_internet2_edu-11936;
                mtu 9174;
8           }
```

Ingress, Egress, Transit

Different type of points:

- Ingress point: router which encapsulates the IP packet into an MPLS packet.
- Egress point: router which decapsulates the IP packet from the MPLS packet.
- Transit router: router which simply passes the MPLS packet based on the MPLS label.

Router	Type	Name	Source	Destination	State	Lbl In	Lbl Out
chic	oscars_ion_internet2_edu-11936	Ingress	64.57.28.241	64.57.28.24	Up		
chic	oscars_ion_internet2_edu-11936	Egress	64.57.28.246	64.57.28.121	Up	3	-
kans	oscars_ion_internet2_edu-11936	Transit	64.57.28.241	64.57.28.24	Up	303184	3
kans	oscars_ion_internet2_edu-11936	Transit	64.57.28.241	64.57.28.24	Up	303184	3
salt	oscars_ion_internet2_edu-11936	Ingress	64.57.28.246	64.57.28.121	Up		
salt	oscars_ion_internet2_edu-11936	Egress	64.57.28.241	64.57.28.24	Up	3	-

Paths and performances provided by Internet2 routers

First approach

First, we tried to ping addresses from loopback on each routers. Then we made the same test with some very common websites :

```
ping count 3 google.com
PING6(56=40+8+8 bytes) 2001:468:1::1 --> 2607:f8b0:4009:800::1004
ping: sendmsg: No route to host
ping6: wrote google.com 16 chars, ret=-1
```

While some less common websites :

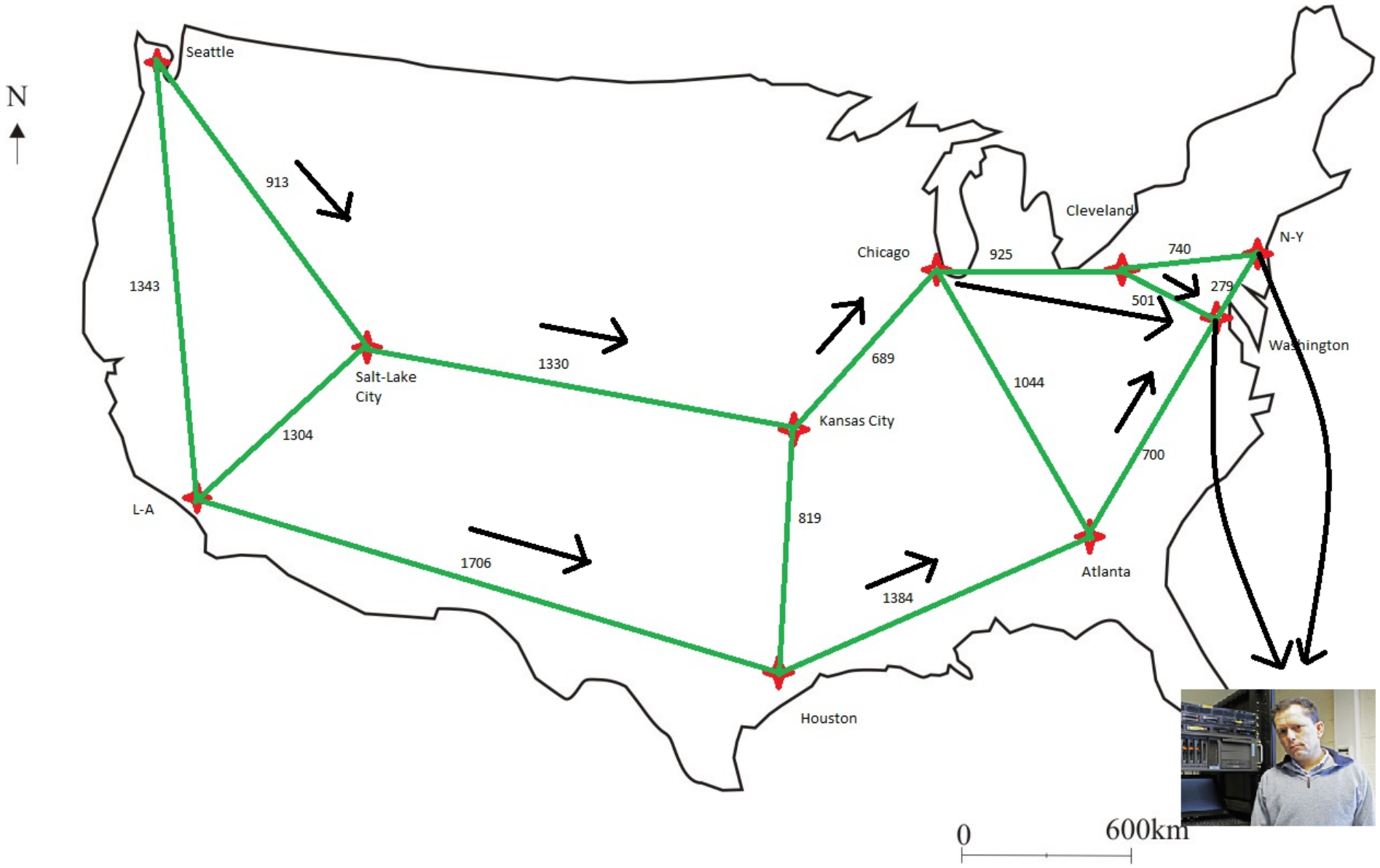
```
ping count 3 uclouvain.be
PING uclouvain.be (130.104.5.100): 56 data bytes
64 bytes from 130.104.5.100: icmp_seq=0 ttl=58 time=136.473 ms
```

Analysing that results

- Different user groups
  - Researchers
  - Networkers
  - Real-time video users

- Commercial peering services
  - Google - Internal Gateway
  - Amazon - aws
  - Akamai - Computation
  - World Bank

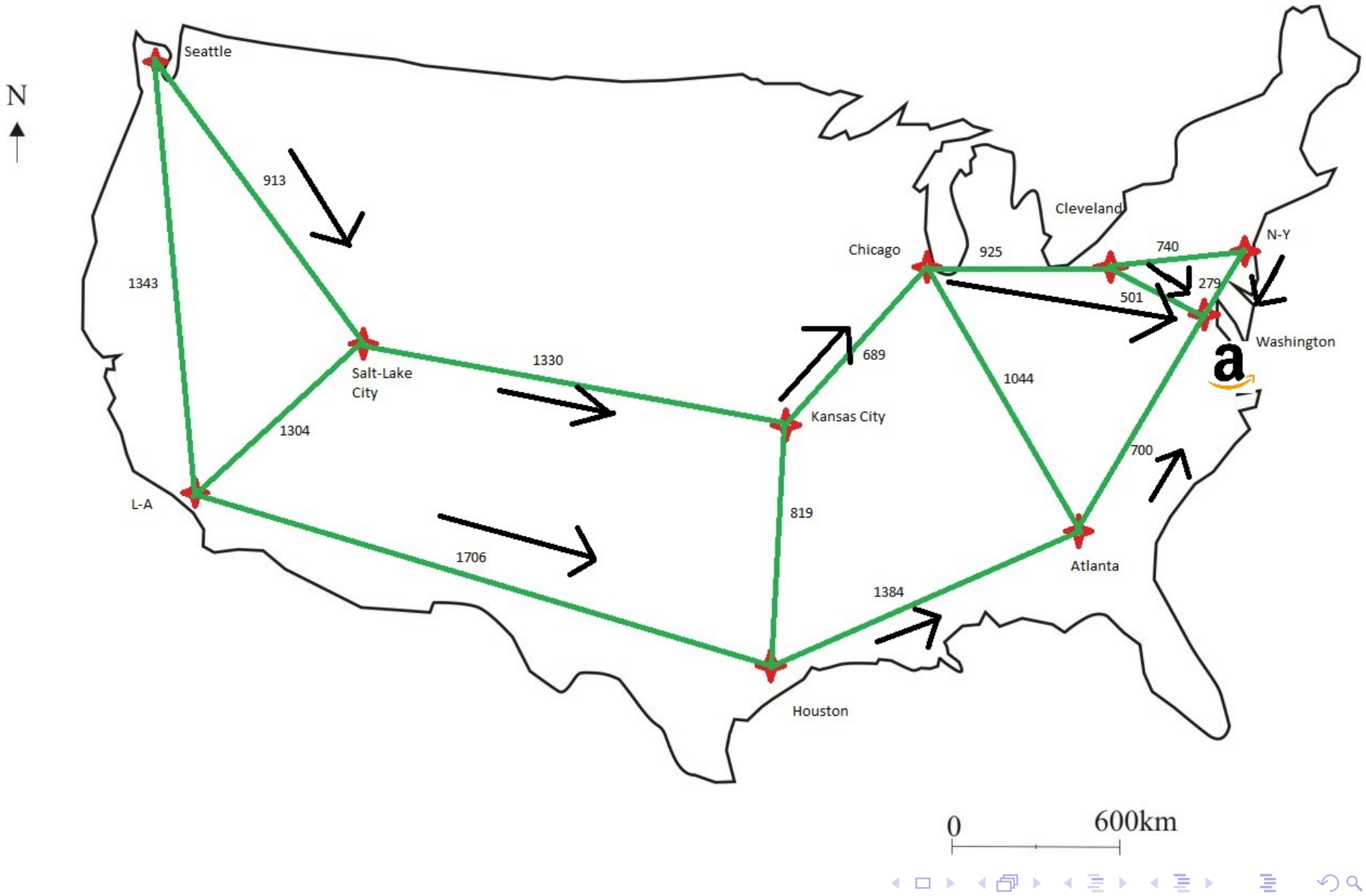
Inside UCL network



Inside UCL network

```
traceroute 130.104.157.210
traceroute to 130.104.157.210 (130.104.157.210), 30 hops max, 40 byte packets
 1  et-9-0-0.115.rtr.wash.net.internet2.edu (198.71.45.57)  17.700 ms  17.693 ms  17.730 ms
 2  abilene-wash.mx1.fra.de.geant.net (62.40.125.17)  111.595 ms  127.825 ms  125.481 ms
 3  ae1.mx1.ams.nl.geant.net (62.40.98.129)  122.229 ms  108.457 ms  121.801 ms
 4  xe-0-0-0.mx1.bru.be.geant.net (62.40.98.138)  125.072 ms  111.178 ms  110.951 ms
 5  belnet-gw.mx2.bru.be.geant.net (62.40.124.162)  111.168 ms  111.307 ms  111.236 ms
 6  ucl.cr2.brueve.belnet.net (193.191.3.86)  127.750 ms  126.487 ms  126.259 ms
 7  CtMichotte.sri.ucl.ac.be (130.104.254.219)  127.078 ms  127.456 ms  140.337 ms
 8  wifi-student1-3537.sri.ucl.ac.be (130.104.157.210)  156.267 ms  115.883 ms  162.040 ms
```

Amazon AWS


N
Seattle
913
1343
Salt-Lake City
1330
1304
L-A
1706
Kansas City
689
819
Houston
1384
Chicago
925
Cleveland
740
279
501
N-Y
Washington
1044
700
Atlanta
0
600km

Amazon AWS

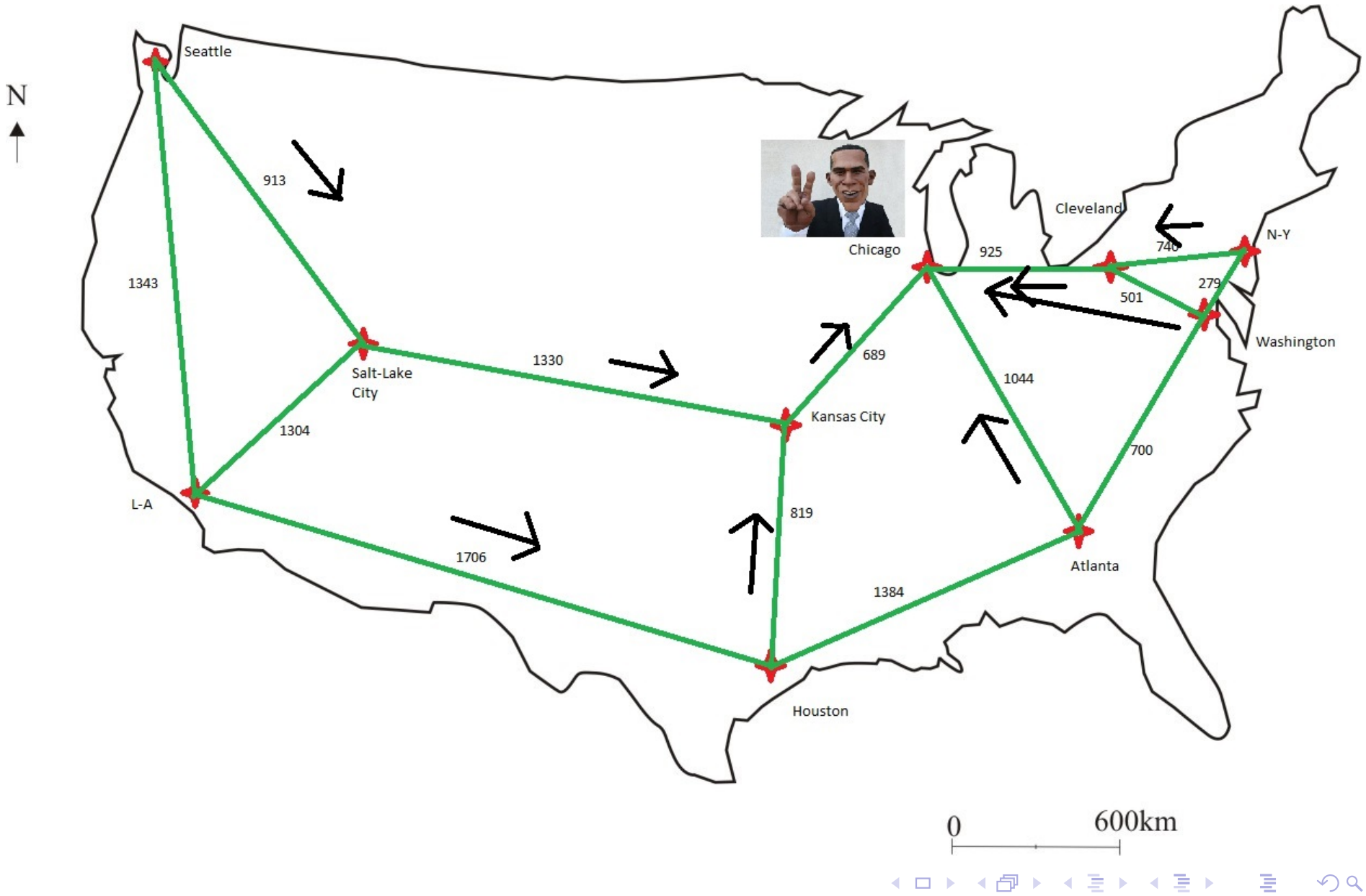
Classic from Chicago:

```
traceroute aws.amazon.com
traceroute to aws.amazon.com (176.32.98.131), 30 hops max, 40 byte packets
 1  et-9-0-0.115.rtr.wash.net.internet2.edu (198.71.45.57)  19.675 ms  17.736 ms  17.603 ms
 2  198.71.46.11 (198.71.46.11)  21.036 ms 198.71.46.9 (198.71.46.9)  18.396 ms
    64.57.30.39 (64.57.30.39)  18.405 ms
 3  72.21.220.69 (72.21.220.69)  19.322 ms 72.21.220.37 (72.21.220.37)  18.925 ms
    72.21.220.69 (72.21.220.69)  18.918 ms
    MPLS Label=403248 CoS=0 TTL=1 S=1
 4  72.21.222.35 (72.21.222.35)  19.096 ms 205.251.245.65 (205.251.245.65)  20.204 ms
    72.21.222.35 (72.21.222.35)  19.409 ms
 5  * *
```

Exception on Washington:

```
traceroute aws.amazon.com
traceroute to aws.amazon.com (205.251.235.191), 30 hops max, 40 byte packets
 1  et-9-0-0.115.rtr.chic.net.internet2.edu (198.71.45.56)  18.321 ms  18.009 ms  39.502 ms
 2  et-10-0-0.106.rtr.kans.net.internet2.edu (198.71.45.15)  29.166 ms  28.953 ms
    29.020 ms
 3  et-4-0-0.110.rtr.salt.net.internet2.edu (198.71.45.19)  49.033 ms  49.487 ms  49.405 ms
 4  et-5-0-0.113.rtr.seat.net.internet2.edu (198.71.45.25)  65.531 ms  65.381 ms  65.305 ms
 5  64.57.30.43 (64.57.30.43)  66.099 ms 64.57.30.45 (64.57.30.45)  65.246 ms
    64.57.30.43 (64.57.30.43)  82.882 ms
 6  205.251.225.180 (205.251.225.180)  104.429 ms  72.816 ms 205.251.225.178
    (205.251.225.178)  74.085 ms
    MPLS Label=300048 CoS=0 TTL=1 S=1
 7  205.251.232.88 (205.251.232.88)  79.369 ms 205.251.232.90 (205.251.232.90)  73.297 ms  73.015 ms
    MPLS Label=304448 CoS=0 TTL=1 S=1
 8  205.251.232.163 (205.251.232.163)  73.525 ms 205.251.232.145 (205.251.232.145)
    72.985 ms 205.251.232.157 (205.251.232.157)  73.540 ms
    MPLS Label=693420 CoS=0 TTL=1 S=1
 9  205.251.230.125 (205.251.230.125)  72.696 ms  73.031 ms  73.813 ms
10  * *
```

Akamai - White House

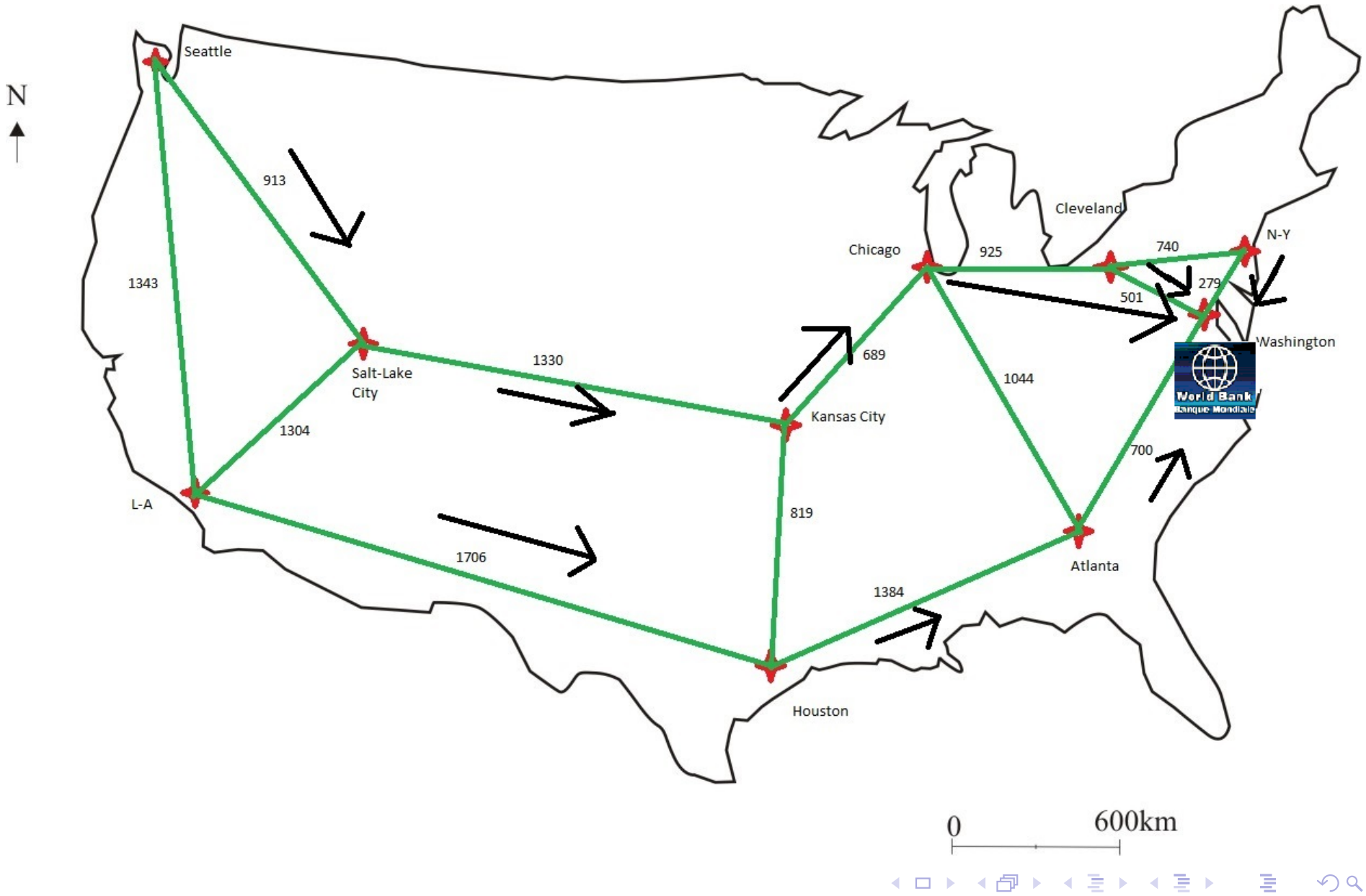


Akamai - White House

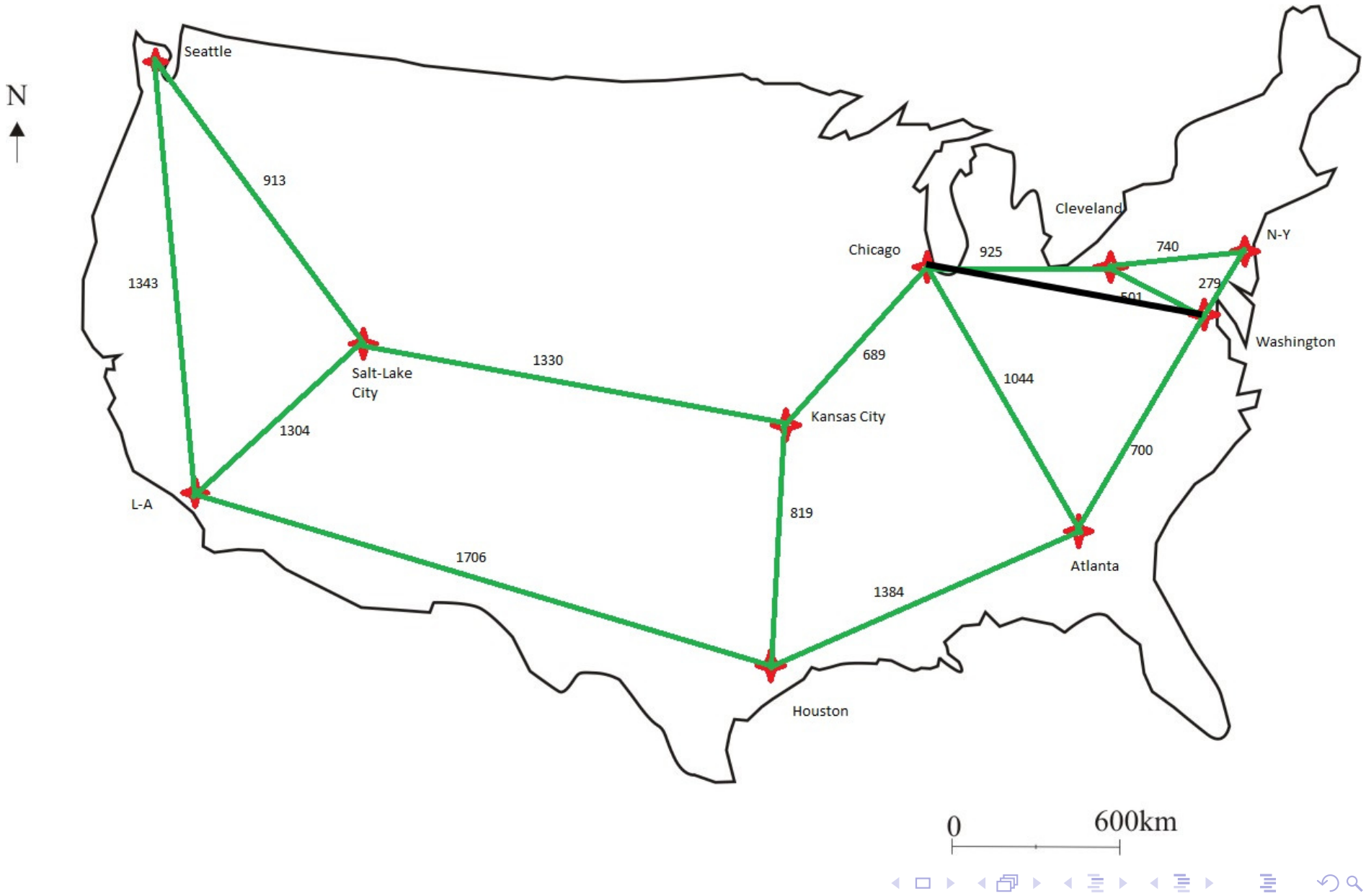
```
traceroute www.whitehouse.gov
traceroute6: Warning: a1128.dsch.akamai.net has multiple addresses; using 2001:18e8:2:10
     e::c631:b109
traceroute6 to a1128.dsch.akamai.net (2001:18e8:2:10e::c631:b109) from
     2001:468:2:204::2, 64 hops max, 12 byte packets
 1  et-9-0-0.115.rtr.chic.net.internet2.edu (2001:468:2:204::1)  17.754 ms  17.925 ms
     17.728 ms
 2  ae-1.2063.rtr.ictc.indiana.gigapop.net (2001:18e8:ff00::1)  22.693 ms  22.809 ms
     22.356 ms
 3  ae-10.9.br2.ictc.net.uits.iu.edu (2001:18e8:ff00:2::2)  22.677 ms  22.529 ms  23.163
     ms
 4  ae-0.0.br2.bldc.net.uits.iu.edu (2001:18e8:3:f002::2)  23.478 ms  23.128 ms  23.233
     ms
 5  ae-10.0.dcr3.bldc.net.uits.iu.edu (2001:18e8:3:f019::2)  23.422 ms  23.692 ms
     23.611 ms
 6  2001:18e8:2:10e::c631:b109 (2001:18e8:2:10e::c631:b109)  23.086 ms  23.859 ms
     23.599 ms
```

- www.whitehouse.gov : 2001:18e8:2:10e::c631:b108 (accessible)
- www.nsa.gov : 2600:1407:f:193::19ff (not accessible but found with DNS)

World Bank


N
Seattle
913
1343
Salt-Lake City
1330
1304
L-A
1706
Chicago
925
689
Kansas City
819
Houston
1384
Cleveland
740
279
501
N-Y
Washington
1044
700
Atlanta
World Bank
Banque Mondiale
0
600km

Ghost Link


N
Seattle
913
1343
Salt-Lake City
1330
1304
L-A
1706
Kansas City
689
819
Houston
Chicago
925
Cleveland
740
N-Y
279
501
Washington
1044
700
Atlanta
1384
0
600km

Conclusion

- This project was a little fuzzy at first with these huge configuration file, but step by step it was more and more clear and finally, we finish with a good idea of the (basical) operation of this network.
- We have shown that the real network doesn't show exactly the same things than the configuration (or the map provided by the website), but it is just for few exceptions.