Session Title: SD-WAN is Dead, Long Live SD-WAN!

Session Description: Since the emergence of SD-WAN in 2014, the WAN ecosystem has undergone a major transformation. Traditionally, businesses relied on carrier-managed private WAN solutions, but today, most have transitioned or are in the process of transitioning to SD-WAN leveraging Internet-based connectivity. Improvements such as service availability, bandwidth capacity, and link quality combined with lower costs and the need for more flexible connectivity options as applications migrate from on-premises to the cloud made this a relatively obvious business choice. However, for many businesses, the transition has not been as seamless as expected.

In regions like the United States, Canada, and Europe, Internet-based WAN connectivity performs comparably to legacy private circuits, making it a viable replacement. Yet, in other parts of the world, inefficient routing presents significant challenges. For example, traffic between South American nations often routes through Florida or Houston, and traffic between African and Middle Eastern nations frequently routes through Frankfurt or London.

Even in 2025, some networks—particularly “eyeball networks”—remain poorly peered in certain regions, making Internet-based WAN transport suboptimal and often unfit for purpose. Conversely, other networks—”content networks”—are exceptionally well-peered in these regions. The key to overcoming the challenge of Internet-based WAN transport lies in leveraging these well-peered content networks to provide transit, creating regional network bridges, and optimize WAN routing. SD-WAN, with its intelligent traffic steering and dynamic path selection, is the solution to unlocking the full potential of Internet-based WAN transport.”

SD-WAN is dead, long live SD-WAN!

Dane Jackson

Director, Global Professional Services

CATO NETWORKS

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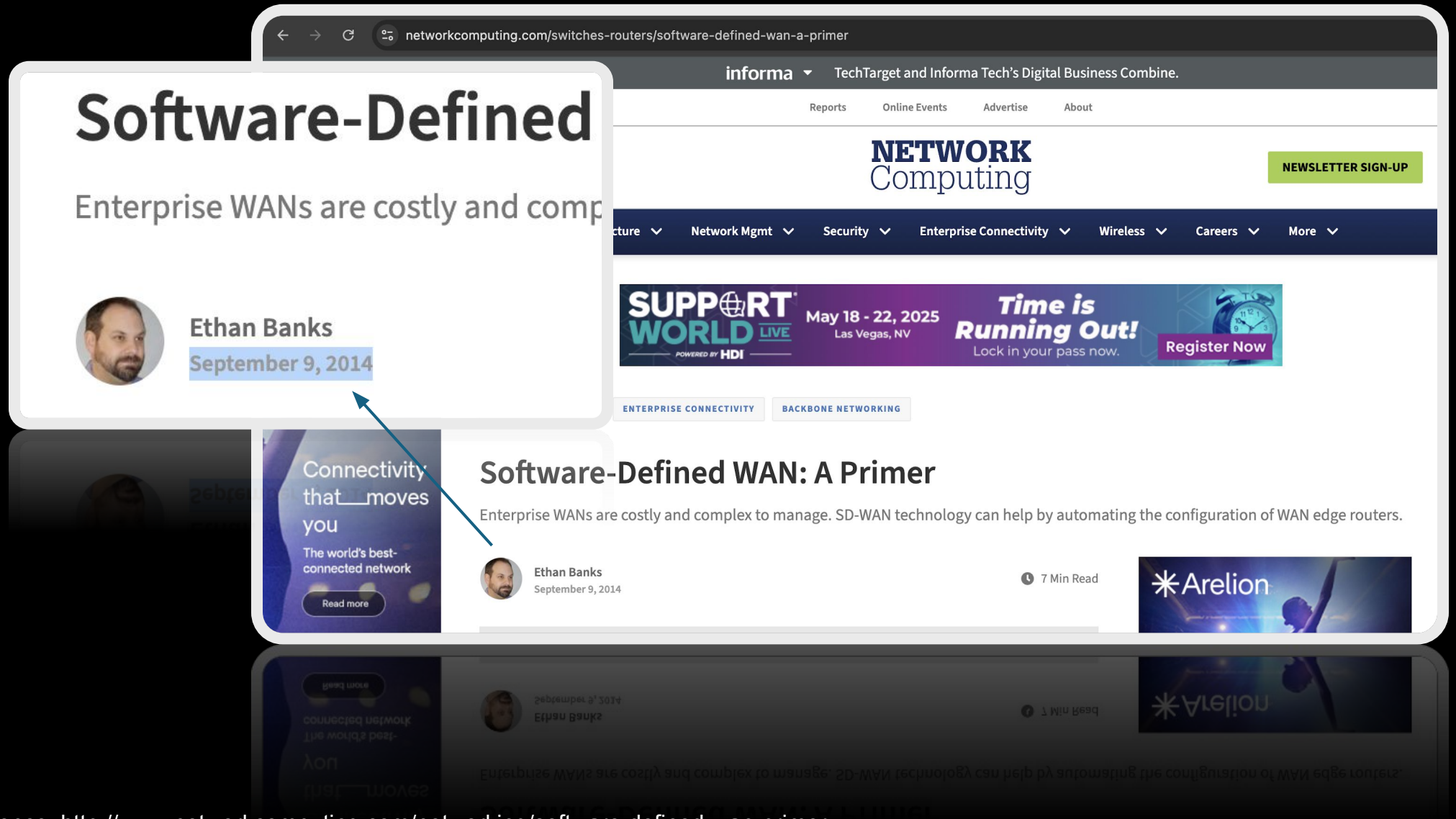
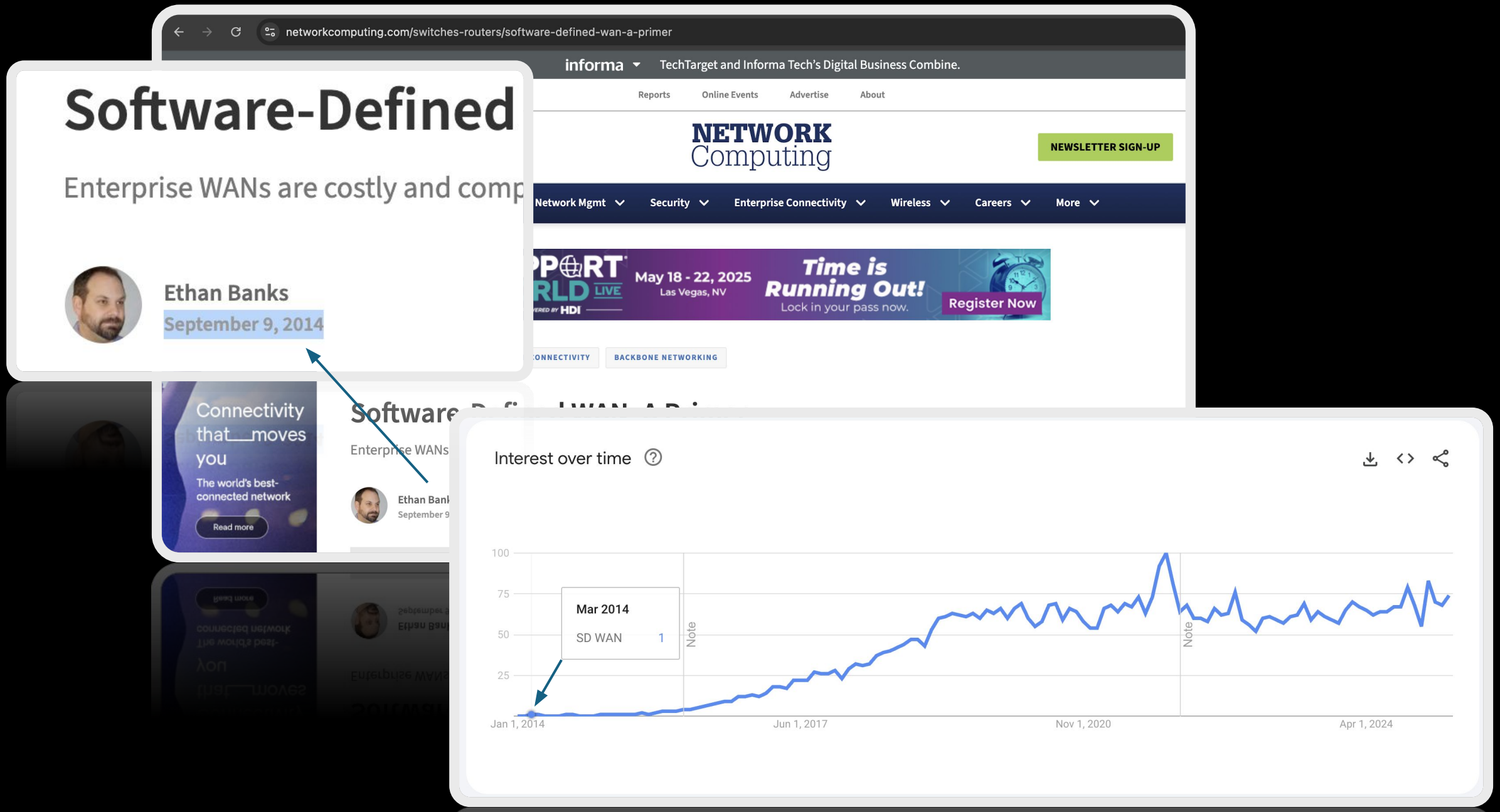
LinkedIn https://www.linkedin.com/in/dane-jackson-35ba9220

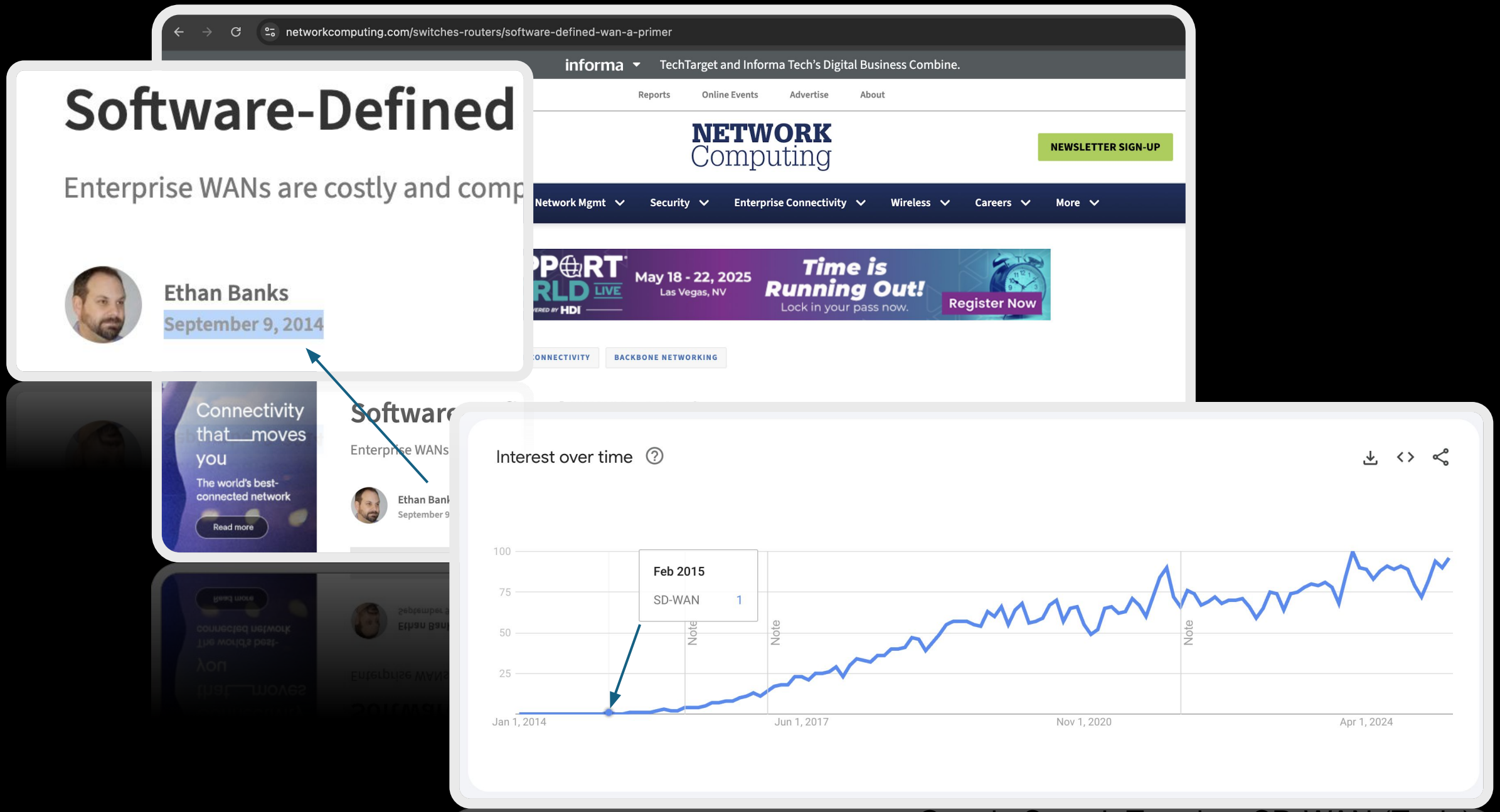
A quick history lesson on SD-WAN



Reference: http://www.networkcomputing.com/networking/software-defined-wan-primer



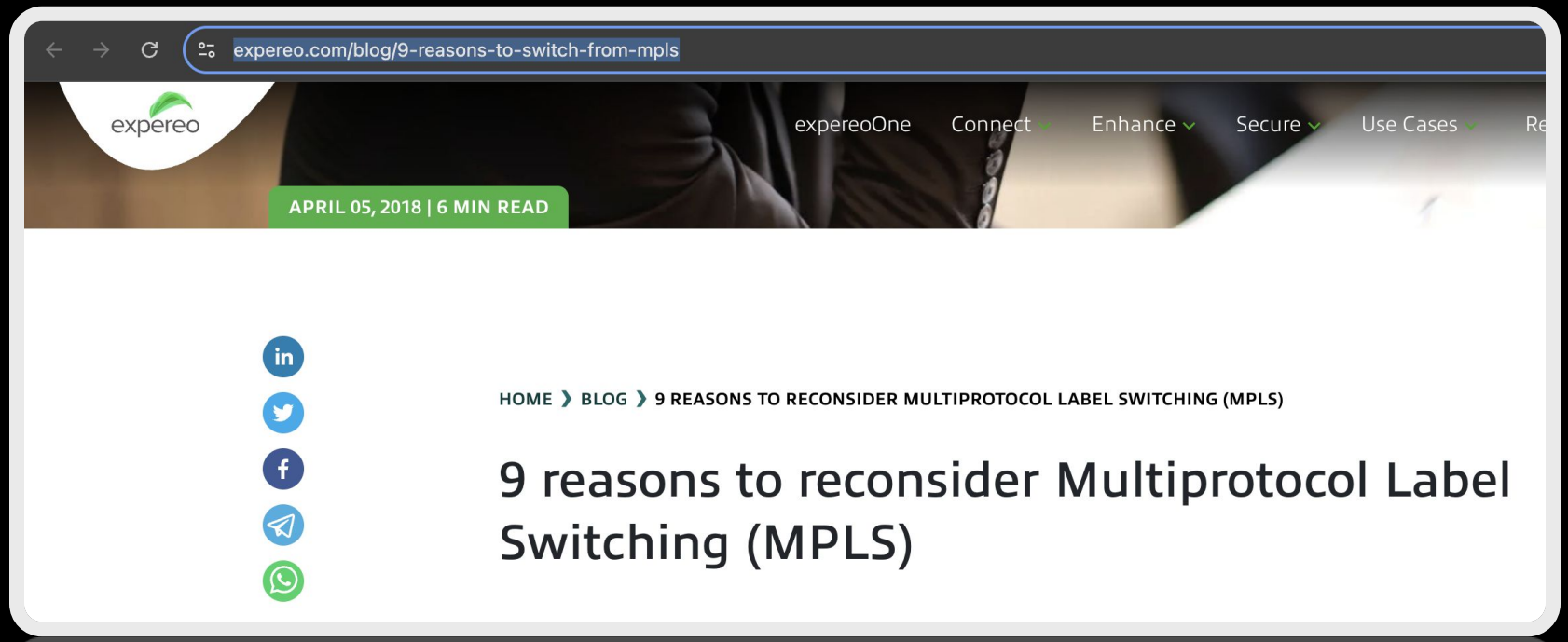
Reference: https://trends.google.com/trends/explore?date=2014-01-01%202025-04-26&q=SD%20WAN&hl=en



Google Search Trends – SD-WAN (Topic)

Reference: https://trends.google.com/trends/explore?date=2014-01-01%202025-04-26&q=%2Fg%2F11b_2r0r5g&hl=en

Ideally, an organization would be able to use broadband connectivity for most interoffice network traffic while putting only mission-critical or quality-sensitive traffic over private MPLS links. Though it's possible to configure routers to do this sort of hybrid WAN manually using technologies like Dynamic Multipoint VPN, Cisco Performance Routing (PfR), and real-time quality measurements, the resulting configuration is complex. Even with such a WAN implementation, it's unlikely that the initial deployment will be the final one. As application profiles change, WAN router configurations need to be changed to



#1. MPLS takes a long time to deploy
#2. MPLS can be expensive

#3. MPLS is ineffective for small or remote sites

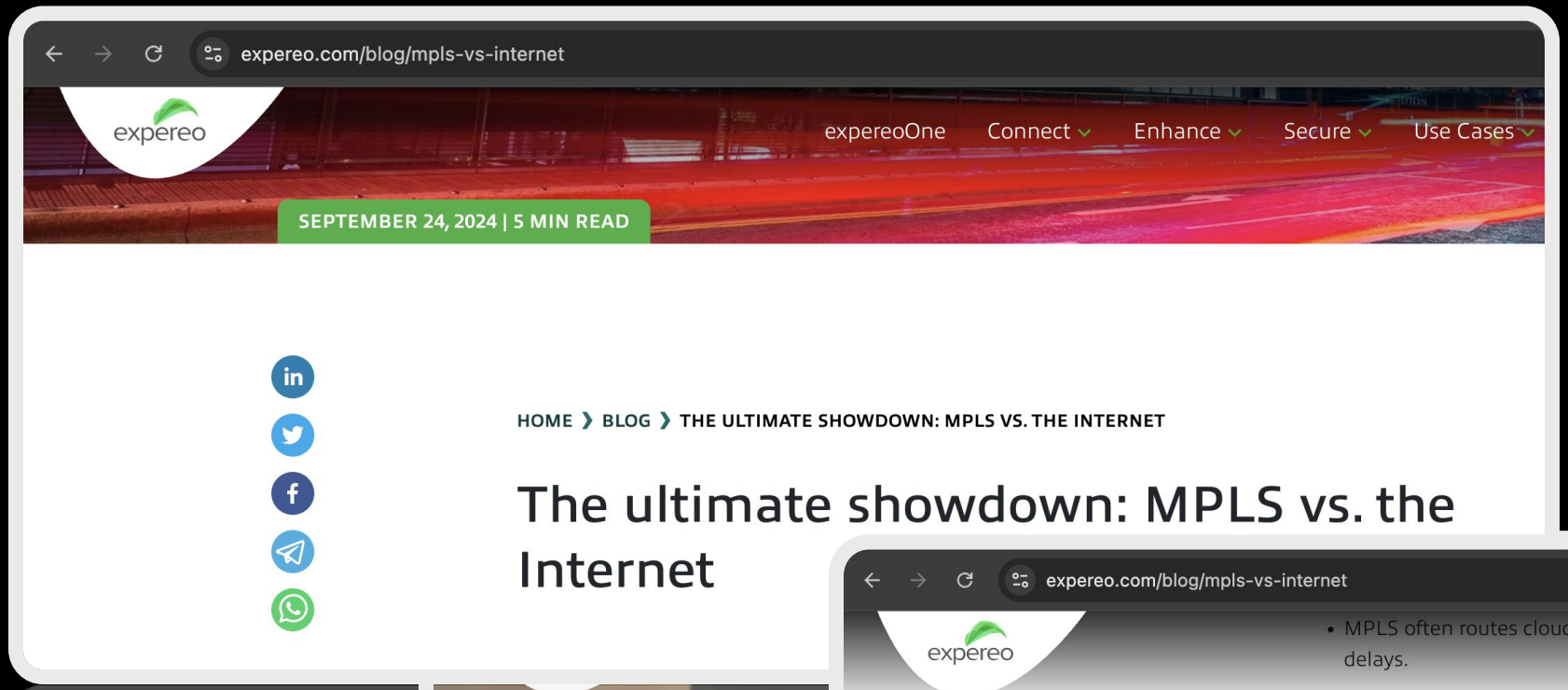
#4. MPLS does not allow Internet traffic to be routed locally

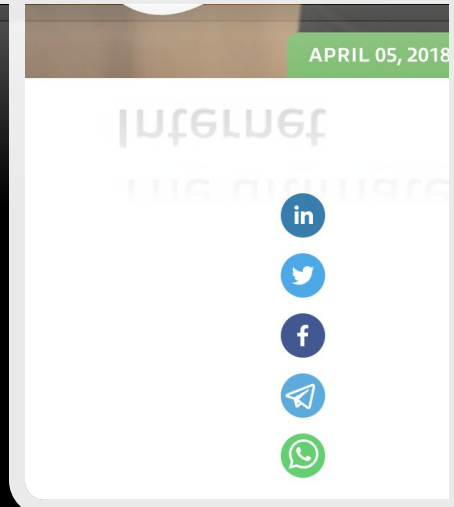
#5. You can see lower performance with MPLS

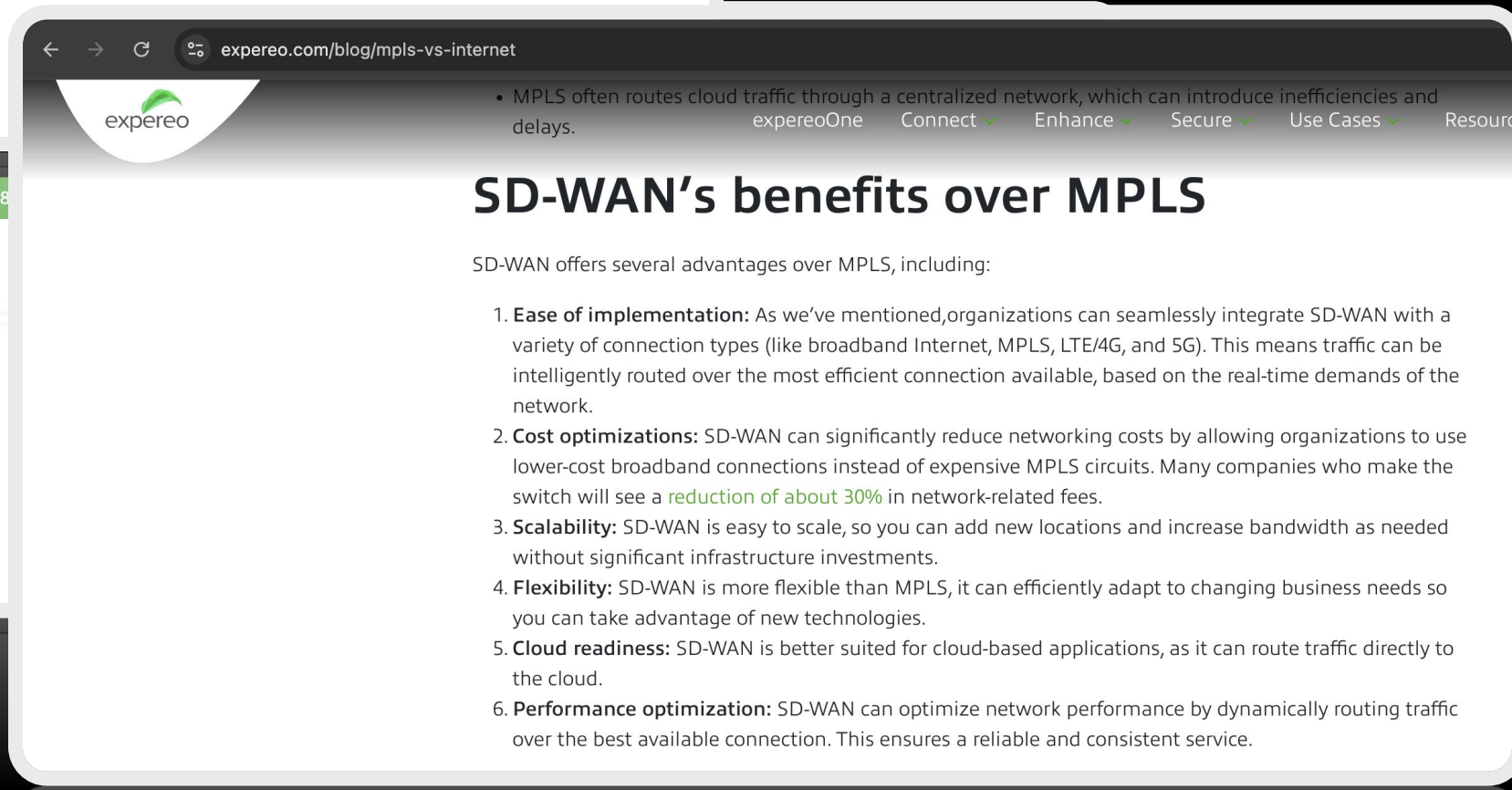
#6. There's limited uptime

#7. MPLS requires the same service provider across the network

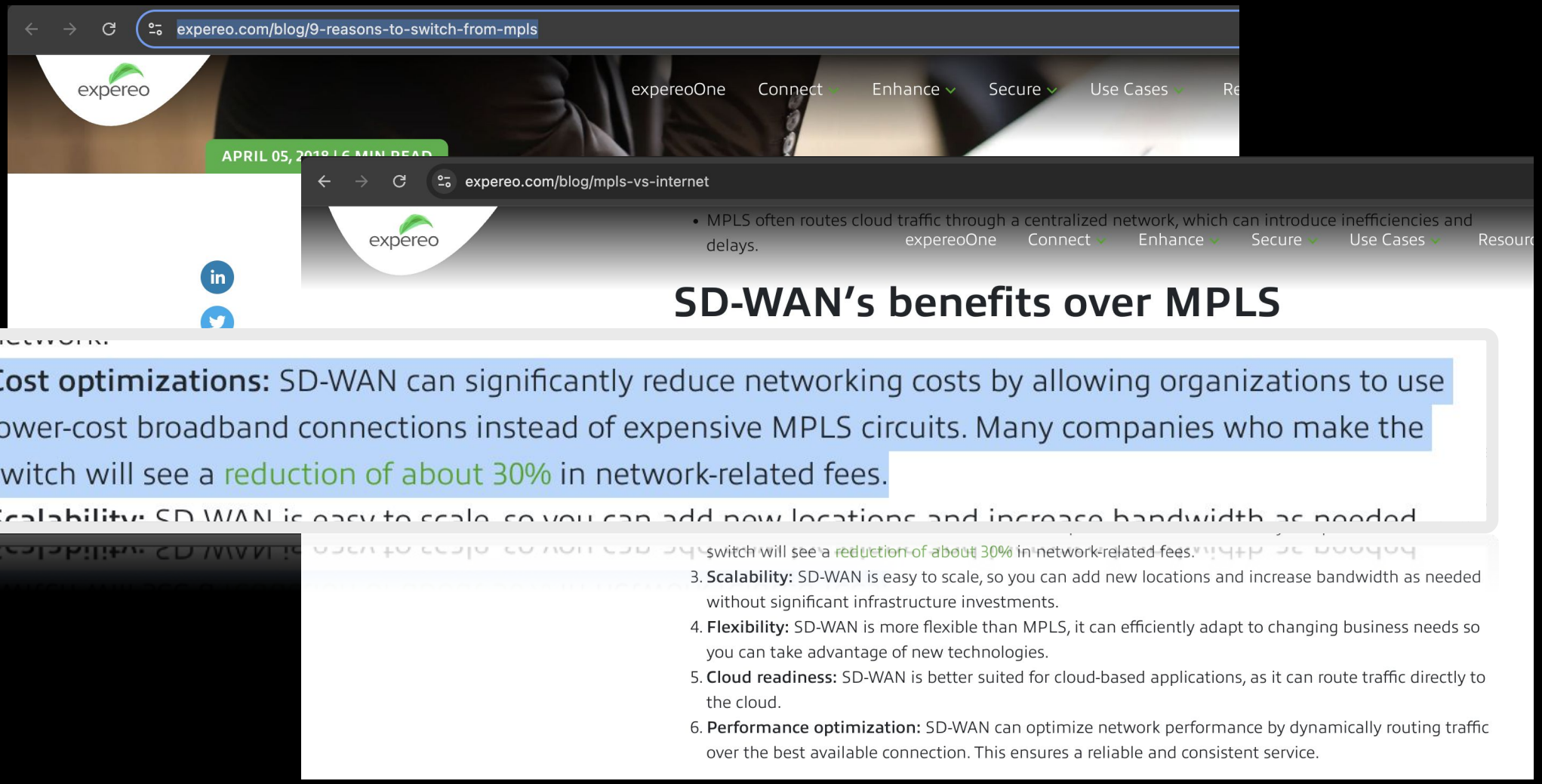
Reference: https://www.expereo.com/blog/9-reasons-to-switch-from-mpls



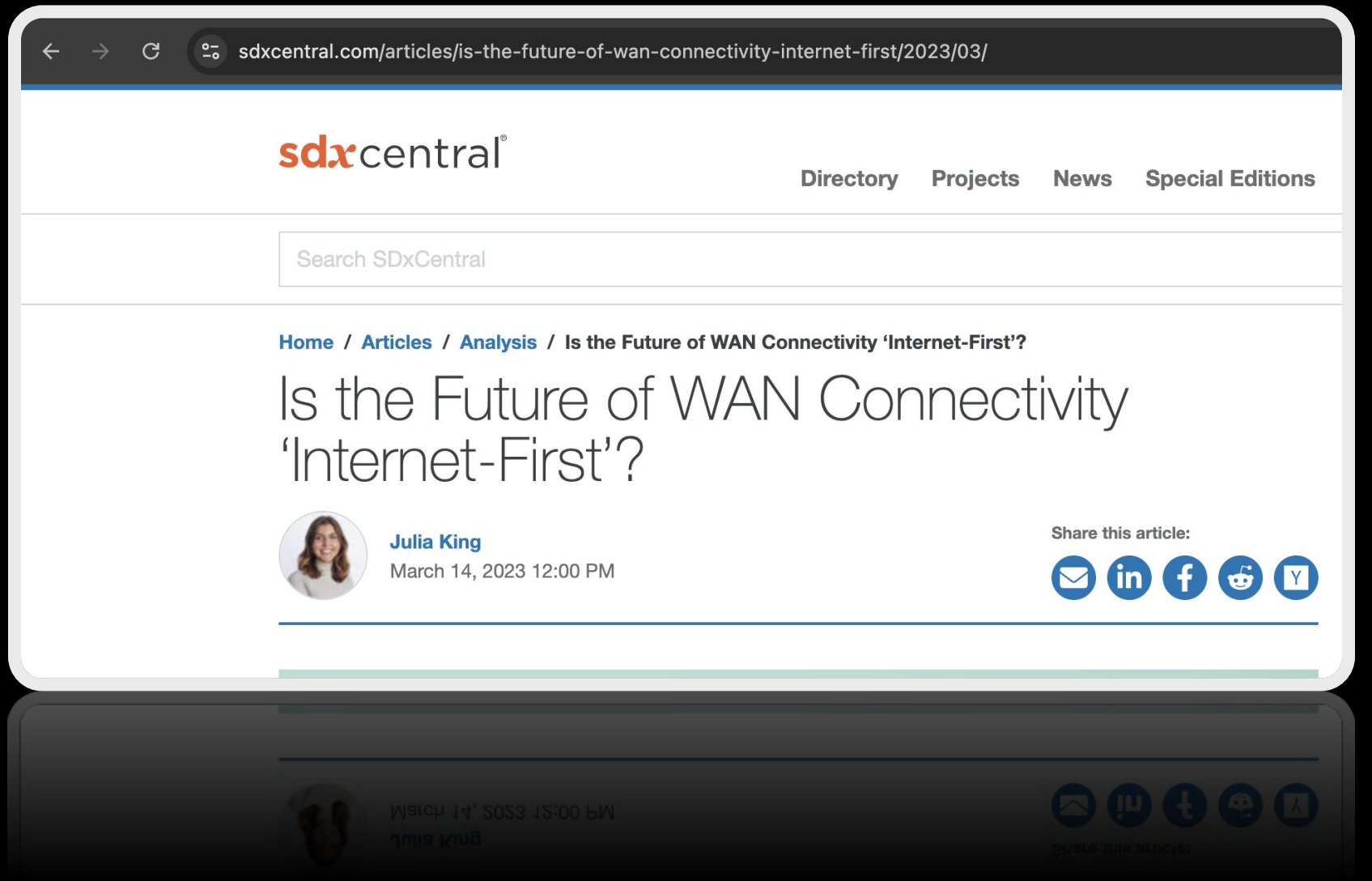




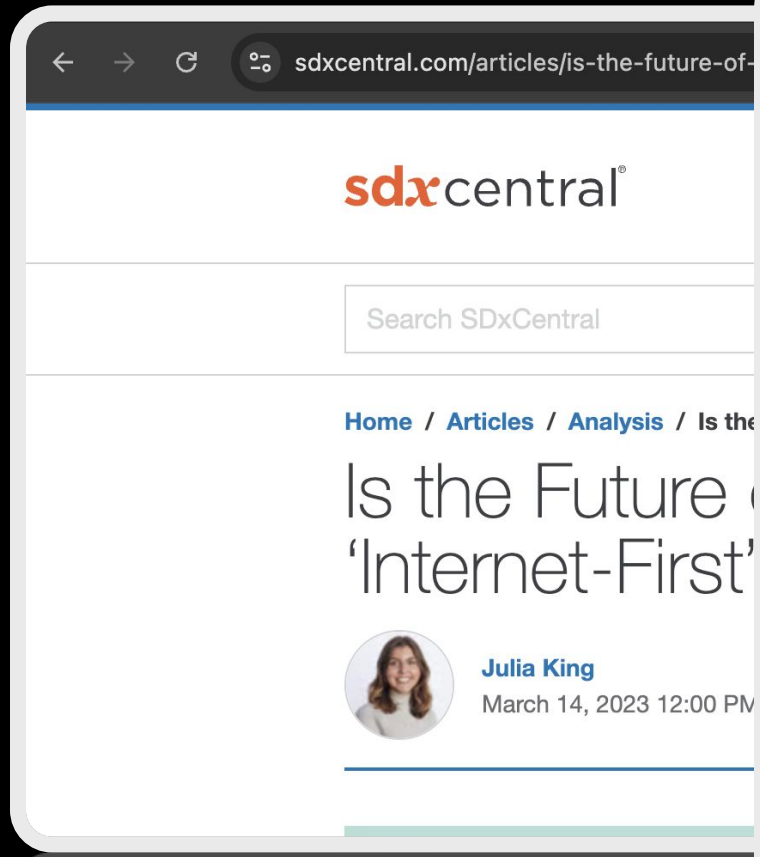
Reference: https://www.expereo.com/blog/mpls-vs-internet



Reference: https://www.expereo.com/blog/mpls-vs-internet



Reference: https://www.sdxcentral.com/articles/is-the-future-of-wan-connectivity-internet-first/2023/03/



sdxcentral.com/articles/is-the-future-of-wan-connectivity-internet-first/2023/03/

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Overcoming Internet Transport Challenges

Enterprises moving from private networks to an "internet-first SD-WAN solution" are finding performance suffering at specific endpoints. There has been a subsequent rise in interest and demand for Ethernet (L2) and wavelength services, both of which Gartner said are "integral to the hybrid solution," as they address site specific deployments to support bigger ports and bandwidth needs.

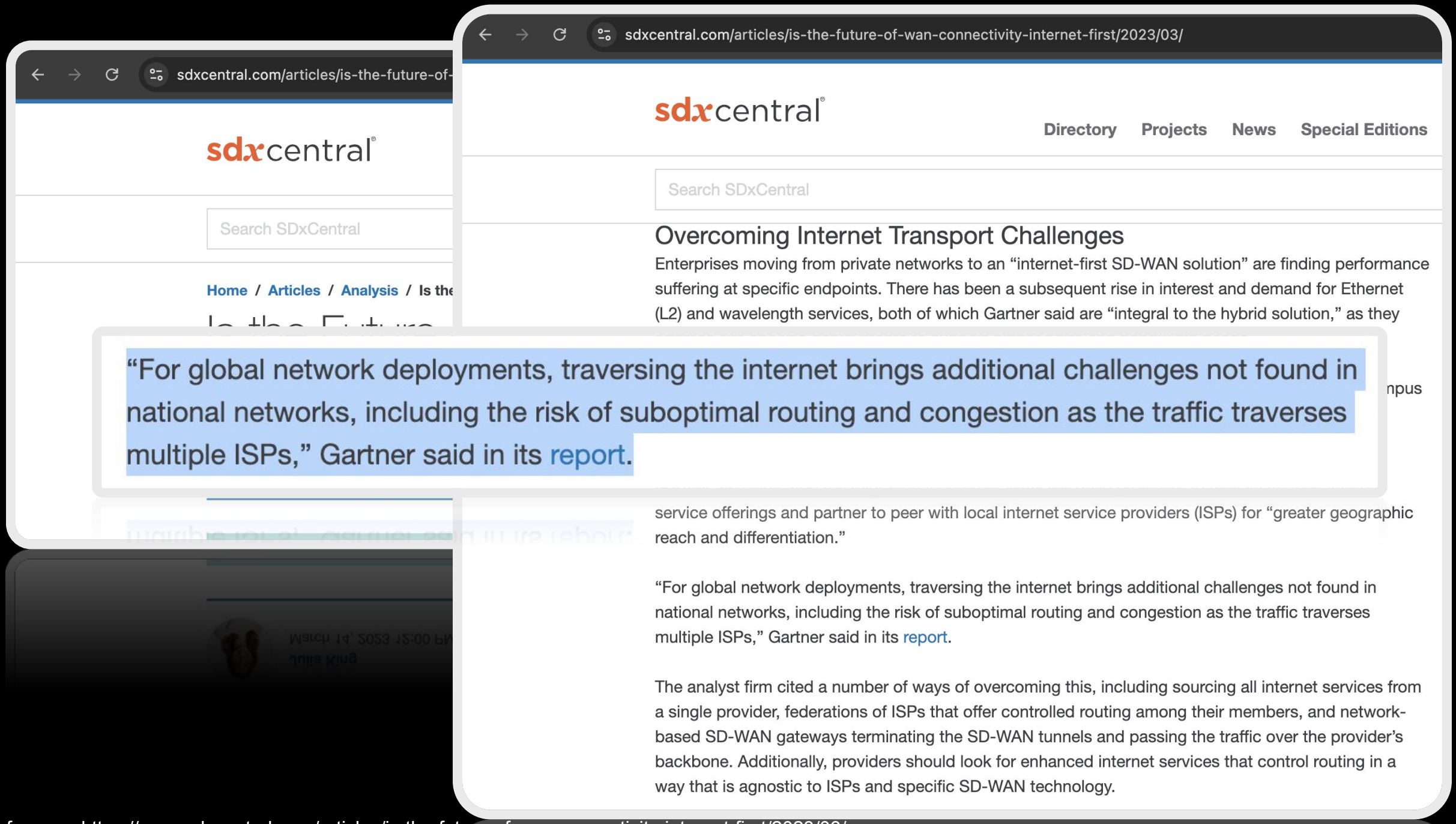
"Though these tend to be utilized more regionally or often used to support local data centers or campus environments, enterprises should not lose sight of these available services to improve performance outcomes and ensure high availability," Young explained.

Gartner also indicated the migration to internet WAN will drive providers to reevaluate their internet service offerings and partner to peer with local internet service providers (ISPs) for "greater geographic reach and differentiation."

"For global network deployments, traversing the internet brings additional challenges not found in national networks, including the risk of suboptimal routing and congestion as the traffic traverses multiple ISPs," Gartner said in its report.

The analyst firm cited a number of ways of overcoming this, including sourcing all internet services from a single provider, federations of ISPs that offer controlled routing among their members, and network-based SD-WAN gateways terminating the SD-WAN tunnels and passing the traffic over the provider's backbone. Additionally, providers should look for enhanced internet services that control routing in a way that is agnostic to ISPs and specific SD-WAN technology.

Reference: https://www.sdxcentral.com/articles/is-the-future-of-wan-connectivity-internet-first/2023/03/



Reference: https://www.sdxcentral.com/articles/is-the-future-of-wan-connectivity-internet-first/2023/03/

Gartner: changes in WAN requirements, SD-WAN/SASE assumptions and magic quadrant for network services

Posted on March 14, 2023 by Alan Weissberger

SD-WAN is dead...

Network Transport ("Underlay") Trends:

tly called "underlay" services) continue to see
ary connectivity. MPLS — the mainstay of enter
isplaced by internet (transport) services. And w
rformance, it commands a slight premium in pr
ink for the most critical locations and in places
g markets and those where the internet is hea
smaller number of higher-capacity MPLS lines
network designs.

Gartner has witnessed that many enterprises using a hybrid of internet and MP
lines than MPLS lines. Direct internet connectivity allows direct access to SaaS
wider variety of access types than MPLS, including dedicated internet access (D
and cellular. DIA lines are typically priced similarly to MPLS lines of comparable
from multiple providers, while MPLS links generally need to be sourced from a

For global network deployments, traversing the internet brings additional challenges not found in national networks, including the risk of suboptimal routing and congestion as the traffic traverses multiple ISPs. There are a number of ways of overcoming this, including:

- Sourcing all internet services from a single provider
- Federations of ISPs that offer controlled routing among their members
- Network-based SD-WAN gateways terminating the SD-WAN tunnels and passing the traffic over the provider's backbone
- Enhanced internet services that control routing in a way that is agnostic to ISPs and specific SD-WAN technology

Higher cost

Increased complexity

Reduced flexibility

Different providers have adopted different approaches from these options and
Providers who have developed a differentiated internet approach include BT, De

Reference: https://techblog.comsoc.org/2023/03/14/gartner-changes-in-wan-requirements-sd-wan-sase-assumptions-and-magic-quadra

Buenos Aires, AR to Bogota, CO

Source ISP	Destination ISP
AS16814 NSS S.A.	AS18678 INTERNEXA S.A. E.S.P

			Loss%	Snt	Last	Avg	Best	Wrst	StDev
1.	AS???	192.168.1.1	0.0%	5	0.3	0.5	0.3	0.7	0.0
2.	AS16814	201.216.197.254	0.0%	5	2.3	2.2	1.6	2.8	0.0
3.	AS???	10.246.1.42	0.0%	5	3.1	2.5	1.8	3.1	0.0
4.	AS???	10.246.1.146	0.0%	5	2.2	5.7	2.2	11.7	3.9
5.	AS10834	200.51.217.105	0.0%	5	2.7	2.6	2.2	3.2	0.0
6.	AS12956	213.140.39.119	0.0%	5	8.4	5.9	1.5	10.5	3.9
7.	AS12956	213.140.39.118	0.0%	5	2.3	2.4	2.3	2.5	0.0
8.	AS12956	176.52.248.79	0.0%	5	24.7	24.6	23.9	25.5	0.5
9.	AS12956	5.53.3.75	0.0%	5	119.3	119.5	119.3	120.0	0.0
10.	AS12956	213.140.43.206	40.0%	5	120.4	120.3	120.0	120.4	0.0
11.	AS12956	216.184.112.139	0.0%	5	124.6	124.8	124.5	125.3	0.0
12.	AS???	???	100.0	5	0.0	0.0	0.0	0.0	0.0
13.	AS???	???	100.0	5	0.0	0.0	0.0	0.0	0.0
14.	AS???	???	100.0	5	0.0	0.0	0.0	0.0	0.0
15.	AS18678	179.1.128.161	80.0%	5	181.1	181.1	181.1	181.1	0.0
16.	AS???	???	100.0	5	0.0	0.0	0.0	0.0	0.0

Buenos Aires, AR to Bogota, CO

Source ISP	Destination ISP
AS16814 NSS S.A.	AS18678 INTERNEXA S.A. E.S.P

			Loss%	Snt	Last	Avg	Best	Wrst	StDev
1.	AS???	192.168.1.1	0.0%	5	0.3	0.5	0.3	0.7	0.0
2.	AS16814	201.216.197.254	0.0%	5	2.3	2.2	1.6	2.8	0.0
3.	AS???	10.246.1.42	0.0%	5	3.1	2.5	1.8	3.1	0.0
4.	AS???	10.246.1.146	0.0%	5	2.2	5.7	2.2	11.7	3.9
5.	AS10834	200.51.217.105	0.0%	5	2.7	2.6	2.2	3.2	0.0
6.	AS12956	213.140.39.119	0.0%	5	8.4	5.9	1.5	10.5	3.9
7.	AS12956	213.140.39.118	0.0%	5	2.3	2.4	2.3	2.5	0.0
8.	AS12956	176.52.248.79	0.0%	5	24.7	24.6	23.9	25.5	0.5
9.	AS12956	5.53.3.75	0.0%	5	119.3	119.5	119.3	120.0	0.0
10.	AS12956	213.140.43.206	40.0%	5	120.4	120.3	120.0	120.4	0.0
11.	AS12956	216.184.112.139	0.0%	5	124.6	124.8	124.5	125.3	0.0
12.	AS???	???	100.0	5	0.0	0.0	0.0	0.0	0.0
13.	AS???	???	100.0	5	0.0	0.0	0.0	0.0	0.0
14.	AS???	???	100.0	5	0.0	0.0	0.0	0.0	0.0
15.	AS18678	179.1.128.161	80.0%	5	181.1	181.1	181.1	181.1	0.0
16.	AS???	???	100.0	5	0.0	0.0	0.0	0.0	0.0

Suboptimal routing via Florida

Source ISP	Destination ISP
AS16814 NSS S.A.	AS13489 UNE EPM TELECOMUNICACIONES S.A.

			Loss%	Snt	Last	Avg	Best	Wrst	StDev
1.	AS???	192.168.1.1	0.0%	5	0.5	0.5	0.4	0.7	0.0
2.	AS16814	201.216.197.254	0.0%	5	2.2	2.1	1.6	2.6	0.0
3.	AS???	10.246.1.42	0.0%	5	2.5	2.3	1.8	2.7	0.0
4.	AS???	10.246.1.146	0.0%	5	2.0	3.8	2.0	9.7	3.2
5.	AS10834	200.51.217.105	0.0%	5	5.4	3.6	2.2	5.4	1.2
6.	AS12956	213.140.39.119	0.0%	5	2.3	2.5	2.3	3.0	0.0
7.	AS12956	213.140.39.118	0.0%	5	2.4	3.6	2.4	7.5	2.1
8.	AS12956	176.52.248.79	0.0%	5	24.2	25.6	24.2	29.8	2.3
9.	AS12956	5.53.3.75	0.0%	5	119.6	119.7	119.4	120.0	0.0
10.	AS12956	213.140.43.206	20.0%	5	120.3	120.5	120.3	120.6	0.0
11.	AS???	???	100.0	5	0.0	0.0	0.0	0.0	0.0
12.	AS13489	200.24.33.232	0.0%	5	155.4	155.8	155.4	156.4	0.0
13.	AS13489	200.24.33.235	0.0%	5	158.1	157.4	157.1	158.1	0.0
14.	AS13489	200.24.35.182	0.0%	5	174.5	175.4	174.5	177.0	0.7
15.	AS???	???	100.0	5	0.0	0.0	0.0	0.0	0.0
16.	AS13489	190.71.133.201	0.0%	5	174.0	174.9	173.2	179.4	2.5
17.	AS???	???	100.0	5	0.0	0.0	0.0	0.0	0.0

Buenos Aires, AR to Bogota, CO

Source ISP	Destinat
AS16814 NSS S.A.	AS18

```
                                 Loss%
 1. AS???    192.168.1.1          0.0%
 2. AS16814 201.216.197.254       0.0%
 3. AS???    10.246.1.42          0.0%
 4. AS???    10.246.1.146         0.0%
 5. AS10834 200.51.217.105        0.0%
 6. AS12956 213.140.39.119        0.0%
 7. AS12956 213.140.39.118        0.0%
 8. AS12956 176.52.248.79         0.0%
 9. AS12956 5.53.3.75             0.0%
10. AS12956 213.140.43.206       40.0%
11. AS12956 216.184.112.139       0.0%
12. AS???   ???                 100.0
13. AS???   ???                 100.0
14. AS???   ???                 100.0
15. AS18678 179.1.128.161        80.0%
16. AS???   ???                 100.0
```

iplocation.net/ip-lookup

Geolocation data from IP2Location — Product: DB6, 2025-3-1

- IP ADDRESS: 216.184.112.139
- COUNTRY: United States
- REGION: Florida
- CITY: Jacksonville
- ISP: Telxius Cable USA Inc.
- ORGANIZATION: Not available
- LATITUDE: 30.3321
- LONGITUDE: -81.6557

Incorrect location? Contact IP2Location view map

Geolocation data from ipinfo.io — Product: API, real-time

- IP ADDRESS: 216.184.112.139
- COUNTRY: United States
- REGION: Florida
- CITY: Miami
- ISP: Not available
- ORGANIZATION: AS12956 TELEFONICA GLOBAL SOLUTIONS SL
- LATITUDE: 25.7743
- LONGITUDE: -80.1937

Incorrect location? Contact ipinfo.io view map

Geolocation data from DB-IP — Product: API, real-time

- IP ADDRESS: 216.184.112.139
- COUNTRY: United States
- REGION: Florida
- ISP: Telefonica Global Solutions SL
- ORGANIZATION: TelXius Cable USA, Inc.
- LATITUDE: 25.7964

14.	AS13489	200.24.35.182	0.0%
15.	AS???	???	100.0
16.	AS13489	190.71.133.201	0.0%
17.	AS???	???	100.0

M TELECOMUNICACIONES S.A.

```
ast   Avg  Best  Wrst StDev
  0.5   0.5   0.4   0.7   0.0
  2.2   2.1   1.6   2.6   0.0
  2.5   2.3   1.8   2.7   0.0
  2.0   3.8   2.0   9.7   3.2
  5.4   3.6   2.2   5.4   1.2
  2.3   2.5   2.3   3.0   0.0
  2.4   3.6   2.4   7.5   2.1
 24.2  25.6  24.2  29.8   2.3
119.6 119.7 119.4 120.0   0.0
120.3 120.5 120.3 120.6   0.0
  0.0   0.0   0.0   0.0   0.0
155.4 155.8 155.4 156.4   0.0
158.1 157.4 157.1 158.1   0.0
174.5 175.4 174.5 177.0   0.7
  0.0   0.0   0.0   0.0   0.0
174.0 174.9 173.2 179.4   2.5
  0.0   0.0   0.0   0.0   0.0
```

Buenos Aires, AR to Bogota, CO

Source ISP	Destination ISP
AS16814 NSS S.A.	AS52468 Ufinet Colombia S. A.

```
Start: Tue Apr 29 18:44:28 2025
HOST: socket                      Loss%   Snt   Last   Avg  Best  Wrst StDev
  1. AS???   192.168.1.1           0.0%     5    0.5   0.6   0.4   0.8   0.0
  2. AS16814 201.216.197.254       0.0%     5    1.3   1.8   1.3   2.1   0.0
  3. AS???   10.246.1.42           0.0%     5  110.4  78.5   2.5 110.4  43.3
  4. AS???   10.246.1.146          0.0%     5    5.7   5.1   1.9   9.3   3.0
  5. AS10834 200.51.217.105        0.0%     5   13.6   6.3   2.1  13.6   4.4
  6. AS12956 213.140.39.119        0.0%     5    2.3   2.4   1.7   3.4   0.5
  7. AS12956 213.140.39.118        0.0%     5    2.3   2.5   1.9   2.9   0.0
  8. AS???   ???                  100.0     5    0.0   0.0   0.0   0.0   0.0
  9. AS12956 94.142.107.121        0.0%     5    2.3   2.7   2.3   3.5   0.0
 10. AS3549  200.189.207.162       0.0%     5   96.6  94.6  93.5  96.6   1.2
 11. AS???   ???                  100.0     5    0.0   0.0   0.0   0.0   0.0
 12. AS3549  200.49.4.198         40.0%     5   99.0  99.4  99.0  99.6   0.0
 13. AS3549  204.199.115.178       0.0%     5  143.8 146.2 138.8 154.9   5.8
 14. AS52468 181.78.24.145         0.0%     5  138.5 139.6 137.7 141.7   1.5
 15. AS???   ???                  100.0     5    0.0   0.0   0.0   0.0   0.0
```

```
; <<>> DiG 9.10.6 <<>> -x 200.189.207.162
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 65301
;; flags: qr rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 0, ADDITIONAL: 1


;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 1232
;; QUESTION SECTION:
;162.207.189.200.in-addr.arpa. IN PTR


;; ANSWER SECTION:
162.207.189.200.in-addr.arpa. 86253 IN PTR ae5.3501.ebr1.bgo2.cirionteчnologies.net.
```

Suboptimal routing via Brazil

Buenos Aires, AR to Bogota, CO

Source ISP	Destination IS
AS16814 NSS S.A.	AS52468 Ufine

```
Start: Tue Apr 29 18:44:28 2025
HOST: socket                        Loss%   Snt   L
  1. AS???   192.168.1.1             0.0%     5
  2. AS16814 201.216.197.254         0.0%     5
  3. AS???   10.246.1.42             0.0%     5  11
  4. AS???   10.246.1.146            0.0%     5
  5. AS10834 200.51.217.105          0.0%     5   1
  6. AS12956 213.140.39.119          0.0%     5
  7. AS12956 213.140.39.118          0.0%     5
  8. AS???   ???                    100.0     5
  9. AS12956 94.142.107.121          0.0%     5
 10. AS3549  200.189.207.162         0.0%     5   9
 11. AS???   ???                    100.0     5
 12. AS3549  200.49.4.198           40.0%     5   9
 13. AS3549  204.199.115.178         0.0%     5  14
 14. AS52468 181.78.24.145           0.0%     5  13
 15. AS???   ???                    100.0     5   0
```

iplocation.net/ip-lookup

Geolocation data from IP2Location — Product: DB6, 2025-3-1

- IP ADDRESS: 200.189.207.162
- ISP: Cirion Technologies do Brasil Ltda.
- COUNTRY: Brazil
- ORGANIZATION: Not available
- REGION: Sao Paulo
- LATITUDE: -23.5471
- CITY: Sao Paulo
- LONGITUDE: -46.6372

Incorrect location? Contact IP2Location view map

Geolocation data from ipinfo.io — Product: API, real-time

- IP ADDRESS: 200.189.207.162
- ISP: Not available
- COUNTRY: Brazil
- ORGANIZATION: AS3549 Level 3 Parent, LLC
- REGION: São Paulo
- LATITUDE: -23.5475
- CITY: São Paulo
- LONGITUDE: -46.6361

Incorrect location? Contact ipinfo.io view map

Geolocation data from DB-IP — Product: API, real-time

- IP ADDRESS: 200.189.207.162
- ISP: Level 3 Communications, Inc.
- COUNTRY: Brazil
- ORGANIZATION: Cirion Technologies do Brasil Ltda
- REGION: São Paulo

Nairobi, KE to Johannesburg, ZA

Source ISP	Destination ISP
AS37061 Safaricom Limited	AS3741 Dimension Data

```
                                 Loss%   Snt   Last   Avg  Best  Wrst StDev
 1. AS37061 197.248.144.216       0.0%     5    1.6   2.3   1.6   3.9   0.5
 2. AS33771 196.201.222.252       0.0%     5    7.0   8.3   6.8  13.7   3.0
    AS33771 196.201.222.254
 3. AS33771 196.201.222.253       0.0%     5    7.6   7.6   7.4   7.8   0.0
 4. AS5384  195.229.27.213       80.0%     5  156.7 156.7 156.7 156.7   0.0
 5. AS5384  5.195.70.166          0.0%     5  130.2 130.6 130.2 130.9   0.0
 6. AS5384  195.229.2.95          0.0%     5  150.0 147.3 146.5 150.0   1.4
 7. AS???   80.81.193.173         0.0%     5  192.9 193.2 192.8 194.1   0.0
 8. AS3741  168.209.0.53          0.0%     5  195.3 196.1 194.8 197.8   1.0
 9. AS3741  168.209.201.94        0.0%     5  208.0 207.9 207.5 208.2   0.0
10. AS3741  168.209.100.145       0.0%     5  207.6 208.8 207.5 213.5   2.6
11. AS3741  196.38.76.0           0.0%     5  207.6 207.6 207.3 207.8   0.0
12. AS3741  196.38.76.15          0.0%     5  207.5 207.7 207.5 208.2   0.0
13. AS3741  196.213.163.9         0.0%     5  216.3 216.9 215.6 218.7   1.0
14. AS???   ???                 100.0     5    0.0   0.0   0.0   0.0   0.0
```

Nairobi, KE to Johannesburg, ZA

Source ISP	Destination ISP
AS37061 Safaricom Limited	AS3741 Dimension Data

```
                                Loss%   Snt   Last   Avg  Best  Wrst StDev
 1. AS37061 197.248.144.216      0.0%     5    1.6   2.3   1.6   3.9   0.5
 2. AS33771 196.201.222.252      0.0%     5    7.0   8.3   6.8  13.7   3.0
    AS33771 196.201.222.254
 3. AS33771 196.201.222.253      0.0%     5    7.6   7.6   7.4   7.8   0.0
 4. AS5384  195.229.27.213      80.0%     5  156.7 156.7 156.7 156.7   0.0
 5. AS5384  5.195.70.166         0.0%     5  130.2 130.6 130.2 130.9   0.0
 6. AS5384  195.229.2.95         0.0%     5  150.0 147.3 146.5 150.0   1.4
 7. AS???   80.81.193.173        0.0%     5  192.9 193.2 192.8 194.1   0.0
 8. AS3741  168.209.0.53         0.0%     5  195.3 196.1 194.8 197.8   1.0
 9. AS3741  168.209.201.94       0.0%     5  208.0 207.9 207.5 208.2   0.0
10. AS3741  168.209.100.145      0.0%     5  207.6 208.8 207.5 213.5   2.6
11. AS3741  196.38.76.0          0.0%     5  207.6 207.6 207.3 207.8   0.0
12. AS3741  196.38.76.15         0.0%     5  207.5 207.7 207.5 208.2   0.0
13. AS3741  196.213.163.9        0.0%     5  216.3 216.9 215.6 218.7   1.0
14. AS???   ???                100.0     5    0.0   0.0   0.0   0.0   0.0
```

Suboptimal routing via Germany & UAE

```
; <<>> DiG 9.10.6 <<>> -x 80.81.193.173
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 44160
;; flags: qr rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 0, ADDITIONAL: 1


;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 1232
;; QUESTION SECTION:
;173.193.81.80.in-addr.arpa. IN PTR


;; ANSWER SECTION:
173.193.81.80.in-addr.arpa. 43200 IN PTR ar1-fra.isnet.net.
```

Nairobi, KE to Johannesburg, ZA

Source ISP	Destination ISP
AS37061 Safaricom Limited	AS3741 Dimension Data

```
                                Loss%   Snt   Last   Avg  Best
 1. AS37061 197.248.144.216      0.0%     5    1.6   2.3   1.
 2. AS33771 196.201.222.252      0.0%     5    7.0   8.3   6.
    AS33771 196.201.222.254
 3. AS33771 196.201.222.253      0.0%     5    7.6   7.6   7.
 4. AS5384  195.229.27.213      80.0%     5  156.7 156.7 156.
 5. AS5384  5.195.70.166         0.0%     5  130.2 130.6 130.
 6. AS5384  195.229.2.95         0.0%     5  150.0 147.3 146.
 7. AS???   80.81.193.173        0.0%     5  192.9 193.2 192.
 8. AS3741  168.209.0.53         0.0%     5  195.3 196.1 194.
 9. AS3741  168.209.201.94       0.0%     5  208.0 207.9 207.
10. AS3741  168.209.100.145      0.0%     5  207.6 208.8 207.
11. AS3741  196.38.76.0          0.0%     5  207.6 207.6 207.
12. AS3741  196.38.76.15         0.0%     5  207.5 207.7 207.
13. AS3741  196.213.163.9        0.0%     5  216.3 216.9 215.
14. AS???   ???                100.0     5    0.0   0.0   0.
```

iplocation.net/ip-lookup

Geolocation data from IP2Location — Product: DB6, 2025-5-1

- IP ADDRESS: 195.229.27.213
- COUNTRY: United Arab Emirates
- REGION: Dubayy
- CITY: Dubai
- ISP: Emirates Telecommunications Group Company (Etisalat Group) PJSC
- ORGANIZATION: Not available
- LATITUDE: 25.2585
- LONGITUDE: 55.3047

Incorrect location? Contact IP2Location view map

Geolocation data from ipinfo.io — Product: API, real-time

- IP ADDRESS: 195.229.27.213
- COUNTRY: United Arab Emirates
- REGION: Fujairah
- CITY: Al Fujairah City
- ISP: Not available
- ORGANIZATION: AS8966 EMIRATES TELECOMMUNICATIONS GROUP COMPANY (ETISALAT GROUP) PJSC
- LATITUDE: 25.1164
- LONGITUDE: 56.3414

Incorrect location? Contact ipinfo.io view map

Geolocation data from DB-IP — Product: API, real-time

- IP ADDRESS: 195.229.27.213
- COUNTRY: United Arab Emirates
- REGION: Abu Dhabi
- CITY: Abu Dhabi
- ISP: Emirates Telecommunications Corporation
- ORGANIZATION: Emirates Telecommunications Group Company (Etisalat Group) Pjsc
- LATITUDE: 24.4539
- LONGITUDE: 54.3773

Nairobi, KE to Johannesburg, ZA

Source ISP
AS37061 Safaricom Limite

```
 1. AS37061 197.248.144.216
 2. AS33771 196.201.222.252
    AS33771 196.201.222.254
 3. AS33771 196.201.222.253
 4. AS5384  195.229.27.213
 5. AS5384  5.195.70.166
 6. AS5384  195.229.2.95
 7. AS???   80.81.193.173
 8. AS3741  168.209.0.53
 9. AS3741  168.209.201.94
10. AS3741  168.209.100.145
11. AS3741  196.38.76.0
12. AS3741  196.38.76.15
13. AS3741  196.213.163.9
14. AS???   ???
```

iplocation.net/ip-lookup

Geolocation data from IP2Location — Product: DB6, 2025-5-1

- IP ADDRESS: 80.81.193.173
- COUNTRY: Germany
- REGION: Hessen
- CITY: Frankfurt am Main
- ISP: DE-CIX Management GmbH
- ORGANIZATION: Not available
- LATITUDE: 50.1109
- LONGITUDE: 8.6820

Incorrect location? Contact IP2Location view map

Geolocation data from ipinfo.io — Product: API, real-time

- IP ADDRESS: 80.81.193.173
- COUNTRY: Germany
- REGION: Hesse
- CITY: Frankfurt Am Main
- ISP: Not available
- ORGANIZATION: Not available
- LATITUDE: 50.1155
- LONGITUDE: 8.6842

Incorrect location? Contact ipinfo.io view map

Geolocation data from DB-IP — Product: API, real-time

- IP ADDRESS: 80.81.193.173
- COUNTRY: Germany
- REGION: North Rhine-Westphalia
- CITY: Cologne (Ehrenfeld, Cologne)
- ISP: CIX Management GmbH
- ORGANIZATION: DE-CIX Management GmbH
- LATITUDE: 50.9485
- LONGITUDE: 6.90934

Incorrect location? Contact DB-IP view map

Product: DB6, 2025-5-1

Emirates Telecommunications Group Company (Etisalat Group) PJSC

ANIZATION: Not available

TUDE: 25.2585

GITUDE: 55.3047

view map

Product: API, real-time

Not available

ANIZATION: AS8966 EMIRATES TELECOMMUNICATIONS GROUP COMPANY (ETISALAT GROUP) PJSC

TUDE: 25.1164

GITUDE: 56.3414

view map

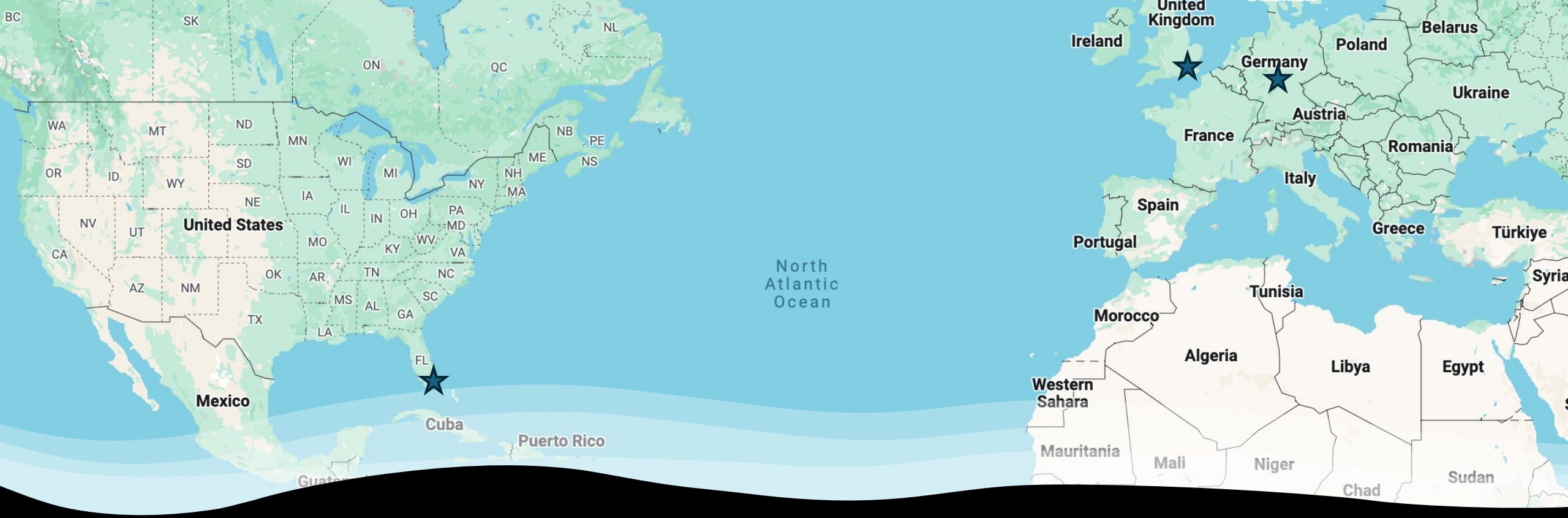
Product: API, real-time

Emirates Telecommunications Corporation

ANIZATION: Emirates Telecommunications Group Company (Etisalat Group) Pjsc

TUDE: 24.4539

GITUDE: 54.3773



- Commonly reappearing peering points – ***Frankfurt & London for Africa and Middle East, Miami for LATAM***
- Increasing use of SD-WAN with Internet underlay resulting in new load to these POPs
- Significant current and increasing risk of path saturation

The Internet is not always a capable transport replacement...

Image: MS Copilot

Long live
SD-WAN!

The World Has Changed – But SD-WAN Isn’t Dead

- SD-WAN is widely adopted, but it's not always a plug-and-play solution
- Many assumptions about global Internet performance are assumed or overstated

Suboptimal Routing is the Hidden Threat

- High latency, jitter result in degraded application performance

Reimagining SD-WAN is the Key

- Use well-peered content delivery networks to bridge inter-regional or inter-carrier gaps
- Leverage providers with POP-to-POP architectures for proximity and speed
- Tap into cloud-native backbone infrastructure from providers like AWS, Azure, Google

Evolve or Fall Behind

- Enterprises must expand their SD-WAN strategies with geography and routing in mind
- Leverage dynamic path steering and regional intelligence to get more complete SD-WAN value
- The future is intelligent, adaptive SD-WAN — not abandoned SD-WAN.

Argentina ISP	POP Latency
Cabelma S.A.	30ms
Comnet S.A.	23ms
CPS	24ms
CTL LATAM	21ms
Estrella Jorge Alberto	54ms
Horizon High Reach Limited	32ms
NSS S.A.	23-29ms
Persano SA	25ms
Ravago Argentina S.r.l.	25ms
Spinel SRL	24ms
Techtel LMDS Comunicaciones Interactivas S.A.	38ms
Telecentro S.A. - Clientes Residenciales	229ms
Telecom Argentina S.A.	23-39ms
Telefonica de Argentina	23-48ms
Telmex Argentina S.A.	28-33ms

Columbia ISP	POP Latency
Align Technology do Brasil Ltda	2ms
Colombia Movil	13ms
Colombia Telecomunicaciones S.A. ESP Bic	6-22ms
Columbus Networks de Colombia Limitada	2ms
Consejo Superior Judicatura-Compartel	5ms
Digitel	10ms
ETB - Colombia	3ms
HLF Colombia Ltda	3ms
IFX Networks Colombia SAS	2ms
Logicom de Colombia S.A.S	21ms
Ravago de Colombia SA	2ms
Telmex Colombia S.A.	4-36ms
UNE Epm Telecomunicaciones S.A.	25ms
Align Technology do Brasil Ltda	2ms
Colombia Movil	13ms

POP to POP ~70ms
RTT ~95-115ms (35% reduction)

Argentina ISP	POP Latency
Cabelma S.A.	30ms
Comnet S.A.	23ms
CPS	24ms
CTL LATAM	21ms
Estrella Jorge Alberto	54ms
Horizon High Reach Limited	32ms
NSS S.A.	23-29ms
Persano SA	25ms
Ravago Argentina S.r.l.	25ms
Spinel SRL	24ms
Techtel LMDS Comunicaciones Interactivas S.A.	38ms
Telecentro S.A. - Clientes Residenciales	229ms
Telecom Argentina S.A.	23-39ms
Telefonica de Argentina	23-48ms
Telmex Argentina S.A.	28-33ms

Columbia ISP	POP Latency
Align Technology do Brasil Ltda	2ms
Colombia Movil	13ms
Colombia Telecomunicaciones S.A. ESP Bic	6-22ms
Columbus Networks de Colombia Limitada	2ms
Consejo Superior Judicatura-Compartel	5ms
Digitel	10ms
ETB - Colombia	3ms
HLF Colombia Ltda	3ms
IFX Networks Colombia SAS	2ms
Logicom de Colombia S.A.S	21ms
Ravago de Colombia SA	2ms
Telmex Colombia S.A.	4-36ms
UNE Epm Telecomunicaciones S.A.	25ms
Align Technology do Brasil Ltda	2ms
Colombia Movil	13ms

Not always perfect…

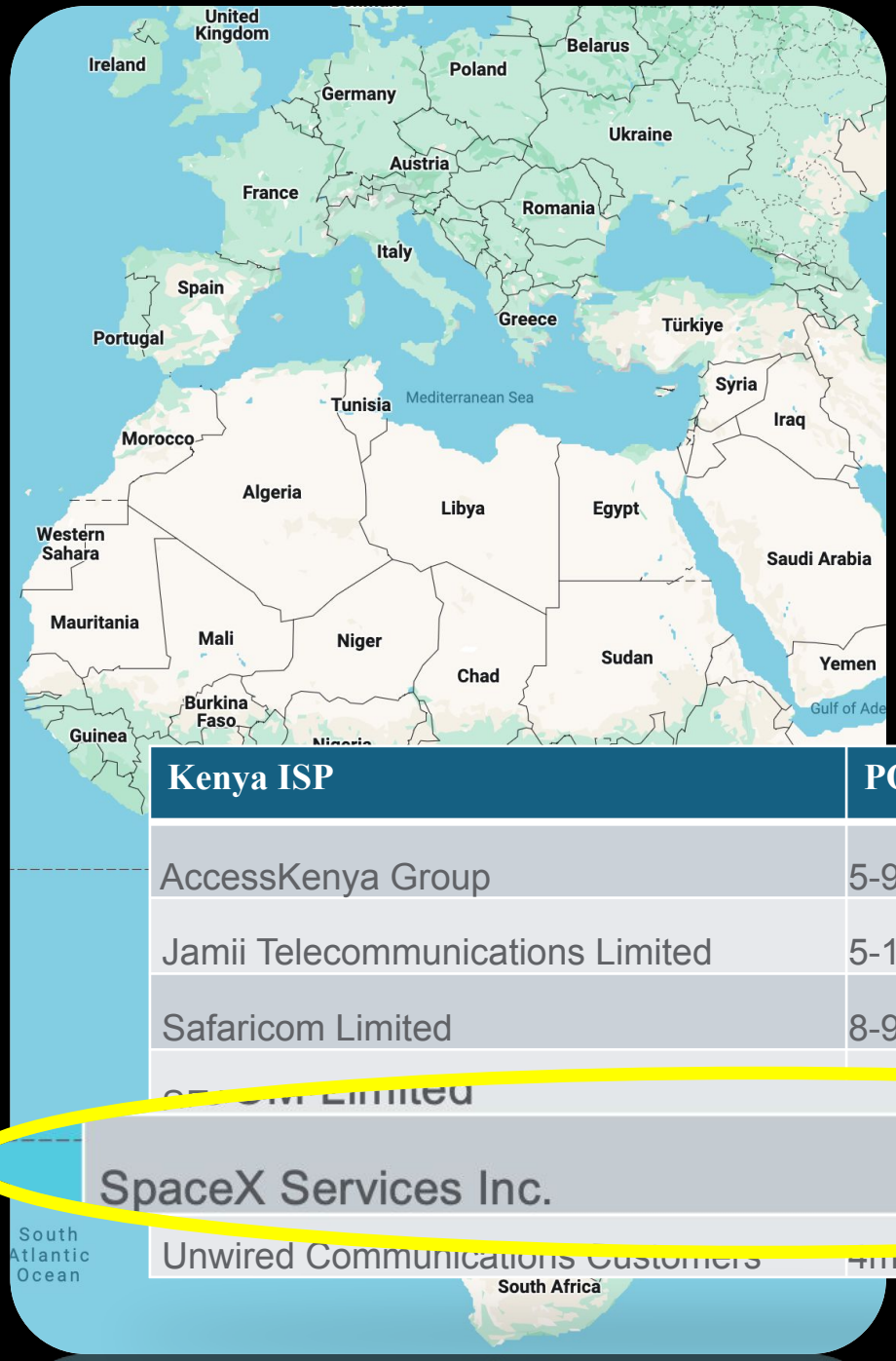
Argentina ISP	POP Latency
Cabelma S.A.	30ms
Comnet S.A.	23ms
CPS	24ms
CTL LATAM	21ms
Estrella Jorge Alberto	54ms
Horizon High Reach Limited	32ms
NSS S.A.	23-29ms
Persano SA	25ms
Ravago Argentina S.r.l.	25ms
Spinel SRL	24ms
EMBS Comunicaciones Interactivas S.A.	30ms
Telecentro S.A. - Clientes Residenciales	229ms
Telecom Argentina S.A.	23-39ms
Telefonica de Argentina	23-48ms
Telmex Argentina S.A.	28-33ms

South Africa ISP	POP Latency
Afrihost (Pty) Ltd	3-104ms
Clear Access (Pty) Ltd	2-6ms
Dimension Data	26-167ms
Fixed Line ISP	1-18ms
ICTGlobe Management (Pty) Ltd	4-142ms
JHB Broadband	2-11ms
Kibo Connect	1-22ms
Level 7 Wireless (Pty) Ltd	3-18ms
Liquid Telecommunications Operations Limited	2-29ms
Metrofibre Networx	1-7ms
MTN SA	3-65ms
Saicom Voice Services	4-12ms
SEACOM Limited	2-3ms
Vodacom	6-65ms
Vox Telecom Ltd	2-34ms

Kenya ISP	POP Latency
AccessKenya Group	5-9ms
Jamii Telecommunications Limited	5-10ms
Safaricom Limited	8-9ms
SEACOM Limited	14ms
SpaceX Services Inc.	18-42ms
Unwired Communications Customers	4ms

POP to POP ~55ms
RTT ~75-105ms (50% reduction)

South Africa ISP	POP Latency
Afrihost (Pty) Ltd	3-104ms
Clear Access (Pty) Ltd	2-6ms
Dimension Data	26-167ms
Fixed Line ISP	1-18ms
ICTGlobe Management (Pty) Ltd	4-142ms
JHB Broadband	2-11ms
Kibo Connect	1-22ms
Level 7 Wireless (Pty) Ltd	3-18ms
Liquid Telecommunications Operations Limited	2-29ms
Metrofibre Networx	1-7ms
MTN SA	3-65ms
Saicom Voice Services	4-12ms
SEACOM Limited	2-3ms
Vodacom	6-65ms
Vox Telecom Ltd	2-34ms



Still not perfect…

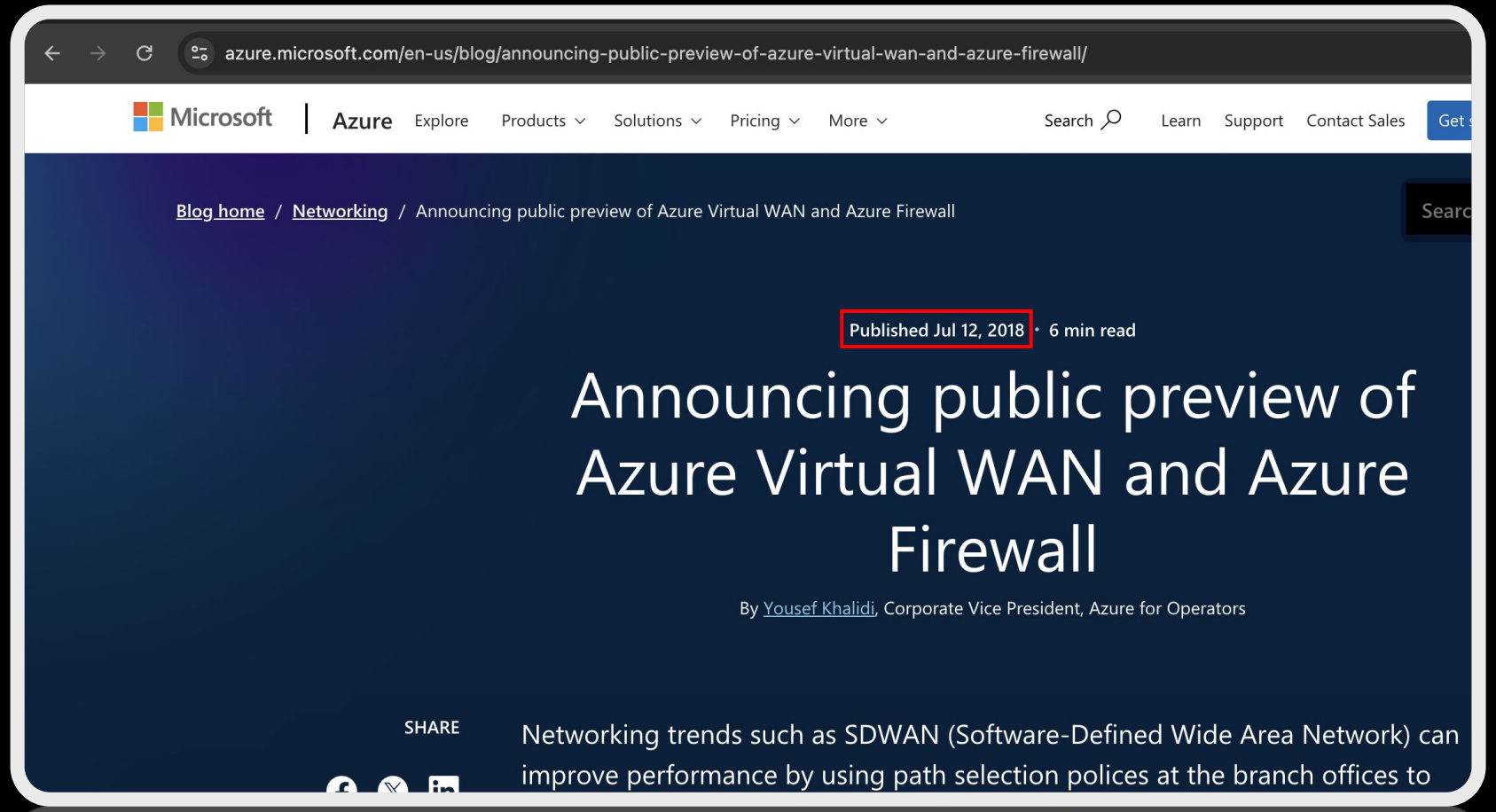
South Africa ISP	POP Latency
Afrihost (Pty) Ltd	3-104ms
[illegible] (Pty) Ltd	[illegible]
Dimension Data	26-167ms
Fixed Line ISP	1-18ms
ICTGlobe Management (Pty) Ltd	4-142ms
JHB Broadband	2-11ms
Kibo Connect	1-22ms
Level 7 Wireless (Pty) Ltd	3-18ms
Liquid Telecommunications Operations Limited	2-29ms
Metrofibre Networx	1-7ms
MTN SA	3-65ms
Saicom Voice Services	4-12ms
[illegible] Limited	2-3ms
Vodacom	6-65ms
Vox Telecom Ltd	2-34ms

And new variables….

Kenya ISP	POP Latency
AccessKenya Group	5-9ms
Jamii Telecommunications Limited	5-10ms
Safaricom Limited	8-9ms
[illegible] Limited	14ms
SpaceX Services Inc.	18-42ms
Unwired Communications Customers	4ms

BTW, the major public cloud providers are catching on…

First out of the gate!



Reference: https://azure.microsoft.com/en-us/blog/announcing-public-preview-of-azure-virtual-wan-and-azure-firewall/

Some can even transit across Chinese borders!

alibabacloud.com/blog/understanding-alibaba-cloud-network-new-product-launch-at-the-apsara-conference-2020_596712

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Community > Blog > Understanding Alibaba Cloud Network – New Product Launch at the Apsara Conference 2020

Understanding Alibaba Cloud Network – New Product Launch at the Apsara Conference 2020

Alibaba Clouder October 12, 2020 9,395 0

This article discusses the three core cloud network products released at the Apsara Conference 2020 and how enterprises can use them to migrate applications to the cloud smoothly.

Catch the replay of the Apsara Conference 2020 at this link!

By Alibaba Cloud_Network

On September 18, 2020, Zhu Shunmin, Director of the Networking Products Team and Basic Product Business Unit at Alibaba Cloud, launched a series of new products for the cloud network at the Apsara Conference 2020.

Application Load balancing | Enterprise VPC | CEN-TR | Private Link

SHARE

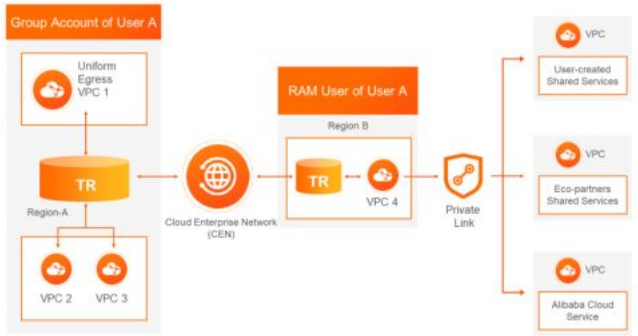
Networking trends such as SDWAN (Softwa improve performance by using path selecti

alibabacloud.com/blog/understanding-alibaba-cloud-network-new-product-launch-at-the-apsara-conference-2020_596

Alibaba Group | APSARA

Release 1: Enterprise Cloud Network

Release of CEN-TR (Transit Router) and Commercialization of Private Link



Benefits

Easy Maintenance
Large-scale Virtual Private Cloud (VPC) Interconnection

Enhanced Security
Flexible Access Control

CEN-TR

Transit Router (TR) is a new component in the Cloud Enterprise Network (CEN) and an enterprise-level virtual router. Today, many users have built a global network integrating on-cloud and off-cloud applications and deployed complex business systems based on Alibaba Cloud. CEN-TR enables enterprises to control routers in a fine-grained manner, including routers deployed between on-cloud VPCs, and between on-cloud VPC and off-cloud IDC, ensuring security isolation.

Reference: https://www.alibabacloud.com/blog/understanding-alibaba-cloud-network-new-product-launch-at-the-apsara-conference-2020_596712

aws.amazon.com/about-aws/whats-new/2018/11/introducing-aws-transit-gateway/

aws

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Introducing AWS Transit Gateway

Posted On: Nov 26, 2018

AWS Transit Gateway is a new service that enables customers to connect thousands of

rstanding-alibaba-cloud-network-new-product-launch-at-the-apsara-conference-2020_596

se 1: Enterprise Cloud Network

R (Transit Router) and Commercialization of Private Link

aws.amazon.com/about-aws/whats-new/2022/07/general-availability-aws-cloud-wan/

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Announcing the general availability of AWS Cloud WAN

Posted On: Jul 12, 2022

Today, AWS announced the general availability of AWS Cloud WAN, a wide area networking (WAN) service that helps you build, manage, and monitor a unified global network. The service manages traffic running between your AWS resources and your on-prer environments.

With Cloud WAN, you can use a central dashboard and network policies to create a global network that spans multiple locations ar networks—removing the need to configure and manage different networks individually by using different technologies. You can us your network policies to specify which of your Amazon Virtual Private Clouds, AWS Transit Gateways, and on-premises locations yc want to connect to by using an AWS Site-to-Site VPN, AWS Direct Connect, or third-party software-defined WAN (SD-WAN) products. The Cloud WAN central dashboard generates a complete view of the network to help you monitor network health, securi and performance. Cloud WAN automatically creates a global network across AWS Regions by using Border Gateway Protocol (BGP)

Conference 2020.

Application Load balancing

Enterprise VPC

VPC and off-cloud IDC, ensuring security isolation.

SHARE

Networking trends such as SDWAN (Softwa improve performance by using path selecti

OSS cloud services

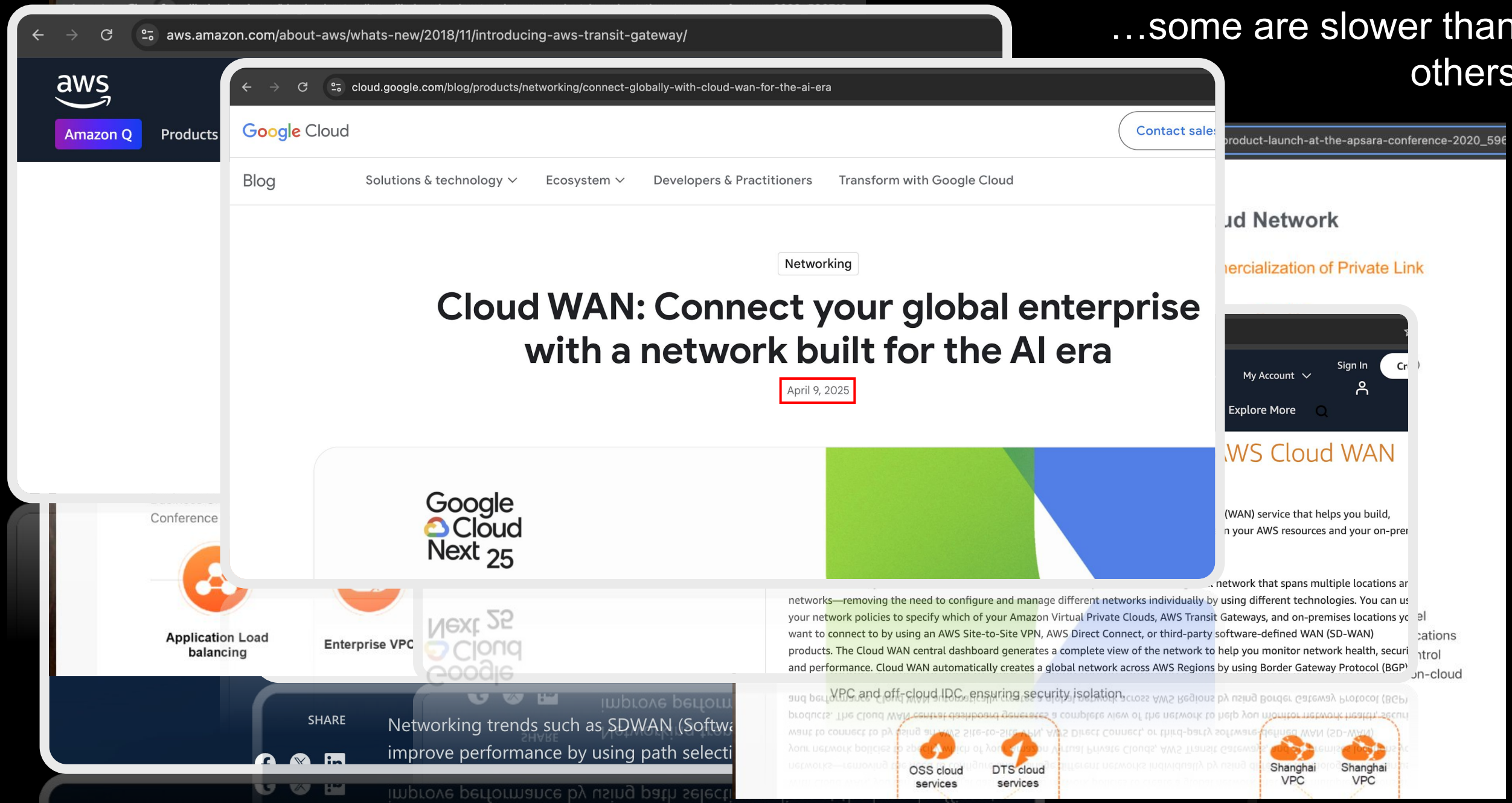
DTS cloud services

Shanghai VPC

Shanghai VPC

Reference: https://aws.amazon.com/about-aws/whats-new/2018/11/introducing-aws-transit-gateway/
Reference: https://aws.amazon.com/about-aws/whats-new/2022/07/general-availability-aws-cloud-wan/

…some are slower than others



Reference: https://cloud.google.com/blog/products/networking/connect-globally-with-cloud-wan-for-the-ai-era

SD-WAN is ~~dead~~, long live SD-WAN!

Thank you!