Timor-Leste

Internet EXchange Point:

Enhancing Local Internet Performance and Digital Growth

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About me:

As a **Technical Regulator** at the **National Communications Authority of Timor-Leste (ANC)**, with expertise in **network infrastructure, cybersecurity**, and **ICT Development**. Have been instrumental in several national initiatives aimed at strengthening connectivity and digital resilience, most notably contributing to the design and implementation planning of the **Timor-Leste Internet Exchange Point (TLIXP)**. As a member of the **Timor-Leste Network Operators Group (TLNOG)** and also was selected as an **APNIC Fellow at APNIC 48** in Chiang Mai, Thailand, in 2019.

Overview

1. Internet Infrastructure Landscape in Timor-Leste
2. Implementation of Timor-Leste Internet Exchange Point
3. Internet Exchange Point architecture
4. Steps to Implement Timor-Leste Internet Exchange Point
5. Conclusion

1. Internet Infrastructure Landscape in Timor-Leste

1.1 Connectivity

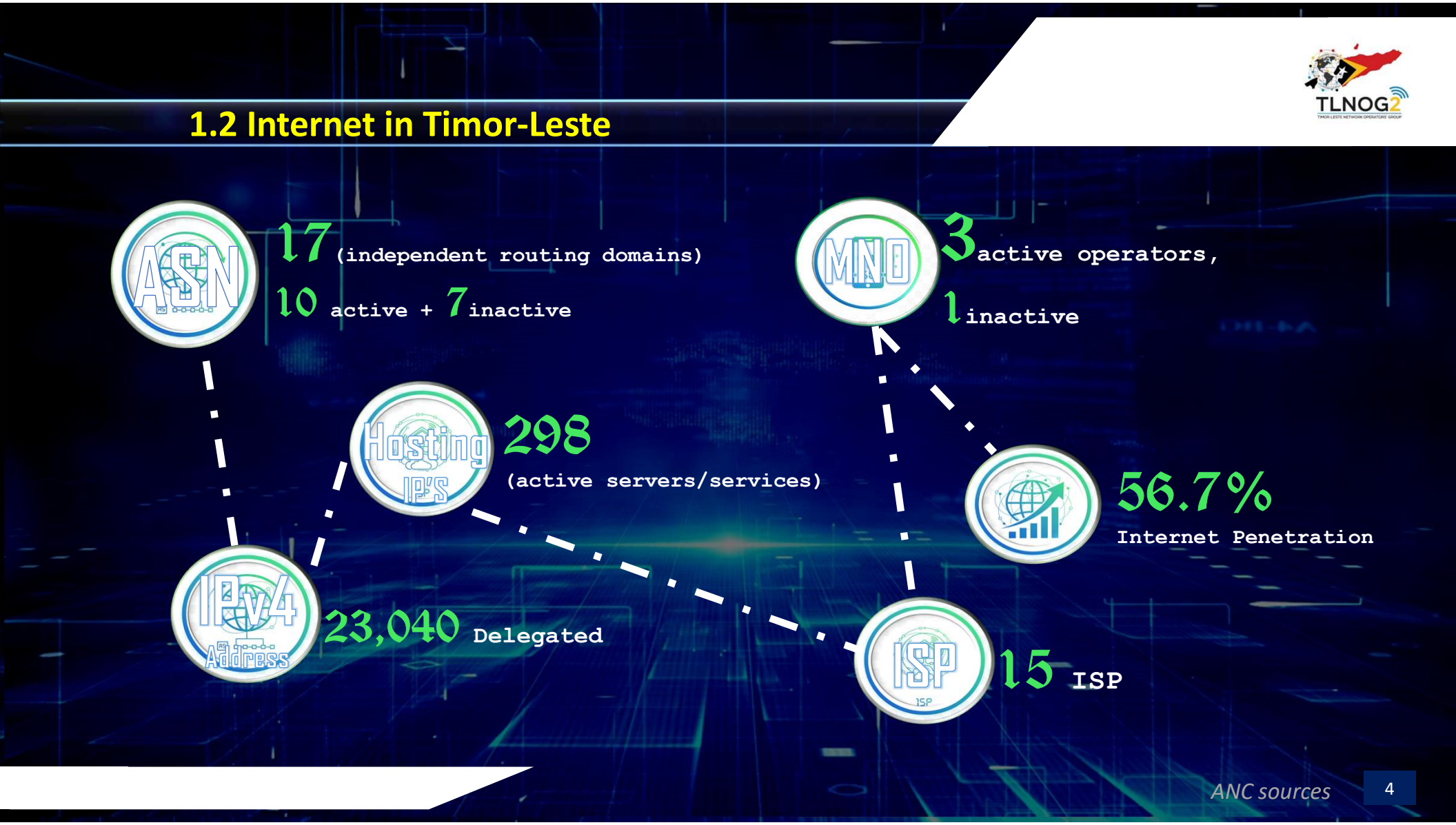
Existing Connectivity:

- Until recently, Timor-Leste relied on satellite uplinks and Indonesian terrestrial transit (via fiber or microwave from Nusa Tenggara Timur).
- International bandwidth usage: ± 78 Gbps
- Bandwidth was expensive, limited, and high-latency, with median speeds often <5 Mbps.

New Infrastructure Connectivity:

- TLSSC (Timor-Leste South Submarine Cable) System:
- Connects Dili → Darwin + Port Hedland, Australia.
- Deployment led by Timor-Leste government in partnerships with Vocus Group and Alcatel Submarine Networks (ASN).
- Capacity: Estimated 27 Tbps. Will dramatically reduce wholesale transit costs and latency.

1.2 Internet in Timor-Leste

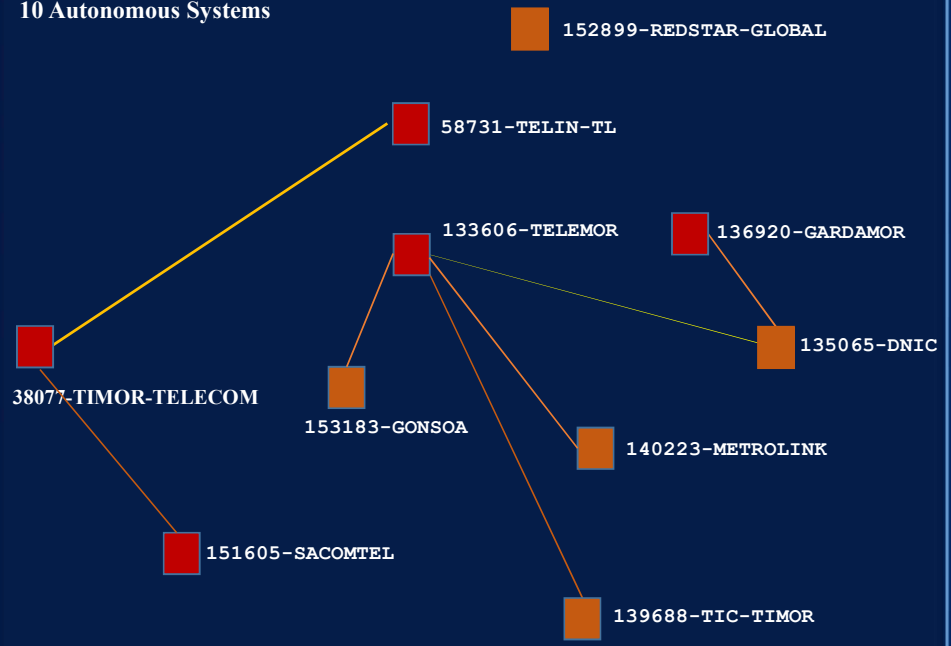


ANC sources

1.3 AS interconnections

Visible IPv6
1 interconnections among
2 Autonomous Systems

Visible IPv4 interconnections
7 interconnections among
10 Autonomous Systems



https://rex.apnic.net/as-interconnections?economy=TL&allocationType=ipv6,ipv4

1.4 Local CDN Deployment

Meta CDN (Facebook, Instagram, WhatsApp)

has deployed a Meta Content Delivery Network (Meta CDN) in Dili with 32 IPs in the country.

These are local caches of popular content from **Facebook, Instagram, and WhatsApp.** Reducing international bandwidth usage and improving performance for those services.

META CDN - PARTNER NETWORKS - TIMOR LESTE

Network	City	Category	IP Count	Sample ASN Route
Viettel	Dili	ISP/Telco	22	43.243.122.0/24

META CDN - OTHER NETWORKS - TIMOR LESTE

ASN Label	ASN	IP Count	Sample ASN Route
Telekomunikasi Indonesia International (...	AS58731	7	103.231.123.0/24
Timor Telecom	AS38077	3	180.189.175.0/24

https://www.netify.ai/resources/cdn/meta-cdn/country/tl

1.5 Local CDN Deployment

Google Global Cache (GGC)

Confirms that Google has deployed GGC nodes in Dili, Timor-Leste. To serve local ISPs and improve latency/performance.
Implication faster YouTube, Play Store, Android updates.

https://peering.google.com/#/infrastructure

1.6 Internet Traffic Map

1.7 Traceroute Timor Telecom -> Telkomcel

```
                                My traceroute  [v0.95]
ThinkPad (10.250.12.70) -> telkomcel.tl (150.242.110.106)          2025-11-13T14:31:04+0900
Keys:  Help   Display mode   Restart statistics   Order of fields   quit
                                                      Packets               Pings
 Host                                                Loss%   Snt   Last   Avg  Best  Wrst StDev
  1. _gateway                                         0.0%    39    3.7   7.9   3.3 106.4  16.4
  2. 10.20.22.62                                      0.0%    39   30.3  33.4  18.2  70.2  13.0
  3. (waiting for reply)
  4. 10.20.28.14                                      0.0%    39   26.0  24.6  16.6  48.0   7.0
  5. 180.189.173.50  >> Timor Telecom                 0.0%    39   22.5  27.6  17.3 105.0  13.9
  6. 103.236.129.25   >> Sacomtel                     0.0%    39   21.7  28.5  18.7  70.4  11.0
  7. (waiting for reply)
  8. 103.88.196.89     >> Indonesia Comnets Plus      0.0%    39   67.7  73.0  65.7 163.0  15.6
  9. 103.144.182.209                                  0.0%    39  249.2 244.3 211.6 263.9  13.4
 10. 103.144.133.195                                  0.0%    39   73.1  71.0  64.0  89.5   7.2
 11. 103.144.133.106                                  0.0%    39   70.6  71.8  63.9 103.8   8.7
 12. telin-as7713-2.sgix.sg >> Telin AS7712-2         2.6%    39  238.2 246.9 207.3 274.9  15.6
 13. 180.240.204.9                                    0.0%    39  223.7 244.5 207.9 281.6  15.2
 14. (waiting for reply)
 15. 36.67.255.241  >> Telin Jakarta                  0.0%    38  258.1 253.9 225.7 314.9  17.1
 16. 36.67.255.242                                    0.0%    38  244.1 252.3 224.6 295.2  17.6
 17. 150.242.110.5  >> Telkomcel TL                   2.6%    38  252.4 247.4 211.8 267.9  11.9
 18. telkomcel.tl                                     0.0%    38  257.3 251.0 208.7 279.8  15.1
```

1.8 Traceroute Timor Telecom -> Telemor

```
                                My traceroute  [v0.95]
ThinkPad (10.250.12.70) -> telemor.tl (43.243.121.198)                2025-11-13T14:29:44+0900
Keys:  Help   Display mode   Restart statistics   Order of fields   quit
                                                    Packets                Pings
 Host                                             Loss%   Snt   Last   Avg  Best  Wrst StDev
  1. _gateway                                      0.0%   338    4.5   6.0   3.3 106.5   7.0
  2. 10.20.22.62                                   0.0%   338   32.1  40.5  20.1 169.6  17.8
  3. (waiting for reply)
  4. 10.20.28.14                                   0.0%   338   26.9  25.1  15.9 124.8   9.2
  5. 180.189.173.50    >> Timor Telecom            0.0%   338   35.0  27.4  17.2 154.6  13.1
  6. 180.189.173.150                               0.0%   338   23.2  26.2  16.7 102.7   9.8
  7. 43.254.56.125     >> Viettel (Telemor)       24.9%   338   36.7  26.7  17.3 217.4  15.4
  8. 185.242.39.20                                22.3%   338   19.7  23.8  16.0 119.1  10.1
  9. 10.226.199.218                               24.0%   338   34.5  26.4  16.2 132.4  10.6
 10. 43.243.121.198                               19.8%   338   19.4  26.3  17.2 101.9  10.5
```

1.9 Traceroute Telkomcel > Timor Telecom

```
                                My traceroute  [v0.95]
ThinkPad (10.142.78.71) -> timortelecom.tl (180.189.1602025-11-14T22:54:31+0900
Keys:  Help   Display mode   Restart statistics   Order of fields   quit
                                     Packets               Pings
 Host                              Loss%   Snt   Last   Avg  Best  Wrst StDev
  1. _gateway                       0.0%    51    3.4   3.4   1.8   5.6   0.6
  2. 10.210.14.97                   0.0%    51   46.5 215.0  17.2 3681. 673.3
  3. 10.11.5.14                     0.0%    51   21.1 208.6  17.9 3623. 657.3
  4. 10.150.2.99                   41.2%    51   22.8 464.4  15.6 5147. 1203.
  5. 10.150.0.129                   0.0%    51   17.6 292.4  16.4 5047. 925.1
  6. 36.91.235.189 >> Telkomcel TL  0.0%    51   32.7 294.8  22.5 4964. 907.2
  7. 180.240.193.93                81.6%    50   64.9  77.3  64.9 126.0  19.4
  8. 180.240.193.93                87.8%    50   73.6 284.0  63.4 1368. 531.3
  9. 180.240.204.8                  0.0%    50   69.5 348.5  64.4 4710. 876.8
 10. 38757.sgw.equinix.com >> Indo Comnets Plus 0.0%    50   75.0 338.1  64.9 4600. 854.2
 11. 103.144.182.210               0.0%    50   77.5 345.8  77.2 4506. 831.4
 12. 103.88.196.90                 0.0%    50  121.5 367.8 112.4 4449. 814.2
 13. 103.236.128.18                4.0%    50  113.6 366.0 110.6 4349. 810.1
 14. 103.236.129.26  >> Sacomtel   0.0%    50  128.0 350.3 113.9 4252. 775.2
 15. 192.168.250.249               0.0%    50  112.6 343.2 112.6 4148. 754.4
 16. www.timortelecom.tl           2.0%    50  130.5 325.8 112.6 4050. 737.3
```

1.10 Traceroute Telkomcel > Telemor

```
                    My traceroute  [v0.95]
ThinkPad (10.142.78.71) -> telemor.tl (43.243.121.198) 2025-11-14T22:57:25+0900
Keys:  Help   Display mode   Restart statistics   Order of fields   quit
                                    Packets               Pings
 Host                             Loss%   Snt   Last   Avg  Best  Wrst StDev
  1. _gateway                      0.0%    47    5.5   3.5   2.8   7.0   0.8
  2. 10.210.14.97                  0.0%    47   28.4  91.0  17.2 1903. 298.4
  3. 10.11.5.14                    0.0%    47   34.5  84.0  16.7 1831. 285.6
  4. 10.150.2.99                  42.6%    47   30.6 115.9  16.0 1760. 357.3
  5. 10.150.0.129                  2.1%    47   17.6  77.6  15.7 1688. 261.8
  6. 36.91.235.189  >> Telkomcel TL 0.0%    47   28.7  81.5  23.3 1619. 244.7
  7. 119.11.187.25  >> PT NTT Indonesia 0.0% 47   56.6 111.1  56.0 1578. 231.2
  8. 119.11.185.41                 2.2%    46   58.0 150.1  54.5 2512. 419.7
  9. 113.59.233.65                 2.2%    46  237.7 143.4  67.9 2457. 357.8
 10. 160.30.30.246  >> Gonsoa      2.2%    46  165.8 168.9  92.4 2501. 360.7
 11. 43.243.179.61  >> Viettel (Telemor) 2.2% 46 114.2 162.5  92.7 2429. 348.8
 12. 185.242.39.20                4.3%    46   94.4 157.4  92.4 2357. 340.3
 13. 10.226.199.219               4.3%    46   94.1 152.1  93.6 2285. 329.3
     10.226.199.218
 14. 43.243.121.198               2.2%    46   96.3 174.3  92.0 2213. 352.1
```

1.11 Traceroute Telemor > Timor Telecom

```
                                   My traceroute  [v0.95]
ThinkPad (10.142.78.71) -> timortelecom.tl (180.189.160.207)        2025-11-13T15:08:27+0900
Keys:  Help   Display mode   Restart statistics   Order of fields   quit
                                                    Packets               Pings
 Host                                             Loss%   Snt   Last   Avg  Best  Wrst StDev
 1. _gateway                                       0.0%    50    7.7   7.8   3.5  34.8   4.5
 2. 10.226.70.62                                   0.0%    49   43.3  41.9  22.0  77.5   8.2
 3. 10.226.66.50                                   0.0%    49   24.1  42.2  20.1 118.7  17.1
 4. (waiting for reply)
 5. 10.226.66.242                                  0.0%    49   27.8  33.5  22.5  61.7  10.2
 6. 43.243.179.70  >> Viettel (Telemor)            0.0%    49   38.0  31.4  19.8  62.8   9.3
 7. 43.254.56.126                                 22.4%    49   27.3  35.0  20.7 111.4  15.2
 8. 192.168.250.249                               24.5%    49   28.5  30.7  19.4  88.3  11.4
 9. www.timortelecom.tl                           18.4%    49   27.5  32.4  20.4  82.4  13.3
```

1.12 Traceroute Telemor > Telkomcel

```
                                My traceroute  [v0.95]
ThinkPad (10.142.78.71) -> telkomcel.tl (150.242.110.106)          2025-11-13T15:06:48+0900
Keys:  Help   Display mode   Restart statistics   Order of fields   quit
                                                  Packets                Pings
 Host                                          Loss%   Snt   Last   Avg  Best  Wrst StDev
  1. _gateway                                   0.0%    30    6.5   7.9   3.8  15.1   2.6
  2. 10.226.70.62                               0.0%    30   33.0  47.0  25.9 159.3  24.8
  3. 10.226.66.146                              0.0%    30   23.6  36.3  21.8  87.5  13.1
  4. (waiting for reply)
  5. 10.226.66.242                              0.0%    29   22.2  38.6  22.2 244.6  40.3
  6. 43.243.179.62   >> Viettel (Telemor)       0.0%    29   24.2  34.9  20.5 149.3  23.6
  7. 160.30.30.245   >> Gonsoa                  0.0%    29   44.4  60.8  44.4  86.3  10.6
  8. 113.59.234.46   >> Gonsoa                  0.0%    29   69.0  85.7  61.5 447.0  70.2
  9. 113.59.232.195  >> Internet Masuk Desa      0.0%    29   65.7  81.1  60.5 375.1  57.0
 10. 119.11.187.25   >> PT NTT Indonesia        0.0%    29   65.8  86.5  62.1 303.2  46.6
 11. 36.67.255.241   >> TELIN Indonesia         0.0%    29   98.7 106.7  90.5 231.7  25.1
 12. 36.67.255.242                              0.0%    29   98.1 115.6  94.2 256.8  30.8
 13. 150.242.110.5   >> Telkomcel TL            0.0%    29   96.7 111.6  96.7 185.3  17.1
 14. 150.242.110.106                            0.0%    29   99.6 112.6  96.8 195.1  21.1
```

2. Implementation of Timor-Leste Internet Exchange Point

2.1 Internet Exchange Point (IXP)

IXP is a physical infrastructure that allows different Internet Service Providers (ISPs) and networks to exchange Internet traffic directly, rather than through third-party networks or international links.

Why IXPs are important?

- Improves internet speed and reduce latency by localizing traffic
- Reduces costs for ISPs by lowering transit fees
- Enhances network resilience and redundancy
- Encourages local content hosting and development

3. Steps to Implement an IXP

3.1 Stakeholder Engagement and Agreement

Identify Key Stakeholders:

- The ANC will be host Timor-Leste Internet Exchange Point
- Major ISPs: VIETTEL TL (Telemor), TELIN TL (Telkomcel), Timor Telecom SA
- Government and public institutions (DNIC, TIC TIMOR)
- International partners (APNIC, ISOC)

Facilitate Initial Meetings:

- Present benefits of IXP: latency reduction, cost savings, national sovereignty
- Build trust and transparency

3.2 Guidelines for Peering Policy

Objectives:

- Promote open and fair interconnection among participants
- Ensure stability and security of the exchange
- Encourage traffic locality and efficiency

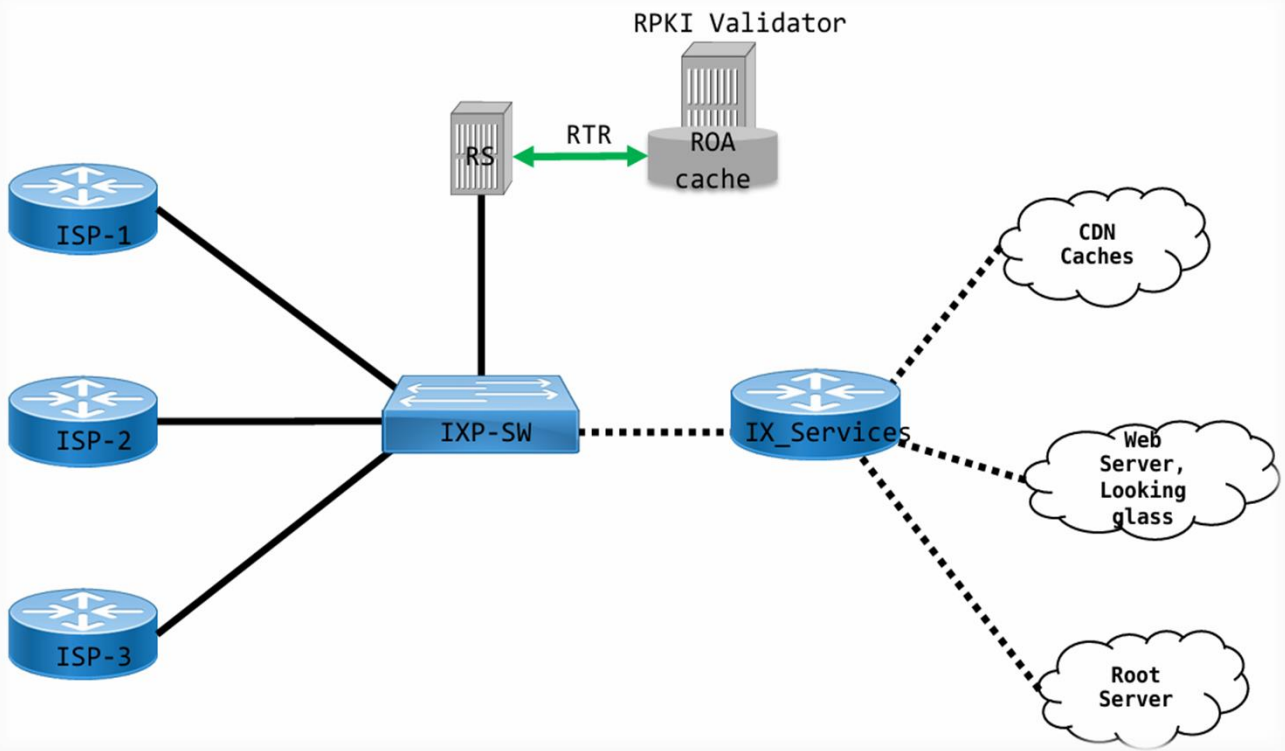
Peering types: Multilateral peering aggrement

Traffic policies: Acceptable use, traffic ratios, and route filtering

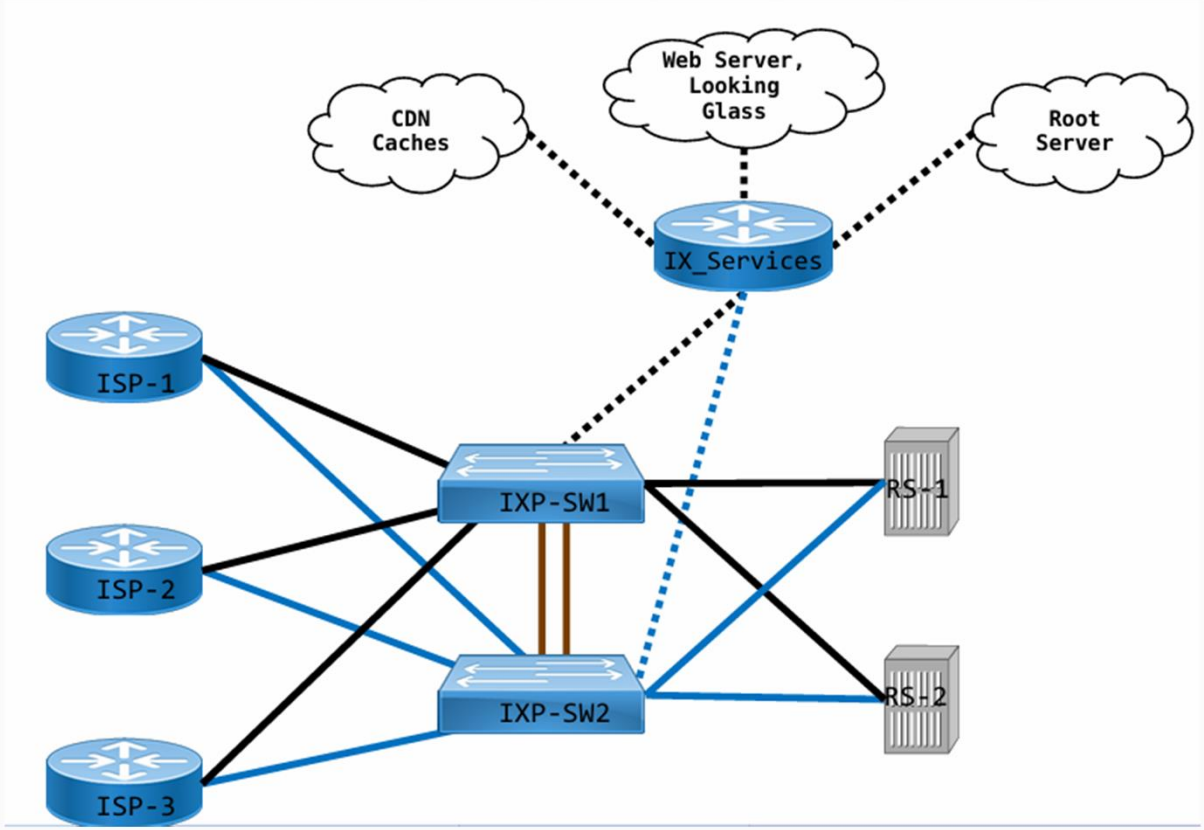
Cost and fees: free peering

4. Internet Exchange Point architecture

4.1 Design v1



4.2 Design v2


Web Server,
Looking
Glass
CDN
Caches
Root
Server
IX_Services
ISP-1
ISP-2
ISP-3
IXP-SW1
IXP-SW2
RS-1
RS-2

5. Steps to Implement Timor-Leste Internet Exchange Point

5.1 IXP Core Components

- ***Switching Infrastructure*** a core Ethernet switch model (Cisco Nexus 9000 series) aggregates connections from all IXP members and connects to the route server.
- ***Management Switch*** manages out-of-band connectivity for administrative tasks and connects to IXP Manager and Operator systems.
- ***Server:*** running virtualization for:
  route server software (BIRD2) Facilitates multilateral peering by simplifying BGP configuration among members.
  IXP Manager a server running the IXP management software used to configure members, monitor traffic, and administer peering policies.
  RPKI Validator, NTP Server and Bind9 DNS NS for domain ixp.tl
- ***Router*** to support IX services to CDN Caches, web server, looking glass etc.
- ***2x 42U Racks*** and ***Patch panel*** for enable easier equipment upgrades and port relocation
- ***UPS*** (servers, route servers, switches, CDN caches, etc.)

Ongoing Process:

- ***Server:*** running virtualization for Looking Glass, M-Root DNS, AS112 service, Monitoring tools, mirror/cache for opensource/linux project, cache for windows update for Apple mac/Iphone updates.

6. Conclusion

Summary:

Establishing an Internet Exchange Point in Timor-Leste is vital to improving local internet performance, reducing costs, and fostering digital growth.

Call for action:

Collaboration among government, ISPs, and other stakeholders is essential to build and sustain a successful IXP.

Future outlook:

A well-implemented IXP will encourage local content, improve user experience, and strengthen Timor-Leste's internet infrastructure for years to come.

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