Quarterly Report on Monitoring of ICT Infrastructure

འབྲུག་བདེ་དོན་བསྒྲུབ་འཕེལ་དང་བདེ་བསྒྲུབ་དབང་འཛིན།

Bhutan InfoComm and Media Authority

Royal Government of Bhutan

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1. Background

As per the office order vide BICMA/Office Order(5)/2024-2025/536, the officials from IID visited Lingzhi, Naro, Soe and Laya to carry out monitoring of the fiber network and fiber transmission network (CWDM network) of Govtech in Naro, Lingzhi and Soe Gewog center. The team also monitored the CWDM network of Govtech and PTN network of BTL in Laya, Gasa.

2. ADSS fiber and CWDM(Coarse Wavelength Division Multiplexing) Equipment at Naro Gewog Center

The team monitored ADSS fiber cable and CWDM equipment of Govtech agency installed at Naro gewog center. Naro gewog center is connected with 24 ADSS fiber pairs and out of 24 fiber pairs, only 3 pairs of GIN fiber cable have been utilized for GovNet internet connectivity to Naro Gewog center, Naro BHU and RNR center.

One unit of CWDM equipment having 8 channel capacity has been installed at Naro Gewog center. Out of 8 channels, only 3 channels have been utilized for GovNet internet connectivity to Naro Gewog center, Naro BHU and RNR center.

Figure 1: ADSS fiber and CWDM equipment installed at Naro gewog Center

2.1 Monitoring of Internet connectivity at Naro Gewog center

The team monitored the internet connectivity at Naro Gewog center and it was observed that there was **no internet connectivity at Naro Gewog center** which could have been due to fiber break down in ADSS fiber enroute to Naro Gewog center. The team could not conduct the internet bandwidth test and RTT latency test due to no internet connectivity at Naro Gewog Center during that time. Further, the team observed dropped ADDS fiber as shown in the picture below enroute to Naro gewog center.

Figure 2 : ADSS fiber damaged enroute to Naro gewog Center

2.2 Assessment of ADSS fiber utilization by the telecom service providers in Naro Gewog

The team observed that despite the reach of government ADSS fiber in Naro Gewog center, the telecom service providers have not utilized the free ADSS fiber for their mobile backhaul network. BTL has a BTS site nearby Naro Gewog center which can be connected with ADSS fiber to have a backhaul redundancy network in addition to the microwave backhaul network. TICL does not have a nearby site near Naro GC and a weak Tashicell signal can be received from distant BTS sites.

3. ADSS fiber and CWDM(Coarse Wavelength Division Multiplexing) Equipment at Lingzhi Gewog Center

Lingzhi gewog center is connected with 24 ADSS fiber pairs and out of 24 fiber pairs, only 3 pairs of fiber cable have been utilized for GovNet internet connectivity to Lingzhi Gewog center, Lingzhi BHU and Lingzhi school.

One unit of CWDM equipment having 8 channel capacity has been installed at Lingzhi Gewog center. Out of 8 channels, only 3 channels have been utilized for GovNet internet connectivity to Lingzhi Gewog center, Lingzhi BHU and Lingzhi school.

Figure 3 : ADSS fiber and CWDM equipment installed at Lingzhi gewog Center

3.1 Monitoring of Internet connectivity at Lingzhi Gewog center and Lingzhi Lower Secondary school

The team monitored the internet connectivity at Lingzhi Gewog center and Lingzhi Lower Secondary School and the observations are as follows;

3.1.1 Lingshi GC internet connectivity test

A. Internet bandwidth test

It was observed that lingzhi GC has access to internet bandwidth of download speed at around 92 Mbps and upload at 94 Mbps.

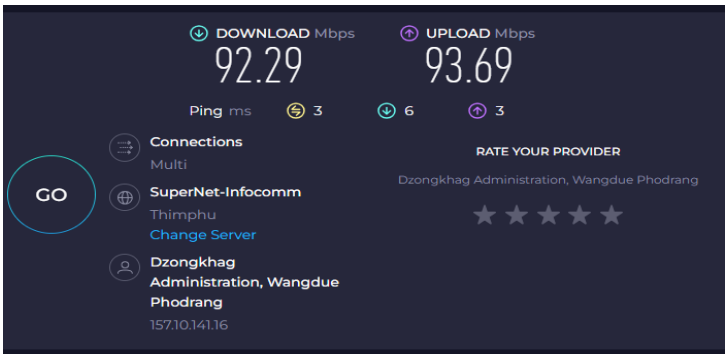


Figure 4: Internet bandwidth test at Lingzhi GC

B. Google RTT latency test(ping test)

It was observed that the average google RTT latency time is 77ms which is within our standard of 150 ms.

```
Microsoft Windows [Version 10.0.19042.1586]
(c) Microsoft Corporation. All rights reserved.

C:\Users\USER>ping www.google.com -t

Pinging www.google.com [74.125.200.105] with 32 bytes of data:
Reply from 74.125.200.105: bytes=32 time=77ms TTL=104
Reply from 74.125.200.105: bytes=32 time=77ms TTL=104
Reply from 74.125.200.105: bytes=32 time=77ms TTL=104
Reply from 74.125.200.105: bytes=32 time=77ms TTL=104
Reply from 74.125.200.105: bytes=32 time=78ms TTL=104
Reply from 74.125.200.105: bytes=32 time=77ms TTL=104
Reply from 74.125.200.105: bytes=32 time=77ms TTL=104
Reply from 74.125.200.105: bytes=32 time=77ms TTL=104
Reply from 74.125.200.105: bytes=32 time=77ms TTL=104
Reply from 74.125.200.105: bytes=32 time=77ms TTL=104
Reply from 74.125.200.105: bytes=32 time=77ms TTL=104
Reply from 74.125.200.105: bytes=32 time=77ms TTL=104
Reply from 74.125.200.105: bytes=32 time=77ms TTL=104

Ping statistics for 74.125.200.105:
    Packets: Sent = 15, Received = 15, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 77ms, Maximum = 78ms, Average = 77ms
```

Figure 5: Google RTT ping test at Lingzhi GC

C. Youtube RTT latency test(Ping test)

It was observed that the average Youtube RTT latency time is 76ms which is within our standard of 150 ms.

```
C:\Users\USER>ping www.youtube.com -t

Pinging youtube-ui.l.google.com [172.217.194.190] with 32 bytes of data:
Reply from 172.217.194.190: bytes=32 time=76ms TTL=104
Reply from 172.217.194.190: bytes=32 time=76ms TTL=104
Reply from 172.217.194.190: bytes=32 time=76ms TTL=104
Reply from 172.217.194.190: bytes=32 time=77ms TTL=104
Reply from 172.217.194.190: bytes=32 time=77ms TTL=104
Reply from 172.217.194.190: bytes=32 time=76ms TTL=104
Reply from 172.217.194.190: bytes=32 time=76ms TTL=104
Reply from 172.217.194.190: bytes=32 time=76ms TTL=104
Reply from 172.217.194.190: bytes=32 time=76ms TTL=104
Reply from 172.217.194.190: bytes=32 time=76ms TTL=104
Reply from 172.217.194.190: bytes=32 time=76ms TTL=104
Reply from 172.217.194.190: bytes=32 time=76ms TTL=104
Reply from 172.217.194.190: bytes=32 time=77ms TTL=104
Reply from 172.217.194.190: bytes=32 time=77ms TTL=104
Reply from 172.217.194.190: bytes=32 time=76ms TTL=104

Ping statistics for 172.217.194.190:
    Packets: Sent = 15, Received = 15, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 76ms, Maximum = 77ms, Average = 76ms
```

Figure 6: Youtube RTT ping test at Lingzhi GC

D. Facebook RTT latency test(ping test)

It was observed that the average facebook RTT latency time is 103ms which is within our standard of 150 ms. However, average packet drop is 11% which is more than our threshold of 2%.

```
C:\Users\USER>ping www.facebook.com -t

Pinging star-mini.c10r.facebook.com [157.240.235.35] with 32 bytes of data
Reply from 157.240.235.35: bytes=32 time=103ms TTL=52
Reply from 157.240.235.35: bytes=32 time=103ms TTL=52
Reply from 157.240.235.35: bytes=32 time=103ms TTL=52
Reply from 157.240.235.35: bytes=32 time=104ms TTL=52
Reply from 157.240.235.35: bytes=32 time=103ms TTL=52
Reply from 157.240.235.35: bytes=32 time=103ms TTL=52
Reply from 157.240.235.35: bytes=32 time=103ms TTL=52
Request timed out.
Reply from 157.240.235.35: bytes=32 time=103ms TTL=52
Reply from 157.240.235.35: bytes=32 time=103ms TTL=52
Reply from 157.240.235.35: bytes=32 time=103ms TTL=52
Request timed out.
Reply from 157.240.235.35: bytes=32 time=103ms TTL=52
Reply from 157.240.235.35: bytes=32 time=103ms TTL=52
Reply from 157.240.235.35: bytes=32 time=103ms TTL=52
Reply from 157.240.235.35: bytes=32 time=103ms TTL=52
Reply from 157.240.235.35: bytes=32 time=103ms TTL=52
Reply from 157.240.235.35: bytes=32 time=103ms TTL=52

Ping statistics for 157.240.235.35:
    Packets: Sent = 18, Received = 16, Lost = 2 (11% loss),
Approximate round trip times in milli-seconds:
    Minimum = 103ms, Maximum = 104ms, Average = 103ms
```

Figure 7: Facebook RTT ping test at Lingzhi GC

3.1.2 Lingshi Lower Secondary School internet connectivity test

A. Internet bandwidth test

It was observed that lingzhi LSS has access to internet bandwidth of download speed at around 894 Mbps and upload at 535 Mbps.

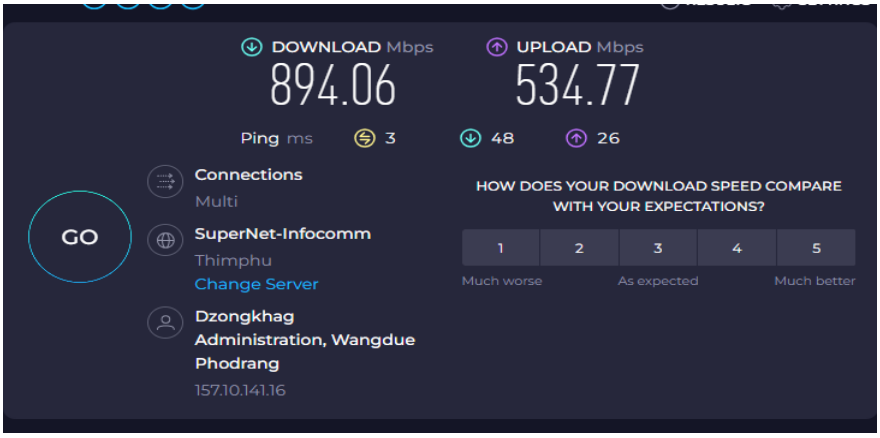


Figure 8: Internet bandwidth test at Lingzhi LSS

B. Google RTT latency test(ping test)

It was observed that the average google RTT latency time is 84 ms which is within our standard of 150 ms.

```
C:\Users\Dell>ping www.google.com -n 15

Pinging www.google.com [172.217.194.106] with 32 bytes of data:
Reply from 172.217.194.106: bytes=32 time=196ms TTL=104
Reply from 172.217.194.106: bytes=32 time=76ms TTL=104
Reply from 172.217.194.106: bytes=32 time=77ms TTL=104
Reply from 172.217.194.106: bytes=32 time=77ms TTL=104
Reply from 172.217.194.106: bytes=32 time=77ms TTL=104
Reply from 172.217.194.106: bytes=32 time=77ms TTL=104
Reply from 172.217.194.106: bytes=32 time=77ms TTL=104
Reply from 172.217.194.106: bytes=32 time=77ms TTL=104
Reply from 172.217.194.106: bytes=32 time=77ms TTL=104
Reply from 172.217.194.106: bytes=32 time=77ms TTL=104
Reply from 172.217.194.106: bytes=32 time=77ms TTL=104
Reply from 172.217.194.106: bytes=32 time=77ms TTL=104
Reply from 172.217.194.106: bytes=32 time=77ms TTL=104
Reply from 172.217.194.106: bytes=32 time=77ms TTL=104
Reply from 172.217.194.106: bytes=32 time=77ms TTL=104

Ping statistics for 172.217.194.106:
    Packets: Sent = 15, Received = 15, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 76ms, Maximum = 196ms, Average = 84ms
```

Figure 9: Google RTT ping test at Lingzhi LSS

C. Youtube RTT latency test(ping test)

It was observed that the average Youtube RTT latency time is 77ms which is within our standard of 150 ms.

```
C:\Users\Dell>ping www.youtube.com -n 15

Pinging youtube-ui.l.google.com [74.125.200.91] with 32 bytes of data:
Reply from 74.125.200.91: bytes=32 time=77ms TTL=104
Reply from 74.125.200.91: bytes=32 time=77ms TTL=104
Reply from 74.125.200.91: bytes=32 time=77ms TTL=104
Reply from 74.125.200.91: bytes=32 time=77ms TTL=104
Reply from 74.125.200.91: bytes=32 time=77ms TTL=104
Reply from 74.125.200.91: bytes=32 time=77ms TTL=104
Reply from 74.125.200.91: bytes=32 time=77ms TTL=104
Reply from 74.125.200.91: bytes=32 time=77ms TTL=104
Reply from 74.125.200.91: bytes=32 time=77ms TTL=104
Reply from 74.125.200.91: bytes=32 time=77ms TTL=104
Reply from 74.125.200.91: bytes=32 time=77ms TTL=104
Reply from 74.125.200.91: bytes=32 time=77ms TTL=104
Reply from 74.125.200.91: bytes=32 time=77ms TTL=104
Reply from 74.125.200.91: bytes=32 time=77ms TTL=104
Reply from 74.125.200.91: bytes=32 time=77ms TTL=104

Ping statistics for 74.125.200.91:
    Packets: Sent = 15, Received = 15, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 77ms, Maximum = 77ms, Average = 77ms
```

Figure 10: youtube RTT ping test at Lingzhi GC

D. Tiktok RTT latency test(ping test)

It was observed that the average Tiktok RTT latency time is 13 ms which is within our standard of 150 ms.

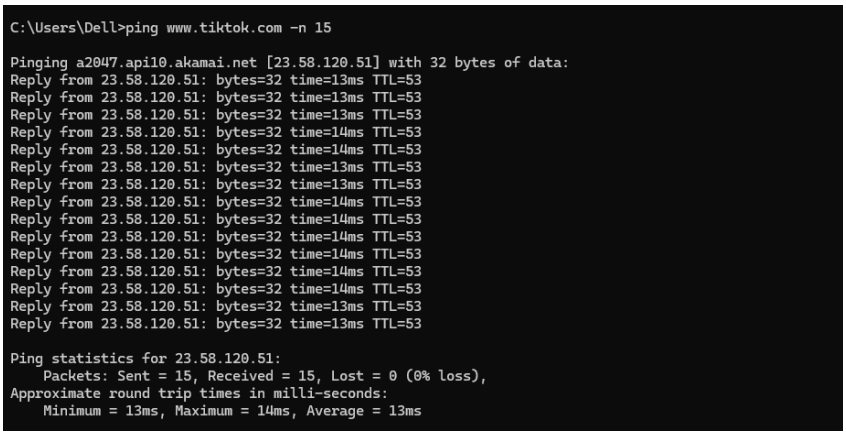


Figure 11: Titok RTT ping test at Lingzhi GC

3.2 ADSS fiber utilization by the telecom service providers in Lingzhi Gewog

The team observed that despite the reach of government ADSS fiber in Lingzhi Gewog center, the telecom service providers have not utilized the free ADSS fiber for their mobile backhaul network. Both BTL and TIPL have a BTS site nearby lingzhi Gewog center which can be connected with ADSS fiber to have a backhaul redundancy network in addition to the microwave backhaul network.

4. ADSS fiber and CWDM(Coarse Wavelength Division Multiplexing) Equipment at Soe Gewog Center

Soe gewog center is connected to 24 ADSS fiber pairs and out of 24 fiber pairs, only 5 pairs of fiber cable have been utilized for GovNet internet connectivity to Soe Gewog center, Soe BHU, RNR , Forest park office and Soe ECR School.

One unit of CWDM equipment having 8 channel capacity has been installed at Soe Gewog center. Out of 8 channels, only 5 channels have been utilized for GovNet internet connectivity to Soe Gewog center, BHU, RNR, Forest park office and Soe Primary school.

Figure 12: ADSS fiber and CWDM equipment at Soe Gewog center

4.1 Monitoring of Internet connectivity at Soe Gewog center

A. Internet bandwidth test

It was observed that Soe GC has access to internet bandwidth of download speed at around 83 Mbps and upload at 94 Mbps.

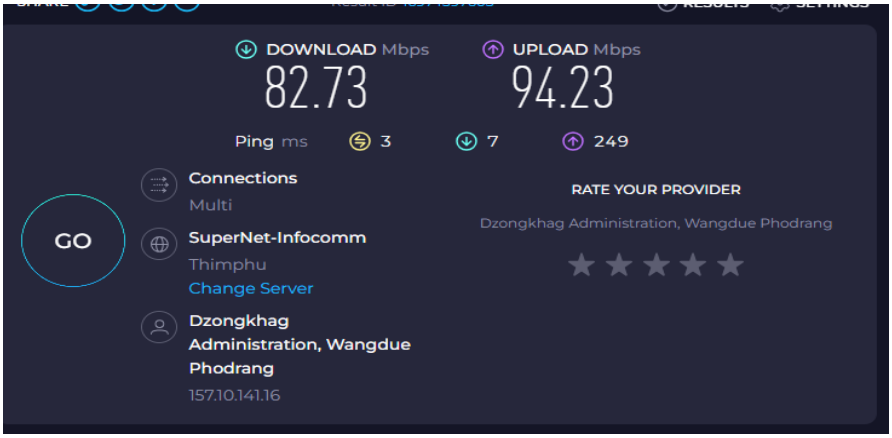


Figure 13: Internet bandwidth test at Soe GC

B. Google RTT latency test(ping test)

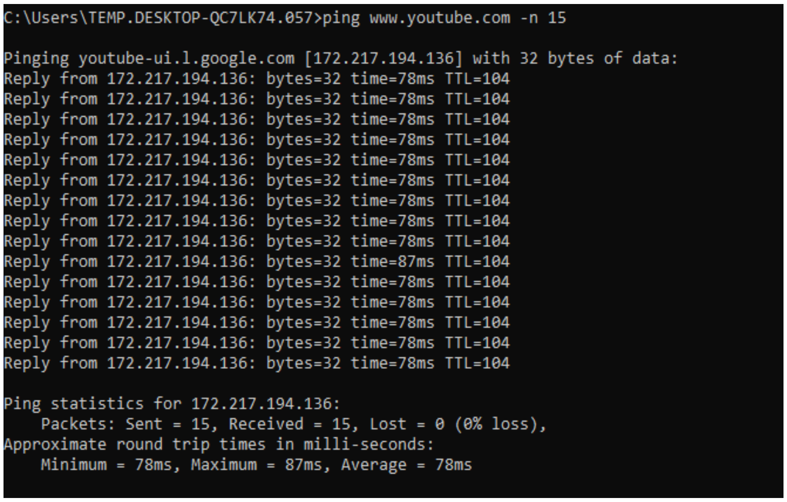
It was observed that the average google RTT latency time is 78ms which is within our standard of 150 ms.

```
C:\Users\TEMP.DESKTOP-QC7LK74.057>ping www.google.com -n 15

Pinging www.google.com [74.125.200.103] with 32 bytes of data:
Reply from 74.125.200.103: bytes=32 time=77ms TTL=104
Reply from 74.125.200.103: bytes=32 time=78ms TTL=104
Reply from 74.125.200.103: bytes=32 time=78ms TTL=104
Reply from 74.125.200.103: bytes=32 time=78ms TTL=104
Reply from 74.125.200.103: bytes=32 time=77ms TTL=104
Reply from 74.125.200.103: bytes=32 time=77ms TTL=104
Reply from 74.125.200.103: bytes=32 time=77ms TTL=104
Reply from 74.125.200.103: bytes=32 time=78ms TTL=104
Reply from 74.125.200.103: bytes=32 time=78ms TTL=104
Reply from 74.125.200.103: bytes=32 time=78ms TTL=104
Reply from 74.125.200.103: bytes=32 time=83ms TTL=104
Reply from 74.125.200.103: bytes=32 time=79ms TTL=104
Reply from 74.125.200.103: bytes=32 time=78ms TTL=104
Reply from 74.125.200.103: bytes=32 time=78ms TTL=104
Reply from 74.125.200.103: bytes=32 time=77ms TTL=104

Ping statistics for 74.125.200.103:
    Packets: Sent = 15, Received = 15, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 77ms, Maximum = 83ms, Average = 78ms
```

Figure 14: Google RTT ping test at Soe GC

C. Youtube RTT latency test(ping test)

It was observed that the average youtube RTT latency time is 78ms which is within our standard of 150 ms.

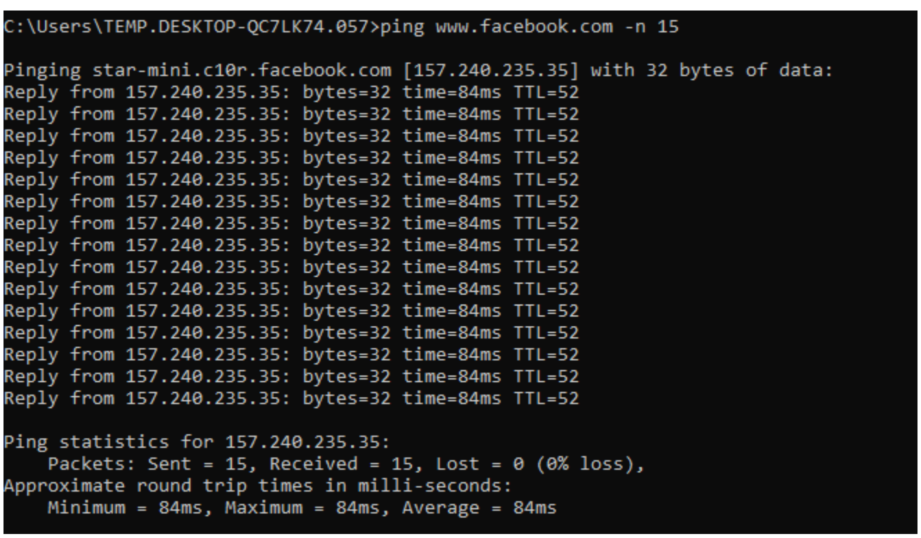


```
C:\Users\TEMP.DESKTOP-QC7LK74.057>ping www.youtube.com -n 15

Pinging youtube-ui.l.google.com [172.217.194.136] with 32 bytes of data:
Reply from 172.217.194.136: bytes=32 time=78ms TTL=104
Reply from 172.217.194.136: bytes=32 time=78ms TTL=104
Reply from 172.217.194.136: bytes=32 time=78ms TTL=104
Reply from 172.217.194.136: bytes=32 time=78ms TTL=104
Reply from 172.217.194.136: bytes=32 time=78ms TTL=104
Reply from 172.217.194.136: bytes=32 time=78ms TTL=104
Reply from 172.217.194.136: bytes=32 time=78ms TTL=104
Reply from 172.217.194.136: bytes=32 time=78ms TTL=104
Reply from 172.217.194.136: bytes=32 time=78ms TTL=104
Reply from 172.217.194.136: bytes=32 time=87ms TTL=104
Reply from 172.217.194.136: bytes=32 time=78ms TTL=104
Reply from 172.217.194.136: bytes=32 time=78ms TTL=104
Reply from 172.217.194.136: bytes=32 time=78ms TTL=104
Reply from 172.217.194.136: bytes=32 time=78ms TTL=104
Reply from 172.217.194.136: bytes=32 time=78ms TTL=104

Ping statistics for 172.217.194.136:
    Packets: Sent = 15, Received = 15, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 78ms, Maximum = 87ms, Average = 78ms
```

Figure 15: Youtube RTT ping test at Soe GC

D. Facebook RTT latency test(ping test)

It was observed that the average facebook RTT latency time is 84 ms which is within our standard of 150 ms.



```
C:\Users\TEMP.DESKTOP-QC7LK74.057>ping www.facebook.com -n 15

Pinging star-mini.c10r.facebook.com [157.240.235.35] with 32 bytes of data:
Reply from 157.240.235.35: bytes=32 time=84ms TTL=52
Reply from 157.240.235.35: bytes=32 time=84ms TTL=52
Reply from 157.240.235.35: bytes=32 time=84ms TTL=52
Reply from 157.240.235.35: bytes=32 time=84ms TTL=52
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Reply from 157.240.235.35: bytes=32 time=84ms TTL=52
Reply from 157.240.235.35: bytes=32 time=84ms TTL=52
Reply from 157.240.235.35: bytes=32 time=84ms TTL=52
Reply from 157.240.235.35: bytes=32 time=84ms TTL=52

Ping statistics for 157.240.235.35:
    Packets: Sent = 15, Received = 15, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 84ms, Maximum = 84ms, Average = 84ms
```

Figure 16: Facebook RTT ping test at Soe GC

4.2 Assessment of ADSS fiber utilization by the telecom service providers in Soe Gewog

The team observed that despite the reach of government ADSS fiber in Soe Gewog center, the telecom service providers have not utilized the free ADSS fiber for their mobile backhaul network. BTL has a BTS site nearby Soe Gewog center which can be connected with ADSS fiber to have a backhaul redundancy network in addition to the microwave backhaul network. TICL does not have a nearby site near Soe GC and Tashicell signal can be received from Soe RBA area site.

5. ADSS fiber and CWDM(Coarse Wavelength Division Multiplexing) Equipment at Laya Gewog Center

Laya gewog center is connected with 24 ADSS fiber pairs under GIN project and out of 24 fiber pairs, only 4 pairs of fiber cable have been utilized for GovNet internet connectivity to laya Gewog center, laya BHU and Laya School. Laya is connected with 24 pairs of Nationalized ADSS fiber connected to Damji Substation. Out of 24 pairs of Nationalized ADSS fiber, only 3 pairs have been utilized with one each to Laya GC, BTL backhaul network and TICL backhaul network in the Laya area.

One unit of CWDM equipment having 8 channel capacity has been installed at Laya Gewog center. Out of 8 channels, only 4 channels have been utilized for GovNet internet connectivity to Laya Gewog center, BHU, RNR and Laya school.

Figure 17: ADSS fiber and CWDM equipment at Laya Gewog Center

5.1 Monitoring of Internet connectivity at Laya Gewog center

A. Internet bandwidth test

It was observed that Laya GC has access to internet bandwidth of download speed at around 70 Mbps and upload at 48 Mbps.

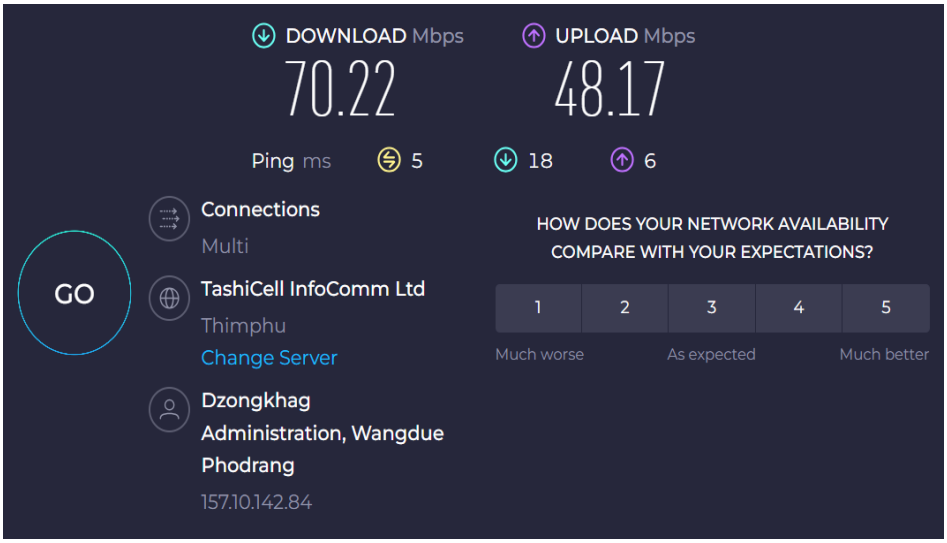

Figure 18: Internet bandwidth test at Laya GC

B. Google RTT latency test(ping test)

It was observed that the average google RTT latency time is 89ms which is within our standard of 150 ms.

```
C:\Users\User>ping www.google.com -n 15

Pinging www.google.com [142.251.10.104] with 32 bytes of data:
Reply from 142.251.10.104: bytes=32 time=87ms TTL=99
Reply from 142.251.10.104: bytes=32 time=86ms TTL=99
Reply from 142.251.10.104: bytes=32 time=88ms TTL=99
Reply from 142.251.10.104: bytes=32 time=91ms TTL=99
Reply from 142.251.10.104: bytes=32 time=88ms TTL=99
Reply from 142.251.10.104: bytes=32 time=89ms TTL=99
Reply from 142.251.10.104: bytes=32 time=92ms TTL=99
Reply from 142.251.10.104: bytes=32 time=90ms TTL=99
Reply from 142.251.10.104: bytes=32 time=90ms TTL=99
Reply from 142.251.10.104: bytes=32 time=91ms TTL=99
Reply from 142.251.10.104: bytes=32 time=88ms TTL=99
Reply from 142.251.10.104: bytes=32 time=89ms TTL=99
Reply from 142.251.10.104: bytes=32 time=89ms TTL=99
Reply from 142.251.10.104: bytes=32 time=91ms TTL=99
Reply from 142.251.10.104: bytes=32 time=90ms TTL=99

Ping statistics for 142.251.10.104:
    Packets: Sent = 15, Received = 15, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 86ms, Maximum = 92ms, Average = 89ms
```

Figure 19: Google RTT ping test at Laya GC

C. Youtube RTT latency test(ping test)

It was observed that the average youtube RTT latency time is 89ms which is within our standard of 150 ms.

```
C:\Users\User>ping www.youtube.com -n 15

Pinging youtube-ui.l.google.com [74.125.200.190] with 32 bytes of data:
Reply from 74.125.200.190: bytes=32 time=92ms TTL=99
Reply from 74.125.200.190: bytes=32 time=89ms TTL=99
Reply from 74.125.200.190: bytes=32 time=89ms TTL=99
Reply from 74.125.200.190: bytes=32 time=90ms TTL=99
Reply from 74.125.200.190: bytes=32 time=87ms TTL=99
Reply from 74.125.200.190: bytes=32 time=87ms TTL=99
Reply from 74.125.200.190: bytes=32 time=92ms TTL=99
Reply from 74.125.200.190: bytes=32 time=87ms TTL=99
Reply from 74.125.200.190: bytes=32 time=88ms TTL=99
Reply from 74.125.200.190: bytes=32 time=87ms TTL=99
Reply from 74.125.200.190: bytes=32 time=88ms TTL=99
Reply from 74.125.200.190: bytes=32 time=90ms TTL=99
Reply from 74.125.200.190: bytes=32 time=89ms TTL=99
Reply from 74.125.200.190: bytes=32 time=91ms TTL=99
Reply from 74.125.200.190: bytes=32 time=90ms TTL=99

Ping statistics for 74.125.200.190:
    Packets: Sent = 15, Received = 15, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 87ms, Maximum = 92ms, Average = 89ms
```

Figure 20: Youtube RTT ping test at Laya GC

D. Facebook RTT latency test(ping test)

It was observed that the average facebook RTT latency time is 89ms which is within our standard of 150 ms.

```
C:\Users\User>ping www.facebook.com -n 15

Pinging star-mini.c10r.facebook.com [57.144.150.1] with 32 bytes of data:
Reply from 57.144.150.1: bytes=32 time=85ms TTL=46
Reply from 57.144.150.1: bytes=32 time=85ms TTL=46
Reply from 57.144.150.1: bytes=32 time=86ms TTL=46
Reply from 57.144.150.1: bytes=32 time=92ms TTL=46
Reply from 57.144.150.1: bytes=32 time=93ms TTL=46
Reply from 57.144.150.1: bytes=32 time=131ms TTL=46
Reply from 57.144.150.1: bytes=32 time=85ms TTL=46
Reply from 57.144.150.1: bytes=32 time=89ms TTL=46
Reply from 57.144.150.1: bytes=32 time=97ms TTL=46
Reply from 57.144.150.1: bytes=32 time=87ms TTL=46
Reply from 57.144.150.1: bytes=32 time=84ms TTL=46
Reply from 57.144.150.1: bytes=32 time=87ms TTL=46
Reply from 57.144.150.1: bytes=32 time=100ms TTL=46
Reply from 57.144.150.1: bytes=32 time=87ms TTL=46
Reply from 57.144.150.1: bytes=32 time=84ms TTL=46

Ping statistics for 57.144.150.1:
    Packets: Sent = 15, Received = 15, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 84ms, Maximum = 131ms, Average = 91ms
```

Figure 21: Facebook RTT ping test at Laya GC

5.2 Monitoring of PTN fiber network of BTL at Laya Site

The team also monitored the PTN fiber network of BTL at the Laya site. PTN at Laya is connected to Gasa BTL office site via Nationalized ADSS fiber from Damji Substation to Laya GC. PTN network of BTL at laya is backhaul network for Laya BTS site and its D- site. 3 ports of 1 Gbps have been utilized for 3G Node B and 4G e Node B and one E1 port has been utilized for 2G BTS as shown in figure below.

Figure 22: PTN fiber network of BTL at Laya BTS site

6. Actions Taken based on the field visit

- The letter on network connectivity issues in Naro gewog center has been shared with Govtech and BPC. Accordingly, the Network connectivity in Naro gewog center was resolved by Govtech and BPC.

- We have advised both BTL and TIPL on utilization of the existing ADSS fiber in Naro, Soe and Lingzhi for Mobile Backhaul network connectivity. BTL and TIPL shared that they have included the backhaul network using ADSS in future network expansion plans.

7. Recommendation/ Way Forward

- To carry out further detailed monitoring of ICT Infrastructure especially the fiber network in Gewog centers, quality of internet services, quality of experience of G2C services in other Dzongkahgs.

- To carry out monitoring of backbone fiber networks of both telcos to validate and audit the information details submitted by telcos on fiber backbone networks.