Use of Simplex Satellite Configurations to support Internet Traffic

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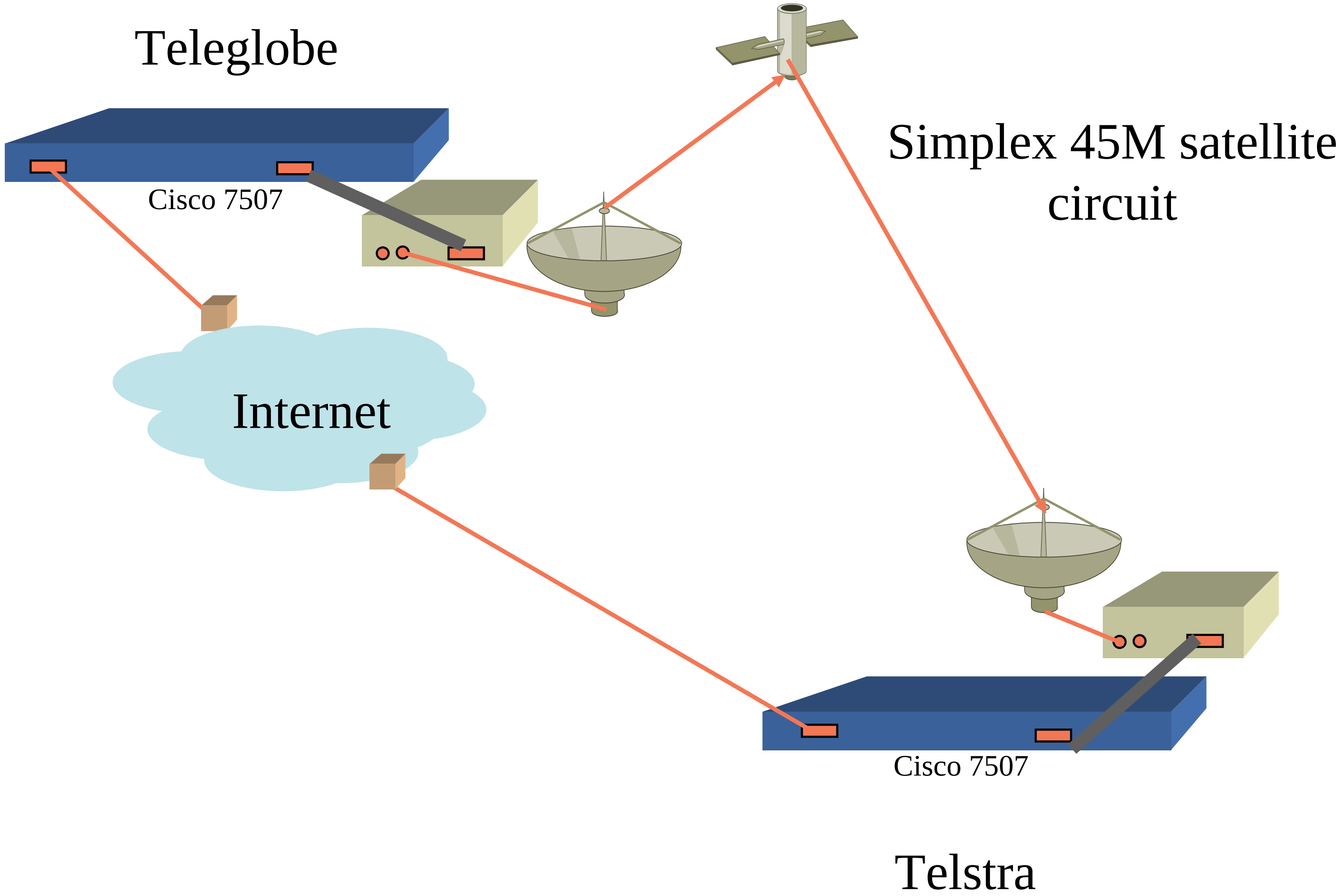
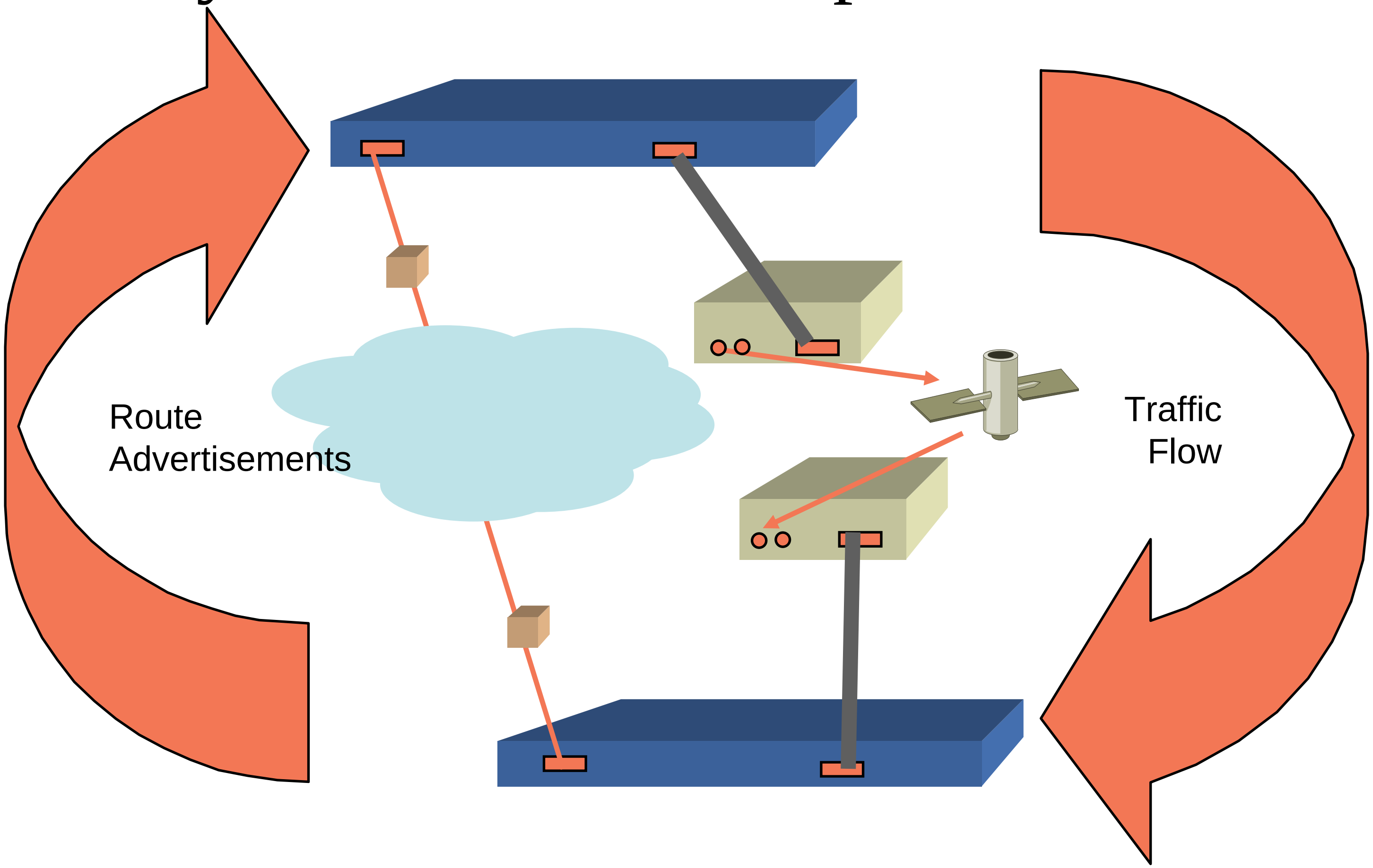
Configuration of Simplex Circuit



IP Configuration

- Interconnection by
  - unidirectional satellite link
  - Internet-based return path
- End to end reachability signaling via BGP4 protocol keepalive functionality

Asymmetric BGP Keepalive flow

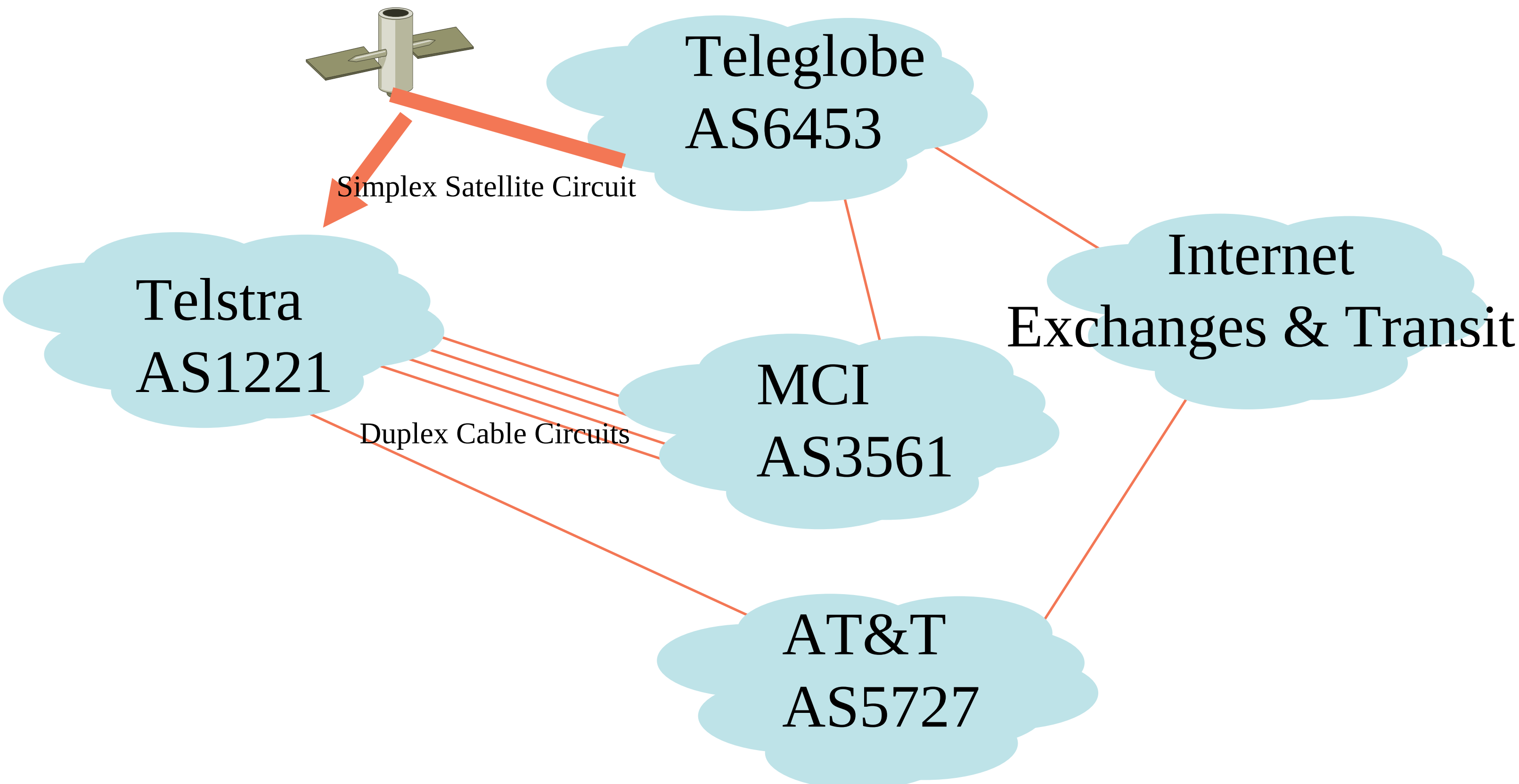


Any break in the unidirectional circuit will cause a BGP keepalive failure, which in turn will cause the BGP session to fail. This eliminates the need for an HDLC keepalive signal along the satellite path

Internet Configuration

- Telstra and Teleglobe connect exclusively via a simplex 45M satellite circuit
- Telstra uses cable circuits to connect to MCI and AT&T in North America
- Teleglobe uses cable circuits to connect to MCI and other ISPs and exchange points in North America

Internet Configuration



Router Configuration

- Telstra and Teleglobe use Cisco 7500 routers to manage the simplex satellite circuit at the IP level
- The routers are configured to use multihop BGP4 in an asymmetric circuit configuration, to allow Telstra to pass routes to the Teleglobe router
- The Teleglobe router announces these BGP-learned routes into the Internet from this router
- On circuit failure the BGP session is closed, and the corresponding route announcements are withdrawn, causing traffic to revert back to available cable circuits in a backup configuration

Sender configuration

Generic cisco configuration for the simplex sender

```
version 11.2
!
interface Loopback3
 ip address 3.3.3.2 255.255.255.255
!
interface Ethernet0
 ip address 2.2.2.2 255.255.255.224
!
interface Serial0
 ip address 1.1.1.2 255.255.255.252
 no keepalive
 ignore-dcd
!
router bgp 50
 timers bgp 5 30
 neighbor 3.3.3.1 remote-as 25
 neighbor 3.3.3.1 ebgp-multihop 10
 neighbor 3.3.3.1 update-source Loopback3
!
ip route 3.3.3.1 255.255.255.255 Serial0
```

Receiver configuration

Generic cisco configuration for the simplex receiver

```
version 11.1
!
interface Loopback3
 ip address 3.3.3.1 255.255.255.255
!
interface Ethernet0
 ip address 2.2.2.1 255.255.255.224
!
interface Serial0
 transmit-interface Ethernet0
 ip address 1.1.1.1 255.255.255.252
 no keepalive
 ignore-dcd
!
router bgp 25
 timers bgp 5 30
 redistribute static
 neighbor 3.3.3.2 remote-as 50
 neighbor 3.3.3.2 ebgp-multihop 10
 neighbor 3.3.3.2 update-source Loopback3
!
ip route 0.0.0.0 0.0.0.0 2.2.2.2
ip route 3.3.3.2 255.255.255.255 2.2.2.2
```

Configuration Features

- BGP4 set to multihop configuration, linking loopback addresses as BGP peers
- Reciever set to associate ethernet as the transmit interface via cisco ‘transmit interface” interface
- remote loopback address is statically loaded into the router
- BGP timers brought down to 5 second keepalive and 30 second holddown (this may vary according to the characteristics of the return cable path)
- Note that NO return path tunnel is used in this configuration

Circuit Stability Tests

- Stability of BGP achieved
- Time to propagate serial line break to BGP
  - 35 seconds
- Time to detect restoration of serial line to BGP
  - 10 seconds

Interface performance

Cisci interface statistics dump for 3 weeks, 5 days of operation

```
Hssi6/0 is up, line protocol is up
  Hardware is cxBus HSSI
  Internet address is 207.45.214.250/30
  MTU 4470 bytes, BW 45045 Kbit, DLY 200 usec, rely 255/255, load 1/255
  Encapsulation HDLC, loopback not set, keepalive not set
  Last input 00:00:00, output 3w5d, output hang never
  Last clearing of "show interface" counters 3w5d
  Queueing strategy: fifo
  Output queue 0/40, 0 drops; input queue 0/75, 34630 drops
  5 minute input rate 3903000 bits/sec, 933 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
     1528989342 packets input, 3622447977 bytes, 1 no buffer
     Received 37506 broadcasts, 0 runts, 0 giants 0 parity
     364154 input errors, 21630 CRC, 215558 frame, 126966 overrun, 0 abort
     0 packets output, 0 bytes, 0 underruns
     0 output errors, 0 applique, 3 interface resets
     0 output buffer failures, 0 output buffers swapped out
     116 carrier transitions
```

Interface performance

Measured on a 3 week 5 day period

- Line error rate
  - less than 0.02% packet error rate

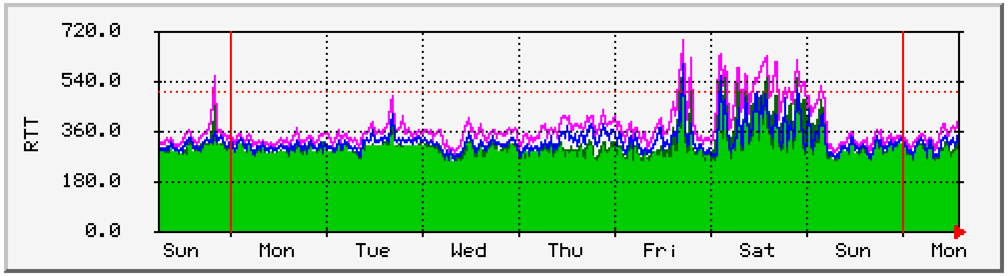
- Dropped packets
  - less than 0.002% packet drop rate in receiver router queue

Internet performance

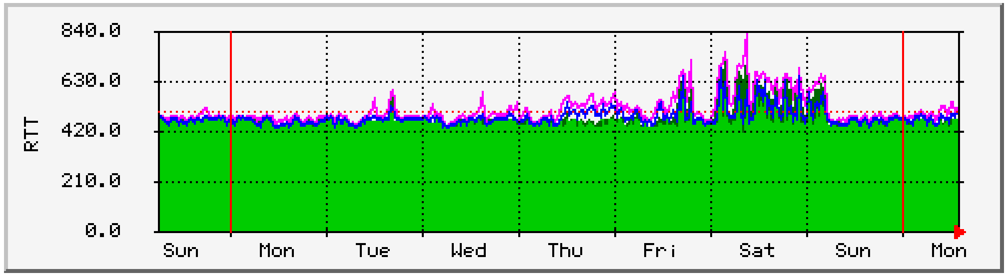
- Test of Delay, Packet loss and Throughput
  - Tests were conducted using 50 packet ping sequences every 300 seconds, logging packet loss and round trip delay. Throughput was measured using SNMP polling of interface octet counters on the receive end.
  - The environment constructed here is perhaps one of the more challenging environments where a simplex satellite circuit can be deployed. The two operators have no other direct Internet connection other than the simplex circuit. Ping packets in the reverse direction have to transit a third party to complete the loop, so that ping-based measurements of the overall performance impact of the simplex satellite circuit have to recognise the impact of the third party transit.
  - Overall the test results indicate that the simplex satellite circuit itself performs well in an Internet configuration.

Delay Measurements

Ping Round Trip time measurements



Symmetric ping - Australia - US East coast - cable circuits

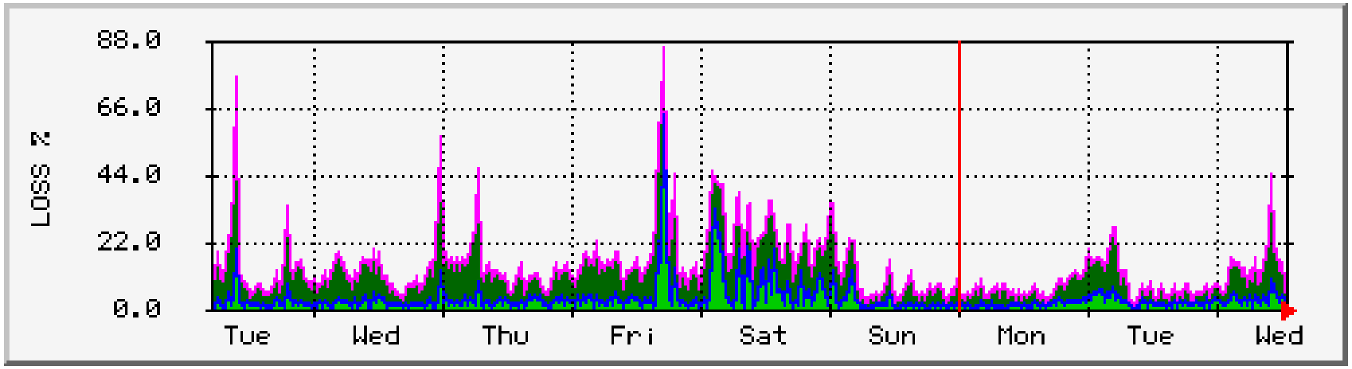


Asymmetric ping - Australia to US East coast - cable
US East coast to Australia - satellite

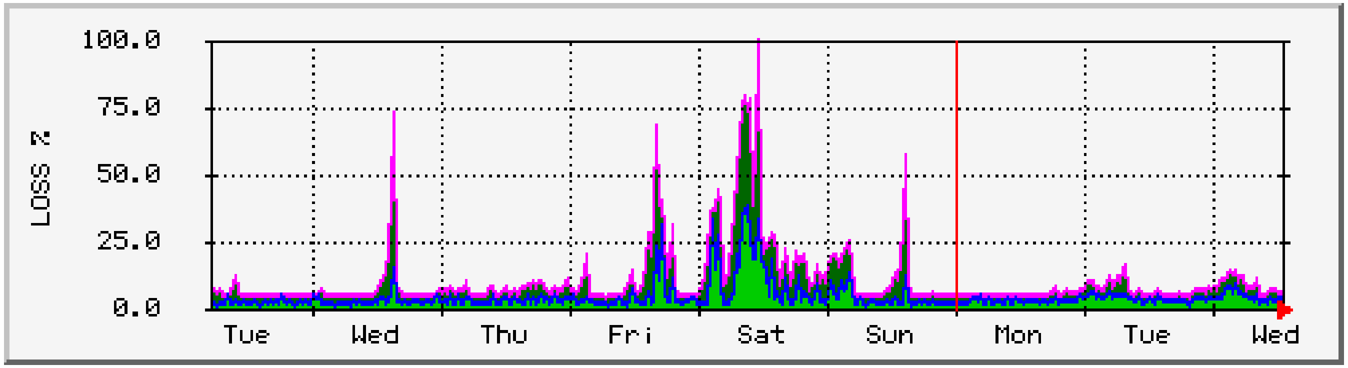
Delay Measurements

- Propagation Delay rises from 291 ms cable symmetric to 449 ms cable and satellite asymmetric circuits
- Satellite hop induces no additional variation in delay (no increased jitter component)

Ping Loss Measurements



Symmetric ping - Australia - US East coast - cable circuits

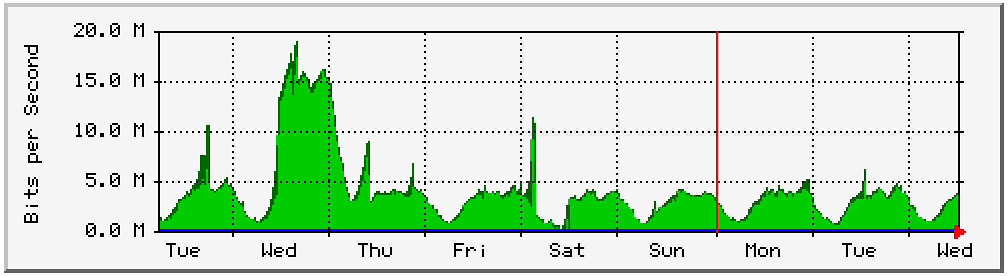


Asymmetric ping - Australia to US East coast - cable
US East coast to Australia - satellite

Ping Loss Measurements

- While there is some variation between symmetric cable path ping packet loss and asymmetric cable / satellite ping packet loss, no appreciable quantum loss degradation was visible on the asymmetric path.
- Loss events are attributable to engineering within the transit networks, as distinct from loss caused by router queue exhaustion on the satellite transmission side

Throughput Measurements



Peak load tested to date on the circuit is 20Mbps.
Average load tested is 5Mbps

Current routing configuration uses BGP AS path prepending to use satellite circuit for Teleglobe and connected Teleglobe customers as preferred route.

Link Monitoring

- Link Monitoring is undertaken through continuous SNMP polling at 300 second intervals.
- Link loads, ping RTT and ping Loss reports can be accessed at:
  - http://www.telstra.net/ops/satellite