

### **Broadcast Media over** the Internet

**Bernhard Pusch** Head of Global Internet Strategy Telstra Corporation

### **Video and Internet experience**



### **Broadcast**



ad hoc event bookings annually



Broadcast bookings, operations and engineering support across the world



Global partnerships via the Telstra Global Media Network Partner Alliance



Years of experience managing major broadcast events Internet



## **Applications for broadcast on the internet**



#### Distribution



- · Compatibility with consumer decoders is key
- Adapts to consumer bandwidth
- · End of the production chain
- Mainly handled by Content Distribution Networks
- Flows mainly regional

#### Contribution



- · Part of the Workflow
- · Historically sent on satellite or private lines
- Reliability is critical
- Flows can be regional or global
- End to end latency can be major factor (sports)
- Further processing needed

### Why use the Internet?



- + Internet is increasingly pervasive
- + Low cost
- + Generally availability is high
- + Access via 4G, 5G, Wifi
- + Protocols (ARQ, RIST,....) well tested
- Cloud providers are increasingly the destination

- Performance Variability
- Limited SLAs available
- Packet loss and jitter
- Security
- Protocols add 5-7x latency "penalty"



### Let's get down to the basics



#### **Network of Networks**

#### **Inter-Connections via**

- Direct x-connects in a DC
- Internet Exchange between DCs

#### **Network types**

- Multi-regional
- Regional
- In-country

# Each network sets its own policy and communicates with others (BGP)

Congestion and jitter occur between networks
 not within networks



## **Internet regional differences**



- Latencies medium(10-70ms)
- Plentiful Capacity
- Mainly terrestrial routes
- Large number of providers

- Latencies relatively low (10-20ms)
- Plentiful Cheap Capacity
- Mainly terrestrial routes
- Least problematic performance
- Large number of providers



- Very variable performance
- Plentiful capacity only to major markets
- Caribbean islands often constrained
- Inter-regional connectivity centred on Brazil

Performance can be surprisingly good

Latency variation between E & W



- High latency variability (10-200ms) Plentiful Capacity in core markets
- Mainly submarine routes
- Earthquakes can cause instability
- Indirect routes are common
- Content filtering is common





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### **Other considerations**

#### **Great Chinese Firewall**

- Tunnels are officially not permitted
- Regular source of congestion

#### **Indirect routes**

- · Neighbouring countries don't always connect
- · Some routes (especially in Asia) may go via US causing very high latency
- **DDoS** attacks
  - Best to protect key gateways to avoid congestion
- **Multi-Path Connections for improved availability** 
  - Ideally similar latency on each path
  - Avoid paths with same intermediate networks



### **Tools**

- PeeringDB (www.peeringdb.com)
  - Provides information on key interconnection
    points by carrier
- HE BGP Toolkit (he.bgp.net)
  - Key peers of each carrier network
- Looking Glass (ISP website)
  - Most Global carriers allow you to test latency from network nodes to specific IP addresses

### Conclusion







On short-medium routes in Europe, US, and Asia (<30ms) performance can be surprisingly good



In other regions more care is needed



Ideally the least number of carrier interconnection points should be traversed

• It helps to be a carrier with an internet backbone



### For inter-region routes, latency can be a problem

- 4-7x latency needs to be added in buffers to cater for re-transmission
- Hybrid Solution with Dedicated (for interregion) plus internet (for last mile) will improve results



Multi-Path Connections for improved availability