Earth Station Bandwidth Management Tools

November 19th, 2014
Inmartech at OSU

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Satellite Bandwidth

	At Sea	On Shore
Cost	5x-10x+ shore cost	Free at office, <$100 at home
Availability	Limited by shadow and footprint	Always on
Amount	256kbps-2Mbit	5-100Mbit+
Accessibility	Limited workstation	WiFi everywhere
Sharing	20-50 Users/ship	Family at home

Network Environment

	At Sea (Limited BW)	On Shore (Unlimited BW)
Networked Devices	Laptop maybe	Phone, tablet, laptop, workstation
Connection Count	Generally one path out for everything	Work internet, home internet, coffee shop WiFi, 3G/4G network, etc.
Automated Processes	As few as possible	Backup, updates, iCloud, Dropbox, etc
Communications	News sites, IM, email	Email, Skype, VoIP, Vcon, IM, news
Work Uses	Collaboration, data/code exchange, outreach, professional development	Collaboration, data/code exchange, outreach, professional development
Life Use	Banking, shopping, etc.	Banking, shopping, mapping, local info, etc.
Entertainment Use	Where do you draw the line?	Streaming media, gaming, social networking, Instagram, etc.

Science/Scientist Trends

- Science is generating more data
- Scientists are getting younger, more tech savvy and device heavy
- Science and scientists are getting more bandwidth dependent
- More variety of science with limited bunks makes for more collaboration with shore
- Outreach is becoming more frequent (blogs, vcon, websites, twitter, etc.)

Technology Trends

- More cloud services means more data exchange and less traceability
- Software design is assuming and requiring more connectivity
  - Increasing emphasis on mobility, tablets, thinner clients, thicker servers
  - Data synchronization between many devices
- More security means less network efficiency
- Heavier graphic loads in general

Limitations

- Shipboard bandwidth will likely always be less than shore (even at 50Mbit Ka-band)
- Shipboard bandwidth will likely always be more expensive than shore
- Bandwidth needs/wants per user will increase
- Human behavior will vary based on how much bandwidth is available to them at what cost

The Key Question

- Left unrestricted or insufficiently restricted, the natural use patterns on a ship tend toward saturation at high data rates (shore use mentality)
- With some restrictions, it might be in the 512kbps/ship range…today.

- How does one find that sweet spot of offered services to derive a high value for the bandwidth that is purchased?

The 5 Kilo Bucket

- "The link is unusable because there isnt enough bandwidth for what we are doing."
- 10 kilos of data to fit in a 5 kilo bucket
- Increase the bucket size?
  - Buy more bandwidth, but it costs money and will it solve the problem?
  - QoS, compression, TCP trickery, etc. only help so much (10-20%)
  - Caching helps up to 50%, less all the time
  - Even with all the tricks and efficient sharing, there is frequent congestion if access is unlimited
- Pass less data?
  - Restrict access, destination, or protocol?
  - But what gets dropped vs allowed?

The Easy Approach

- Option 1: Try to keep up with shore capabilities, swipe the credit card, hope to stay ahead of saturation

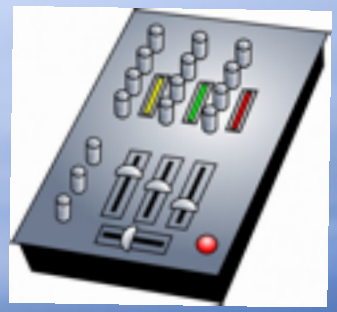
- Option 2: Limit services offered to minimum possible, save as much bandwidth as possible for heavy science times, buy less bandwidth overall

- Option 3: Restrict usage to just what is necessary for science…as if you could determine that precisely…

The Questions

- But how do you know what is useful?
- People live and work at sea…can/should they be provided with some BW for their life?
- How do you limit undesired, unnecessary behavior, but still allow flexibility?
- How do you automate this and take control out of the hands of the tech?
- How do you maintain flexibility for unusual science/cruise requirements?

Option 4: A Balanced Approach



- Prevent abuse where it makes sense
  - Develop clear acceptable use policies
  - Limit # of terminals, data rates, devices per user, etc?
  - Block some inappropriate content, protocols
  - Cache/proxy heavy data (like updates)
- Make the science BW accessible to users that need it
- Provide a limited amount of "Life" BW at a user's discretion (maybe a per user daily quota)

Option 4: Implementation

- How do you make option 4 happen?
- Where do you set the dials?
- What policy is defined? What is the scope? Fleet wide? Institution? Ship?
- Is there technology off-the-shelf to get it out of tech hands? Roll your own?

- Does it work for the scientists?
- Does it work for the funding agencies?