

Satellite Carriage of Digital Broadcast Signals

Key Differentiators

DBS

- National
- Digital
- Space
- Wireless

Cable

- Local
- Analog
- Terrestrial
- Wireline

DBS Satellite Basics

- Limited number of orbital locations and “channels,” determined by international plan
- “CONUS” beams cover the entire contiguous United States
 - Majority of channels – can only be used once
- Spot beams cover smaller areas and achieve efficiency of frequency reuse
 - Like multiple FM stations on 97.1 nationwide
 - Key advance enabling local-into-local service
 - Only a few channels

Capacity Basics

- How to measure capacity?
 - The available “pipe” (MHz)
 - The amount of information carried (Mbps)
- Differences are important
 - A broadcaster’s DTV signal has the same size pipe available as does its analog signal (6 MHz)
 - But DTV involves carriage of much more information
 - Because cable does not digitize analog signal, cable is moving from reserving a pipe to processing information
 - Because DBS has always digitized analog signal, DBS is moving from processing information to processing more information

Digital Transmission Terminology

- Compression: removing unneeded bits so that less information must be transmitted to convey information
 - E.g., MPEG-2
- Modulation: technique for coding digital information onto a carrier wave
 - E.g., 4PSK, 256 QAM
- Multiplexing: combining multiple streams of information into a single stream

Broadcast Technology Basics

- Analog signal transmitted in 6 MHz of spectrum
- Development of the ATSC standard began in the early 1990's, adopted by FCC in 1995
- For digital television, 19.4 Mbps payload is derived from the 6 MHz terrestrial bandwidth and the ATSC RF modulation parameters
 - Sufficient for carrying 1080 active lines of interlace video for year 1995 MPEG encoder technology
 - Use of lower resolution formats allows multi-channel transmission within the payload

Cable Retransmission of Local Broadcast Signals

- Only carry stations in franchise area
 - Average @ 10-12 per market (*e.g.*, DC)
- Analog OTA signal retransmitted in analog format using 6 MHz of cable bandwidth
 - No digital processing
- High definition digital OTA signal requires only half as much cable bandwidth or less
 - Digital processing used to increase efficiency
- ***Because cable is currently analog, digital transition actually saves capacity***

DBS Retransmission of Local Broadcast Signals

- Must use limited number of orbital locations to retransmit hundreds of local stations nationwide
- Analog OTA signal first digitized to SD, then compressed and multiplexed
 - Can fit about 12 SD stations into each DBS channel
- HD digital OTA signal is much larger – can only fit 2 HD stations into each DBS channel, even with compression and multiplexing
- *Because DBS has always been digital, transition to HD requires much more capacity*

Next-Generation Satellite Technology

- Improved compression (MPEG-4)
- Higher order modulation (8PSK)
- Improved coding
- Applying all of this technology, can carry about 4 HD stations in a single channel
- But requires new set-top boxes to receive

Broadcasters Can Implement Technologies Pioneered by DBS

- In 1990's, compression and multiplexing were new and untested technologies
- Today, compression and multiplexing are in widespread use and are vital to the operation of DBS service
- Advances pioneered by DBS operators are now available for application to ATSC transmissions

Bandwidth Requirements Are Not Static

- Applying digital technologies pioneered by DBS, broadcasters will be able to put more content into their available bandwidth
 - No longer a choice between HD *or* multiple SD, rather can have HD *and* one or more SD
- Creates an ever escalating load for DBS operators to carry with limited capacity allocated to fixed spot beams

Implications of a “Full 19.4 Mbps” Carriage Requirement

- If DBS operators are required to allocate a 19.4 Mbps “pipe” to each DTV station, they will only be able to carry a *single station* in each DBS channel
- DIRECTV currently uses only 10 DBS channels for spot beams providing local service to over 100 markets
- With this capacity, DIRECTV could only serve a single, mid-sized market with 10 local stations at 19.4 Mbps each
 - DBS spot beams are fixed, so would be rendered useless
- ***Operators must be allowed to use most advanced technology to enhance spectrum efficiency***

Implications of a Multicast Carriage Requirement

- Even assuming full digital processing, carriage of multiple SD streams would multiply expense and logistical complexity
- Carriage of multiple HD *and* SD streams would crash the system
 - Spot beam patterns assume single stream per station, so would have insufficient capacity for multiple streams
 - Under SHVERA, if DIRECTV cannot carry all stations in a market, it cannot even carry one
- ***Operators must be allowed to continue to carry only a single, primary video stream***

Implications of a Dual Carriage Requirement

- Even assuming carriage of the compressed, primary DTV signal only, a dual carriage requirement would significantly limit local carriage
 - If forced to carry HD wherever SD is offered, will forego or even exit markets
- ***DBS operators must be allowed to decide whether they have sufficient capacity to provide HD local service***