Agenda

- ✓ *ATV Review*
- ✓ *DTV Overview*
- ✓ *Transport Basics*
- ✓ *Television Stuff – A & V*
- ➢ **Metadata – PSI & PSIP**
- Amateur DTV

Metadata

- Data about included data is metadata
- Metadata tells the decoder which kinds of information are contained in each PID, and which PID's go together.
- There are two kinds of Metadata
  - Program Specific Information (PSI) - Tables in the stream defined in the MPEG standards
  - Program and System Information Protocol (PSIP) -Tables defined in ATSC A/65

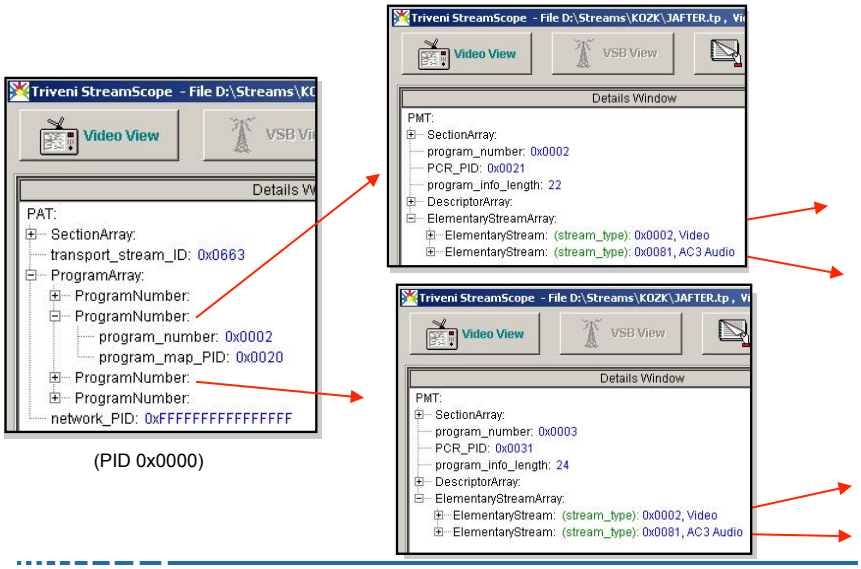
Signaling vs Announcement

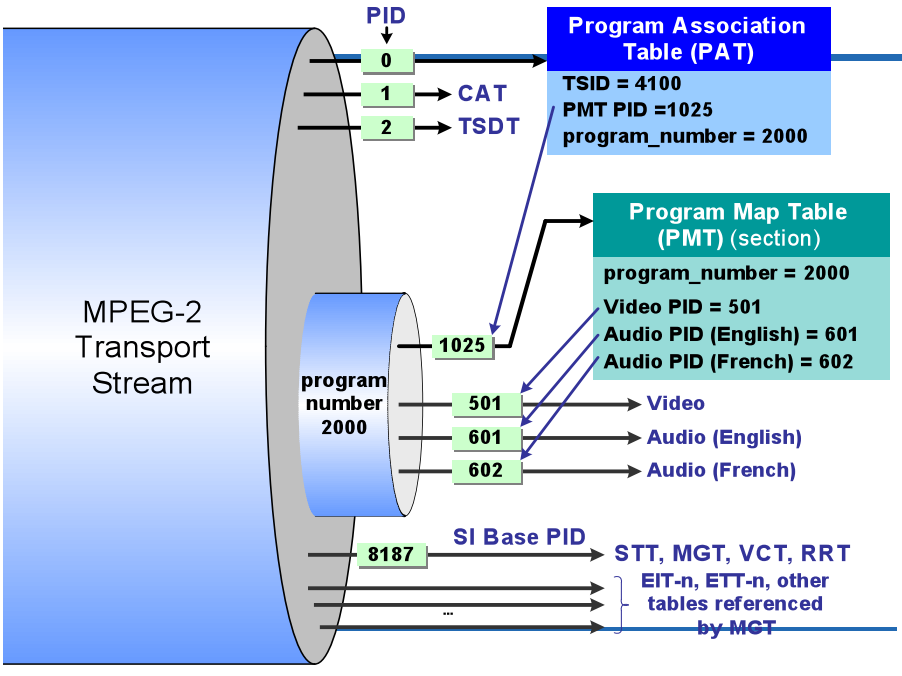
- Signaling
  - Information about what is "on now"
  - Used to assemble program elements into whole
    - Provides linkages
    - Ex: PMT and/or VCT used to link different components of television program (I.e. video and audio)
  - Used to define characteristics of current program
    - Captioning, ratings, redistribution…
- Announcement
  - Information about what will be available in the future
  - Program Guide information (name, description schedule)
  - Characteristics of future programs (captioning, ratings, redistribution…)
  - Typically does not provide linkages between program elements

MPEG-2 Program Specific Information (PSI)

- Gives very basic tuning information:
  - PAT (Program Association Table: one for entire transport stream; identifies "programs" (virtual channels) in stream and gives PIDs for PMTs.
  - PMT (Program Map Table): one per "program"; identifies elementary streams in "program" and gives their types (audio, video, etc.) and PIDs.
- Supports tuning by physical channel number and MPEG-2 program number.

Graphical View of PAT/PMT





PSIP Background

- Program and System Information Protocol
- Metadata inserted into broadcast stream
- Enables:
  - Tuning to virtual channels
  - Displaying channel name (on channel changes)
  - Interactive electronic program guides (EPGs)
  - Automatic language selection for audio track
  - Caption decoding
  - "V-Chip" function (parental content blocking)
  - Accurate receiver time-of-day clock setting
  - Redistribution Control

PSIP from the User's Viewpoint

- "Where am I?"
  - Channel number, channel name
- "Where am I going?"
  - Channels organized by major/minor groups
  - Enables EPG in the receiver/STB
    - What's on now?
    - What programs do I want to plan to watch?
- "How can I get where I want to go?"
  - Direct entry of channel number
  - Navigation on the EPG grid

Virtual Channel Concept

- Breaks the link between RF channel number and user's notion of channel number
  - Analog broadcast → "channel number" was the same as the RF carrier designation
  - Digital broadcast → "channel number" is defined by Virtual Channel Table (VCT)
- One digital TS can include multiple channels of programming
- 8-VSB carrier freq. may shift during transitions

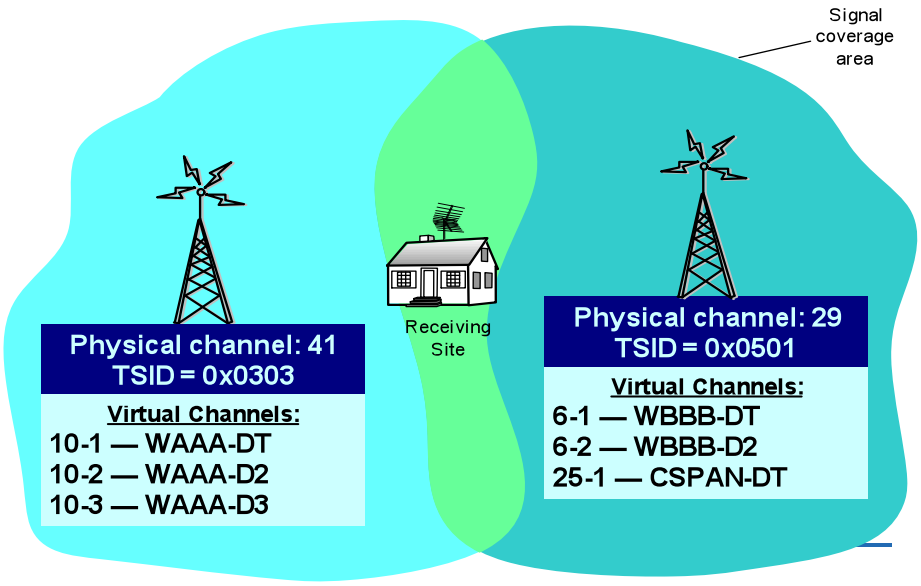
Two-Part Channel Numbers

- 1st part: "major channel"
- 2nd part: "minor channel"
- Broadcasters retain their brand identity
  - Digital services groupable with analog
    - Will become irrelevant soon
  - KZZZ has been associated with Channel 7 for years; KZZZ-DT can be found on Channel 7-1

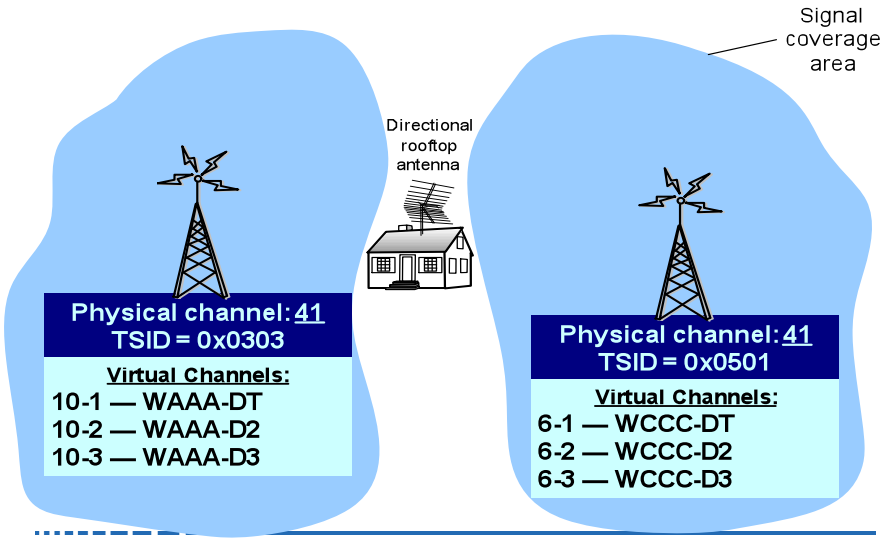
Transport Stream ID (TSID)

- Assigned to be unique
- Managed by FCC
- DTV tuning by triplet
  - RF frequency
  - Major channel number
  - TSID
- Receivers may find duplication of RF freq and/or major channel number
  - RF/Channel #/TSID always unique

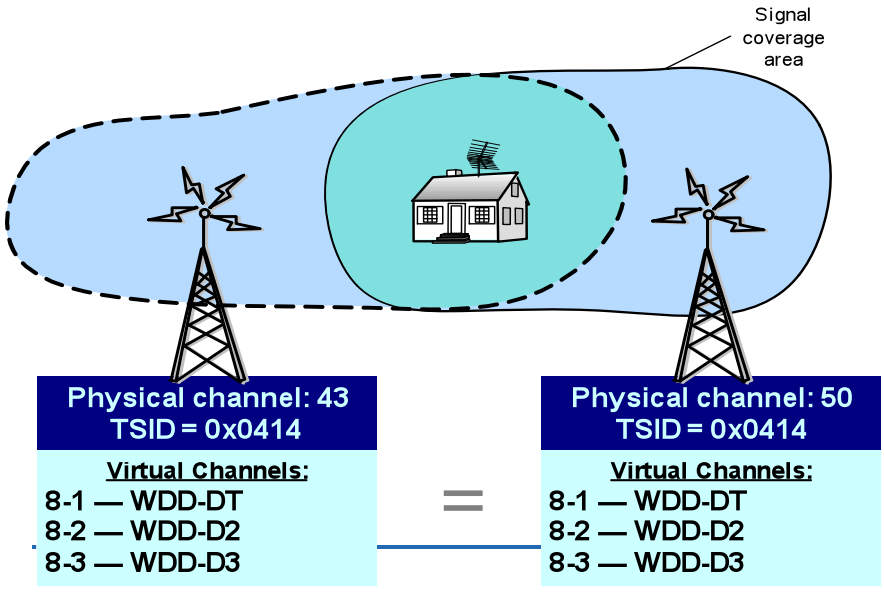
Simple Reception of 2 Stations



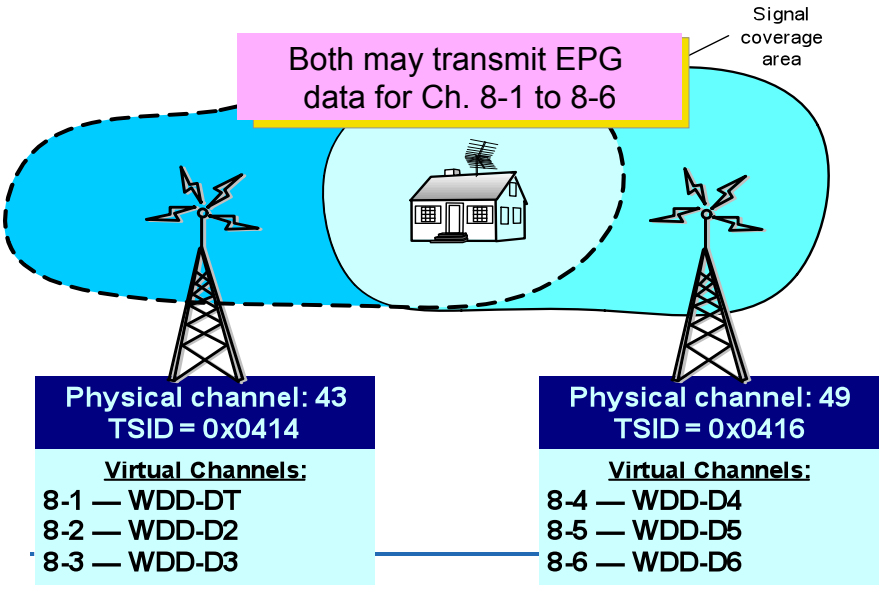
Directional Antenna Example



Virtual Channels -- Translators



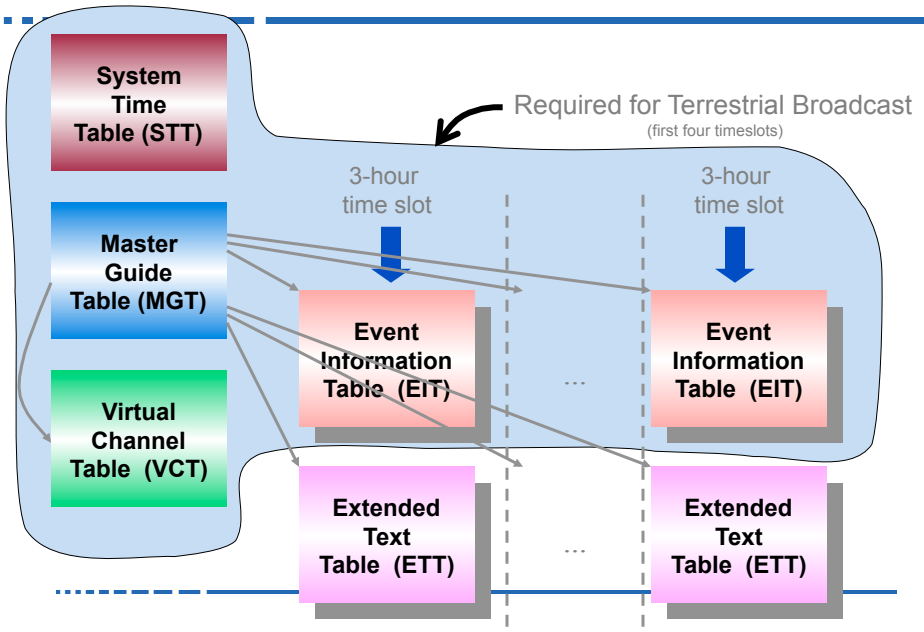
Virtual Channels — Duopoly



ATSC PSIP Tables

- Master Guide Table (MGT)
  - Directory of all PSIP tables (signaling)
- System Time Table (STT)
  - What time is it? (signaling)
- Virtual Channel Table (VCT)
  - List of the virtual channels in the transport (signaling)
- Rating Region Table (RRT)
  - Ratings definitions for the region (signaling)
- Event Information Table (EIT)
  - Event scheduling (announcement - used for EPG)
- Extended Text Table (ETT)
  - Event descriptions (announcement – used for EPG)

Main PSIP Tables



Master Guide Table (MGT)

- MGT is the top-level "roadmap"
  - Identifies what PSIP tables are in transport stream
  - Gives PIDs so receiver can find them
  - Indicates when any table has been updated♪

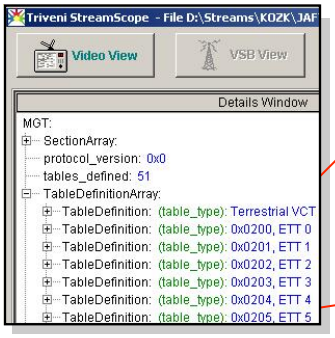


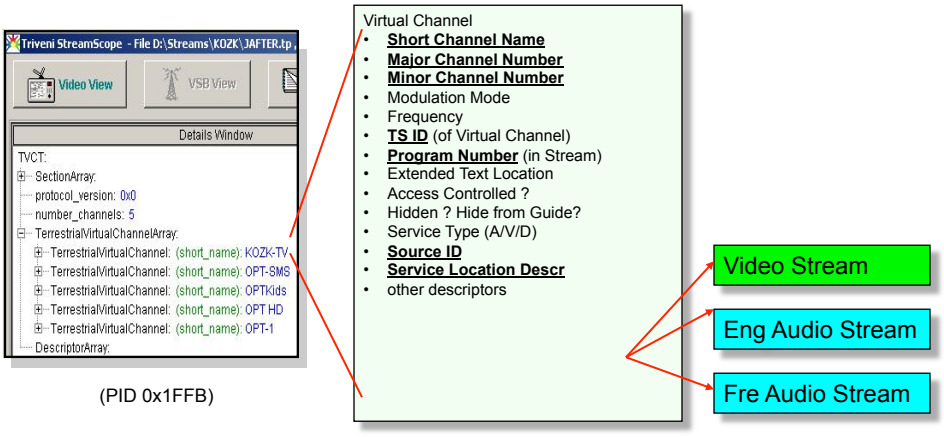
Table Reference
- Table Type (VCT, EIT-0, etc.)
- PID where table can be found
- Referenced Table Version
- Referenced Table Size
- <descriptors>

(PID 0x1FFB)

Virtual Channel Table (VCT)

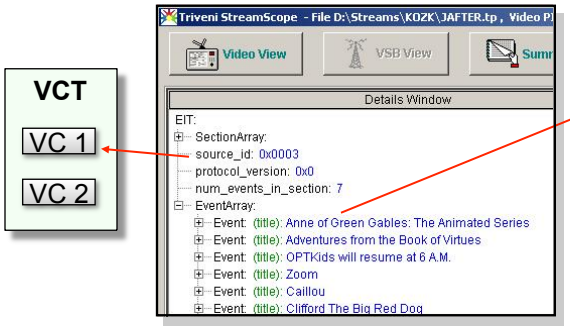
- Has same info as PAT & PMTs, plus more.
- Allows tuning by virtual major-minor channel number, rather than physical channel number and MPEG-2 "program" number.
- Allows language track selection.
- Allows channel name to be displayed on channel changes and in EPG.
- ATSC receivers are designed to use VCT; may have trouble with PAT and PMTs alone.

Virtual Channel Table (VCT)



Event Information Tables (EITs)

- Describe "events" (TV programs).
- EIT-0 through EIT-127; each covers 3 hour period
- EIT-0 thru EIT-3 required. ♪



Event
- Event ID
- Start Time (GPS)
- Duration in Seconds
- Title (multiple languages)
- Extended Text Location

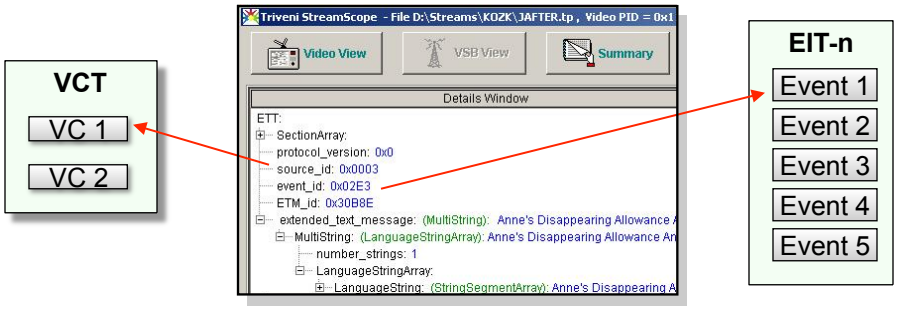
Descriptors
- Content Advisory
- Closed Captioning
- AC-3 Audio
- Broadcast Flag

Electronic Program Guide (EPG)

Channel	6:30pm	7:00pm	7:30pm
KXYZ-DT (7-1)	Local News	Ben's Lab	Thunder Car
KXYZ-D2 (7-2)	Movie: "Frontier Brain Surgeon"		
KXYZ-D3 (7-3)	Movie: "Burnout" (5:00)	Gena	Horace Horse

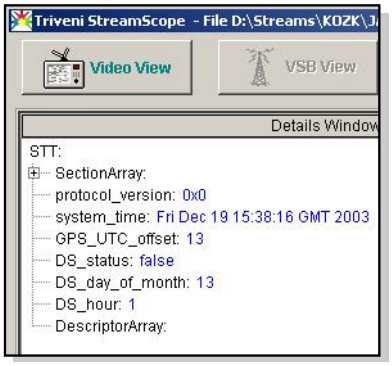
Extended Text Tables (ETTs)

- ETT-0 thru ETT-127, plus a "channel ETT"
- Text descriptions for channels and events
- May use Huffman coding to reduce bandwidth♪
- May be in multiple languages



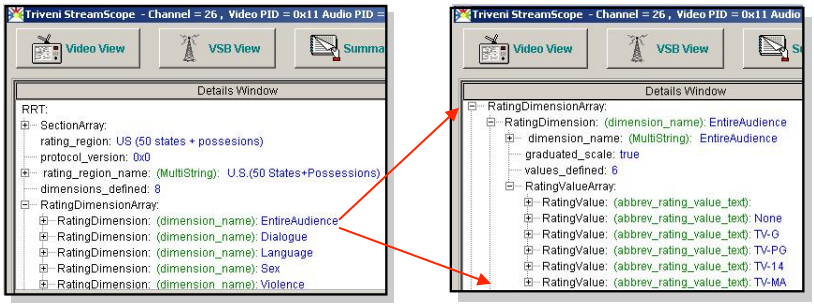
System Time Table (STT)

- Clock Time
  - Current GPS time
  - Daylight savings time indicators



Rating Region Table (RRT)

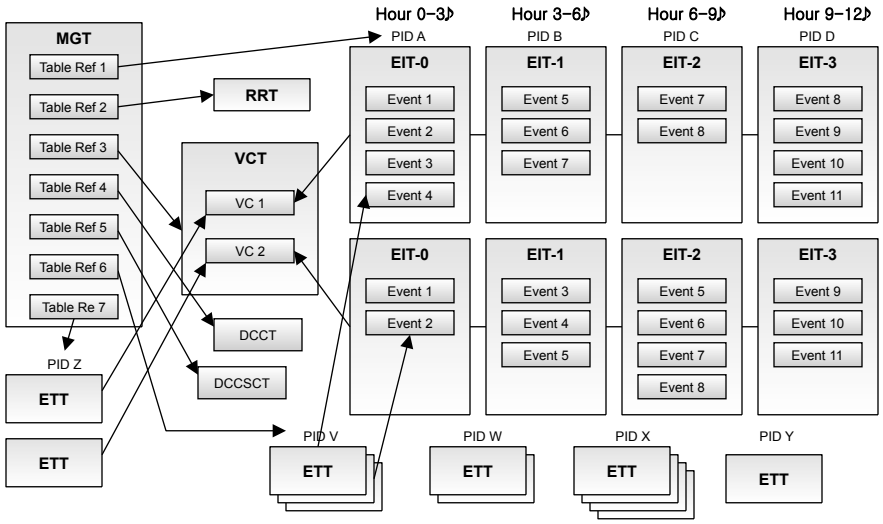
- Defines content advisory system(s) in use
  - Defines rating scheme(s) for rating region(s) (MPAA and TV Parental Guidelines in USA)
  - Ratings referenced by Content Advisory Descriptors in EITs

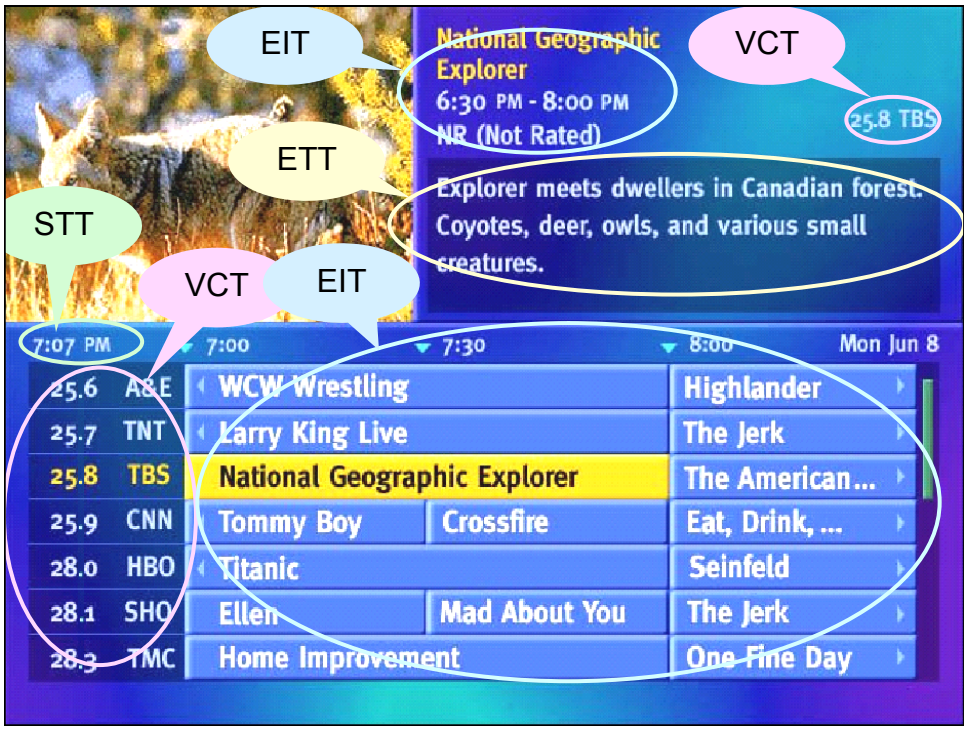


PSIP Descriptors

- Descriptors are tag-length-data structures
- Descriptor tag must be a registered value
- Some ATSC-defined descriptors include:
  - Content Advisory
  - Redistribution Control
  - ATSC Private Info
  - Service Location
  - Component Name
  - Caption Service
  - Audio Stream (AC-3)
  - Extended Channel Name
  - ATSC Conditional Access

PSIP Tables: The Big Picture





PSIP and PSI Link

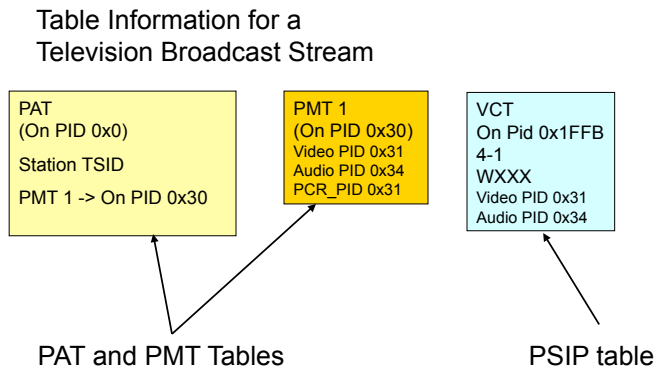


Table Intervals

- Metadata is transmitted periodically in the transport stream
- Each table in the system, MPEG or PSIP, has a defined repetition rate. e.g. the Program Association Table (PAT) must appear in the transport stream every 100ms
- If the table does not appear frequently enough in the stream, it can cause minor problems while decoding
- If the table is MISSING all together then larger decoding problems begin to occur