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# ATSC Program and System Information Protocol (PSIP)

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*WBA/SBE*  
*BROADCASTERS CLINIC 2000*

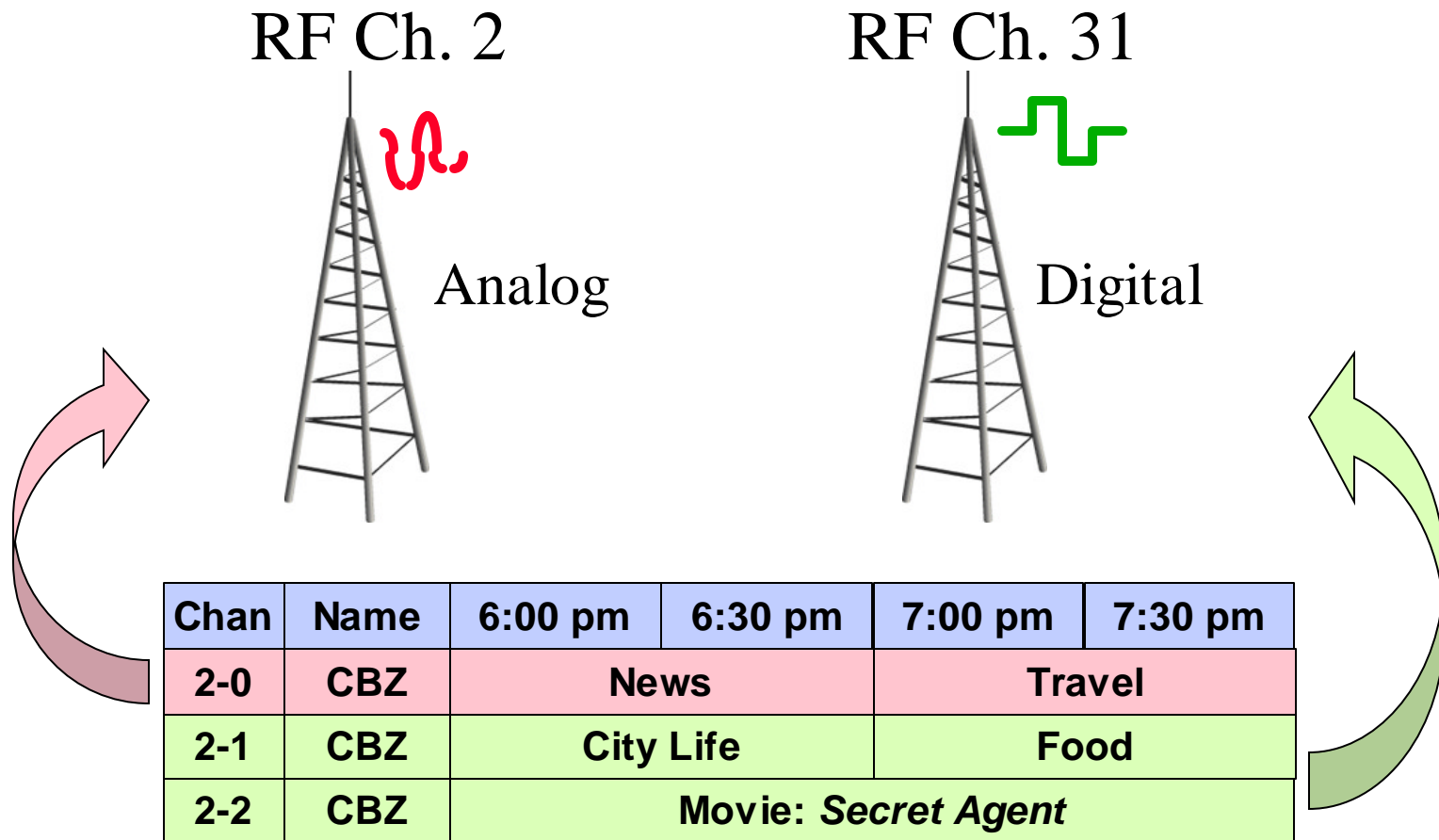
PSIP - *a name only a mother could love...*

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# Program and System Information Protocol

# Preserves Branding

*...retain viewership during the transition to DTV...*



# Program Announcement

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- Provides channel navigation and selection using an electronic program guide

Chan	Name	6:00 pm	6:30 pm	7:00 pm	7:30 pm	8:00 pm	8:30 pm
6-0	CBZ	City Life		Travel		Movie: <i>Texas Wild II</i>	
6-1	CBZ	City Life		Travel		Movie: <i>Texas Wild II</i> (HDTV)	
6-2	CBZ	Movie: <i>Secret Agent</i>					
6-3	LCL	Local News		Airport Info			

- Simple enough to go in every receiver
- Extensible for higher end products
- Small change in tuning paradigm for consumer
- Compatible with printed media

# Data Service Announcement

- Provides announcement of data-enhanced programming or other data services

Chan	Name	6:00 pm	6:30 pm	7:00 pm	7:30 pm	8:00 pm	8:30 pm
6-0	CBZ	City Life		Travel		Movie: <i>Texas Wild II</i>	
6-1	CBZ	City Life		Travel		Movie: <i>Texas Wild II</i> (HDTV)	
6-2	CBZ	Local Football <i>Data Enhanced with Player Stats</i>					
77-100	DATA	Tax Software		Gaming Software			



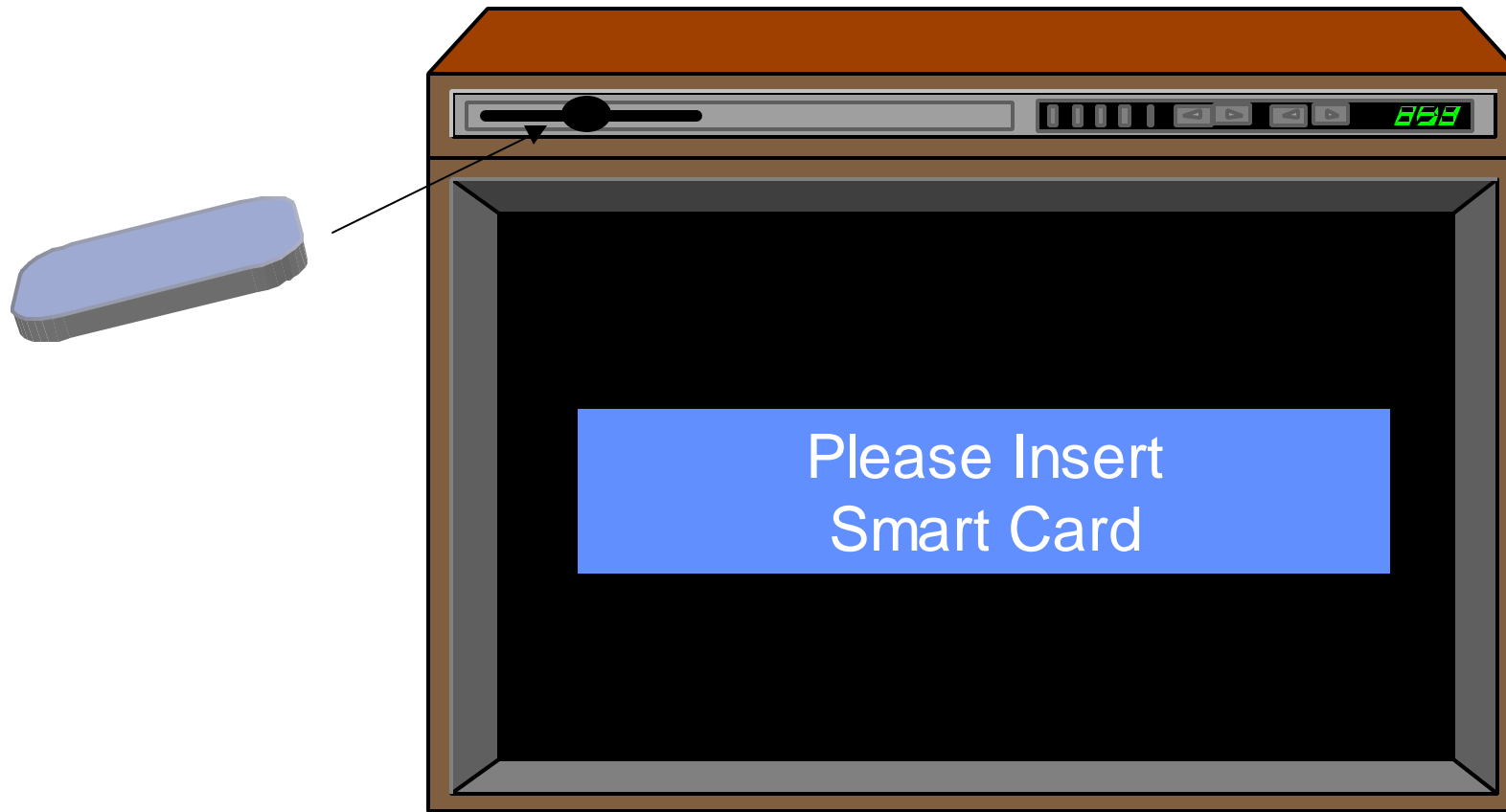
# V-Chip

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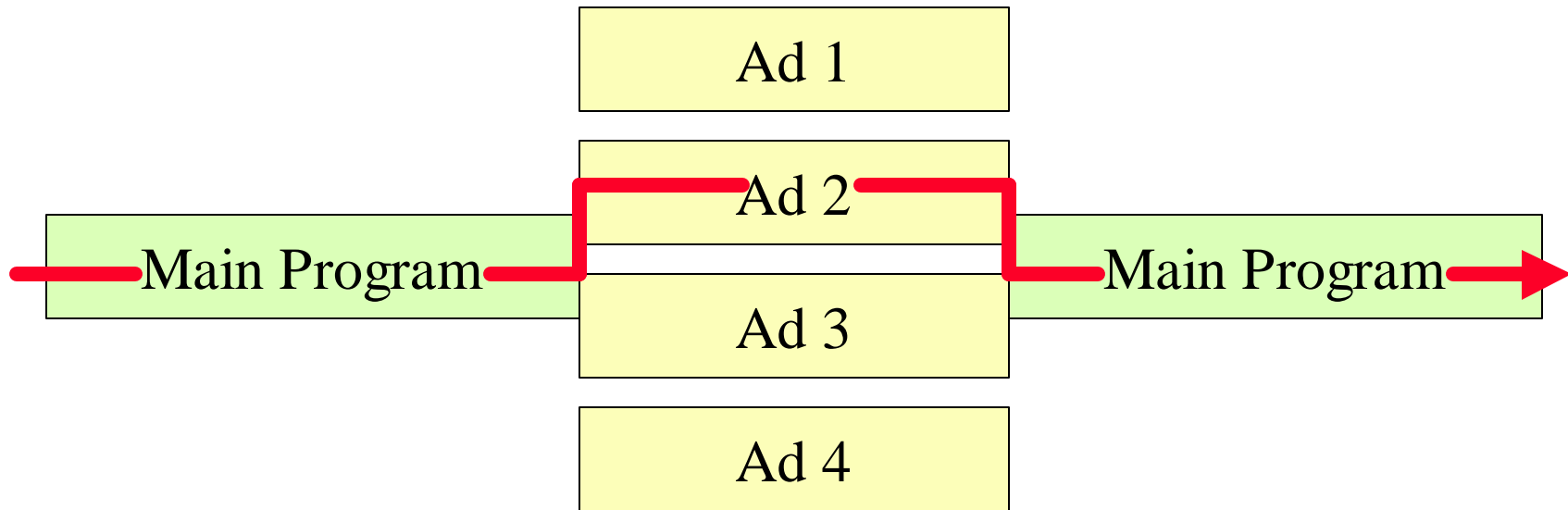
# Conditional Access

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# Directed Channel Change

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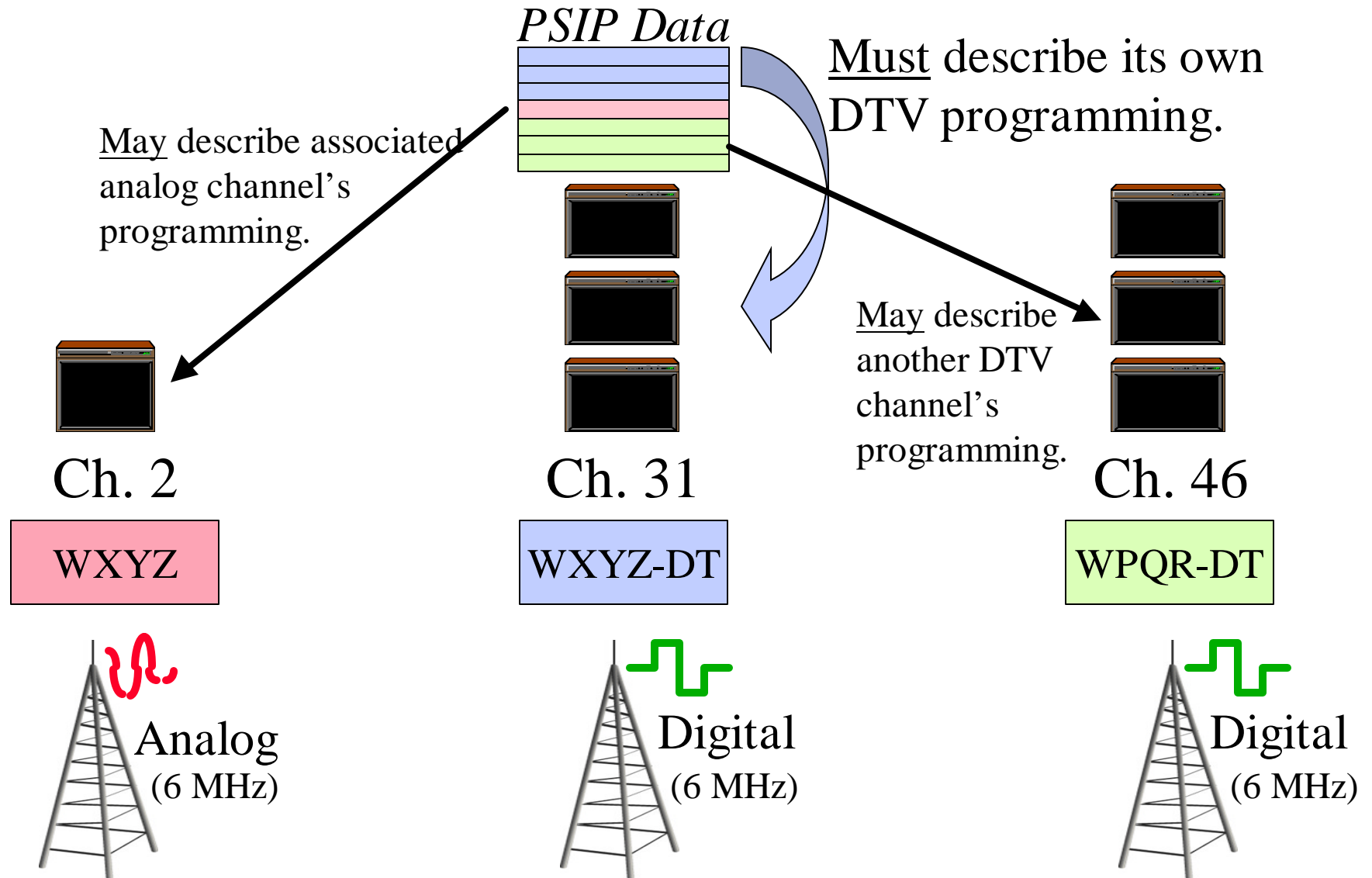
Switch based on user preferences  
or demographics

# PSIP = A Station's DTV Identity

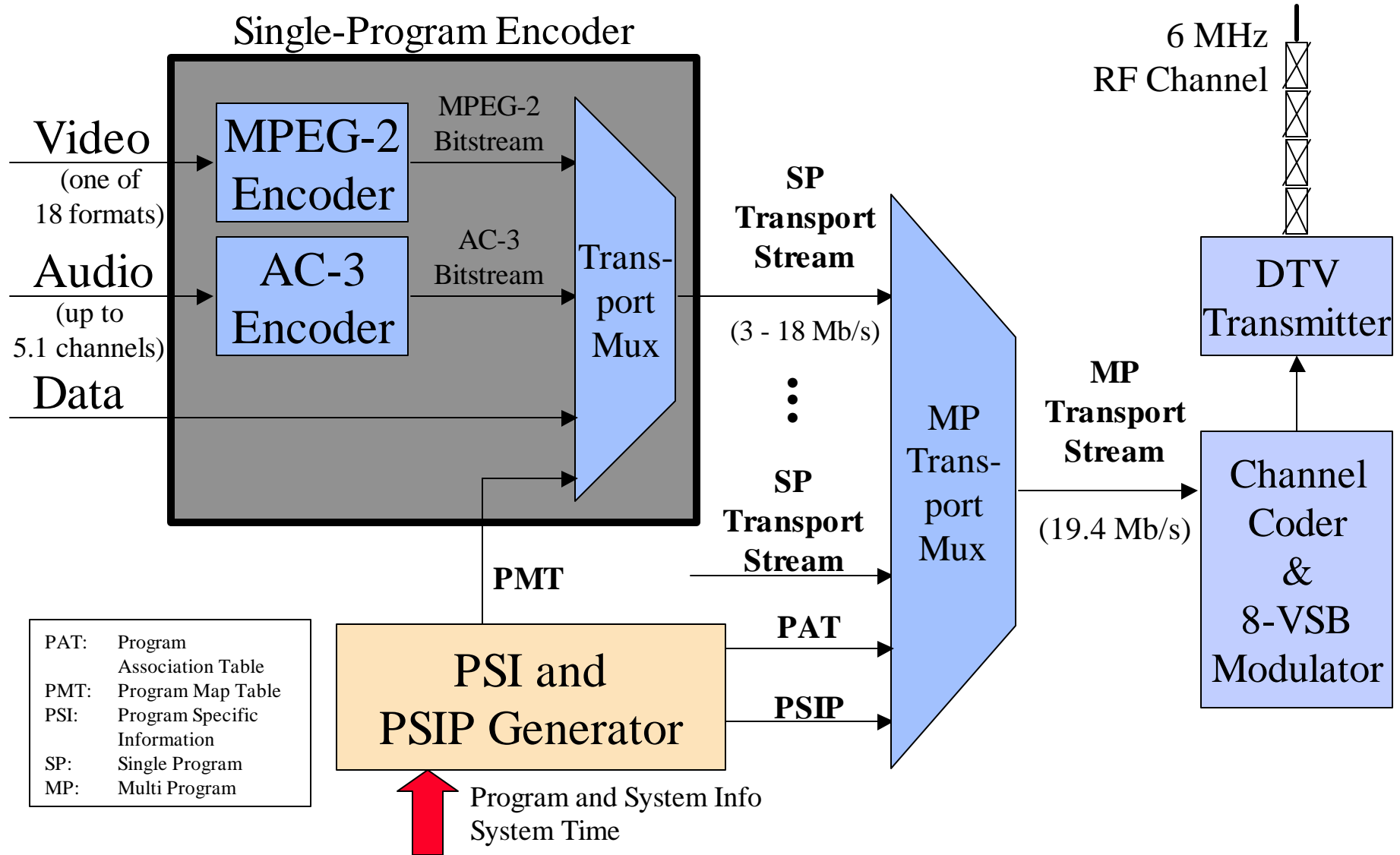
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- A normative part of the ATSC DTV standard
- Must be transmitted by ATSC terrestrial broadcasters in their DTV Transport Stream
- Is an ATSC (not FCC) requirement
- Key PSIP info that identifies your station:
  - Major Channel Number
  - Call Letters
  - Transport Stream ID (TSID)
  - RF Carrier Frequency

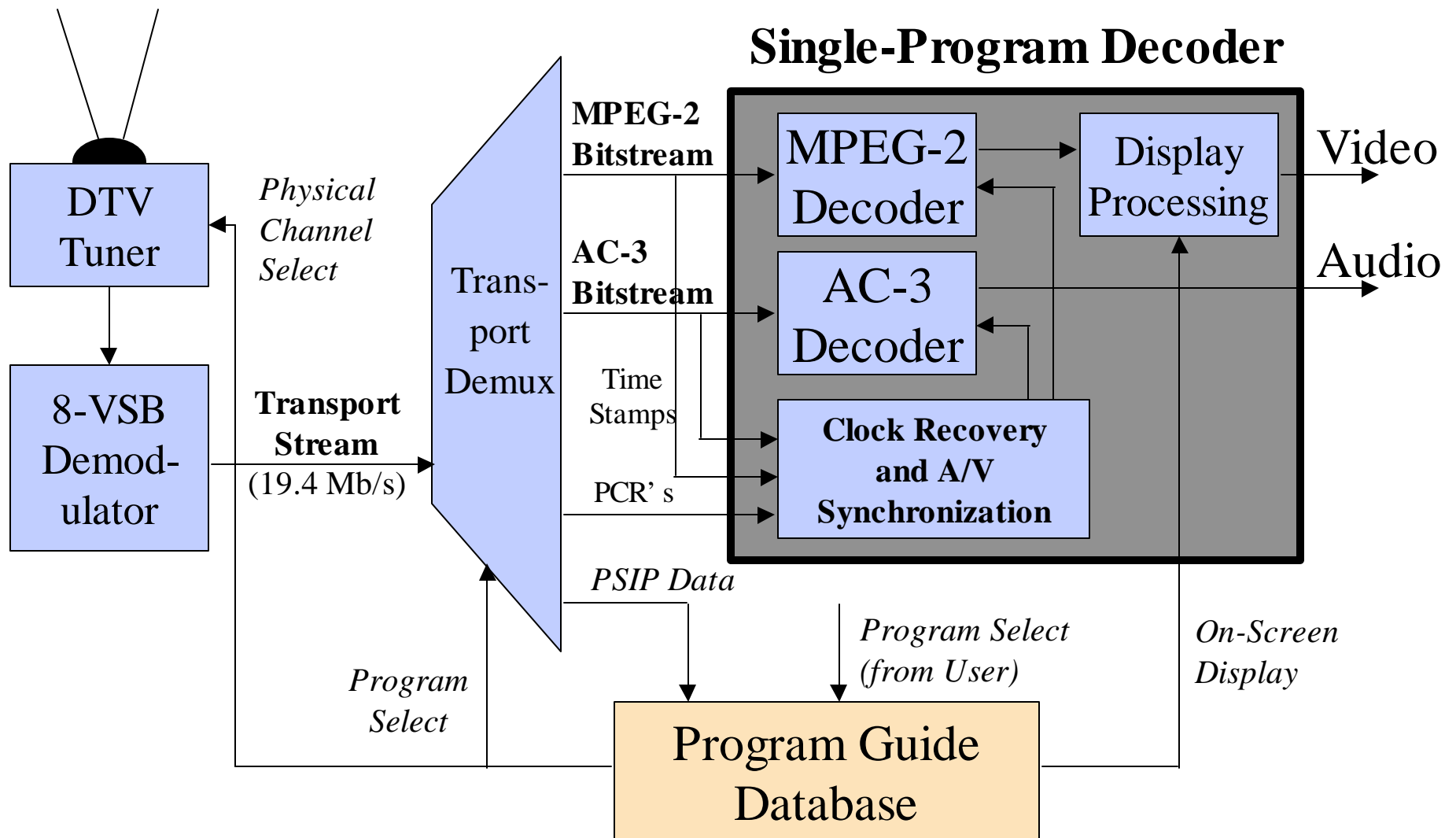
# Scope of PSIP



# ATSC Transmission System



# ATSC Decoder



# ATSC Standards

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- Standards documents:

- A/52: AC-3 Audio Compression
- A/53: ATSC DTV Standard (contains video formats)
- A/54: Guide to use of the ATSC DTV Standard

- ~~– A/55: Program Guide (Optional)~~
- ~~– A/56: System Information (Optional)~~

- A/57: Program/Episode/Version Identification
- A/58: Harmonization with DVB SI (Rec. Practice)
- A/63: Standard for Coding 25/50 Hz Video
- A/64: Transmission Measurement & Compliance...

- A/65 Rev A and Amd 1: Program and System Info Protocol...

- A/70: Conditional Access System for Terrestrial Broadcast
- A/80: Modulation and Coding Reqt's for DTV Apps. Over Satellite

- A/90: Data Broadcast Standard

- For more info, see [www.atsc.org](http://www.atsc.org)

*replaced by*

*Contains PSIP extensions for announcement of data services*

# PSIP Tables (A/65 Rev A)

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- STT**      System Time Table - provides date and time
- MGT**      Master Guide Table - provides version, size and PID's of all other tables (except STT)
- VCT**      Virtual Channel Table - provides attributes for all virtual channels in this Transport Stream
- RRT**      Rating Region Table - provides rating information for multiple geographic regions
- EIT**      Event Information Table - provides information for events on the virtual channels
- ETT**      Extended Text Table - provides detailed descriptions of virtual channels and events

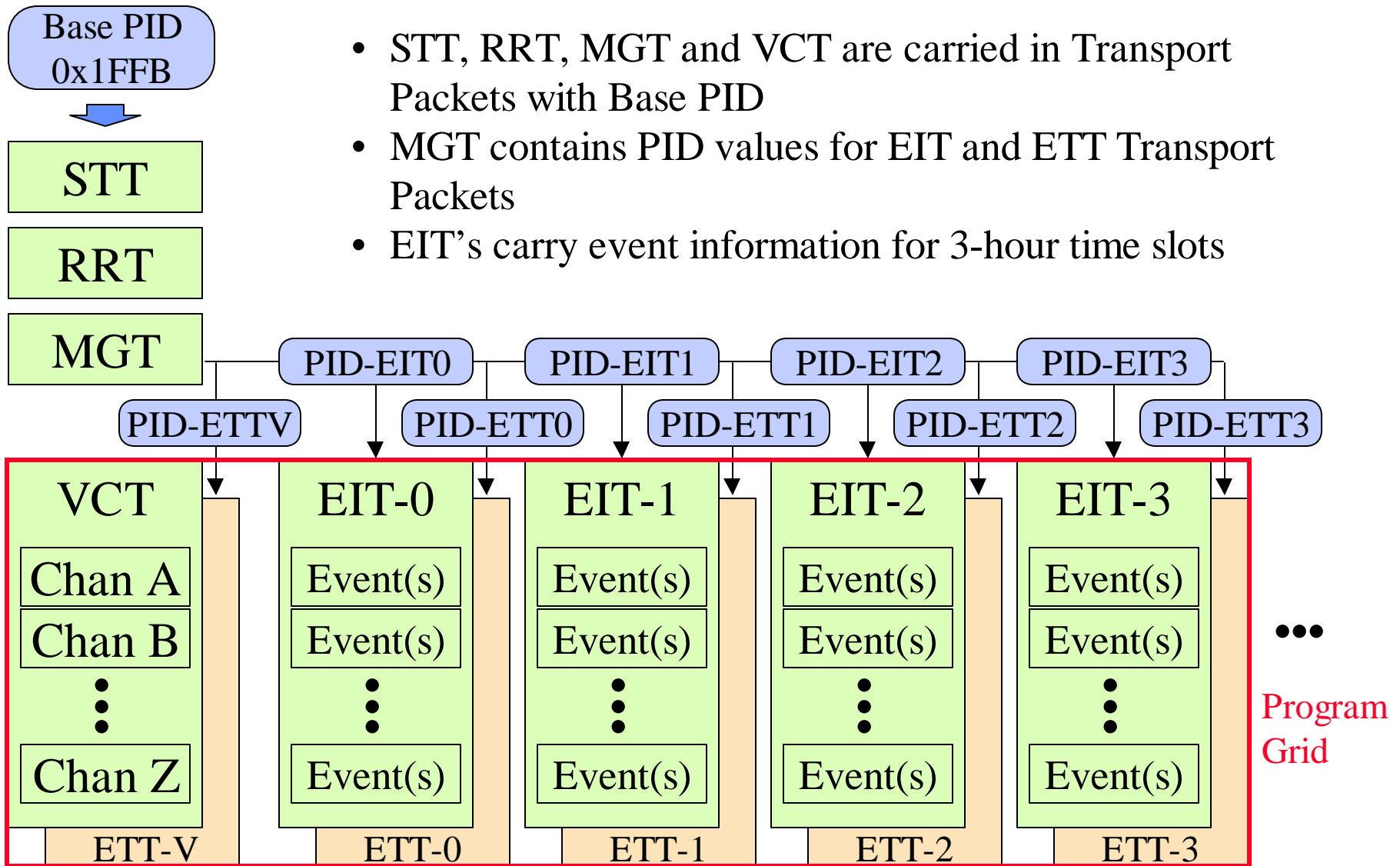
# What's Required for Transmission?

*...an ATSC, not FCC, requirement...*

Table	Required for Broadcast?	Required for Cable?
STT	✓	✓
MGT	✓	✓
VCT	✓ (TVCT)	✓ (CVCT)
RRT	✓	✓
EIT	✓ (EIT-0, -1, -2, -3) <i>(all others optional)</i>	<i>optional</i>
ETT	<i>optional</i>	<i>optional</i>

*Note: CEA and NCTA have agreed on PSIP over cable.  
Out-of-band profiles are defined in SCTE DVS-234r2.*

# Table Hierarchy



- STT, RRT, MGT and VCT are carried in Transport Packets with Base PID
- MGT contains PID values for EIT and ETT Transport Packets
- EIT's carry event information for 3-hour time slots

# Generic PSIP Table Format

- PSIP tables follow format of MPEG-2 Systems “Private Sections”
- 9-byte header; N bytes of table data; 4-byte CRC (check sum) trailer
- 10+N bytes following section\_length field
- 13+N bytes total size

Syntax of MPEG-2 Private Section		Bytes	Bits	Format	
Header	table_id	3	1	8	uimsbf
	section_syntax_indicator		1	'1'	
	private_indicator		1	'0'	
	reserved		2	'11'	
	section_length		12	uimsbf	
	table_id_extension	6	2	16	uimsbf
	reserved		2	'11'	
	version_number		1	5	uimsbf
	current_next_indicator		1	1	bslbf
	section_number		1	8	uimsbf
	last_section_number		1	8	uimsbf
	protocol_version	1	8	uimsbf	
	actual_table_data	N	8*N	-	
	CRC_32	4	4	32	rpchof

# Table Header and Trailer Summary

- Fields that are variable or peculiar to a specific table are highlighted

Syntax	Bytes	STT	MGT	TVCT	RRT	EIT-j	ETT-k	
table_id	1	0xCD	0xC7	0xC8	0xCA	0xCB	0xCC	
section_syntax_indicator	3	'1'	'1'	'1'	'1'	'1'	'1'	
private_indicator		'1'	'1'	'1'	'1'	'1'	'1'	
reserved		'11'	'11'	'11'	'11'	'11'	'11'	
section_length (allowed values)	2	17-1021	14-4093	13-1021	18-1021	11-4093	14-4093	
table_id_extension	2	0x0000	0x0000	TSID	rating_region	source_id	0x0000	
reserved	6	'11'	'11'	'11'	'11'	'11'	'11'	
version_number		1	0	0-31	0-31	0-31	0-31	0-31
current_next_indicator		'1'	'1'	0-1	'1'	'1'	'1'	
section_number		1	0	0	0-255	0	0-255	0
last_section_number		1	0	0	0-255	0	0-255	0
protocol_version		1	0	0	0	0	0	0
actual_table_data	N	-	-	-	-	-	-	
CRC_32	4	4	rpchof	rpchof	rpchof	rpchof	rpchof	

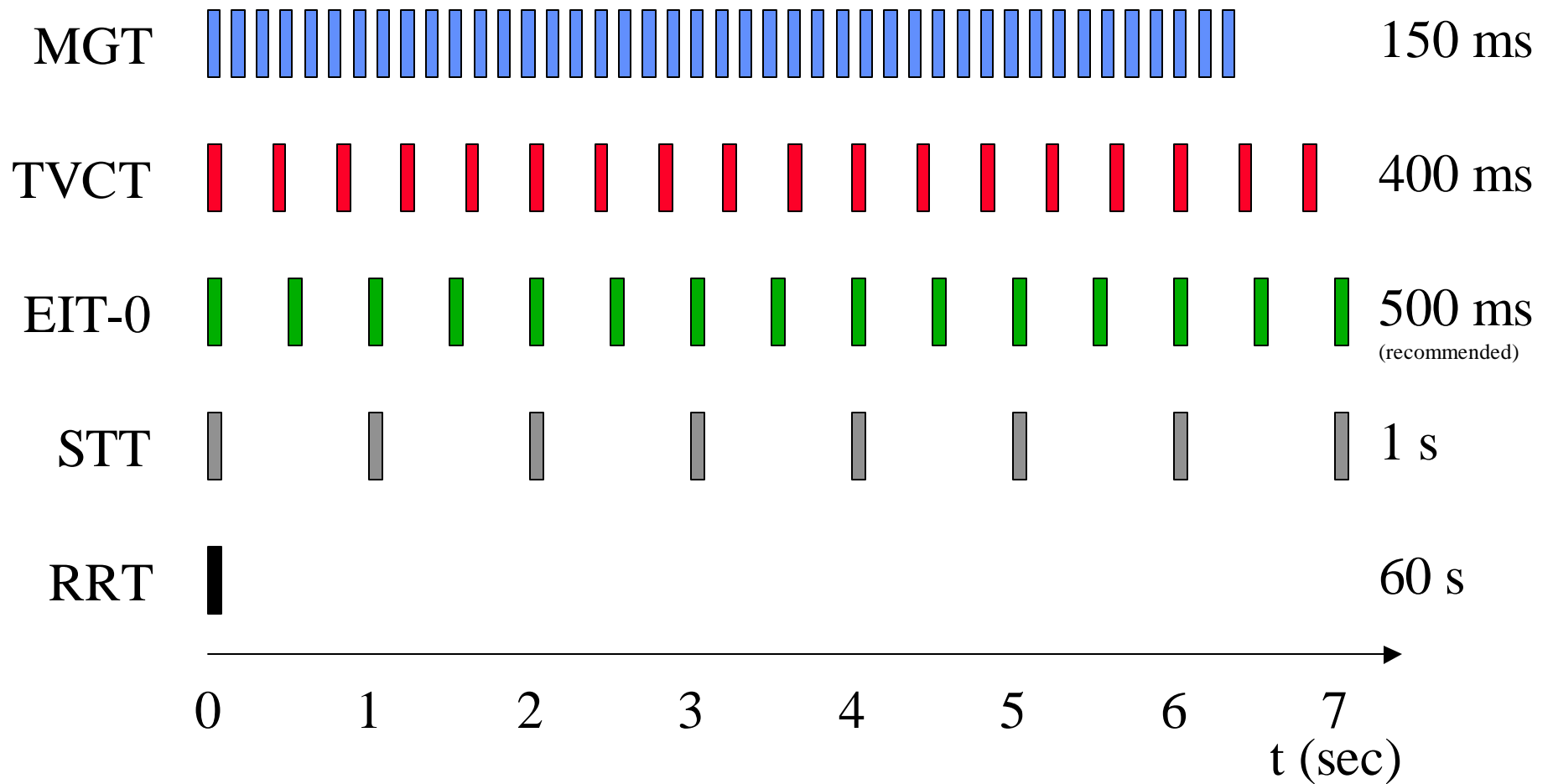
# Other Table Parameters

Parameter	STT	MGT	TVCT	RRT	EIT-j	ETT-k
Maximum Section Size (bytes)	1024	4096	1024	1024	4096	4096
Maximum Sections per Table	1	1	256	1	256	1
Maximum Table Size (bytes)	1024	4096	256*1024	1024	256*4096	4096
Typical Table Size (bytes)	20	138	443	901	356 per chan	520 per chan or event
Maximum Cycle Time (msec)	1000	150	400	60000	500 (rec EIT-0)	—
Maximum Bit Rate (kbps)					250	250
sb_leak_rate					625	625
sb_size (bytes)					1024	1024

*Smoothing buffer parameters*

# Maximum Cycle Times

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# PSIP Tables (A/65 Rev A)

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# STT Format

Syntax of STT Table	Bytes	Bits	Format or Note
STT Header	9	9*8	STT Header
system_time	7	32	Number of GPS sec since 00:00:00, 1/6/80 Must be accurate to $\pm 4$ sec
GPS.UTC_offset		8	UTC = GPS - GPS.UTC_offset
DS_status		1	0 = Not in DST; 1 = In DST
reserved		2	'11'
DS_day_of_month		5	Day of month in which transition occurs (1-31)
DS_hour		8	Local hour at which transition occurs (0-18)
descriptors		D	8*D
CRC_32	4	32	32-bit Cyclic Redundancy Check

↑ daylight savings  
 ↓

- In order to calculate correct local time, receiver must:
  - calculate UTC (local time in Greenwich, England)
  - adjust for local time zone difference
  - adjust for daylight savings time (if applicable)
  - convert to date and time format for display

# What is GPS?

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- Global Positioning System (GPS) units are used for “System Time” (current date and time of day) in STT and event start times in EIT’s.
- GPS time begins at **00:00:00, January 6<sup>th</sup>, 1980.**
- GPS time is related to Coordinated Universal Time (UTC), which is the current local time at Greenwich, England.
- $UTC = GPS - GPS\_UTC\_offset$  (offset = 13 “leap seconds” as of Jan. 1, 1999)
- Example:  $UTC = 599,320,813 - 13 = 599,320,800 = 2:00:00 \text{ PM, Jan } 2^{\text{nd}}, 1999$
- For more info, see <http://tycho.usno.navy.mil/gps.html> and HP’s App. Note 1289 “*The Science of Timekeeping*”

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# Master Guide Table (MGT)

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- Lists key information about all other PSIP tables (except STT):
  - version numbers
  - table sizes
  - PID's
- Allows simpler decoder designs since any change in PSIP status is flagged in this table.
- Only the base PID (0x1FFB) needs to be monitored to detect change in PSIP status.

# MGT Example: Time T<sub>0</sub>

MGT  
tables\_defined = 6; version = 8

Type	Name	PID	Version	Bytes
0x0000	TVCT (current_next = 1)	0x1FFB	<u>2</u>	<u>450</u>
0x0100	EIT-0	<u>0x1AA0</u>	<u>2</u>	<u>98</u>
0x0101	EIT-1	<u>0x1AA1</u>	<u>2</u>	<u>68</u>
0x0102	EIT-2	<u>0x1AA2</u>	<u>1</u>	<u>77</u>
0x0103	EIT-3	<u>0x1AA3</u>	<u>1</u>	<u>80</u>
0x0301	RRT (rating_region = 1)	0x1FFB	<u>0</u>	<u>990</u>

Note: Underlined values are variable from station to station.

# MGT Example: EIT-1 Content Changes

MGT  
tables\_defined = 6; version = 9\*

Type	Name	PID	Version	Bytes
0x0000	TVCT (current_next = 1)	0x1FFB	<u>2</u>	<u>450</u>
0x0100	EIT-0	<u>0x1AA0</u>	<u>2</u>	<u>98</u>
0x0101	EIT-1	<u>0x1AA1</u>	<u>3</u> *	<u>73</u> *
0x0102	EIT-2	<u>0x1AA2</u>	<u>1</u>	<u>77</u>
0x0103	EIT-3	<u>0x1AA3</u>	<u>1</u>	<u>80</u>
0x0301	RRT (rating_region = 1)	0x1FFB	<u>0</u>	<u>990</u>

Note: Asterisks indicate changed values

# MGT Example: Just prior to EIT Cross-over

MGT				
tables_defined = <u>6</u> ; version = <u>9</u>				
Type	Name	PID	Version	Bytes
0x0000	TVCT <small>(current_next = 1)</small>	0x1FFB	<u>2</u>	<u>450</u>
0x0100	EIT-0	<u>0x1AA0</u>	<u>2</u>	<u>98</u>
0x0101	EIT-1	<u>0x1AA1</u>	<u>3</u>	<u>73</u>
0x0102	EIT-2	<u>0x1AA2</u>	<u>1</u>	<u>77</u>
0x0103	EIT-3	<u>0x1AA3</u>	<u>1</u>	<u>80</u>
0x0301	RRT <small>(rating_region = 1)</small>	0x1FFB	<u>0</u>	<u>990</u>

Note: EIT content shifts every three hours. EIT PID shifting is an easy way to implement this (but not required).

# MGT Example: Just after EIT Cross-over

MGT  
tables\_defined = 6; version = 10\*

Type	Name	PID	Version	Bytes
0x0000	TVCT (current_next = 1)	0x1FFB	<u>2</u>	<u>450</u>
0x0100	EIT-0	<u>0x1AA1</u>	<u>3</u>	<u>73</u>
0x0101	EIT-1	<u>0x1AA2</u>	<u>1</u>	<u>77</u>
0x0102	EIT-2	<u>0x1AA3</u>	<u>1</u>	<u>80</u>
0x0103	EIT-3	<u>0x1AA0*</u>	<u>1</u>	<u>88</u>
0x0301	RRT (rating_region = 1)	0x1FFB	<u>0</u>	<u>990</u>

Note: EIT-0 content is shifted out. EIT-1 becomes EIT-0, etc. PID's may cycle through a fixed pool as shown, but this is not required.

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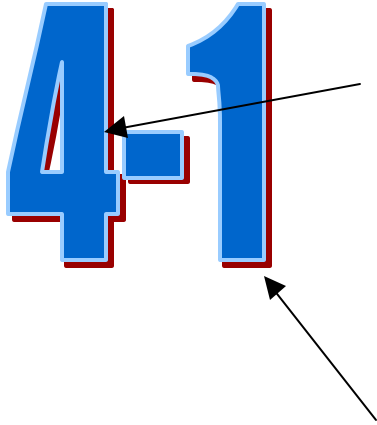
# Virtual Channel Table (VCT)

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- Contains list of channels in the Transport Stream.
- May also include broadcaster's analog channel and digital channels in other Transport Streams.
- TVCT = Terrestrial VCT; CVCT = Cable VCT
- Key info in VCT:
  - short name
  - major and minor channel numbers
  - modulation mode and carrier frequency
  - Transport Stream ID (TSID) and program number
  - source ID, service type, access controlled and hidden flags
  - Service Location Descriptor: contains list of PID's for elementary streams

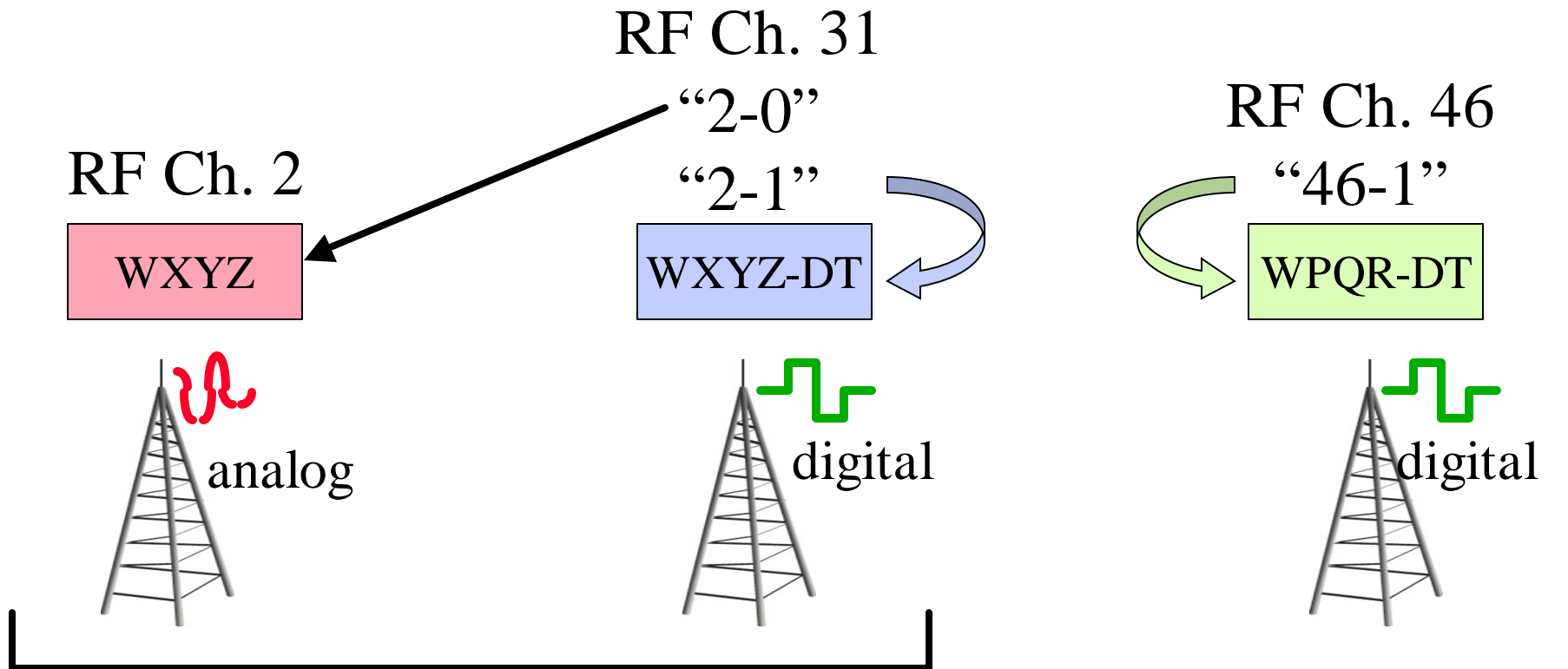
# Major and Minor Channel Numbers

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- major\_channel\_number is used to group all services associated with a broadcaster's NTSC brand
- minor\_channel\_number specifies a particular channel within that group. "0" is reserved for analog service. All other values (1-999) are allowed for digital services. One suggestion is to start with 1 and to continue numerically.
- A/65, Annex B assigns major\_channel\_numbers as follows:
  - for existing NTSC broadcasters, major\_channel\_number is the same as the current NTSC RF channel number (2-69)
  - for new DTV broadcasters, major\_channel\_number is the same as the new DTV RF channel number (2-69)
  - major\_channel\_numbers in range 70 - 99 may be used to identify groups of digital services carried separately

# Major-Minor Channel Number Example



*An existing analog broadcaster with a second digital channel. Branding is preserved. The DTV RF channel number is hidden from the viewer!*

*A digital-only broadcaster (no analog channel)*

# Which Delimiter?

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- None specified. All shown are legal.
- Dots and commas may not reproduce well in printed program guides.
- Dashes are popular. May become *de facto* standard.

# Channel TSID - What and Why?

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- Channel TSID is a 16-bit number that stands for
  - Transport Stream ID (digital)
  - Transmission Signal ID (analog )
- The receiver may use the Channel TSID to verify that the Transport Stream acquired at the referenced carrier frequency is actually the desired multiplex.
- Can help resolve co-channel issues and instances where a DTV signal frequency is translated without modification of listed carrier frequency.

# Channel TSID



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- For digital programs contained in this Transport Stream, the Channel TSID must match this Transport Stream ID.
- For digital programs contained in other Transport Streams, the Channel TSID must match the Transport ID of the other streams.
- For analog programs, the Channel TSID must match the “Transmission Signal ID”, or must contain 0xFFFF if unknown.
- TSID Assignments proposed by MSTV ([www.mstv.org](http://www.mstv.org)):
  - NTSC = even TSID, DTV = odd TSID
  - Example
    - WNBC (Ch. 4) = 0x086E
    - WNBC-DT (Ch. 28) = 0x086F

# Proposed TSID's for New York City

NTSC			DTV		
Chan	Dec	Hex	Chan	Dec	Hex
2	2156	0x086C	56	2157	0x086D
4	2158	0x086E	28	2159	0x086F
5	2160	0x0870	44	2161	0x0871
7	2162	0x0872	45	2163	0x0873
11	2164	0x0874	33	2165	0x0875
25	2166	0x0876	24	2167	0x0877
31	2168	0x0878	30	2169	0x0879


  
 Transmission Signal ID  
 (TSID)


  
 Transport Stream ID  
 (TSID)

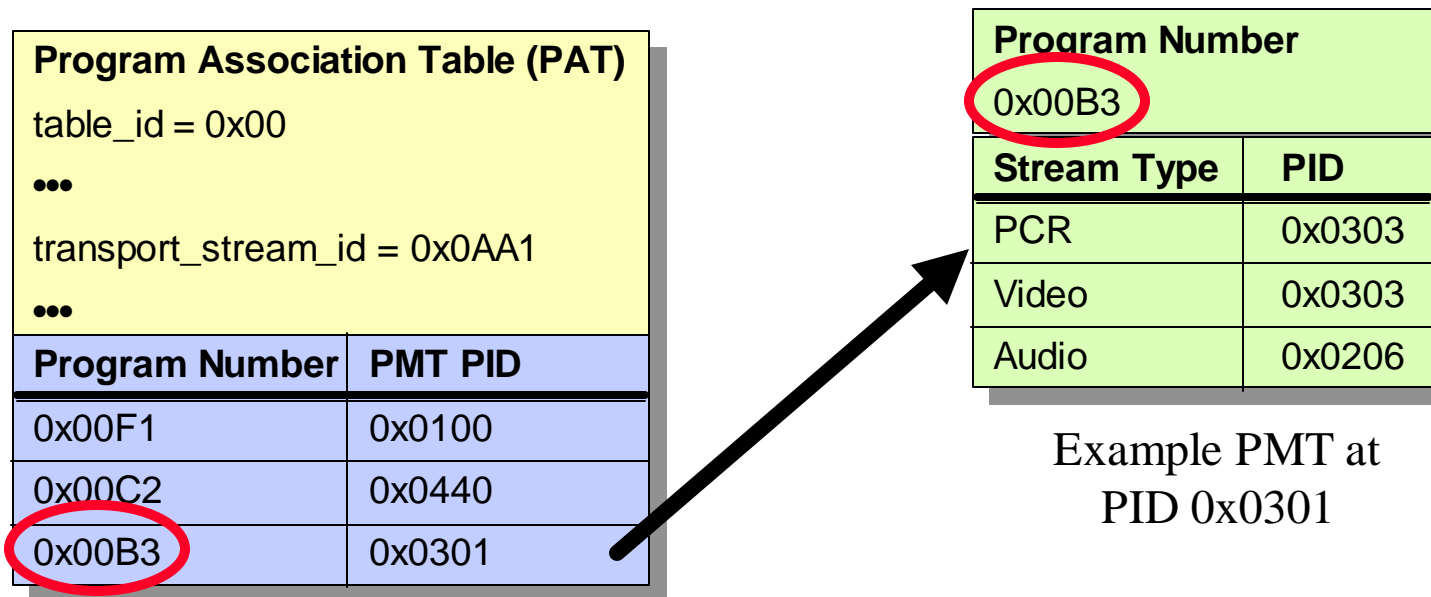
# TSID Issues

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- If a broadcaster is transmitting the same signal in different RF channels, each TSID should be unique.
- If a signal is frequency translated without other modification, then the TSID will remain the same, but the carrier frequency listed in the VCT will be wrong. In this case, receiver should match channel\_TSID's with actual TSID's to ensure correct presentation.
- A receiver should minimize reliance on carrier frequencies listed in the VCT. Instead, a receiver should associate the TSID with the carrier frequency at which it is found.

# PAT and PMT

- The Program Association Table (PAT) associates **MPEG-2 Program Numbers** with Program Map Table (PMT) PID's
- The PMT associates program elements with PID's
- These tables are *required* for MPEG-2 compliance



Example PAT

Example PMT at  
PID 0x0301

# TSID and Program Number

- Transport Stream ID and Program Numbers in the VCT and PAT must match

Program Association Table (PAT)	
table_id = 0x00	
...	
transport_stream_id = 0x0AA1	
...	
Program Number	PMT PID
0x00F1	0x0100
0x00C2	0x0440
0x00B3	0x0301

Example PAT

Terrestrial Virtual Channel Table (TVCT)		
table_id = 0xC8		
...		
transport_stream_id = 0x0AA1		
...		
Program Number	Channel TSID	Descriptor
0x00F1	0x0AA1	Service Location
0x00C2	0x0AA1	Service Location
0x00B3	0x0AA1	Service Location
0x0AA0	0x0AA0	Analog program
0x00F4	0x0AA3	Service Location
0x00E5	0x0AA3	Service Location

Corresponding TVCT

# Service Location Descriptor

- The PID's in the Service Location Descriptor and in the PMT must match

Program Association Table (PAT)	
table_id = 0x00	
...	
transport_stream_id = 0x0AA1	
...	
Program Number	PMT PID
0x00F1	0x0100
0x00C2	0x0440
0x00B3	0x0301

Terrestrial Virtual Channel Table (TVCT)		
table_id = 0xC8		
...		
transport_stream_id = 0x0AA1		
...		
Program Number	Channel TSID	Descriptor
0x00F1	0x0AA1	Service Location
0x00C2	0x0AA1	Service Location
0x00B3	0x0AA1	Service Location

Example  
PAT

Stream Type	PID
PCR	0x0303
Video	0x0303
Audio	0x0206

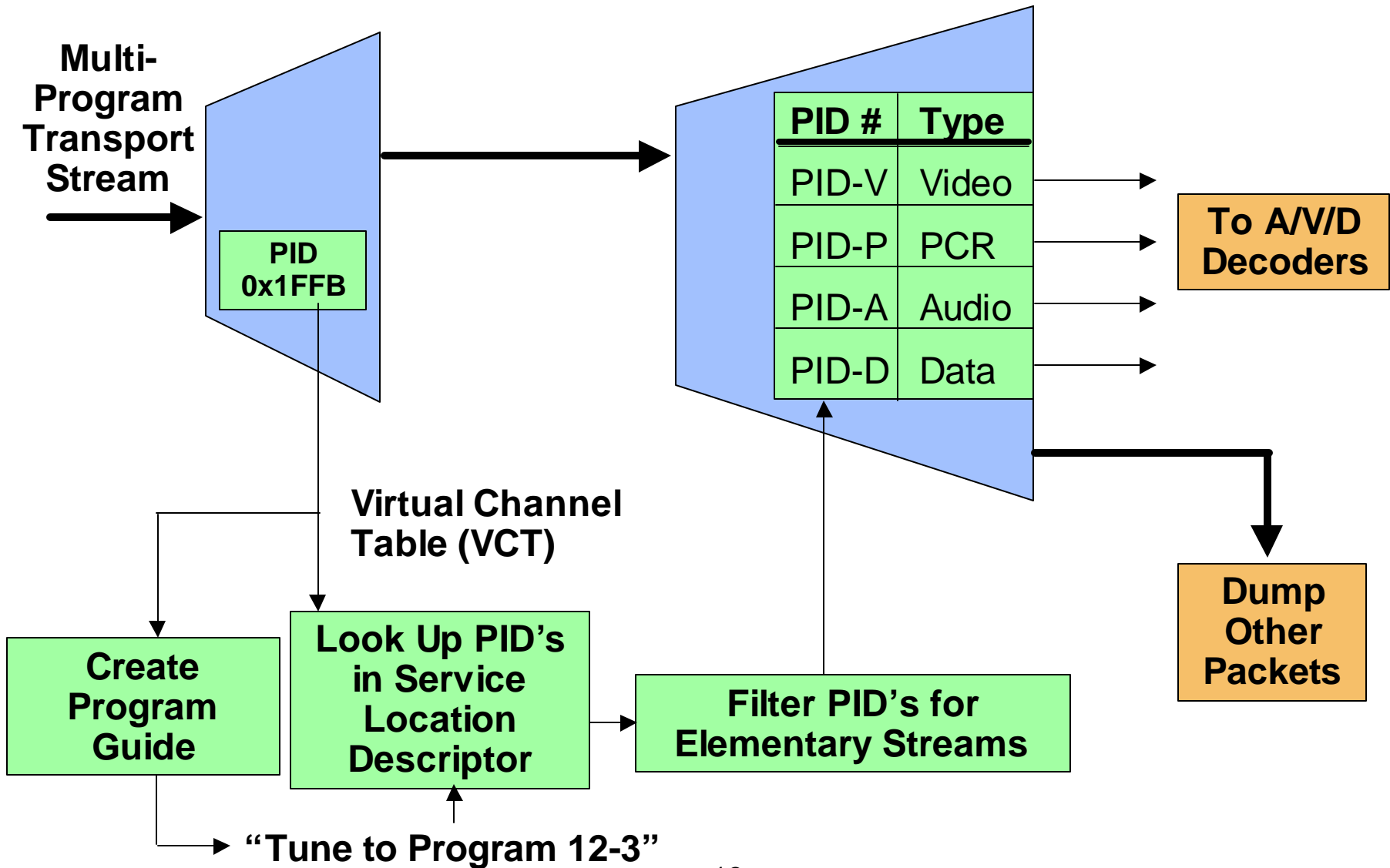
Example  
PMT

Corresponding  
TVCT

Corresponding  
Service Location Descriptor

Stream Type	PID
PCR	0x0303
Video	0x0303
Audio	0x0206

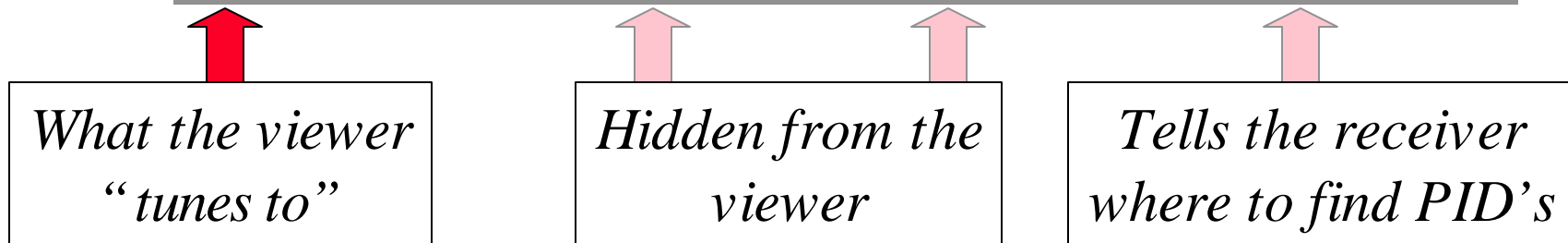
# PID's and Tuning



# The Program Number Myth

- MPEG-2 Program Numbers are not related to Major-Minor Channel Numbers!
- MPEG-2 Program Numbers are hidden from the viewer and serve to link MPEG-2 data structures (PAT and PMT).
- Major-Minor channels numbers are what viewers “tune to”!

Terrestrial Virtual Channel Table (TVCT)			
Major-Minor Number	Program Number	Channel TSID	Descriptor
12-1	0x00F1	0x0AA1	Service Location
12-2	0x00C2	0x0AA1	Service Location
12-3	0x00B3	0x0AA1	Service Location



# TVCT Example

TVCT  
number\_channels\_in\_section = 5; TSID = 0x0AA1

Major Num.	Minor Num.	Short Name	Carrier Freq (MHz)	Channel TSID	Program Number	Service Type	Source ID	Descriptors
12	0	NBZ	205.25	0x0AA0	0xFFFF	analog	20	ch name
12	1	NBZ-D	620.31	0x0AA1	0x0F21	digital	21	ch name; serv loc
12	5	NBZ-S	620.31	0x0AA1	0x00B2	digital	38	ch name; serv loc
12	12	NBZ-M	620.31	0x0AA1	0x0CC7	digital	54	ch name; serv loc
12	31	NBZ-H	620.31	0x0AA1	0x0CD0	digital	14	ch name; serv loc

*This is where the Service Location Descriptor appears.*

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# Event Information Tables

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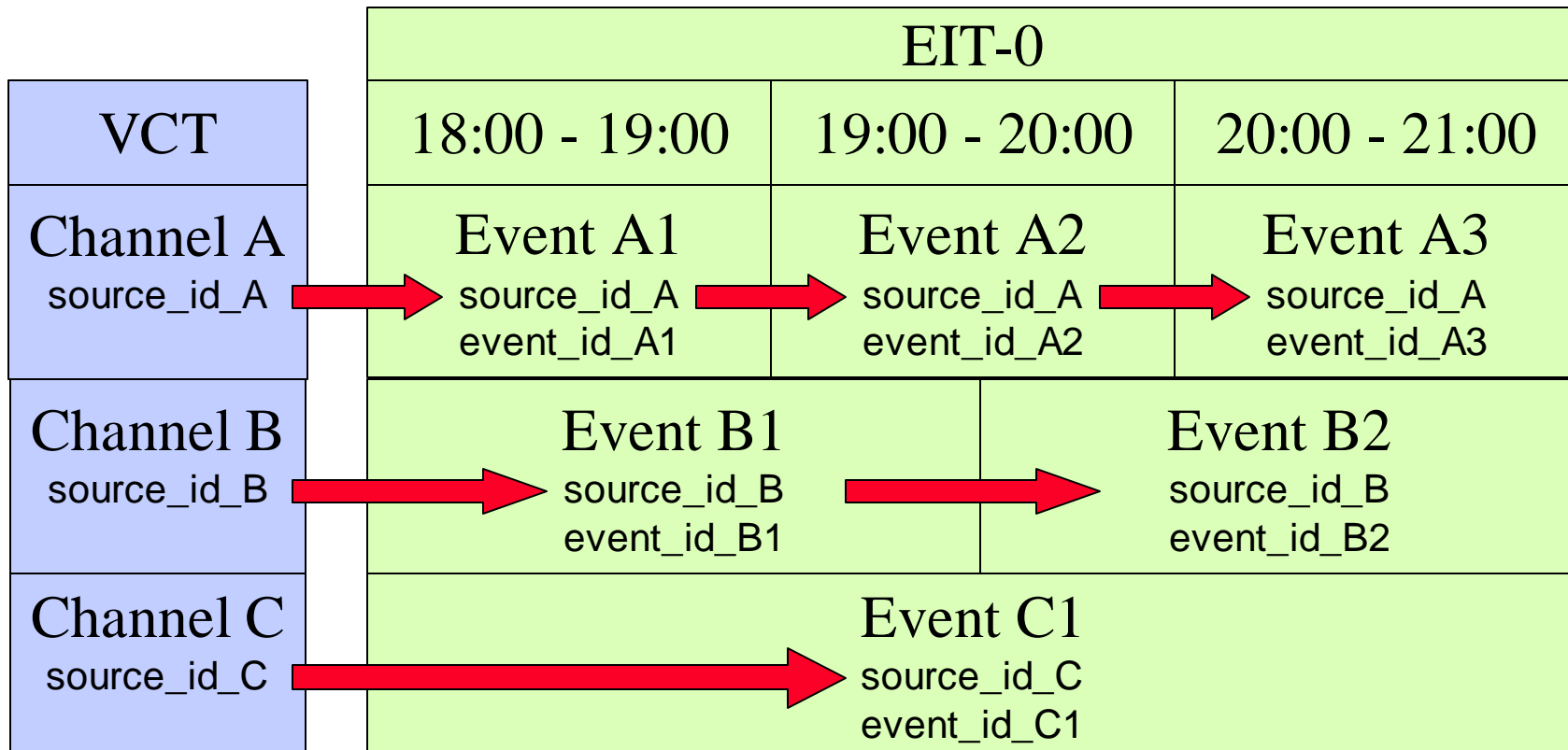
- Each EIT spans 3 hours
- Start time for each EIT is constrained to be one of the following UTC times:
  - 0:00 (midnight), 3:00, 6:00, 9:00
  - 12:00 (noon), 15:00, 18:00, 21:00
- EIT-0 represents the current 3 hours of programming
- For terrestrial PSIP, first 4 EIT's (EIT-0, -1, -2, -3), representing 12 hours, are required
- Maximum number of EIT's = 128 (16 days)

# EIT Example

EIT-0  
source\_id = 22  
num\_events\_in\_section = 3

Event ID	Local Start Time	Length (seconds)	ETM Location	Title	Descriptors
51	12:30	7200	01 (this PTC)	Soccer Live	content_advisory
52	14:30	3600	00 (no ETM)	Golf Report	closed_caption
53	15:30	9000	01 (this PTC)	Car Racing	content_advisory

# Source ID's and Event ID's



- *Source ID's link events to virtual channels. 0x0001 - 0x0FFF are unique within this Transport Stream; 0x1000 - 0xFFFF are unique at the regional level.*
- *Event ID's are unique within this Transport Stream.*

# Events that Span EIT Boundaries

<b>VCT</b>  <b>Channel A</b> <small>source_id_A</small>  <b>Channel B</b> <small>source_id_B</small>  <b>Channel C</b> <small>source_id_C</small>	<b>EIT-0</b>			<b>EIT-1</b>		
	<b>18:00 - 19:00</b>	<b>19:00 - 20:00</b>	<b>20:00 - 21:00</b>	<b>21:00 - 22:00</b>	<b>22:00 - 23:00</b>	<b>23:00 - 0:00</b>
	<b>Event A1</b> <small>event_id_A1</small>	<b>Event A2</b> <small>event_id_A2</small>	<b>Event A3</b> <small>event_id_A3</small>	<b>Event A4</b> <small>event_id_A4</small>	<b>Event A5</b> <small>event_id_A5</small>	<b>Event A6</b> <small>event_id_A6</small>
	<b>Event B1</b> <small>event_id_B1</small>	<b>Event B2</b> <small>event_id_B2</small>		<b>Event B3</b> <small>event_id_B3</small>	<b>Event B4</b> <small>event_id_B4</small>	
<b>Event C1</b> <small>event_id_C1</small>		<b>Event C2</b> <small>event_id_C2</small>		<b>Event C3</b> <small>event_id_C3</small>		

*Event C2 spans an EIT time interval. It must appear in both EIT's, with the same event ID.*

# PSIP Tables (A/65 Rev A)

---

<b>STT</b>	<u>System Time Table</u> - provides date and time
<b>MGT</b>	<u>Master Guide Table</u> - provides version, size and PID's of all other tables (except STT)
<b>VCT</b>	<u>Virtual Channel Table</u> - provides attributes for all virtual channels in this Transport Stream
<b>RRT</b>	<u>Rating Region Table</u> - provides rating information for multiple geographic regions
<b>EIT</b>	<u>Event Information Table</u> - provides information for events on the virtual channels
<b>ETT</b>	<u>Extended Text Table</u> - provides detailed descriptions of virtual channels and events

# ETT Format

---

Syntax of ETT Table	Bytes	Bits	Format or Note
ETT Header	9	9*8	ETT Header
ETM_id	4	32	<b>channel ETM_id =</b> source_id + '0000000000000000' + '00' <b>event ETM_id =</b> source_id + event_id + '10'
extended_text_message	M	8*M	Multiple string structure message
CRC_32	4	32	32-bit Cyclic Redundancy Check

- The Extended Text Table (optional) is used to provide detailed descriptions of virtual channels or events.
- These descriptions are called Extended Text Messages (ETM's).
- The format of the 32-bit ETM\_id tells the receiver whether the ETM describes a channel or an event
- This format allows the receiver to search for a single description quickly without having to parse the payload of a large table

# PSIP Tables (A/65 Rev A)

---

<b>STT</b>	<u>System Time Table</u> - provides date and time
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<b>RRT</b>	<u>Rating Region Table</u> - provides rating information for multiple geographic regions
<b>EIT</b>	<u>Event Information Table</u> - provides information for events on the virtual channels
<b>ETT</b>	<u>Extended Text Table</u> - provides detailed descriptions of virtual channels and events

# Rating Region Table

---

- The RRT defines the rating standard for a particular geographic region and/or country
- To date, the following rating regions have been defined:
  - US (50 states + possessions)
  - Canada
  - Taiwan
  - South Korea
- The Content Advisory Descriptor indicates, for a given event, the ratings for any or all of the rating dimensions defined in the RRT.
- Full implementation in the U.S. requires document EIA-766: “U.S. Region Rating Table (RRT) and Content Advisory Descriptor for Transport of Content Advisory Information Using ATSC A/65 Program and System Information Protocol (PSIP)”, September 1998.

# RRT Information for U.S.

---

- This is documented in EIA-766 and summarized below and in the following slides:

<u>Syntax Element</u>	<u>Value</u>
rating_region	0x01
version_number	00000
rating_region_name_text()	US (50 states + possessions)
dimensions_defined	0x08

<u>Text Formatting</u>	<u>Value</u>
ISO_639_language_code	0x656E67
compression_type	0x00
mode	0x00
number_strings	0x01
number_segments	0x01

# RRT Information for U.S.

RRT

rating\_region = 1 (first instance)

rating\_region\_name\_text = "US (50 states + possessions)"

dimension\_name = "Entire Audience"; dimension index = 0; grad = "1"

index	abbrev	value
0	" "	" "
1	"None"	"None"
2	"TV-G"	"TV-G"
3	"TV-PG"	"TV-PG"
4	"TV-14"	"TV-14"
5	"TV-MA"	"TV-MA"

# RRT Information for U.S.

RRT

rating\_region = 1 (first instance)

rating\_region\_name\_text = "US (50 states + possessions)"

dimension\_name = "Dialogue"; dimension index = 1; grad = "0"

index	abbrev	value
0	" "	" "
1	"D"	"D"

dimension\_name = "Language"; dimension index = 2; grad = "0"

index	abbrev	value
0	" "	" "
1	"L"	"L"

dimension\_name = "Sex"; dimension index = 3; grad = "0"

index	abbrev	value
0	" "	" "
1	"S"	"S"

# RRT Information for U.S.

RRT

rating\_region = 1 (first instance)

rating\_region\_name\_text = "US (50 states + possessions)"

dimension\_name = "Violence"; dimension index = 4; grad = "0"

index	abbrev	value
0	" "	" "
1	"V"	"V"

dimension\_name = "Children"; dimension index = 5; grad = "1"

index	abbrev	value
0	" "	" "
1	"TV-Y"	"TV-Y"
2	"TV-Y7"	"TV-Y7"

dimension\_name = "Fantasy Violence"; dimension index = 6; grad = "0"

index	abbrev	value
0	" "	" "
1	"FV"	"FV"

# RRT Information for U.S.

RRT

rating\_region = 1 (first instance)

rating\_region\_name\_text = "US (50 states + possessions)"

dimension\_name = "MPAA"; dimension index = 7; grad = "0"

index	abbrev	value
0	" "	" "
1	"N/A"	"MPAA Rating Not Applicable"
2	"G"	"Suitable for All Ages"
3	"PG"	"Parental Guidance Suggested"
4	"PG-13"	"Parents Strongly Cautioned"
5	"R"	"Restricted, under 17 must be accompanied by adult"
6	"NC-17"	"No One 17 and Under Admitted"
7	"X"	"No One 17 and Under Admitted"
8	"NR"	"Not Rated by MPAA"

# Directed Channel Change

---

- A newly added feature to the ATSC PSIP standard
- Documented in Amendment 1 to A/65 Rev. A
- Defines two tables at base PID (0x1FFB)
  - Directed Channel Change Table (DCCT)
  - Directed Channel Change Selection Code table (DCCSCT)
- An *optional* capability that offers broadcasters the ability to steer viewers between linked, alternative streams of broadcast program content
- Switch can happen *automatically* or *interactively*.

# Switching Criteria

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- Switch is based on one or more selection criteria, such as
  - unconditional switch to specified channel
  - program ID (episode/version)
  - geographic info
  - demographic info
  - content subject categories
  - content advisory value
  - authorization level

# Selection Criteria

---

- **Geographics**

- State
- County Subdivision

NW	N	NE
W	C	E
SW	S	SE

- County
- Postal Code

- **Demographics**

- Males
- Females
- Ages 2-5
- Ages 6-11
- Ages 12-17
- Ages 18-34
- Ages 35-49
- Ages 50-54
- Ages 55-64
- Ages 65+
- Working

# A sampling of content subject categories

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- Action
- Animated
- Automobil
- Baseball
- Basketball
- Business
- Classical
- College
- Combat
- Comedy
- Hobby
- Home
- Horror
- Information
- Instruction
- International
- Mystery
- Nature
- Politics
- Racing
- Art
- Biography
- Boating
- Cartoon
- Children
- Community
- Computers
- Country Music
- Family
- Headlines

# PSIP Descriptors

Descriptor Name	Tag	Terrestrial						
		CAT	PMT	MGT	VCT	EIT	DCCT	DCCSCT
stuffing	0x80	*	*	*	*	*	*	*
AC-3 audio	0x81		S			M		
caption service	0x86		O			M		
content advisory	0x87		O			M		
ATSC conditional access	0x88				O	O		
program identifier	0xnm		O			M		
extended channel name	0xA0				M			
service location	0xA1				S			
time-shifted service	0xA2				M			
component name	0xA3		M					
dcc departing request	0xA8						M	
dcc arriving request	0xA9						M	
dcc location code	0xAB							M
user private	0xC0-0xFE	*	*	*	*	*	*	*

## Legend

- \* descriptor may appear without restrictions
- M when present, descriptor must appear in location shown
- O when present, descriptor may optionally appear in second location shown
- S descriptor **must** be present in the location shown

# Content Advisory Descriptor

---

- **U.S. Content Advisory** descriptor information is documented in EIA-766 and summarized below and in the following slide:

<u>Syntax Element</u>	<u>Value</u>
rating_region	0x01
rated_dimensions	[0x01, 0x08] (program specific)
rating_dimension	[0x00, 0x07] (signifies dimension)
rating_value	Index into Rating Message Table
rating_description_length	0x00
rating_description_text	None

*From EIA-766, Sept. 1998*

# Content Advisory Descriptor Examples

## Example 1: “TV - Y”

rating_region
rated_dimensions

rating_dimension_0
rating_value

0x01	Rating region = US
0x01	Number of rated dimensions

0x05	Signifies dimension “Children”
1	Signifies “TV-Y”

## Example 2: “TV - MA - L - S”

rating_region
rated_dimensions

rating_dimension_0
rating_value

rating_dimension_1
rating_value

rating_dimension_2
rating_value

0x01	Rating region = US
0x03	Number of rated dimensions

0x00	Signifies dimension “Entire Audience”
5	Signifies “TV-MA”

0x02	Signifies dimension “Language”
1	With Above, Signifies “TV-MA-L”

0x03	Signifies dimension “Sex”
1	With Above, Signifies “TV-MA-L-S”

# ATSC Conditional Access Descriptor

---

Syntax	Bytes	Bits	Format or Note
descriptor_tag	2	8	0x88
descriptor_length		8	Number of bytes following this field
CA_system_ID	2	16	Conditional Access System ID (privately defined)
private_data_byte	T	8*T	Private CA info

- The ATSC Conditional Access System (A/70) requires PSIP in order to be implemented. However, PSIP does not require CA descriptors.
- If present in the VCT, the CA descriptor is applicable to *all events* on that virtual channel.
- The CA descriptor can be made *event-specific* by placing it in the EIT.

# Service Location Descriptor

Syntax	Bytes	Bits	Format or Note
descriptor_tag	2	8	0xA1
descriptor_length		8	Number of bytes following this field
reserved	3	3	'111'
PCR_PID		13	PID of TS packets containing PCR for this program
number_elements		8	Number of PID's used for this program

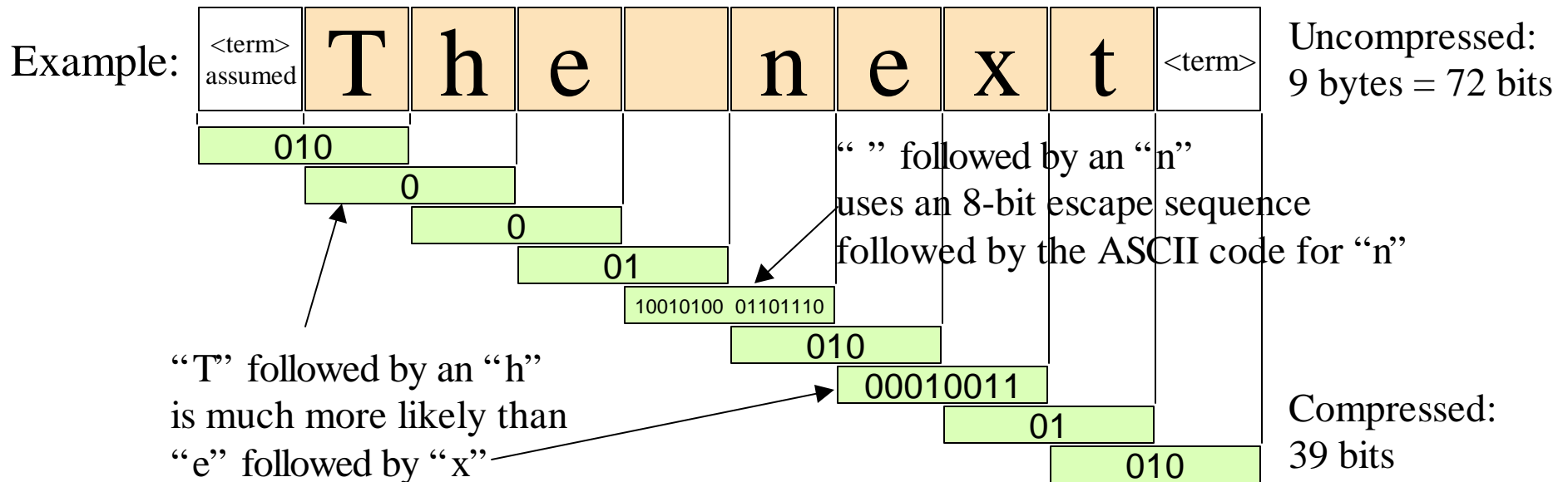
for each element

stream_type	6	8	0x00: ITU-T/ISO/IEC reserved
			0x01-0x7F: As specified in Table 2.29 (stream type assignments) of MPEG-2 Systems, ISO/IEC 13818-1
			0x80: Used in other systems
			0x81: ATSC A/53 audio
			0x82-0x84: Used in other systems
			0x85: UPID (ATSC A/57)
			0x86-0xBF: Reserved
			0xC0-0xFF: User private
reserved		3	'111'
elementary_PID		13	PID for this elementary stream
ISO_639_language_code		24	Language used for this elementary stream

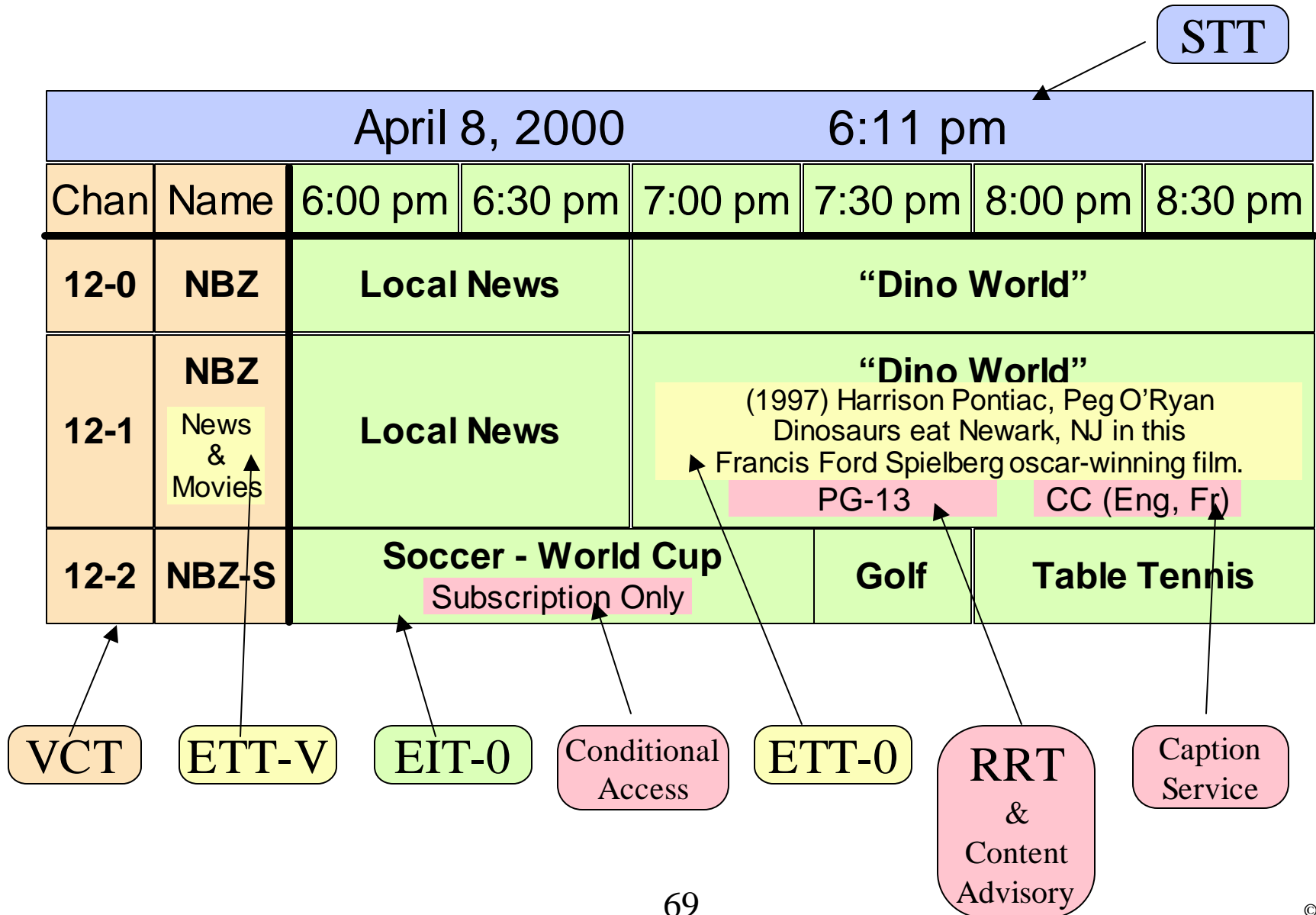
*Note: this descriptor must be present in the TVCT!*

# Huffman-Based Text Compression

- First-order (two-character) Huffman coding may be used for text compression
- Receivers must support Huffman decoding (requires less than 2KB of storage)
- Optimized Huffman tables for Titles and Program Descriptions are provided



# Program Guide Formation



# PSIP and Data Services

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- The new ATSC Data Broadcast Standard (A/90) lists several requirements for PSIP:
  - Each virtual channel in the VCT shall include no more than one data service
  - The Data Event Table (DET) announces
    - data service portion of an audio/video/data or audio/data event
    - data-only services
  - DET's are similar to EIT's in structure
  - Long Term Service Table (LTST) can announce data events far into the future.

# DET Example

DET-0  
source\_id = 22  
num\_data\_in\_section = 3

Data ID	Local Start Time	Length (seconds)	ETM Location	Title	Descriptors
71	12:30	7200	01 (this PTC)	Oodles 'o bits	data_service
72	14:30	3600	00 (no ETM)	Solitaire	data_service
73	15:30	9000	01 (this PTC)	Game Pak	data_service, PID_count

*Adapted from ATSC A/90  
Data Broadcasting Standard*

# Data Service Descriptor

Syntax	Bytes	Bits	Format or Note
descriptor_tag	2	8	0xA4
descriptor_length		8	Number of bytes following this field
data_service_profile	1	8	0x00: reserved 0x01: ATSC Data Bcast Service Profile G1 0x02: ATSC Data Bcast Service Profile G2 0x03: ATSC Data Bcast Service Profile G3 0x04: ATSC Data Bcast Service Profile A1 0x05-0xFF: ATSC reserved
data_service_level	1	8	0x00: no synchronized stream in service 0x01: Data Service Level 1 (DBESn = 120120 B) 0x02-0x03: ATSC reserved 0x04: Data Service Level 4 (DBESn = 480480 B) 0x05-0x0F: ATSC reserved 0x10: Data Service Level 16 (DBESn = 1921920 B) 0x11-0x3F: ATSC reserved 0x40: Data Service Level 64 (DBESn = 7687680 B) 0x41-0xFF: ATSC reserved
private_data_length	1	8	Length in bytes of field that follows
for each byte			
private_data_byte	1	8	Private data



*Note: a Data Service Descriptor is required for every data event*

# Data Profile Attributes

	Guranteed BW			Opportunistic BW
Attributes	Profile G1	Profile G2	Profile G3	Profile A1
Max Terrestrial Data Rate	383,896 b/s	3,838,960 b/s	19.2 Mb/s	19.2 Mb/s
sb_leak (x 400 b/s)	960	9600	48,000	48,000
sb_size (bytes)	4500	4500	10,000	10,000

Smoothing buffer parameters

# PID Count Descriptor

---

Syntax	Bytes	Bits	Format or Note
descriptor_tag	2	8	0xA5
descriptor_length		8	Number of bytes following this field
reserved	2	3	'111'
total_number_of_PIDs		13	Max number of concurrent PID's for the data services. Shall include PID's for Data Service Table and Network Resources Table
reserved	2	3	'111'
min_number_of_PIDs		13	Minimum number of PID's that a receiver must monitor simultaneously to provide a meaningful rendition of the service. 0 means the minimum number is unspecified.

This *optional* descriptor can help the receiver determine resources required for PID handling.

# Long Term Service Table

Syntax of LTST Table	Bytes	Bits	Format or Note
LTST Header	9	9*8	LTST Header (table_id = 0xD2)
num_data_in_section	1	8	Number of events in this DET section

for each data:

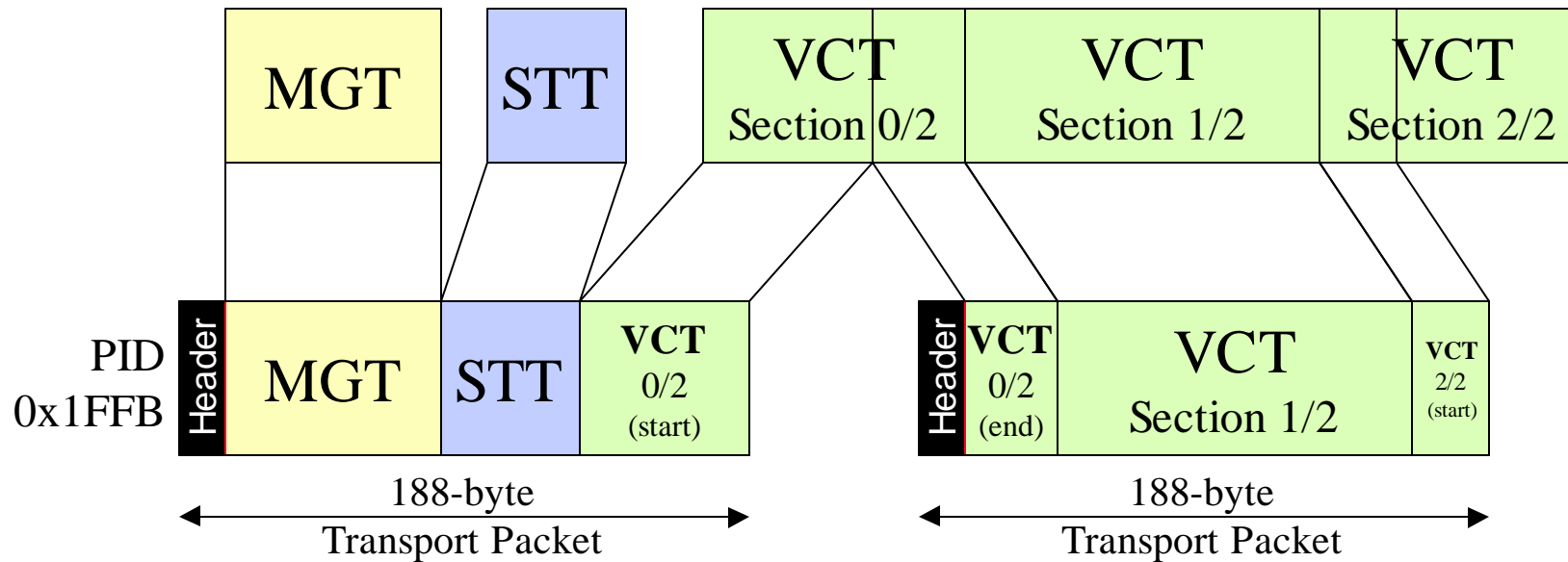
reserved	10	1	'1'	
AV_association_flag		1	1 means the data is associated with AV event	
data_id		14	Data ID.	
start_time		32	In units of GPS seconds since 12 am, 1/6/80	
length_in_seconds		16	Duration of data in sec (unbounded = 0xFFFF)	
reserved		7	'1111111'	
ETM_flag		1	Indicates whether ETM is available	
title_length		8	Length (in bytes) of title_text (0 = no title)	
title_text		T	8*T	Data title (multiple string structure format)
reserved		2	4	'1111'
descriptors_length	2	12	Total length (in bytes) of data descriptors	
descriptors	D	8*D	Descriptor data	

CRC_32	4	32	32-bit Cyclic Redundancy Check
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This is a special Data Event Table that can announce data services beyond the currently defined time period (far into the future).

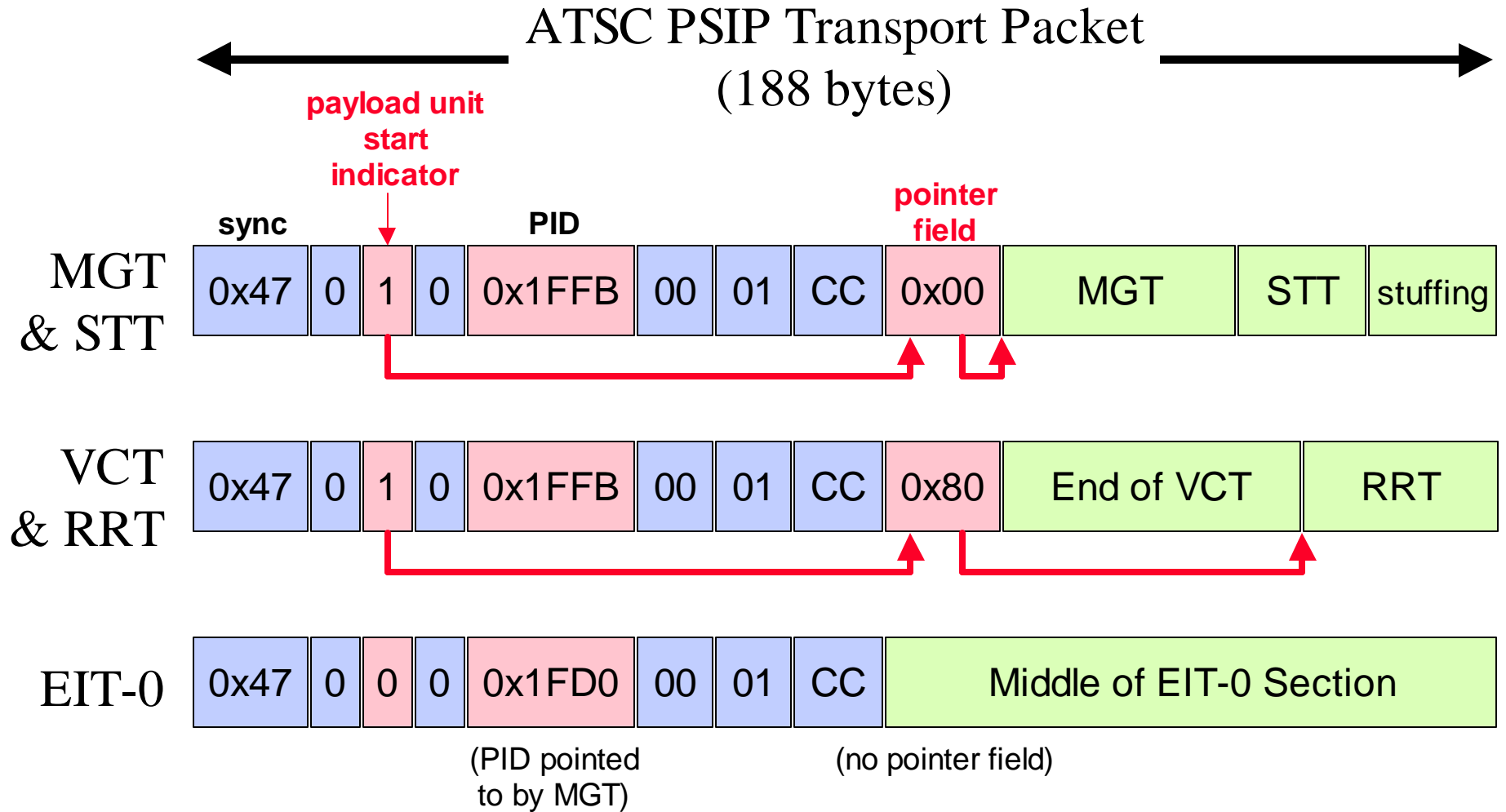
# Mapping PSIP Tables to Transport Packets

Some tables (like VCT)  
can contain multiple *sections*

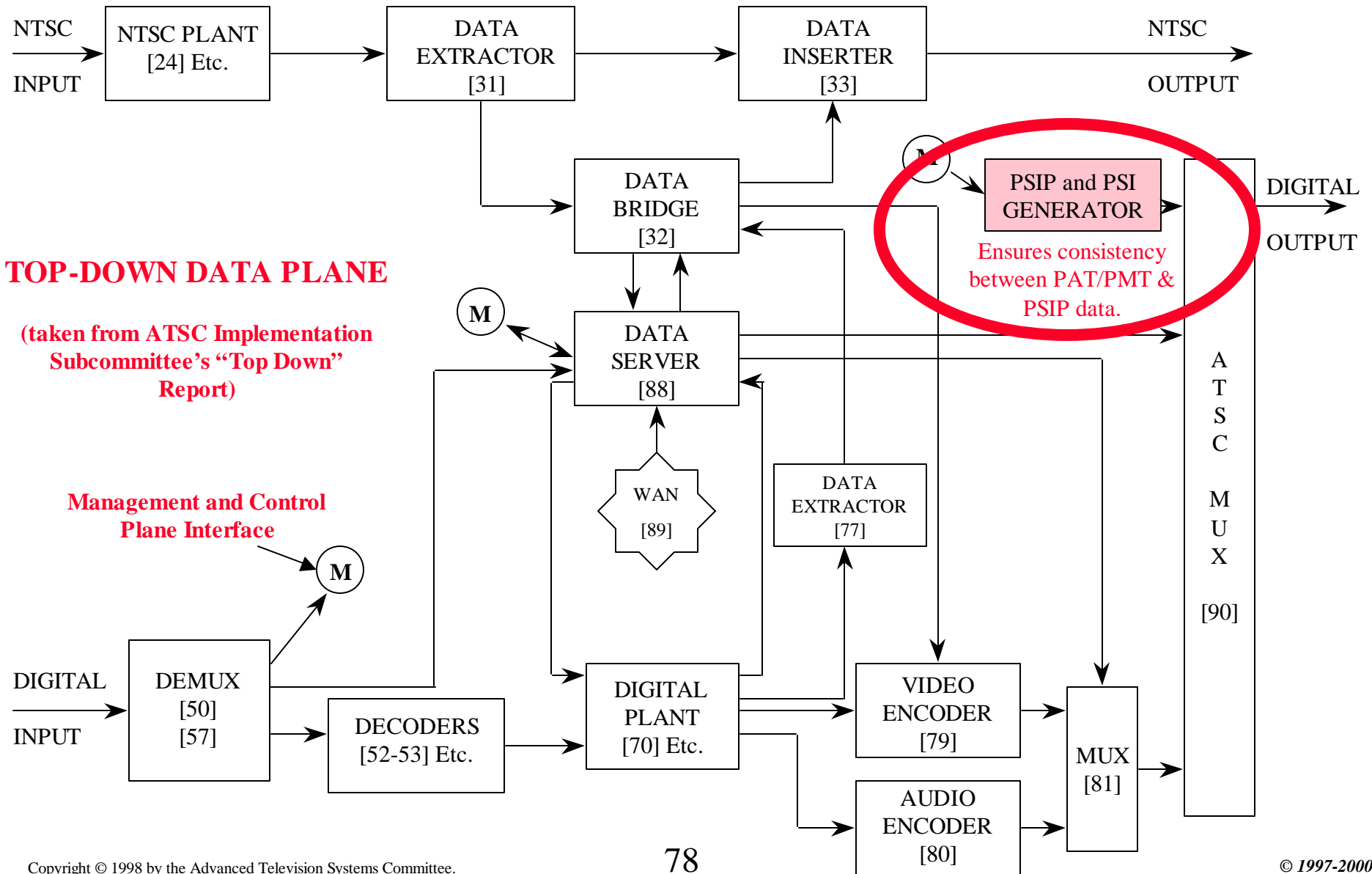


PSIP table sections *carried by the same Packet ID (PID)*  
can be packed into the same Transport Packet.

# Example PSIP Packets



# PSIP Generation and Insertion



## TOP-DOWN DATA PLANE

(taken from ATSC Implementation Subcommittee's "Top Down" Report)

Management and Control Plane Interface

# Things to check at *your* station

---

- Major number = NTSC number
- Minor number 0 reserved for NTSC station
- TSID value is correct  
go to [www.mstv.org](http://www.mstv.org) to find the value
- Carrier frequencies for DTV and NTSC are correct
- First 4 EIT's are filled out and being sent
- STT is correct and incrementing properly
- RRT is correct and being sent

# Relevant ATSC Committee Work

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- PSIP Ad Hoc Group
  - identifies and resolves specification and implementation issues
- Extensions to Accommodate Non-Alphabetic Characters
  - supporting PSIP in other ATSC countries, such as Taiwan
- Advanced EPG Functionality
  - looking at content-based description of events to allow improved browsing
- Implementation Subcommittee
  - identifies implementation issues in studios and receivers
  - participates in “Plugfest” interoperability events

# Relevant PSIP Documents

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- PSIP Standard (A/65A)
  - “Program and System Information Protocol for Terrestrial Broadcast and Cable (Revision A) and Amendment No. 1”, 31 May 2000.
  - Contains main PSIP requirements
  - Amendment 1 is Directed Channel Change
- Conditional Access Standard (A/70)
  - “Conditional Access System for Terrestrial Broadcast and Amendment 1”, 31 May 2000.
  - Defines ATSC\_CA\_descriptor for VCT and EIT
- Data Broadcast Standard (A/90)
  - “ATSC Data Broadcast Standard”, 26 July 2000.
  - Defines PSIP extensions (tables and descriptors) for announcement of data services

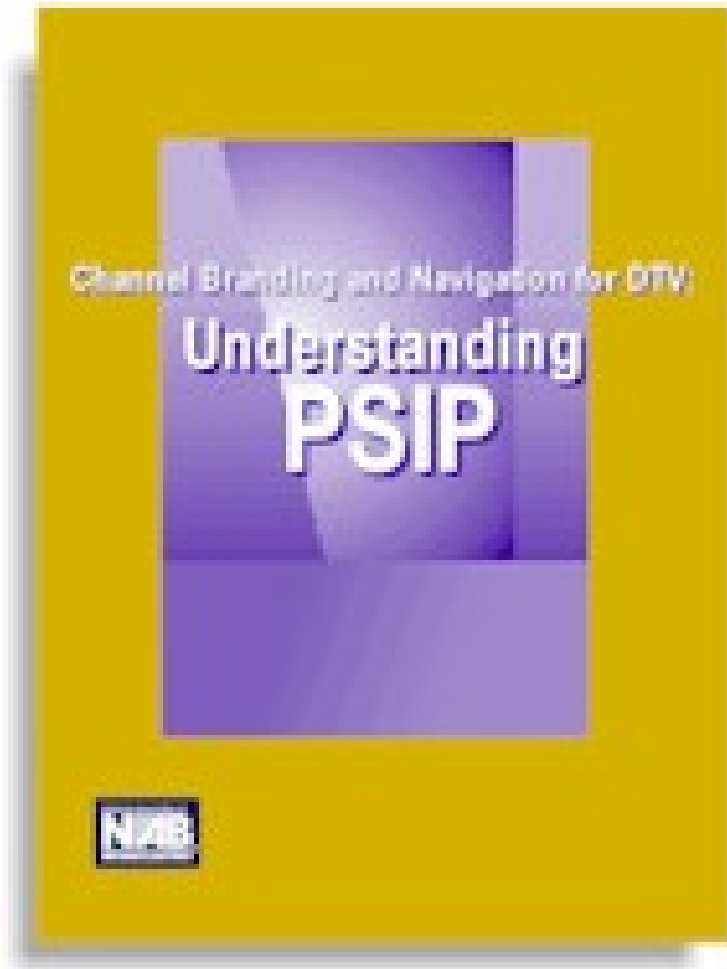
# Relevant PSIP Documents (cont'd)

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- “U.S. Region Rating Table (RRT) and Content Advisory Descriptor for Transport of Content Advisory Information Using ATSC A/65 Program and System Information Protocol (PSIP)”, September 1998 (EIA-766)
  - Used for rating and content advisory in the U.S.

# For more information

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Available from the NAB store:

*[www.nab.org/nabstore/](http://www.nab.org/nabstore/)*

# Thank you!

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- And thanks to the following for reviewing and improving this presentation:
  - Art Allison (NAB)
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