Arris (C-COR)
Switched Digital Video (SDV) Training
SDV System Architecture
Introductions

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Course Contents:

- **General System Architecture**
  - Basic SDV Architecture
  - Failover Configuration
- **Communication Protocols**
  - MCP
  - CCP
  - Mechanics of Communication
- **Event Flows**
Motorola STB Requirements

- **EPG A25.x** (version number of the STB)
- Requires an IP address (Interactive)
- Must be a ‘responder’ (two-way IP communication with **SM**)
- Must be assigned a channel map with mini-car service defined
  - **Mini-car** is the carousel and is sent by the Session Manager
  - The ‘**Mini-car**’ reference is hard-coded into the IPG
Detailed SDV System Architecture

Satellite receivers
- DSR
- DSR
- DSR

Video Plane
- Signal Aggregator
- Digital Multiplexer (program clamping)
- Encryption Device
- GigE Switch
- Edge Modulator
- Combiner

Satellite receivers
- Broadcast programs
- Switched programs

MPEG Formats
- ASI
- DHEI
- 100BT

IP Communications
- Video
- Interactive and carousel communications

IGMP v2 or later
Detailed SDV System Architecture

Video Plane

Satellite receivers
- DSR
- DSR
- DSR

MPEG Formats
- ASI
- DHEI
- 100BT

Signal Aggregator
- GigE
- UDP/IP

Digital Multiplexer
- (program clamping)

Encryption Device

Stage 1

Stage 2

Stage 3

GigE Switch
- IGMP
- v2 or later

Edge Modulator

Combiner

Broadcast programs

Switched programs

SDV Clients
(Service Group 1)
- STB
- STB
- STB
- STB

IP Communications
- Video
- Interactive and carousel communications
Detailed SDV System Architecture

**Video Plane**
- Satellite receivers: DSR, DSR, DSR
- MPEG Formats: ASI, DHEI, 100BT
- Signal Aggregator
- GigE Switch
- Encryption Device
- Digital Multiplexer (program clamping)

**Control Plane**
- Bandwidth allocation, event and status logging
- SRM & ERM
- Management Console
- Application Switch
- GigE Switch
- Edge Modulator
- Broadcast programs
- Combiner
- IGMP v2 or later
- Switched programs

**Headend Components**
- RPD
- NC1500
- OM1000

**SDV Clients** (Service Group 1)
- STB
- STB
- STB

**MPEG Formats**

**IP Communications**
- Video
- Interactive and carousel communications
Acronyms Explained

- NGOD: Comcast speak for Next Generation On Demand
- ERM: Edge Resource Manager
- SDV-SM: Session Manager
- MC: Management Console
- RPD: Reverse Path Demod
- OM: Forward Path Modulator
- NC1500: Network Gateway between Applications Net and Headend Net
- SEM: Smartstream Edge Mod (Motorola encryption)
- TSID: Transport Stream ID
# NGOD SDV Protocols

<table>
<thead>
<tr>
<th>Protocol:</th>
<th>Specifies Communication Between:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>S6</strong> (Session Management) <em>(NGOD)</em></td>
<td>Session Manager and Edge Resource Manager</td>
</tr>
</tbody>
</table>
| **D6** (Discovery) *(NGOD)* | • Edge Resource Manager and Edge Modulator  
• Edge Modulator and Session Manager |
| **R6** (Resource Management—RTSP protocol) *(NGOD)* | Edge Resource Manager and Edge Modulator |
| **N** (Logging/SNMP) *(NGOD)* | nABLE Management Console and external logging application |
| **MCP** (Mini-Carousel Protocol) *(NGOD)* | Between SM and SDV clients |
| **CCP** (Channel Change Protocol) *(NGOD)* | Between SM and SDV clients |
How SDV and Broadcast Switch Channels

<table>
<thead>
<tr>
<th>Source Name</th>
<th>Virtual Channel Number (VCN)</th>
<th>Source ID</th>
<th>Frequency (EIA No.)</th>
<th>Program Number</th>
</tr>
</thead>
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<td>Slapstick</td>
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<td>542</td>
<td>131</td>
<td>18</td>
</tr>
<tr>
<td>History</td>
<td>73</td>
<td>9276</td>
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- In SDV environments EIA frequencies are allocated to channels **dynamically** and thus the ‘Slapstick’ channel may be streamed to service group 1 over one EIA and at another time a different EIA
- Broadcast environments assign **static** frequencies and program numbers
Creating/Configuring Mini-car Background Service

1. On each OM1000 to be used, open port no. 8857

OM 1000
(Forward Path Out-Of-Band Modulator)

Input socket:
10.10.10.1:8857
Creating/Configuring Mini-car Background Service

1. On each OM1000 to be used, open port no. 8857

2. Create a background service named “mini_car”.

3. Assign “mini_car” service to each OM1000 to be used. This generates a Program ID (PID) for each OM1000.

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3. Assign “mini_car” service to each OM1000 to be used. This generates a Program ID (PID) for each OM1000.

4. On MC, configure SDV-SM to stream mini-carousel to OM1000’s. For each OM1000 to be used, specify:
   - IP address of the OM1000 input.
   - Input port no. 8857
   - PID generated in step 3.
   - TTL value of “1”.

5. Mini-carousel streams to each OM1000 for which SDV-SM was configured in step 4.
Creating/Configuring Mini-car Background Service

1. On each OM1000 to be used, open port no. **8857**.

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   - Input port no. 8857
   - PID generated in step 3.
   - TTL value of “1”.

5. Mini-carousel streams to each OM1000 for which SDV-SM was configured in step 4.

6. SDV Client is pre-programmed to look for a service named “mini_car”.

**OM 1000**

- **Forward Path Out-Of-Band Modulator**
- **Input socket:** 10.10.10.1:8857
- **“mini_car” service**

**SDV Clients**

- Service Group 1
  - STB
  - STB
  - STB

**End**
SDV Error Conditions

- The **Right** thing happens
- The **Wrong** thing happens
- The **Right** thing that looks like the **Wrong** thing
SDV Error Codes
Tera Term
• Open source software terminal emulator
• Emulates multiple types of terminals
• Supports telnet, SSH 1 & 2, and serial port connections
• Built in scripting language

A25.2.x
• The latest generation of iGuide
• Contains embedded SDV Client Software
• Serial port debug supported on ASTB only
ASTB (only) Set-up

- Select **Menu** and Go to **Setup**
- Select **Cable Box** and Select **Configuration**
- Press **FAV** key **seven** times
- This brings you to a table, arrow down to last row, **SDB**, right arrow to **All** and hit **Select**. This turns on debug output via the serial port.
STB Events

- **Auto Discovery** (Determines the service group and region to which subscriber belongs)
- **Channel Change** requests for both broadcast and switched video programming
- **Mini-car** carries “active map” message so **SDV client** can determine if switched program exists in service group or not
- **Forced tune** events occur when service group is out of bandwidth
- **Forced tune** events occur when client inactivity exceeds limits
- ALL user activity is monitored and reported

**NOTE:** “Forced tune” is not an EAS event (“force tune”)
Auto Discovery

Animated Flow Diagram
Auto Discovery

**Viewer**
- Turn on AC Power
  - (Plug in STB)

**Set-top Box**
- Continuously broadcast configuration message

**QAM**
- Continuously broadcast configuration message
  - (part of mini-carousel)

**Om1000 Forward Path Modulator**
- SDBConfiguration

**Session & Resource Manager**
**Auto Discovery**

- **Viewer**
  - Turn on AC Power (Plug in STB)

- **Set-top Box**
  - Continuously broadcast TSIDs
  - Read Configuration Message

- **QAM**
  - Continuously broadcast configuration message

- **Om1000 Forward Path Modulator**
  - Continuously broadcast configuration message (part of mini-carousel)

- **Session & Resource Manager**
  - SDBConfiguration
**Auto Discovery**

- **Viewer**
  - Turn on AC Power (Plug in STB)

- **Set-top Box**
  - Continuously broadcast configuration message
  - Read Configuration Message
  - Scan QAM frequencies
  - For TSIDs
  - Sends TSIDs

- **QAM**
  - Continuously broadcast configuration message

- **Om1000 Forward Path Modulator**
  - SDBConfiguration
  - Continuously broadcast configuration message (part of mini-carousel)

- **Session & Resource Manager**
  - Map TSIDs
  - TSI Group ID/Service Group
**Auto Discovery**

- **Viewer**
  - Turn on AC Power (Plug in STB)

- **Set-top Box**
  - Continuously broadcast TSIDs
  - Read Configuration Message
  - Scan QAM frequencies For TSIDs
  - SDBAutoDiscoveryRequest Sends TSIDs
  - SDBInitRequest (optional)

- **QAM**
  - Continuously broadcast configuration message

- **Om1000 Forward Path Modulator**
  - SDBConfiguration
  - Continuously broadcast configuration message (part of mini-carousel)

- **Session & Resource Manager**
  - Map TSIDs TSI Group ID/Service Group
  - SDBAutoDiscoveryConfirm
  - SDBInitConfirm
Auto Discovery

**Viewer**

- Turn on AC Power (Plug in STB)

**Set-top Box**

- Continuously broadcast configuration message
- Read Configuration Message
- Scan QAM frequencies For TSIDs
- SDBAutoDiscoveryRequest Sends TSIDs

**QAM**

- Continuously broadcast configuration message
- Scan QAM frequencies For TSIDs

**Om1000 Forward Path Modulator**

- SDBConfiguration
- Continuously broadcast configuration message (part of mini-carousel)
- Map TSIDs TSI Group ID/Service Group
- SDBAutoDiscoveryConfirm
- SDBInitRequest (optional)
- SDBInitConfirm
Channel Change with *Active* Channel in Carousel

Animated Flow Diagram
Channel Change with Active Channel in Carousel

**Viewer**
- Change Channel

**Set-top Box**
- Check whether request is for a switched channel
- SDBProgramSelectRequest message

**OM100 Forward Path Modulator**
- Continuously broadcast active channel list

**Session Manager**
- Continuously broadcast active channel list (part of mini-carousel)

**Edge Modulator**
- Video (QAM already streaming)

**Management Console**

Configurable update interval
Channel Change with Active Channel in Carousel

**Viewer**
- Change Channel
- Video on requested channel displays

**Set-top Box**
- Continuously broadcast active channel list
- Check whether request is for a switched channel

**OM100 Forward Path Modulator**
- SDBProgramSelectRequest message
- If request is for a switched channel, read active channels
- If requested channel is active, tune to it
- SDBProgramSelectConfirm message

**Session Manager**
- Continuously broadcast active channel list (part of mini-carousel)

**Edge Modulator**
- Video (QAM already streaming)
- Update date, e.g. list of STBs tuned to requested channel

**Management Console**
- Update Management Console with current data

**Session Manager**

**Message Flow**
- SDBProgramSelectRequest message
- SDBProgramSelectConfirm message

**OM100**

**Session Manager**

**Edge Modulator**

**Management Console**

**Configurable update interval**
Channel Change with *Non-Active* Channel in Carousel

Animated Flow Diagram
Channel Change with Non-Active Channel in Carousel

- **Viewer**: Change Channel
- **Set-top Box**: Continuously broadcast active channel list
  - Check whether request is for a switched channel
- **OM100 Forward Path Modulator**: Continuously broadcast active channel list
  - (part of mini-carousel)
- **Session Manager**: Send Setup info to ERM

**Meeting the demands of an on demand world.**
Channel Change with Non-Active Channel in Carousel

- **Viewer**
  - Change Channel

- **Set-top Box**
  - Continuously broadcast active channel list
  - Check whether request is for a switched channel
  - If request is for switched channel, read active channels

- **OM100 Forward Path Modulator**
  - Continuously broadcast active channel list (part of mini-carousel)

- **Session Manager**
  - Requested channel is NOT active
  - Send Setup info to ERM

- **Edge Resource Manager**

- **Edge Device**

- **GigE Switch**

Requested channel's source ID
Channel Change with Non-Active Channel in Carousel

1. **Viewer**
   - Change Channel

2. **Set-top Box**
   - Continuously broadcast active channel list
   - Check whether request is for a switched channel
   - If request is for switched channel, read active channels
   - Requested channel is NOT active
   - SDBProgramSelect Request (sends requested channel's source ID)

3. **OM100 Forward Path Modulator**
   - Continuously broadcast active channel list (part of mini-carousel)

4. **Session Manager**
   - Send **Setup** info to ERM

5. **Edge Resource Manager**
   - If available bandwidth does NOT exist
   - Send **Un-bind** request for non-watched channel
   - Acknowledge Successful **Leave**

6. **Edge Device**
   - IGMP "Leave" (leave requested program with this multicast IP address)
   - Stop stream for requested channel

7. **GigE Switch**

Meeting the demands of an on demand world.

Arris Switched Digital Video Training
Channel Change with Non-Active Channel in Carousel

**Viewer**
- Change Channel

**Set-top Box**
- Continuously broadcast active channel list
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**OM100 Forward Path Modulator**
- Continuously broadcast active channel list (part of mini-carousel)

**Session Manager**
- Send Setup info to ERM

**Edge Resource Manager**
- If available bandwidth does NOT exist
- Send Un-bind request for non-watched channel
- Acknowledge Successful Leave

**Edge Device**
- IGMP “Leave” (leave requested program with this multicast IP address)
- Stop stream for requested channel

**GigE Switch**
- Stream video for requested channel
- IGMP “Join” (Join requested program with this multicast IP address)
Channel Change with Non-Active Channel in Carousel

**Viewer**
- Change Channel
- Continuously broadcast active channel list
- Check whether request is for a switched channel
- If request is for switched channel, read active channels
- Requested channel is NOT active
- Send Setup info to ERM
- If available bandwidth does NOT exist
- Send Un-bind request for non-watched channel
- Acknowledge Successful Leave
- If available bandwidth exists
- Send Bind request
- Stream video for requested channel
- Acknowledge successful Setup
- Update Management Console with current data

**Set-top Box**
- Continuously broadcast active channel list (part of mini-carousel)
- STBProgramSelectConfirm (sends requested channel’s source ID)
- Tune to requested channel
- Video displays
- Acknowledge successful Setup
- Update data

**OM100 Forward Path Modulator**
- SDBProgramSelect Request (sends requested channel’s source ID)
- Acknowledge successful Join

**Session Manager**
- Acknowledge successful Setup
- Update data

**Edge Resource Manager**
- Acknowledge successful Join
- Stream video for requested channel

**Edge Device**
- IGMP “Join” (Join requested program with this multicast IP address)
- Stream video for requested channel

**GigE Switch**
- IGMP “Leave” (leave requested program with this multicast IP address)
- Stop stream for requested channel
Channel Change with Non-Active Channel in Carousel

**Viewer**
- Change Channel

**Set-top Box**
- Continuously broadcast active channel list
- Check whether request is for a switched channel
- If request is for switched channel, read active channels
- Requested channel is NOT active
- SDBProgramSelect Request (sends requested channel's source ID)

**OM100 Forward Path Modulator**
- Continuously broadcast active channel list (part of mini-carousel)

**Session Manager**
- Send Setup info to ERM
- If available bandwidth does NOT exist
- Send Un-bind request for non-watched channel
  - Acknowledge Successful Leave
  - If available bandwidth exists
  - Send Bind request

**Edge Resource Manager**
- Stream video for requested channel
- Acknowledge successful Setup
  - Update data
  - Acknowledge successful Join

**Edge Device**
- IGMP “Leave” (leave requested program with this multicast IP address)

**GigE Switch**
- Stop stream for requested channel
- IGMP “Join” (Join requested program with this multicast IP address)

**Video displays**
- Tune to requested channel

**Update Management Console with current data**

---

Arris Switched Digital Video Training
User Activity Reports

Viewer
- Viewer tunes to a switched channel
- Display video
- Configurable refresh interval, typically 1 hr
- “Click” (Any viewer activity indicating switched channel is still being watched.)

Set-top Box
- SDV Tune
- SDBUserActivityReport

Session Manager
- Update
- SDBUserActivityReport
- Update
- Reflects detected viewer activity

Arris Switched Digital Video Training
Client Inactivity (No Response)

Animated Flow Diagram
Client Inactivity (NO Response)

- **Viewer**
  - Change Channel
  - Display video

- **Set-top Box**
  - SDV Tune

- **OM100 Forward Path Modulator**

- **Session Manager**
Client Inactivity (NO Response)

- Viewer
  - Change Channel
  - Display video
- Set-top Box
  - Configurable refresh interval, typically 1 hour
  - SDBUserActivityReport message
- OM100 Forward Path Modulator
  - SDV Tune
  - Configurable timeout interval, Typically 12 hours
  - SDBEventIndication “Display ‘Press Any Key’ message”
- Session Manager
  - Update
Client Inactivity (NO Response)

- **Viewer**
  - Change Channel
  - Display video
  - Configurable refresh interval, typically 1 hour

- **Set-top Box**
  - SDV Tune
  - SDBUserActivityReport message

- **OM100 Forward Path Modulator**
  - Configurable timeout interval, Typically 12 hours
  - SDBEventindication “Display ‘Press Any Key’ message”

- **Session Manager**
  - Display ‘Press Any Key’

- SDBEventResponse “No viewer activity”

- Update

- 60 second “wait” interval, assume no key is pressed
Client Inactivity (NO Response)

- **Viewer**
  - Change Channel
  - Configurable refresh interval, typically 1 hour
  - Configurable timeout interval, Typically 12 hours
  - Display video
  - 60 second “wait” interval, assume no key is pressed
  - Display Safe channel

- **Set-top Box**
  - SDV Tune
  - SDBUserActivityReport message
  - Display ‘Press Any Key’

- **OM100 Forward Path Modulator**
  - SDBEventResponse “No viewer activity”
  - Tune to Safe channel
  - SDBProgramSelectResponse

- **Session Manager**
  - Update
  - SDBProgramSelectIndication “Tune to Safe channel”
  - Update
Client Inactivity (NO Response)

**Viewer**
- Change Channel
- Display video
- Configurable refresh interval, typically 1 hour
- Configurable timeout interval, typically 12 hours
- 60 second "wait" interval, assume no key is pressed
- Display Safe channel

**Set-top Box**
- SDV Tune
- SDBUserActivityReport message

**OM100 Forward Path Modulator**
- SDBEventindication "Display ‘Press Any Key’ message"
- Display ‘Press Any Key’
- SDBEventResponse “No viewer activity”
- Tune to Safe channel
- SDBProgramSelectResponse

**Session Manager**
- Update
- SDBProgramSelect indication “Tune to Safe channel”
- Update
Forced to Safe Channel

Your requested channel is temporarily unavailable. Your television has been tuned to this new channel.

Emeril  48 FOOD  7:03pm
7-8p  "Gimme Garlic", New, (2004), Garlic-infused oil and...
Check Viewer Presence (Confirmed)

- Viewer
  - Change Channel
  - Display video
  - Configurable refresh interval, typically 1 hr.

- Set-top Box
  - SDV Tune
  - SDVUserActivityReport messages
  - Configurable timeout interval, typically 12 hrs.
  - 60 second "wait" interval. Assume a key is pressed.
  - Display “Press Any Key”
  - SDBEventIndication “Display ‘Press Any Key’ message.”
  - SDBEventResponse “Viewer Activity”

- OM1000 Forward Path Modulator
  - Update

- Session Manager
  - Update

(Channel continues streaming to the viewer’s STB.)
User Activity Prompt

Press OK/Select to continue viewing.
Session Manager Client Query

When the SM Server and SDV Client have become out of sync

SDBQueryRequest
Occurs when SRM determines SDV client is out of sync with itself

SDBQueryConfirm

Update
STB Power Off

- Subscriber Powering on and Off will not reset the STB configuration
- Removing the power plug from the power outlet WILL reset configuration and start the Auto Discovery process
Questions?
Thanks!