Towards A Second Generation Point of Deployment (POD) Interface for Multi-Tuner Cable Receiving Devices

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Abstract

Under the current agreement between CE companies and cable operators, uni-directional "digital cable ready" televisions may soon be offered to consumers. Cable customers could be able to receive premium digital content without the need for a set-top box through the use of a conditional access point-of-deployment (POD) device.

As these single-program POD devices begin to be deployed, CableLabs along with its members and the vendor community is developing a next-generation POD capable of providing multiple streams of premium digital content. This will enable new devices and expanded services such as picture-in-picture, watch-and-record PVR, and home networking of multiple displays within the home.

This article looks at the features of the second generation POD and some of the technical details of how it will operate.

THE POINT-OF-DEPLOYMENT (POD) MODULE

The Point-of-Deployment (POD) module, as currently defined by SCTE 28 [1], SCTE 41 [2], and OpenCable™ specifications [3,4], provides a common format for decrypting premium MPEG-2 content delivered via a cable network. As a result of the use of open standards the consumer premises equipment can be independent of the conditional access system used on that particular cable plant.

The operation of the POD module is shown in Figure 1. Digital content is received via a QAM tuner and sent to the POD module. Premium content that the customer is entitled to view is decrypted using the network's conditional access system. A dedicated out-of-band communication channel (either one-way from the cable network to the device, or two-way) is required in order for the POD to connect with the conditional access system.

Premium content is then re-encrypted within the POD module with the open standard POD copy protection method defined is SCTE 41 [2]. Authenticated devices are able to decrypt the POD copy protected content for display or recording via a 1394 interface with 5C (DTCP) copy protection.

CableLabs has defined a number of different consumer premise devices that interface with POD modules [5]. These include one-way digital televisions and sophisticated two-way set-tops with the OpenCable middleware (OCAP). Appendix A is a list of the currently defined OpenCable defined devices. In the future corresponding versions compatible with a multistream POD will be defined as well.

Single Streams

The current POD specifications were built upon the National Renewable Security Standard

(NRSS-B) [6]. As such they were designed to work on a single multi-program transport stream received via a single QAM tuner. While it might be possible to multiplex multiple transport streams into a single transport stream, it would require sophisticated hardware on the part of the receiving device. In addition, the current out-of-band signaling methods used on the POD make it difficult to share a common out-of-band transmitter. Therefore it is necessary to define a new POD device and interface capable of supporting multiple transport streams from multiple QAM tuners.

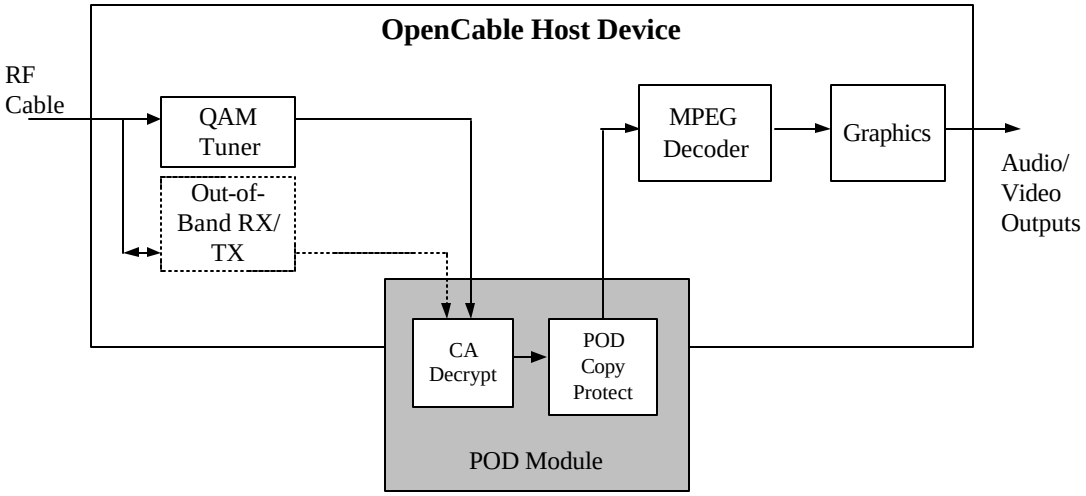

Figure 1 - Current POD and Host Operation Diagram

MULTIPLE STREAMS

Expanded Features

A POD capable of supporting multiple transport streams would enable a number of new digital cable devices. A multi-stream POD would be capable of decrypting multiple premium programs located on different multiplexes received by multiple QAM tuners. Perhaps the simplest feature enabled is picture-in-picture (PIP) where one program is displayed in a window overlaid on another program. Multiple tuners and a POD capable of decrypting multiple programs are required for a device offering this feature.

If the host device contains a hard disk drive (HDD) for temporary storage of MPEG streams, then multiple tuners and a multi-stream POD enables the ability to watch-and-record, or to record two shows simultaneously.

Even more sophisticated host devices might serve multiple displays within the home via a home network. A central home server device may have multiple tuners (at least one per display device) as well as a HDD for storing content for later viewing. Content is then delivered via the home network to the various display devices.

Requirements

In collaboration with the cable operators, CableLabs has defined a tentative list of requirements for the second generation POD device that supports multiple transport streams. These requirements are subject to change as we develop the technical specifications.

1) The Multi-Stream POD specification should encourage the development of retail digital cable set-top and terminal

host devices through the use of OpenCable and other publicly available specifications. Just as the current open standards for the POD module are enabling multiple companies to offer digital-cable ready devices, the multi-stream POD should enable even more innovative products utilizing multiple tuners.

2) The interface shall provide sufficient bandwidth for a maximum data rate which supports the payload from up to six simultaneous 64 QAM transport streams, or up to five 256 QAM transport streams, or any combination that is below the maximum data rate.

3) The Multi-Stream POD shall be able to decrypt multiple Programs from a single Transport Stream as well as multiple Programs from multiple Transport Streams, up to the resource limitations of the POD (see Requirement number 6 below as well).

4) The Multi-Stream POD shall be backward compatible with the Single-Stream POD. It shall appear as a Single-Stream POD in a Single-Stream host device. This will enable the second generation PODs to be used in current single-stream POD devices. Cable operators can transition to the new PODs and still support the deployed single-stream devices.

5) Multi-stream PODs shall support both traditional QPSK out-of-band methods and out-of-band data delivered via cable modem. The POD will indicate to the Host which OOB method to use depending on what the cable plant supports. As a result, second generation PODs will be able to be used on any digital system in North America now and in the future.

6) The Multi-Stream POD interface shall provide a discovery mechanism for a Multi-Stream capable host to discover how many simultaneous Transport Streams and PID decrypts the POD scan handle. This allows the Host to manage POD resources and prioritize which programs to send to the POD.

7) The multistream POD specification shall allow for the use of multiple PODs in a single device. This would allow for any future products that might need more stream support than a single multistream POD can handle. This extensibility ensures any future devices that contain even more tuners than anticipated today could be supported.

8) All two-way multistream Hosts shall contain a cable modem that supports the DSG specification [9]. All multistream PODs shall support DSG out-of-band.

9) Every transport packet that enters the POD from the Host will be returned to the Host in the same order, and with a fixed delay.

Given these requirements, a POD-Host interface specification is being developed that meets the requirements while also creating a viable commercial product. CableLabs is working with cable operators and consumer equipment manufacturers to create these specifications.

Second Generation POD Operation

The multi-stream POD builds on the current POD by providing a command interface, out-of-band communication interface, and transport stream ports. The command interface will use the same layering of objects as the current POD.

Like the current POD, the multistream POD will provide a single transport stream input port and a single output port. As a result the transport streams from multiple tuners will be multiplex into a single stream before entering the POD. The POD will decrypt any selected and authorized premium content programs. Transport packets are returned to the Host device in the same order they are received. The Host then de-multiplexes the various streams and provides them to the various services requesting them. A block diagram is shown in `Figure 2`. In the multiplexer section, the sync byte within the MPEG transport packet header will be modified by the Host in order to uniquely identify the different transport streams. The host de-multiplexer would then use the sync byte to identify packets returning from the multi-stream POD.

The multi-stream POD will use the same HOST-POD communication method as the present POD. The Host and POD communicate via a series of Application Protocol Data Units (APDUs). Most of the APDUs for the multi-stream POD will be identical to the ones for the current POD as defined in [1,3]. This will allow developers to re-use most of the software from single stream PODs and devices. Some APDUs will be modified to include identifiers to indicate to which transport stream they apply. For example, the CA_PMT() APDU is used to indicate which encrypted programs are to be de-crypted by the POD. In the multi-stream POD the CA_PMT() APDU will be modified to indicate which program as well as which transport stream contains that program.

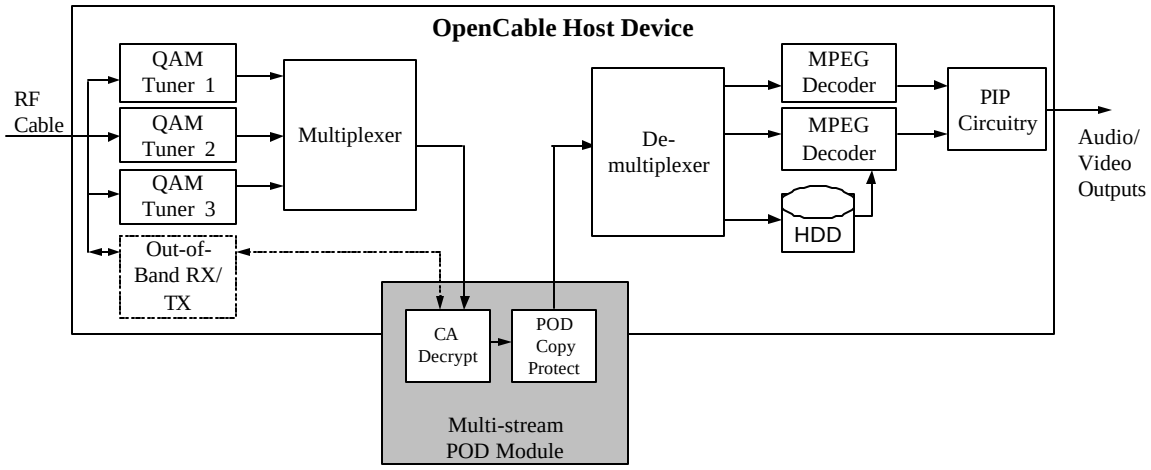

Figure 2 - Sample Multistream POD and Host Diagram

Further Study

CableLabs will continue to work with its member and interested vendor companies to complete and publish the multi-stream POD specification. Interested companies can contact CableLabs for information on how to become part of the drafting team for the multi-stream POD specification.

Appendix A – OpenCable Host Devices

CableLabs defines the following OpenCable host devices to operate with the current POD:

OCAP: OpenCable Application Platform [7,8]. A common middleware specification based on Java for interactive television applications.

OpenCable Set-top Box: Cable box with ability to decrypt digital tiers. Includes one-way and two-way capable boxes, requires POD for decryption of cable provider services. Outputs include RF, DVI, Component outputs and 1394.

OpenCable TV: Cable ready TV with ability to decrypt digital tiers. Includes one-way and two-way capable TVs, requires POD for decryption of cable provider services.

Advanced OpenCable Set-top Box: OpenCable Set-top Box with a cable modem for two-way services.

Advanced OpenCable TV: OpenCable TV with a cable modem for two-way services.

OpenCable HD Set-top Box: OpenCable Set-top Box that supports decoding of High Definition TV. Can be either one-way or two-way, includes new outputs such as DVI and HDMI.

OCAP 1.0 Set-top Box: Supports all OCAP compliant applications, and is two-way.

OCAP 1.0 TV: Supports all OCAP compliant applications, and is two-way.

OCAP 2.0 Set-top Box: Supports all OCAP compliant applications, two-way, with a cable modem (Advanced OpenCable Set-top Box).

OCAP 2.0 TV: Supports all OCAP compliant applications, two-way, with a cable modem (Advanced OpenCable TV).

References

1. ANSI/SCTE 28 2001, "Host POD Interface Standard (formerly DVS 295)"
2. ANSI/SCTE 41 2001, "POD Copy Protection System"
3. "OpenCable Host-POD Interface Specification", OC-SP-HOSTPOD-IF-I12-030210
4. "OpenCable Point-of-Deployment (POD) Copy Protection System", OC-SP-PODCP-IF-I09-030210
5. "OpenCable Host Device Core Functional Requirements", OC-SP-HOST-CFR-I12-030210
6. EIA-679-B, "National Renewable Security Standard"
7. "OpenCable Application Platform Specification (OCAP) 1.0", OC-SP-OCAP1.0-I05-030210
8. "OpenCable Application Platform Specification (OCAP) 2.0", OC-SP-OCAP2.0-I01-020419
9. "DOCSIS Set-top Gateway (DSG) Interface Specification", SP-DSG-I01-020228

Reference Acquisition

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