Response to Competitive Navigation System Interoperability Additional Material

August 7, 2015

Competitive Navigation System Interoperability

Proponents of the "Competitive Navigation System" (Device Proposal) provided additional material for reference at the August 4 DSTAC meeting. This document contributed by the proponents of the "Application-Based Service" proposal addresses this additional material.

The claims of the Additional Material offered by the Device Proposal are incorrect in these fundamental ways.

- The Device Proposal presents no technical basis from which to claim support for the many elements of MVPD service that the proponents claim to support. Features like extensibility, functionalities, and suitability for media and service need to be designed in from the beginning or they are hypothetical. It presents no coherent architecture, only a set of individual components without a plan for how they are combined into a complete system. It is akin to proposing that mobile network providers adapt their networks to serve a new handset having "a battery, some chips, a touch screen and an antenna."
- Much is said about the power of the widget model to replicate parts of MVPD service, but the widget model does not exist and requires invention. The Device Proposal does not provide sufficient technical detail to even consider the widget model to be an execution model. We demonstrate specific instances where the proposal does not support the claimed features. Even if the model were developed, all MVPDs will have to deconstruct their service and reconstruct their service using widgets. Even then, although the Device Proposal recognizes that "an MVPD interactive 'widget' is required" (p. 108), the "[d]isplay of widgets must be conditionally optional" (p. 119), and therefore widgets do not provide the claimed support.
- Rather than requiring "at worst only minor changes," the Device Proposal calls for re-architecting of much of the MVPDs infrastructure, from back-office systems, to headends, uplinks, and central offices, the delivery platforms, network equipment, content servers, security components, and creating new devices for the home, from scratch. It calls for major inventions for all of the system components outlined in the ill-defined proposal. It references at least 37 standards or interfaces that may require extensions, enhancements, or specific usage constraints to be defined—and many of these are either not yet implemented, implemented only in limited ways by a subset of MVPDs, or not intended to work except in a bidirectional system. Some of these are catalogued at the conclusion of this response. These activities would need to be developed, agreed upon, implemented, tested, certified, and ultimately deployed. The hypothetical inventions and developments on which the Device Proposal depends require cross-industry development, deployment, testing, certification or more. They are not minor changes.

These errors are detailed below.

● *The Device Proposal restricts HTTP to the transport of video and descriptive metadata, stripping the original and main purpose of HTTP - delivery of full web pages and web app.*
The use of HTTP to deliver video and metadata is commonplace and not at all against the intent of HTTP. The competitive proposal is pointing to the existing dominant usage of HTTP as the modern method for delivering unicast video content. YouTube, Apple TV, Netflix, Sling.tv and millions of other content platforms on the Internet use HTTP as transport of video and metadata and not merely for web pages and web apps. The RVU, VidiPath and the DTCP-IP content protection system also use HTTP as the delivery method for delivery of video without web pages.

We obviously understand and support the use of HTTP for video transport—it is included in the apps-based proposal. The issue is that the "Device Proposal" *restricts* the use of HTTP to the transport of video and descriptive metadata only, while YouTube, Netflix, Hulu, and all other online Video Distributors use *web pages and web apps* over HTTP to distribute and allow user interaction with their content. They may also provide and/or support native apps for some platforms, e.g. iOS and Android, which use HTTP for video and web services, while relying on the native app platform for UI. To be technology and platform neutral, MVPD apps ought to be treated exactly like Netflix, YouTube, Amazon and other video providers, rather than being denied the use of standard tools and an application layer that allows applications to operate in the manner that makes the Internet such a rich environment for services.

● ... *through an expanded CableCARD MMI that is yet to be invented. The CableCARD MMI does not define how a hyperlink is navigated and selected*.
The CableCARD specification intentionally left implementation details of the navigation of hyperlinks up to the consumer device manufacturer, because that is consistent with how hyperlinks are used in the Internet paradigm. Hypertext and hyperlinks are *intentionally* defined separately from the browser or other technology that navigates them to allow both sides of the interface to be flexible and extensible. Defining them would have limited both the cable operator and the device manufacturer. This has always been part of the implementation in the client side browser/renderer. Just as VidiPath and other HTML5 UIs used by MVPDs provide hyperlinks to client devices, nothing is preventing using those same techniques in HTML content presented through the MMI.

Proponents of the Device Proposal appear to have misunderstood what was intended by this comment. The intent of this comment was to raise the issue that the expanded CableCARD MMI is something that is yet to be invented. The CableCARD MMI on which it is based does not provide the suggested functionality, and no path or architecture has been described for developing the functionality described in the "Competitive Navigation System." Consequently, it is not possible to claim that the required content may be presented through an MMI. Any development project on such an MMI will take many years. By example, the W3C has worked since 2004 to create a platform neutral Man Machine Interface in HTML5, and the most recent 2014 version of HTML5 with the EME, MSE, and Web Crypto extensions is the only MMI that works effectively across virtually all relevant devices.

- *Unlike the application environment we see today, the CableCARD has no provision for JavaScript or other application execution environment in the Host device on the other side of the CableCARD interface. An MMI has to have an execution environment in the client to provide any form of interactivity, or it fails. But the Device Proposal provides for no execution environment within which the widgets delivered through the MMI can operate.*

and

- *Offers no reason why existing specifications like HTML5, EME, MSE and Web Crypto, all developed through the W3C open standards processes, would not be a more appropriate solution, as proposed in the MVPD WG3 and WG4 proposals. Instead, it would require essentially starting from scratch*

The "MVPD" analysis is confusing the reference to the older CableCARD MMI with the actual proposal of a new MMI interface. Yes, the CableCARD MMI (which was defined almost 20 years ago) did not have modern technologies like Javascript, but the proposal does not exclude them. Indeed the proposal envisions the use of technologies like HTML5, EME, MSE and Web Crypto for user interaction "widgets" over the MMI as this would give both MVPDs and consumer device UIs flexibility for innovation.

Proponents of the Device Proposal now say they agree that a comprehensive application environment as specified by the W3C in HTML5, EME, MSE and Web Crypto is appropriate (which is exactly what the App-based proposal is promoting). But the actual proposal rejects those open standards developed for IP media streaming, rejects permitting any application to run on a retail device, and calls instead for all MVPDs to deconstruct existing media services and invent new disconnected widgets that could (possibly) offer discrete features presumably in an execution environment that is not even outlined in the Device Proposal. The Device Proposal provides no reference to any of the many, different widget specs; and whenever challenged about details and deficiencies, the Device Proposal keeps changing the features of the proposed widget model. And even then, execution of these "widgets" is optional to the device. Rather than limiting HTML5, removing the use of extensions, and requiring massive development of new widgets, a proposal that actually envisioned the use of HTML5, EME, MSE and Web Crypto would offer an application environment and support the HTML5 standard, as does the apps-based proposal.

- *Ignores the app-based model that has been widely deployed in the marketplace. *** It removes any APIs and fails to provide an application execution environment, with the expressed purpose of stripping out features of MVPD service. The mobile app platforms provide a predictable execution environment on the client and the application developer can evolve their client apps along with their server functionality without the need to negotiate with a third-party when the client/server interfaces evolve. The retail proposal proposes to disintermediate or interfere with this time proven model, by removing a predictive execution environment and freezing the client/server protocols and interfaces*.

Again the analysis is incorrect in that the competitive proposal does not ignore the app-based model. The proposal states that it is an alternative which, unlike the app-model, actually meets the requirement to enable competitive navigation devices. As an alternative option for the consumer, it also does not prohibit competitive app-based solutions from the MVPD directly. In addition, there is no requirement for an application execution environment. On the contrary, the competitive proposal points out that previous application execution environments for pay television such as OCAP and DVB-MHP were failures because of both the technical complexity and competitive restrictions they placed on navigation devices.

The competitive model does offer a predictive execution environment for the widgets that are needed for implementation of certain features (such as PPV/VOD purchasing, VOD playback including LookBack and StartOver, service upgrades, billing, support relating to the MVPDs service, caller ID, sports scores, etc.) without requiring the added complexity of requiring an execution environment for content delivery. HTML5 is the nearly universal choice for user interaction (as opposed to the prevalent use of HTTP and not HTML5 for content delivery). While the consumer could choose to use an MVPD provided app that reflects the entire MVPD UI (as required in VidiPath), in order to enable competitive navigation UIs the MVPD would provide the Service Interfaces defined in the competitive proposal, and can still optionally offer subsets of the MVPD UI that reflect the various widget components mentioned above.

The competitive proposal strikes the proper balance of implementing an execution environment for what it is good at -- without requiring it for access to content and therefore restricting or preventing a competitive UI. Through this correct, balanced, use of an execution environment, competitive devices would have freedom to innovate on the UI and utilize widgets in the contexts where they are needed to interface with the particulars of a given MVPDs service. Mandating an execution environment for the MVPD application as the only platform for access to service as was attempted and failed in OCAP would only limit innovation and the marketplace.

If the Device Proposal is suggesting that a successful application environment cannot be created because "OCAP and DVB-MHP were failures," then it is mistaken. Successful application environments have been created on iOS, Android and HTML5, among others. By contrast, there is no evidence suggesting that a to-be-invented widget model presents "the proper balance" for an execution environment. In fact, the Device Proposal does not provide sufficient technical detail to even consider the widget model to be a full execution model. It does not exist. There is no widget spec that would support PPV/VOD purchasing, VOD playback including LookBack and StartOver, service upgrades, billing, support relating to the MVPDs service, caller ID, sports scores, etc., as claimed by the Device Proposal. As mentioned above it will take a long time to develop this widget model. For the MVPDs to use this widget model, they will also have to deconstruct their service and reconstruct their service using it. Even then, the widgets remain optional for the device to present.

- *The Device Proposal strips out the very features with which MVPDs compete, improve service and market to consumers, on every retail device envisioned by the proposal. Satellite customers would lose sports scores and statistics for satellite. U-Verse customers would lose instant channel change. Cable customers would lose StartOver and LookBack, telescoped and interactive advertising. Cable program networks would lose the interactive enhancements they have built into their programming, such as shop by remote and multiple camera angles.*

The basis of competition is differentiation and choice. It is incorrect to assert that because a competitor does not include the same feature set of its competitor it has stripped those features. The market will decide which option it prefers. Furthermore, some of the features listed would not be removed in either proposal. The features can be supported in either model. For example in its implementation of the Content Delivery Interface of the Competitive Proposal, U-Verse would implement fast channel change in the interface. The competitive device would request a channel, and the U-Verse interface implementation would perform whatever proprietary protocol is required for fast channel change. U-Verse would do the same in a VidiPath or App-model approach. In both proposals the receiving device does not implement fast channel change, but it is still available to all navigation devices. The same applies to features such as advertising insertion, telescoped ads, switched digital channels, and many more that are network or system specific features. In addition, the abstraction (not stripping as claimed) from network specific technologies that both proposals use gives MVPDs more freedom to make changes to their network technologies. Vidipath clients for example would make the same request for a channel change regardless of how U-Verse implements fast channel change. If they change that technology within their network, the clients would not need to change.

Finally, many of these so-called 'losses' can be covered by the HTML5 widget model explained above. The explosive innovation that will be precipitated by an open, competitive market for navigation devices and navigation UIs would overwhelm whatever disadvantage is attributed to these so-called 'losses'.

This is yet another example where the proponents of the Device Proposal state that virtually anything "can easily be achieved by the MMI widget model" yet offer no technical basis nor detailed development plan for this assertion. The assertion that "U-Verse would implement fast channel change in the interface" is factually incorrect. Instant Channel Change is a feature that can only be implemented in the end client device due to the nature of the video coding and the buffer model used by that system. Implementing ICC solely in the gateway does not provide the ICC experience at the end client device, because the end client device MPEG buffer is always kept full with a number of video frames that haven't been decoded yet (anywhere between 0.5 and 2 seconds of video). These have already been transmitted by the ICC-aware gateway to the client. When a new channel is requested by the client, the *gateway* cannot eliminate the 0.5 to 2 seconds of video that is already in the *client* buffer. This buffer will always result in a 0.5 second or greater channel change latency in a gateway-only implementation and thus not provide an ICC experience for the end client. The proprietary MediaRoom U-Verse technology overcomes this latency by using a combination of multicast and unicast that terminate in the ICC-aware end client device that manages the video in its hardware buffer.

- *The Service Discovery Interface is limited to three elements: lists of available services; metadata about those services; and messaging from the MVPD relating to these services. The metadata and messaging related to these services significantly constrain innovation. The metadata in this interface is limited to describing the service, but does not permit any method of enhancing the service itself (e.g. interactive enhancements, multiple camera angles, request for information, telescoping ads, shop-by-remote etc.).*

By focusing on the number and not the breadth and functionality of interfaces this argument ignores the fact that the interfaces are based on extensible web protocols, the basis for most Internet services which have proven they support rapid innovation. The internet has been built on such extensible technologies. In the competitive proposal services can be enhanced and new ones added without constraining the client device

into running a complete MVPD UI. Extensible protocols such as XML allow client devices to ignore elements they don't support (or choose not to support) and thus new features can be added easily. The standards, protocols, APIs, and interfaces that will eventually be finalized for allowing creation of a competitive navigation device should also include extensible technologies as well where relevant.

Proponents of the Device Proposal state the standards, protocols, APIs and interfaces currently do not exist, rather "that [they] will eventually be finalized." (p. 185) While many protocols are proposed with suggestions that most of them will have to be extended, little or no detail is provided. Naturally, many protocols can be extended, some in backwards-compatible ways. However, features, functions, and flexibility for future extension need to be designed in at the start, including hardware considerations. It often takes a great deal of time and effort to extend and enhance or even simply replace protocols. For example, the transition from IPv4 to IPv6 is one that has been underway for decades and will not be complete for many more years. The transition from HTTP 1.1 to HTTP 2.0 is just beginning and there isn't a clear transition path identified yet. This similarly promises to be a many year transition. As another example, ATSC is currently developing its third version of their standards ATSC 3.0, while only ATSC 1.0 is deployed today. As currently understood, ATSC 3.0 is not backward compatible with ATSC 1.0 and there currently is no transition plan defined. All of these activities represent an enormous of amount of work, specification writing, technology development, field tests, revisions that maintain backward compatibility, testing, certification, etc. Just as the to-be-invented widget model is put forth to magically fill in any gap in the proposal, the assumed extensibility of yet undefined specifications is put forth to provide transparent, shiny, yet ultimately insubstantial gloss over the proposal's shortcomings.

● *Interactive enhancements to the content are not addressed or envisioned in this proposal. Nor is there a process identified for how any of these interfaces would evolve over time, in order to phase out obsolete technologies/features and introduce new technologies/features.*

On the contrary, the competitive proposal distinctly includes interactive enhancements and MVPD-unique elements via the MMI to enable this. Interactive enhancements from the MVPD can easily be achieved by the MMI widget model. Beyond that, the implementers' competitive navigation devices will be able to create their own interactive enhancements that to date have lacked any vehicle for delivery to consumers. Final specifications may include methodologies for phasing out obsolete technologies over time and use extensible technologies for expansion of future capabilities.

This is another example where the proponents of the ill-defined Device Proposal state that virtually anything "can easily be achieved by the MMI widget model" (p. 185), yet they offer no technical basis for this assertion. According to their proposal, the basic requirements for it still need to be developed: "Widget requirements would need analysis to determine the level of HTML that the MMI should support." (p. 119) Even after requirements are identified and selected by an unidentified group using an unexplained process, this MMI widget model is yet to be invented. As a result, there exists no actual support for the use cases identified in WG4 or the services and features WG1 has identified as requirements.

● *There is no indication of how modern business models could be expressed if the only interface from an in-home device is DTCP. The proposal provides much more detail about device authentication through the use of X.509 certificates, yet fails to provide the critical and necessary details about how these certificates are managed, the required trust infrastructure, certification, and any policies necessary to make the certificates*

useful.
DTCP, which is also specified in VidiPath, is not a static specification without improvements. Future versions of DTCP currently in development could satisfy both the CCI and format requirements of modern business models. Specifics on aspects relating to entitlements are not detailed at this point. These should reflect inputs from MVPDs in order to best interoperate with their services.

Proponents of the Device Proposal repeatedly indicate that DTCP can be extended. Developed in 1998, DTCP is a link-layer protection system that offers fairly rigid business models for distribution of content (copy freely, copy once, copy never, copy no more) largely within the context of a home network. Additional business models were added with the "DTCP+" extensions in 2011, although DTCP+ has not been widely adopted. DTCP has never been treated as an exclusive protection system, in-home, link-protection or otherwise. Service providers have been able to select other content protection systems such as DRM systems that provide rich and extensible business models through combinations of software and hardware that are much more flexible and can be renewed more easily, as well as protecting content distributed from the cloud. Service providers have also been able to implement more refined usage rights by using applications and user interfaces. DTCP does not support all the models in use now or potentially in the future, and cannot be assumed to be rapidly extended to meet all new business models. For example, it has been utilized for DirecTV's Ultra High Definition service only after checking against a white list of permissible devices with appropriate software (DirecTV presentation to WG3 on June 3, 2015, http://apps.fcc.gov/ecfs/document/view?id=60001077180). Link-protection is often layered with additional protections, such as apps that define and control usage rights (for example, HTML5 on pg. 24 or VidiPath on pg. 78 of WG4 Report). Without such flexibility, business models can only be advanced pending extension of a single proprietary protection system, and Content Providers and Content Distributors cannot rely on assumed extensibility of DTCP to accommodate rapidly changing business models in a timely manner.

● *It identifies a number of protocols, but does not specify which would be the preferred embodiment. It invokes standards that are not implemented (e.g. SCTE 65 Profiles 4-6 and CEA 2033) or standards that are implemented only by some MVPDs (e.g, Zeroconf which implies a particular provision, management, and fault detection system in the MVPD's network.)*
The Competitive proposal at this point of discussion is not intended as a completely detailed protocol at every level. It is consistent "with the Commission's instruction to recommend an approach that would allow consumer electronics manufactures to build devices with competitive interfaces." It outlines the features and recommended technical interfaces required in order to create a retail market for competitive navigation devices.

Proponents of the Device Proposal admit it is not complete. There are at least 37 standards or interfaces that are explicitly referenced in the proposal (see list following) that may require extensions, enhancements, or specific usage constraints to be defined—and many of these are either not yet implemented, implemented only in limited ways by a subset of MVPDs, or not intended to work except in a bidirectional system. There are dozens of major inventions that would be required, including back office systems, service delivery platforms, gateway devices, network protocols, etc, some of which are catalogued at the conclusion of this response. The "approach" offered in this

proposal cannot be assured to yield results and in a predictable timeframe. Our experience with standards setting processes indicate that this would be a many year process to get to standards, followed by a multi-year development, implementation, test development, and certification process. This is before the first device could reach the first customer. On the contrary, the Apps-Based Proposal makes use of technologies that are developing rapidly in the market place and addressing hundreds of millions of retail devices today. It also proposes to extend this apps approach beyond large platforms by using new W3C HTML5 standards to reach more retail devices.

● *It does not even support linear channels within its own terms. It explicitly acknowledges reliance on "prosthetic" auxiliary devices for satellite and IPTV at the very least – meaning more boxes (and more energy consumption).*
The Competitive proposal includes content protection models similar to the content distribution and DRM/CAS solutions presented in the MVPDs App proposal. They both focus on IP delivery of content either from 'cloud to ground' or from an in-home gateway device. The competitive proposal is an extension of technologies the MVPDs have already deployed and/or have presented to the FCC. None of this requires any radical rearchitecting of networks (indeed it requires at worst only minor changes) because it involves software protocols from either the Cloud or in-home gateways and not network hardware. As for the use of "auxiliary devices" the operator has the option of implementing the interfaces in the cloud or in their existing gateway devices. In the VidiPath and RVU demonstrations a gateway is required as well. All MVPDs require these gateways today either as cable modems DSL modems or fiber termination devices. It is completely possible to not require any new device for this competitive solution.

Proponents of the Device Proposal state "None of this requires any radical rearchitecting of networks (indeed it requires at worst only minor changes) because it involves software protocols from either the Cloud or in-home gateways and not network hardware." and "It is completely possible to not require any new device for this competitive solution." These statements demonstrate a total lack of understanding to MVPD network technologies and the required effort to address the architectural changes envisioned. All MVPDs would be required, in addition to pursuing their own network evolution, to deploy a second overlay infrastructure to support this proposal, at significant cost and after a lengthy development process, following a potentially even longer standards process. Contrary to the assumption of the proponents of the Device Proposal, this second overlay infrastructure would not represent "at worst minor changes", because none of the MVPDs current architectures are evolving in alignment with the many protocols and interfaces referenced by their proposal. The required second overlay infrastructure will require re-architecting of much of the MVPDs infrastructure, from back-office systems, to headends, uplinks, and central offices, the delivery platforms, network equipment, content servers, security components, new "widgets" and newly designed CPE devices. The assumption by the proponents of the Device Proposal seems to be that if one MVPD is deploying a particular protocol or standard, all MVPDs can easily adopt it. Just because one MVPD deploys a particular kind of gateway, this does not mean all MVPDs can deploy a similar gateway. Because one MVPD can deliver content unicast does not mean all MVPDs can deliver content unicast. Even when two MVPDs deliver content via multicast, they don't use the same technology. The App Based proposal reflects the diversity of solutions required in reality.

● *The Device Proposal supports advertising inserted at the network source into the linear channel, but*

*not interactive requests for information, telescoping ads, or promotions. *** The Device Proposal does not provide the tools to support the advertising that funds the dual-revenue MVPD business, or to provide an interactive and accountable ad platform that can continue to compete for those ad revenues.*
Network-sourced ad insertion is the norm for both traditional MVPDs and OVDs. YouTube for example uses network-sourced ad insertion exclusively. Local insertion by the client is extremely rare, primarily in limited one-way systems as noted in the DBS section. Ad insertion for VOD (or any other content played back from an MVPD source directly, such as live linear TV, LookBack, StartOver, cloud recorded DVR) is almost entirely network-sourced today. In the competitive proposal MVPDs can implement novel interactive advertising models such as telescoping ads using an HTML5 playback widget that would have full control over ad insertion and audience measurement. This need not apply to recorded DVR content because for a retail DVR device built on this kind of system; if the content is played back after being recorded, it is then under the user's full control and should not be subject to any service management by the MVPD.

The Device Proposal states that local insertion by the client is used primarily in DBS one-way systems. At minimum, the Device Proposal imposes a significant competitive disadvantage on DBS by not being able to offer targeted advertising. This is not "platform neutral." But the failure to support advanced advertising is far more extensive than that. The Device Proposal offers no local tools in the device for audience measurement (e.g., measuring tune away). Even OTT advertisers provide the player for ads, but the Device Proposal does not provide that option the MVPDs and removes the execution environment for the applications that make advanced advertising work. The suggested widgets are undefined and uninvented. Even if they were developed by every MVPD, and the MVPD networks were re-architected to deliver them, the Device Proposal makes widget support optional to the device, so the device could block the tools of advertising. Nor may an MVPD provide marketing or advertising through the MVPD UI. The only navigation use case supported in the Device Proposal is for a device to use "its own choice of user interface technology [to] present the list of content to a consumer." (p. 124). And because the Device Proposal does not consider a CE device manufacturer to be obligated to honor the advertising requirements of content providers, there are no limits on a device overlaying ads that are specifically prohibited by content agreements. This does not provide support for MVPD advertising.

● *The Device Proposal offers no support for EAS. EAS is delivered through a variety of means across MVPDs (e.g. in-band vs. out-of-band signaling, presentation differences, text crawl with audio override, forced tune, barker channel, etc.). Those differences can be abstracted through an application-based approach, but there is no indication that the EAS via MMI can be implemented across all MVPDs. In fact, if MMI display is only allowed as an option, EAS could not operate as intended.*
The fact that EAS is delivered through a variety of means across MVPDs was solved in the CableCARD case by abstracting the "variety of means" into a common protocol. The VidiPath and RVU section of the WG4 Report states that despite the "variety of means" for delivery of EAS, they abstract them to a common protocol (W3C's Server Sent Events (SSE)) such that the VidiPath and RVU clients do not have to implement all of the different methods. The competitive proposal also proposes such a common protocol within the content delivery interface which transport content and associated metadata.

This is incorrect. MVPDs all use different protocols and each MVPD must implement their different protocol in their VidiPath client. Server Sent Events are a tool that can be used in building EAS, but not all MVPDs use SSEs for EAS. For those that do use SSE, it is not an EAS protocol at all, it is a method of

pushing any information to a client. Further, CableCARD did not resolve the EAS differences across MVPDs. There are at least four methods defined for EAS delivery defined: FAT channels, the QPSK Forward Data channel (QPSK FDC), or over a DSG tunnel (in either Advanced or Basic mode). And this is just cable.

● *Cable operators provide parents the ability to block channels they consider offensive regardless of rating. The Device Proposal offers no support for parental controls, including device restrictions (e.g., by channel, rating, time-of-day, etc.).*
Cable and DBS systems deliver parental control information on their networks today, and the various user interface applications on set-tops and other devices provide tools to the user to block content and/or channels. Competitive navigation devices based on CableCARD provide these and additional tools to customers by using the parental control information delivered on the Cable plant and abstracted by the CableCARD. In the competitive proposal, parental Controls information is required as part of the metadata for programming coming from the MVPD, and the FCC already has such a regulatory requirement. With this information, retail devices will then be able to implement parental controls that comply with the regulatory requirements in their implementations. In the competitive proposal, navigation devices can continue to innovate on such features in the user interface to give consumers more choice in managing potentially offensive content. Users would not benefit from this innovation under the MVPD-app only proposal.

MVPDs provide parents with the ability to prohibit viewing of particular content during periods selected by that subscriber and even more advanced parental controls (e.g., by channel, rating, time-of-day, etc.). MVPDs provide this capability through the MVPD's user interface on the set-top box or through the MVPD's website. Under the Device Proposal, there is no commitment or mechanism for the device manufacturer to enforce those settings. At most, each retail device in the home would need to be individually programmed for V-chip ratings and for any separate parental control system that the retail device may voluntarily offer.

● *Even assuming many required inventions that are undescribed, the Device Proposal would support delivery of VOD, but not a robust verification and audit platform required for the delivery of VOD assets. It would not support EST, Start Over or Look Back.*
This is incorrect, these are covered with the HTML5 playback widget model over MMI for VOD/PPV purchasing, EST, StartOver and LookBack, etc. The content metadata could describe when things like StartOver and LookBack are available for certain pieces of content, and competitive devices that support those features could implement them.

This is another example where the proponents of the ill-defined Device Proposal state that virtually anything "can easily be achieved by the MMI widget model", yet offer no technical basis for this assertion. According to their proposal, the basic requirements for it still need to be developed: "Widget requirements would need analysis to determine the level of HTML that the MMI should support." Even after requirements are selected, this MMI widget model is yet to be invented. As a result, there exists no actual support for use cases identified in WG4 or the services and features WG1 has identified as requirements.

● *The Device Proposal does not support dynamically locally-inserted pre-roll advertising or disabling fast forward during advertisements included with VOD content as is often required as a condition to offering certain content on an on-demand basis.*
This is incorrect. The competitive proposal supports delivery of content over IP in the same manner of most OVD solutions, which means advertising (pre, post and interstitial) is inserted in the network by manipulating the playlist of adaptive bitrate technologies such as HLS and DASH. This is how the vast majority of content is delivered

and multiple advertising models are supported today on the Internet.

The proponents of the Device Proposal overlook the fact that these OVD solutions use their own app or player for their service and are able to implement any number of capabilities, including advertising models, in the client app.

● *Since the Device Proposal intentionally prohibits the MVPD's user interface, there is no MVPD UI for interacting with the MVPD's experience.*

This is incorrect. Just as with CableCARD, the competitive proposal does not prohibit the MVPD's user interface. The MVPD remains free to compete with their own UI using VidiPath or other technology. Unlike with CableCARD there is no requirement for common reliance, the MVPD must merely provide the defined interfaces.

While the Device Proposal does not prohibit the MVPD from offering a competitive UI, it disables the MVPD from offering it as a functional app through the proposed interfaces to a retail device that conforms to the ill-defined proposal. Further, stating, "the MVPD must merely provide the defined interfaces" underestimates the burden that would be required of all MVPDs. In addition to pursuing their own network evolution and UI development, it would be necessary to deploy a second overlay infrastructure to support this proposal, at significant cost and after a lengthy development process, following a potentially even longer standards process. And once these processes are complete the related features of the MVPD service would be frozen due to external dependencies, unlike the App Based model where servers and apps are updated several times per year.

● *The Device Proposal proposes to reduce the MVPD UI to a small set of widgets. But the MMI or widget model envisioned is event driven from the MVPD side only. There is nothing that envisions a subscriber-initiated communication to the MVPD, such as upgrading or downgrading service, ordering technical assistance, subscriber profile changes, parental controls, or a subscriber paying a bill. The Device Proposal claims that HTML widgets are suitable for communicating with all backend systems, but nothing has been described that would assure that functionality across all systems.*

Widgets are not just event driven from the MVPD side, but can also be presented as part of the available MVPD services. This allows competitive UIs to integrate them in context where desired. The MVPD analysis seems internally contradictory in asserting that the use of HTML does not "assure" functionality; HTML is the very basis of the MVPD "Application-Based Service" proposal.

This is another example where the proponents of the ill-defined Device Proposal state that virtually anything "can easily be achieved by the MMI widget model", yet offer no technical basis for this assertion. According to their proposal, the basic requirements for it still need to be developed: "Widget requirements would need analysis to determine the level of HTML that the MMI should support." Even after requirements are selected, this MMI widget model is yet to be invented. As a result, there exists no actual support for the use cases identified in WG4 or the services and features WG1 has identified as requirements.

● *The Device Proposal does not support remote management of tuning or of the account by a network-connected mobile device. It does not support user authentication (e.g. PIN and/or password entry). As detailed above, the Device Proposal does not support user-initiated management functions such as billing systems or a subscriber's ability to upgrade service from the screen.*

This is incorrect. There is nothing in the proposal that would restrict remote management of a user's system. There have been various systems over the years that have allowed remote management of DVRs/TVs without any involvement by MVPDs (Slingbox, SageTV, etc.). Utilizing the widget model allows for user initiated management

functions to occur. Furthermore, many of the features were actually first enabled by competitive retail devices. They may not have been developed if a competitive ecosystem was not in place via CableCARD.

This is not an issue of whether a capability is being restricted or not, rather it is a lack of specificity on how it would actually work. Remote management has to be built into the solution for it to be effective. This is another example where the proponents of the ill-defined Device Proposal state that virtually anything "can easily be achieved by the MMI widget model", yet offer no technical basis for this assertion. According to their proposal, the basic requirements for it still need to be developed: "Widget requirements would need analysis to determine the level of HTML that the MMI should support." Even after requirements are selected, this MMI widget model is yet to be invented. As a result, there exists no actual support for the use cases identified in WG4 or the services and features WG1 has identified as requirements.

- *The Device Proposal also proposes to define an entirely new Public Key Infrastructure (PKI) from scratch. This is a non-trivial exercise. The proposal mentions X.509 certificates, yet stops short of providing the critical and necessary details about how these certificates are managed, the required trust infrastructure (issuance, injection, protection, propagating revocation lists and requirements to query CRLs), and any policies necessary to make the certificates useful (profile, fields and information).*

That the information is not completely defined does not imply that it requires definition of a whole new PKI. There is no reason to do that, and it would instead be developed leveraging existing standards and deployed systems in those areas. As was noted in the presentation to WG3 by NDS (Cisco), legacy conditional access systems used symmetric security keys which made it very important that keys be kept secret and thus a non-trivial exercise to set-up and share keys between vendors. PKI systems are based on asymmetric keys which are designed to allow keys to be shared and even openly published without compromising security.

Proponents of the Device Proposal state "That the information is not completely defined does not imply that it requires definition of a whole new PKI." Yet they do not state what deployed PKI systems could actually be leveraged for the purposes of this proposal, nor even the characteristics of "a common trusted authority" to issue and possibly manage these certificates.

- *The Virtual Headend proposal also does not propose any method by which copy control information (CCI) or any other content usage rights are transmitted or implemented by or carried through to the downstream outputs of the retail device.*

This is incorrect. The proposal specifically mentioned DTCP-IP which includes CCI information, and was approved by CableLabs as an approved digital output. If the content is being transported by DTCP-IP, then that will contain the CCI information that is enforced on the client device per the DTLA license requirements. If the content is being played back via an HTML5 widget, then CCI can be enforced in exactly the same way as it is under the 'app' model, using underlying CDM protection. To the extent necessary, DTCP may be expanded to carry other usage rights information.

Proponents of the Device Proposal repeatedly indicate that DTCP can be extended. Developed in 1998, DTCP is a link-layer protection system that offers fairly rigid business models for distribution of content (copy freely, copy once, copy never, copy no more) largely within the context of a home network. Additional business models were added with the "DTCP+" extensions in 2011, although DTCP+ has not been widely adopted. DTCP has never been treated as an exclusive protection system, in-home, link-protection or otherwise. Service providers have been able to select other content protection systems such as DRM systems that provide rich and extensible business models through

combinations of software and hardware that are much more flexible and can be renewed more easily, as well as protecting content distributed from the cloud. Service providers have also been able to implement more refined usage rights by using applications and user interfaces. DTCP does not support all the models in use now or potentially in the future, and cannot be assumed to be rapidly extended to meet all new business models. For example, it has been utilized for DirecTV's Ultra High Definition service only after checking against a white list of permissible devices with appropriate software (DirecTV presentation to WG3 on June 3, 2015, http://apps.fcc.gov/ecfs/document/view?id=60001077180). Link-protection is often layered with additional protections, such as apps that define and control usage rights (for example, HTML5 on pg. 24 or VidiPath on pg. 78 of WG4 Report). Without such flexibility, business models can only be advanced pending extension of a single proprietary protection system, and Content Providers and Content Distributors cannot rely on assumed extensibility of DTCP to accommodate rapidly changing business models in a timely manner.

List of Standards and Interfaces Referenced in Device Proposal:

Interface/Protocol	Page #
CableCARD MMI	107
Service Discovery Interface	112
Entitlement Information Interface	112
Content Delivery Interface	112
ANSI/SCTE 65 2008 "SERVICE INFORMATION DELIVERED OUT-OF-BAND FOR DIGITAL CABLE TELEVISION"	112
http://standards.ieee.org/getieee802	114
http://www.ietf.org	114
http://tools.ietf.org/html/rfc1122 - Requirements for Internet Hosts -- Communication Layers 1.1	114
http://tools.ietf.org/html/rfc2616 - Hypertext Transfer Protocol -- HTTP	114
https://tools.ietf.org/html/rfc3927 - Dynamic Configuration of IPv4 Link-Local Addresses	114
http://www.ietf.org/rfc/rfc2131.txt - DHCP	114
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https://project-open-data.cio.gov/	115
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http://en.wikipedia.org/wiki/XML	115
http://www.rssboard.org/rss-specification	115
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HTML5 MMI Widgets	116
http://eidr.org - Entertainment Identifier Register	117
CEA-2033 - OpenEPG: A Specification for Electronic Program Guide Data Interchange	117
ATSC A/65:2013 - Program and System Information Protocol for Terrestrial Broadcast and Cable	117
ETSI EN 300 468 v1.4.1 - Digital Video Broadcasting; Specification for Service Information in DVB Systems	117
HTML5	118
X.509 security certificates	119

RFC 5280 - Internet X.509 Public Key Infrastructure Certificate and Certificate Revocation List (CRL) Profile	119
ITU-T X.690 standard	119
OpenSSL - The Open SSL Project, https://www.openssl.org	119
MPEG2 Transport Stream (see ISO 13818) delivered over HTTP	120
MPEG2 Video Encoding	120
H.264 Video Encoding	120
Adaptive streaming formats such as HLS	120
Adaptive streaming formats such as DASH	120
RTSP (Real Time Streaming Protocol) RFC 2326	120
CableCARD DFAST	121
OCUR DRI	121
Open Systems Interconnection (OSI) model85 (ISO/IEC 7498-1)	186

Areas of Significant Invention Required for Device Proposal:

1. Service Discovery Interface – The Device Proposal identifies three functions that require significant invention: Lists of available video services, Metadata about those services, and Messaging from the MVPD relating to these services.
    a. Lists of available video services - MVPDs all have different protocols that describe the available video content sources on their system that are specific to their particular network technology, a common definition that is a superset of all of these and yet not be contradictory would have to be invented. The referenced standards will require significant enhancements or specification effort to be applicable.
    b. Metadata about those services - MVPDs all have different and often proprietary protocols that describe the available video content sources on their system, a common definition that is a superset of all of these and yet not be contradictory would have to be invented. The referenced standards will require significant enhancements or specification effort to be applicable.
    c. Messaging from the MVPD relating to these services – Among the largest areas of innovation is the widget model described in the Device Proposal. The widget model is described in the Device Proposal as supporting MVPD-unique consumer interactions; allowing for a single API to interact with the DCAS and Provider Interface components; “DCAS can communicate privately to an MVPD component and respond;” “Suitable for all communication with MVPD network “back office” components; and Billing, Upselling, and other unique entitlement interactions.” What is absent from this description is any detail of how this MMI widget model actually achieves any of this functionality. It does not describe any limitations or restrictions on a full HTML5 User Agent compliant with the W3C standards, with

the one exception: "Display of widgets must be conditionally optional, based on user input, regulatory requirements, and user action." It does not describe the widget life-cycle, how are widgets instantiated, under what context, how is focus assigned, how are input events filtered or not, how does the user switch between widgets, how is widget context maintained or persisted across widget instantiations, etc. As mentioned above, after exhaustive work, W3C reached HTML5 and the ability to include protected content without plugins, but the Device Proposal declines to include an HTML5 environment suitable for media.

2. Entitlement Information Interface - "It defines a common platform for publishing, communicating, sharing and transferring rights information." There is no information provided on how rights information would be either published, communicated, shared or transferred and more importantly the security that would be used to protect this information either for purposes of protecting theft of content or protecting consumer privacy. There is some discussion about how X.509 certificates could be used for "some form of authentication of the device and/or user and/or household by the Provider Interface." However, none of the truly difficult issues regarding standing up and managing the necessary PKI are discussed. It does suggest that an open source OpenSSL implementation would be a suitable model and we question the logic of this based on the very public Heartbleed security bug in the OpenSSL cryptography library disclosed in April 2014 (https://en.wikipedia.org/wiki/Heartbleed).

3. Content Delivery Interface – This is the interface that "provides individual stream access for Live, Linear, VOD, and network DVR content streams." This interface has the greatest opportunity to freeze innovation. This interface freezes the transport protocols and container formats, the content formats and encodings, and most critically the content protection system, which becomes a single target for attack. The fact that all MVPDs innovate across all of these at different rates and with differing approaches makes evolving a common set very difficult and complex.

4. Virtual Headend – The Device Proposal suggests that MVPDs can easily deploy a Virtual Headend without re-architecting their network or by making at worst only minor changes. In reality the Virtual Headend really represents deploying a second headend to support retail devices. This represents the invention behind the invention outlined above, each MVPD will have to invent solutions that conform to the interfaces loosely outlined in the Device Proposal.

5. Gateway devices – The Device Proposal identifies the potential that some MVPDs may require or elect to use a special purpose gateway and suggest the existing MVPD supplied equipment can easily be repurposed to support the new interfaces that have to be invented. However, it highly likely that a new piece of equipment will have to be invented to fill this gateway local virtual headend.