SmartTV – User Interface Development for SmartTV using Web technology and CEA2014.

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Abstract

Time Warner Cable is the second largest Cable TV operator in North America and is continuing to invest in technologies that allow simple and easy access to Time Warner Cable video content. Consumers want and expect access to video content on all of the devices in their home regardless if they are leased from Time Warner Cable or owned by the consumer. This paper addresses the workshop use case, "*A survey of existing integration of Web technologies"* and reviews how Time Warner Cable has partnered with Samsung to develop a User Interface based on HTML, CSS, and Javascript on a Samsung SmartTV that allows access to DVR, OnDemand, and Live video content.

Introduction

Time Warner Cable has traditionally provided digital video services via one method only, the leasing of a digital terminal device or Set-Top Box (STB). The STB is a specialized piece of hardware that is designed for video decode, CA decryption, and the display of a user interface. The STB is a cost center and thus is limited in CPU, and memory. Traditionally the data path to these devices has also been limited. Because of these limitations, User Interface development has been traditionally accomplished with monolithic applications that are downloaded to each device. Data is carouselled to each device using the one-way broadcast network. Two-way or interactive services are limited to low bandwidth commands and requests for on-demand session setup and video trickplay control.

This type of environment has made it difficult to provide Cable services to Consumer Owned Devices (CODs). The invention of the Cablecard and the OpenCable Application Platform (OCAP) were intended to provide a method to securely provide services to CODs while also allowing operators to provide applications for the implementation of user interfaces. The network limitations and the complexity of the operator's applications led to limited success of this model.

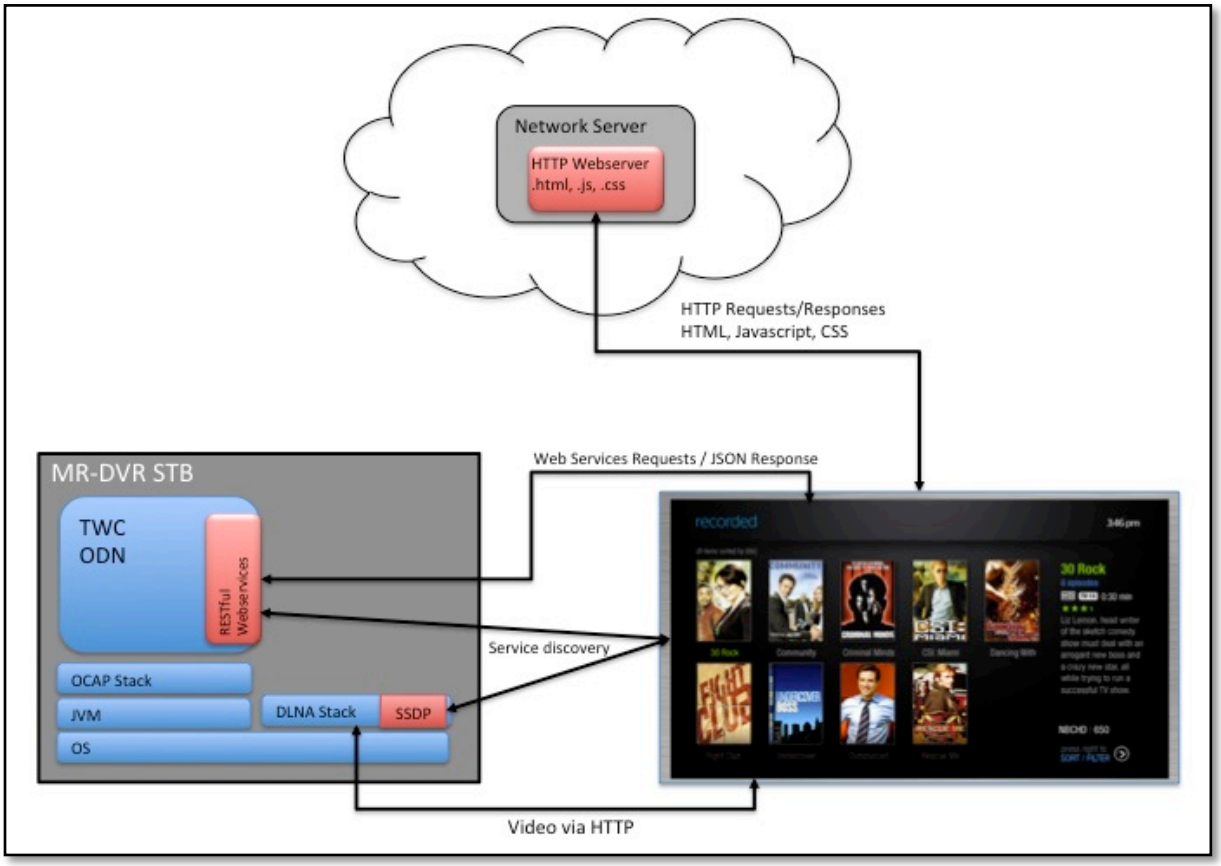
As home networking technology has become more and more pervasive in consumer's homes the network limitations to devices is no longer an issue. This now allows for a more interactive experience, where operators can start to move data and logic into the network. Device manufacturers are increasingly providing Web Browser on all classes of devices from handhelds, to tablets, and TVs. The combination of available network bandwidth and robust Browser implementations is leading to a new implementation of the traditional operator application.

Time Warner Cable has partnered with Samsung to develop an application using Web technologies, HTML/CSS and Javascript, to provide a user interface for accessing

traditional cable video services. Information and data used to generate the user interface is accessed via web services from both services hosted in the network and services hosted locally on a traditional cable STB. The user interface code and resources can be hosted in the network, allowing for faster and more frequent modification.

This type of application development methodology, while initially developed for a consumer owned Samsung SmartTV, will be extended to replace the user interface for operator leased devices.

Architecture



The Time Warner Cable multi-room DVR Set-Top Box is controlled by the Time Warner Cable OCAP Digital Navigator (ODN). This application is a Java application developed using the Open Cable Application Platform (OCAP). A lightweight webserver is embedded inside of ODN and is used to expose a set of web services on the local Home Network. These services are used to control the functions of the STB and include methods to get the list of current recordings on the DVR with metadata, schedule a recording, retrieve a list of linear services available, etc.

The Samsung Smart TV has a web browser that conforms to CEA-2014-A. The Web Browser is compatible with HTML4.1. Time Warner Cable has developed a web application that is served from a web server in the cable network. Once the initial page of the application is loaded via DOCSIS the application calls the web services on the DVR STB via the home network to retrieve data and control the STB.

Video

Video is sourced from the STB using HTTP and the DLNA protocols. CEA-2014-A defines an A/V Object that is used to play the video from the web application. Each recorded video asset and linear service has a unique URI that is generated by the DLNA stack on the STB and is included in the data provided by the ODN web services.

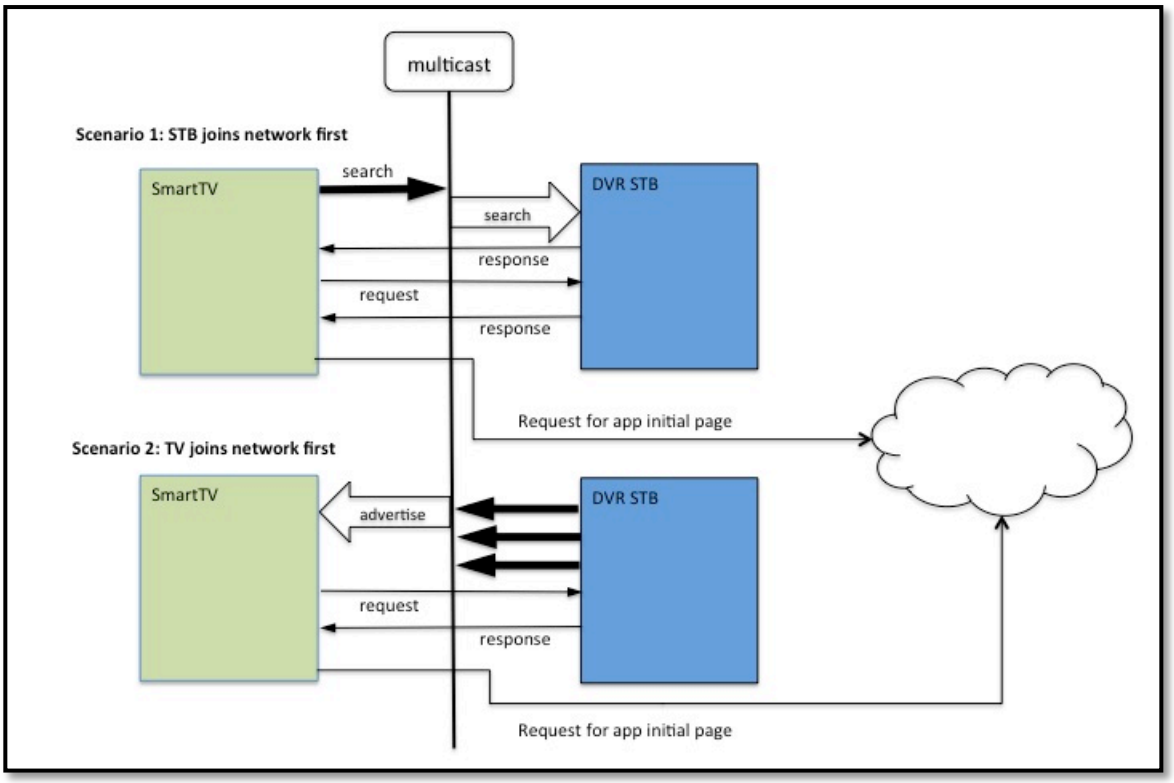
Discovery

One of the challenges of using a web browser as the user interface to a service is the discovery of the initial page of the application. Unlike a traditional browser used for web browsing, a web browser on the Smart TV does not have an address bar for the user to type in the URL to the initial page of the application. Furthermore, the input device for the TV is a standard remote control that makes typing of a long URL string using a software keyboard difficult and tedious. Additionally, our application requires discovery of not only the application server, but also the address of the STB in the home. We have architected 2 solutions that allow us to accomplish this task.

CEA-2014-A – SSDP

CEA-2014-A defines a Remote User Interface discovery protocol based on SSDP – Simple Service Discovery Protocol as defined in the UPnP Device Architecture. The Samsung Smart TV and the TWC MR-DVR STB both support SSDP for the RUI server discovery. The DVR acts as a RUI server and when added to the home LAN sends out an advertisement of its services to a standard multicast address and port (239.255.255.250:1900). The Smart TV acts as a RUI Renderer and when added to the home network sends out a multicast search message on the standard address and port. Each device listens on the standard address and port for these multicast messages.

The search message from the TV contains a search target field, if the services of the server that receives the search message matches the services provided by the server (in this case remote user interface server) the server will respond to the source IP and port that sent the request. The server's response will contain a URL to the description of the server and its services. The client (TV) will read this description to obtain the URL to the initial page of the application.



The advertisement message from the DVR is very similar to the search response message and contains the URL to the description of the server and its services. Just as in the search scenario, the TV will read this description to obtain the initial page of the application (hosted on a server in the TWC network). This initial URL is provided to the DLNA/UPnP stack by the TWC application running on the STB. The IP address of the STB is included in the initial URL as the query string.

Example Initial URL:

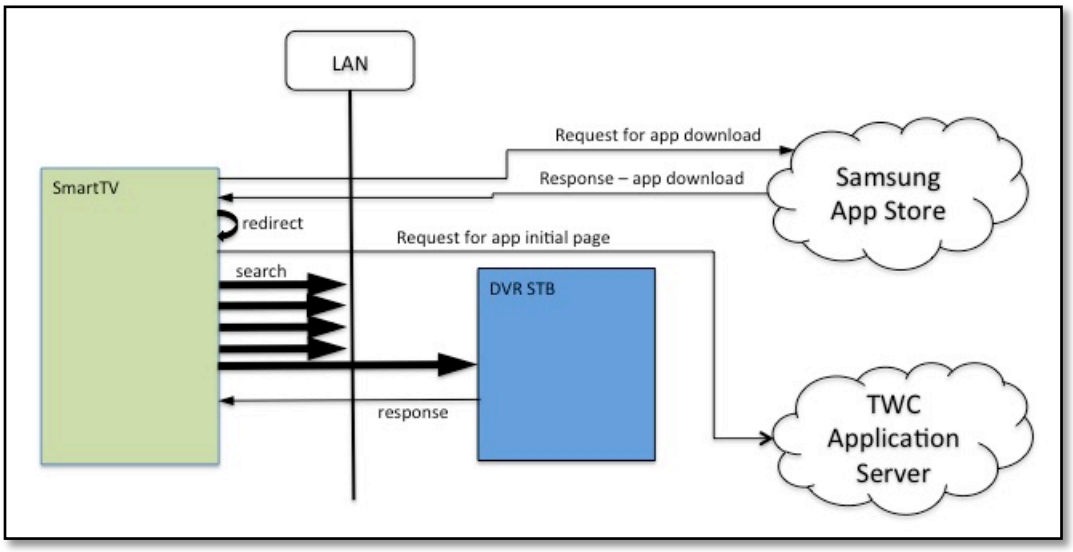
http://developer-twc.twcable.com/remoteui/index.html?ip=192.168.1.5

The TV will read the initial URL and load this page into the browser. The web application will then read the query string to retrieve the IP address of the STB. At this point both servers have been discovered and the application can operate normally.

Samsung App Store – Home Network Search

The Samsung SmartTV support an "App Store" functionality that allows a web application to be loaded from a Samsung hosted server into the TV and then launched into the browser. The initial page is defined using a Samsung proprietary mechanism. The TWC app store configuration has the initial page loaded via the Samsung app store, and then redirects the browser to the initial page of the application hosted on a server in the TWC network. This takes care of the application server discovery, but the application still needs the IP address of the DVR STB in the home network. Since the SSDP mechanism is not accessible at the application Javascript level, the application must use an alternative method to find the DVR. The application must use a Samsung

proprietary Javascript API to obtain the IP address of the TV. The application then initiates a brute force search of all of the IP addresses in the same subnet as the TV. The search is accomplished by sending a HTTP request to a known web service of the STB on each IP address until a response is received. The response message contains the IP address of the STB and allows the application to continue normally.



Conclusions

Web Technologies when combined with home networking protocols can provide very flexible and robust tools for creating a user experience for CE devices to access service provider applications and services.

Additional work is needed to provide a complete environment that can be used on many different devices and in different user scenarios. The items that this project have exposed as needing more effort in the W3C are the following:

1. Discovery – devices need the ability to discover application servers and applications need the ability to discover media and data sources.
2. Video – the CEA 2014 A/V object was used in this project, and the HTML5 video tag is the correct direction for the industry to have a standard interface to video elements. TWC would like to encourage the W3C to continue the development of the video tag so that it can a generic interface to all video formats regardless of encoding, file format, protocols, or content protection. Devices will implement support for different types of video, the video tag must be robust enough and provide a generic mechanism for accessing video and providing the underlying video player with the necessary parameters to function.
3. Home Networking – generic APIs to access devices and service on the home network will allow for the development of applications that will allow the seamless integration of devices in the home.