Simple Getting Simpler

The Need to Simplify the Home Network

A Technical Paper prepared for the Society of Cable Telecommunications Engineers
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Simple Getting Simpler – the need to simplify the new Home Network

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Abstract

The delivery of Internet, voice and video services to the home is changing rapidly. Access to unmanaged and managed content and services on all devices and screens in the home, as well as converging services on the home network, are key new elements of the connected home. While Wi-Fi has made it simple and convenient for consumers to establish primary connectivity between their devices and networks, it's more difficult for cable providers to troubleshoot performance. This difficulty is exacerbated by the rapid increase in diverse, non-traditional content sources and the increasing complexity of user interfaces. Clearly, the home network is ripe for simplification. By simplifying the modes of interaction with services and ensuring consumers can find the right content and service quickly and easily, MSOs can reduce complexity and improve the consumer experience. A key step in this process is a cloud, gateway, and home network service delivery architecture, which can simplify the installation, use, and troubleshooting of services and devices for both users and MSOs. This paper discusses some of the principles, including the four tenets of simplicity, MSOs should follow to devise simpler experiences for consumers in what is an increasingly complex service and device environment.

The Four Tenets of Simplicity

We have four tenets for the simplification of home network design and architectures:
1. Simple for the user
2. Enjoyable for the user
3. Intuitive for the user
4. Secure for the user

As home ecosystems become more complex, user interactions with delivered services must be as simple as possible. Above all, we should avoid "addition for addition's sake" scenarios that needlessly complicate otherwise user friendly services.

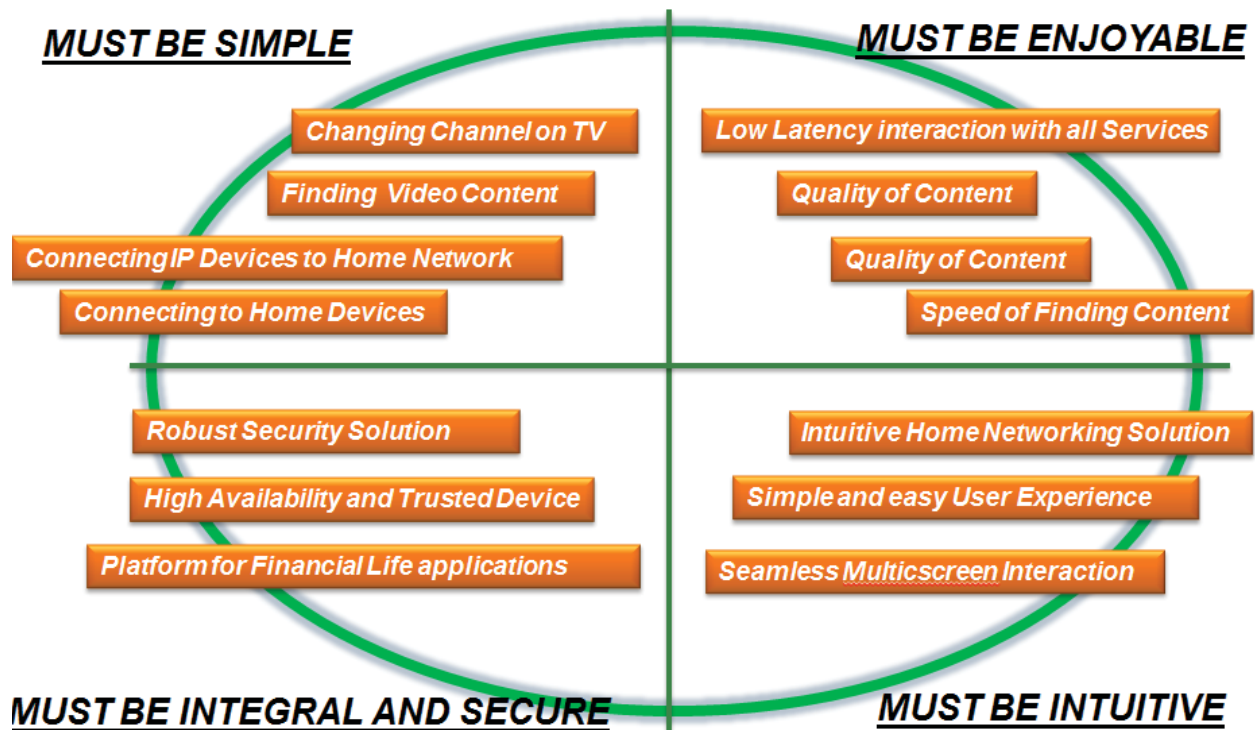Figure 1 illustrates these tenets. We'll discuss them in more detail below.

MUST BE SIMPLE

- Changing Channel on TV
- Finding Video Content
- Connecting IP Devices to Home Network
- Connecting to Home Devices

MUST BE ENJOYABLE

- Low Latency interaction with all Services
- Quality of Content
- Quality of Content
- Speed of Finding Content

MUST BE INTEGRAL AND SECURE

- Robust Security Solution
- High Availability and Trusted Device
- Platform for Financial Life applications

MUST BE INTUITIVE

- Intuitive Home Networking Solution
- Simple and easy User Experience
- Seamless Multiscreen Interaction

Figure 1: The four tenets of simplicity

(1) <u>Simple:</u> New Home Gateway and Cloud Services architectures should be as **simple** as possible and certainly no more challenging for the user than the architectures they replace. This simplicity should encompass the installation process, how users interact with their devices and the ease of troubleshooting problems. For example, users typically have many options ranging from standard remote controls to smart devices such as tablets for as simple an activity as changing channels. MSOs need to ensure such tasks are simple, intuitive, and consistent. We'll return to this topic later in the paper.

(2) <u>Enjoyable:</u> An **enjoyable** user experience is the ultimate goal of any service. Enjoyment has many aspects, from ease of use to the richness of the experience. Without fast and reliable Wi-Fi performance in the home, however, customer satisfaction and enjoyment decreases. We have all experienced the dreaded buffering of IP video services, along with Wi-Fi connectivity problems, at some point. To ensure consumers derive the maximum enjoyment from their connected homes, MSOs using Wi-Fi to deliver services will have to avoid similar problems as much as possible.

(3) <u>Intuitive:</u> Users value **intuitive** functionality, particularly now that they have so many options for sourcing content from so many different sources. New deployments should therefore focus on creating a consistent, intuitive interface that connects all home services. It is especially important in this context to ensure new interfacing solutions, such as Voice and Gesture control, and more familiar interfaces, such as touch and swipe, align with general industry design philosophies for maximum simplicity.

(4) <u>Secure:</u> Now that connected services contain a wide range of sensitive financial, personal, and business information, on-line **security** is an increasingly important consideration for consumers. To win the trust of consumers, we need to eliminate cyber threats and ensure consumers feel reassured about any privacy concerns that may arise from their online interactions, as well as interactive devices including camera- or sound-based sensing solutions. Even simple services such as digital content archiving include a security element, as consumer archives may contain personal images or videos. New service architectures must, from their onset, incorporate robust security and privacy solutions.

With these tenets in mind, we can discuss how they apply to today's multi-service connected home.

The Starting Point: Simplified IP Clients

Figure 2 shows six problems that every MSO will encounter in the new connected home environment, along with solutions that help drive simplification.
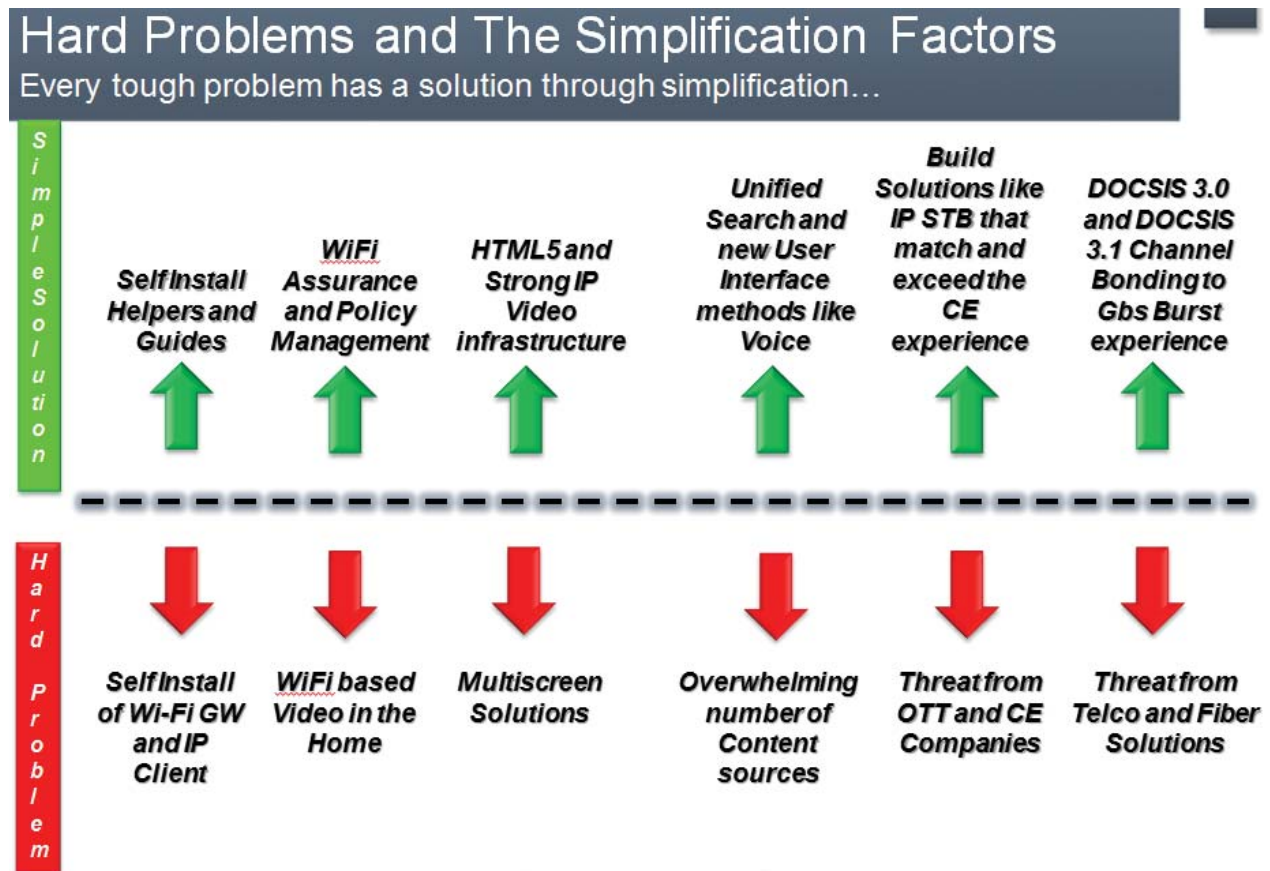

Figure 2: Six hard problems and their solutions

The connected home environment represents a shift away from traditional TV and cable experiences, primarily because consumers are expected to participate actively in the home entertainment experience. To ease this transition and acclimate their customers to a new, interactive environment, MSOs need to retain the hallmarks of "old" TV viewing while also providing user interfaces (UIs) that simplify consumer interactions. IP client devices with their expanded application capabilities provide opportunities for simplifying the installation and management of home local area networks (LANs). Some ideas for innovation in this area include:

- Smartphone and tablet applications to assist technicians or consumers with installation and setup of gateways and IP set-top boxes
- Alternatives to WiFi protected setup (WPS)-based secure pairing of new Wi-Fi devices that may require more than the traditional two minutes of pair time
- Software wizard or helper solutions to notify guide the user when a new device is added or change in service to a connected device.

As these ideas demonstrate, new applications on IP clients can help consumers learn about their home networks' topologies. This knowledge, in turn, can help them track and manage the performance of Wi-Fi-enabled devices in the home. Ultimately, MSOs can leverage this new level of in-home transparency to maintain in-home network performance. If the performance of an in-network Wi-Fi performance falters, for example, applications from the MSOs can help consumers troubleshoot and resolve the problem themselves, without having to call technical support, saving MSO truck rolls. These diagnostic tools therefore can help improve customer satisfaction and simplify MSOs' customer care obligations.

Improving the User Experience with Custom Applications

How do we define a *better* user experience? Custom applications provide a good place to begin. As we saw in the previous section, these new interfaces offer real solutions for in-home device management and troubleshooting. Taking that concept a step further, MSOs can also develop and deploy applications that educate consumers about the *causes* of any problems they experience, making it more likely for them to avoid repeating the problem in the future. For example, imagine a troubleshooting application that not only flagged a problem device, but also showed the consumer that the reason the device had dropped off the network was because it was too far away from the network's access point. It would not only provide the consumer with a simple explanation for the device's failure, but it would also let the consumer know that similar devices needed to be installed within so many feet of the access point in the future. Building upon this concept, we can conceive of other *smart* applications such as software wizards or helpers that provide valuable, interactive advice for consumers. Returning to our access point example, such applications could advise the consumer to:

- Install a Wi-Fi repeater to extend the reach of the network and resolve recurring connectivity issues to a certain area of the home
- Prioritize traffic to devices being used

Simplifying Managed IP Video Services

Single- or multi-screen IP video delivery provides another opportunity for improving the user experience. Managed IP video services often encounter issues with video quality and buffering like those illustrated in Figure 3.

Figure 3: IP video quality issues

MSOs can create smart tools to prioritize traffic to specific types of devices that work in the background and provide policy-based decisions to ensure the home network operates at peak efficiency. The smart tools can largely eliminate buffering and quality issues. Figure 4 shows some of the other benefits MSOs can derive from this approach:

Figure 4: How smart tools can improve the IP video experience

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These tools, deployed within the home ecosystem, can:
- Ensure smooth and seamless performance across different screens
- Leverage the unique functions and features of disparate devices (for example, the swipe function on tablets, or voice-activated features found in smart TVs)
- Enable a single cloud view for multiple screen and window access to content

Managing Content and Devices: Keeping it Simple

Managing disparate content and devices is perhaps *the* challenge facing MSOs, largely due to the complex interaction between managed and unmanaged content and devices. Figure 5 illustrates the more common challenges this mixed environment creates for MSOs:
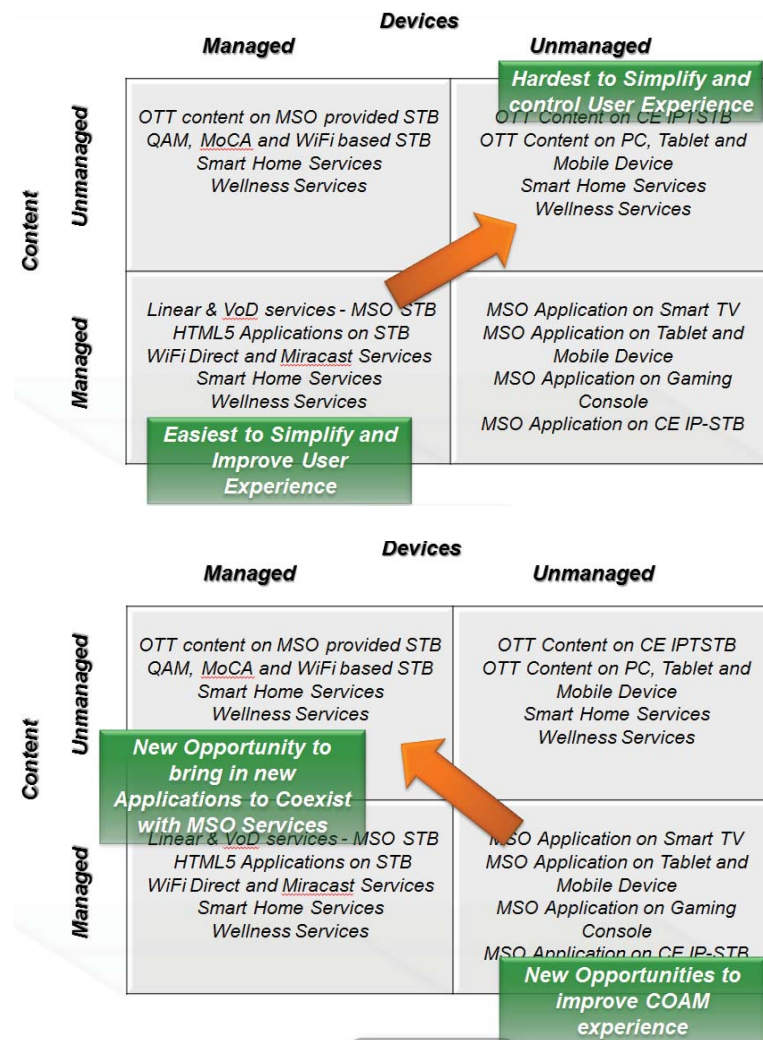

Figure 5: The challenges created by managed and unmanaged devices and content

For our purposes, we can define a managed experience as a high-quality service that is actively supported by an MSO, is always available, and requires zero sign-on. An unmanaged experience, on the other hand, typically involves some level of experimentation. Thus the consumer typically has a high degree of

patience for gaps in availability or bugs in the interface and realizes there is little or customer support for the service. Users of unmanaged services, as can be expected, typically develop a high tolerance to problems.

Devices and applications that try to bridge the gap between managed and unmanaged experiences such as customer owned and managed (COAM) TVs, game consoles, Blu-ray players, OTT video, and companion apps present a unique challenge to MSOs, because they channel unmanaged content through a managed service. A managed video service involves traditional linear content delivered over MPEG QAMs through a set-top box; users turn on their TVs, and they see video. Internet managed services refer to high speed data services provided by the MSO; customers point and click and are ready to surf the Internet. Managed voice services refer to classic hard-line telephone service; consumers pick up the phone, hear a dial tone, and receive sound quality good enough for full duplex speech.

As we know, MSOs deliver these managed services to managed devices very well using highly optimized systems for these applications with a rigid platform that challenges innovation, for example, is the case with QAM video and hard-line voice services. On the other hand, we also know that MSOs deliver unmanaged content to unmanaged devices very well, as we see through casual web surfing, connected apps, Internet voice, and OTT video.

The lesson here is that capability isn't the problem when it comes to providing unmanaged services on managed devices. Rather, the challenge is enabling customer choice. The rigidity of managed device platform ecosystems requires continuing efforts to integrate and optimize unmanaged services and make them appear to the customer as reliable as managed services. Keep in mind this effort goes beyond simply adding Netflix applications to the latest model settop boxes (STBs). It can be much more complex. An example service might include adding home automation capabilities to all in-home products or enabling new applications on the home network with minimal commercial interaction.

Two factors can help MSOs to expand consumer choices while also simplifying their integration efforts:

1. Adopting more nimble, flexible delivery ecosystems such as Linux, Flash, HTML5, Wi-Fi, and reference development kit (RDK). Such ecosystems speed the portable integration of unmanaged services.

2. In addition, MSOs can take advantage of how the consumer experiences of unmanaged services on unmanaged devices has lowered the expectations for unmanaged service availability.

Yes, you read that right. MSOs can benefit by following the market for a particular unmanaged service until consumers begin demanding that service to transition to the "managed experience" category. The effort and direction for MSOs to present an unmanaged service in a managed experience is discussed below.

Managed Services, Unmanaged Devices: Reducing Complexity

Many MSOs now deliver managed services to unmanaged devices. The COAM initiative has shown the industry how our customers embrace using their own devices to get our services. In particular, CVP-2 is the first step towards replicating a managed experience on a truly unmanaged device. Unfortunately, that standard only addresses managed video. What about High Speed Data (HSD)? Many point to TR-069 as a good step forward, and we agree. However, TR-069 is only a conduit or a tool for seeing how unmanaged devices are using the home network. The challenge for MSOs is to build on TR-069 to create operational and customer-facing tools that actually simplify the managed HSD experience.

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Even if we perfected TR-069-based applications and tools, however, alone those tools will not completely enable the efficient delivery of managed HSD services on unmanaged devices. The tools have limited insight into the real workings of the network. A TR-069-capable gateway that supports home network clients that are TR-069 unaware can only get us so far. The gateway could report *if* a client is offline, not *why* it is offline.

If an MSO can know why an unmanaged device is consuming a managed service, then the MSO can optimize that service for that particular unmanaged device. This capability is likely to be (higher-level) application-specific. Simply put, we don't know what services a PC might need, unless we know what app is open and actually in use. While complete transparency might not be attainable, MSOs and industry suppliers should still strive in that direction as they build intelligence into their services, in their devices, and in the home networks they service.

Simplifying the Home Network

As the number of unmanaged devices and services in the home network continues to increase steadily, MSOs need to identify the improvements their customers most value:
1. Improving managed services on managed devices
2. Improving managed services on unmanaged devices
3. Adding unmanaged services to managed devices (in a managed experience)
4. Improving unmanaged services on unmanaged devices

Regardless of how MSOs prioritize these choices, we have some suggestions for points 2 and 3, which should serve as guiding principles for point 4.

Improving managed services to unmanaged devices and unmanaged services to managed devices have a lot in common. Both services require an approach that funnels them through a managed experience. By implementing or improving the following tasks, MSOs can achieve these goals:

1. Simplifying the out-of-the-box experience, from purchase to first full use of a service
2. Monitoring and diagnosing services, including steady state and trouble calls
3. Automatic updates, including updating and/or changing services and devices

For our purposes, the out of the box experience refers to the steps users must complete between the time they purchase the service and the first time they use it. The guiding principle for the out of the box experience must always be plug-and-play. To be more specific, MSOs must strive for the following:
1. Automatic provisioning of the service, regardless of connectivity
2. Zero sign-on
3. Defaulting to known preferences and configuration information, assisted by the applications using the cloud knowledge base
4. Resolving multiple content sources based on known user preferences and MSO policy
5. Matching users to apps and services on any particular device
6. Automatically integrating new devices into the home network

Implementing these improvements will require MSOs to find ways of making user information available to their own applications, while also securing that information from unmanaged devices and other apps on the same device. By concentrating their optimization efforts on these areas, we believe MSOs can effectively simplify managed services on unmanaged devices and unmanaged services on managed

devices. This brings MSOs one step closer to their main goal: delivering all of their services as managed experiences, regardless of what in-home devices their customers use.

Monitoring and Diagnosing In-home Experiences

Monitoring and diagnosing any experience involves several concepts, but the guiding principle is building customized tools and applications that communicate in real-time with devices. The goal is to resolve service-related issues before the customer or the MSO is even aware of them.

The first step in this process is to implement TR-069 to its fullest potential; however, TR-069 clients *are not* required for all applications. TR-069 offers only generic network monitoring capabilities and requires too much customization to support application or service-specific monitoring. MSOs must therefore create service-related applications that can enhance service and device management from both home networked gateways and the cloud. At the same time, applications for MSO devices or managed COAM devices must enable service-specific data set aggregation, analysis, and decision-making based on fluid and dynamic policies. In-home knowledge of service usage by a gateway application will accelerate troubleshooting, which potentially can reduce an MSO's operational expenses and enhance the user's experience. Finally, users are continually updating their devices and introducing new technologies into their home networks. MSOs must be ready to accept and support changes in services, devices, users, topology, or usage. As we discussed earlier in this paper, the guiding principle in this area is enabling the shortest path from user-driven change to service consumption, while minimizing disruptions on unchanged parts of the home network.

Keeping user preferences in the cloud, securely, is the first step toward simplifying home network updates. These preferences should be as generically stated as possible. Hence, intermediate systems can translate those high-level user expectations into application-, service-, and device-specific formats. Getting smart on the definition and dynamics of agnostic user preferences and inferred policies continues to be an area of exciting innovation in our industry. Leveraging this new-found intelligence, MSOs have a good opportunity to match services and preferences to the updated devices. Similarly, if an MSO updates a service, it can propagate service changes easily to all of the affected devices that reside within the home.

Knowing What Users Want

MSOs can use data they already have to determine how consumers currently use their devices and services. This data is a goldmine for devising simplification strategies, because it allows MSOs to recommend programming, services, and apps to their customers proactively. We have already seen some progress in this direction, so the next step is determining where to focus resources for the most immediate and impactful business returns. The following charts, which were captured from actual ARRIS Moxi® Whole Home Deployments[1], provide examples of the data MSOs can examine for such initiatives.

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[1] The ARRIS Moxi® Gateway is a whole-home solution designed to deliver voice, data, home networking, and other advanced services throughout the home. It enables MSOs to extend their footprint and eliminate "box clutter," providing them with a launching pad to leverage their current video distribution architecture and prepare for IP video delivery.
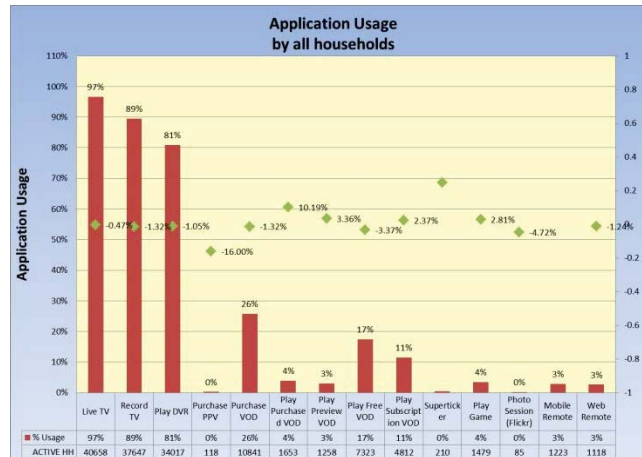
Figure 6: Application Usage

This data tells us that:
- Users still watch Live TV
- Users record more DVR content than they ultimately watch
- Users only play games if they provide a high quality experience
- Users are creatures of habit; they typically use their basic remotes rather than the applications on their mobile devices
- Users can change – as pricing allows dedicated media control tablet

Aligning value-added applications with the TV screen will take time, and will be driven by consumer demand as new, feature-rich devices come to market. As users invest in 4K screens, for example, MSOs can leverage these devices to maximize lean-back applications and speed the simplification of the home experience.

As Figure 7 demonstrates, users typically access electronic program guides and menus to access/configure recorded content, rather than live programming. Coupled with the fact that users mostly ignore thematic selections in favor of standard menus, such as channel grids, we can use this information to simplify content and recommendation search engines by making them as unobtrusive as possible.
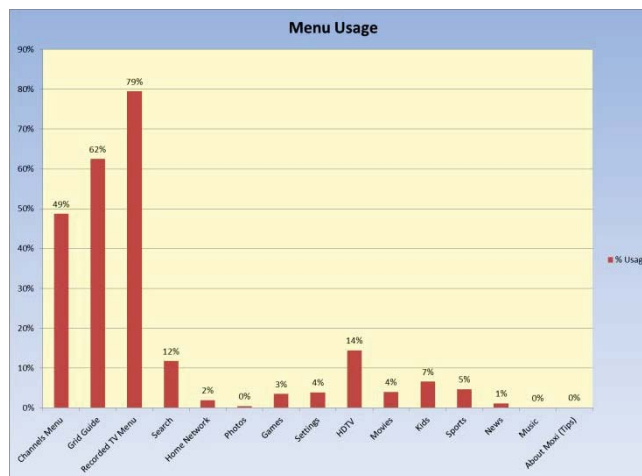

Figure 7: Typical User UI and Menu Usage

Conclusion

As we work to introduce new services and features to our customers, we need to understand the behavioral patterns and wants of our home users. Simplifying the user experience is necessary for the wide adoption of new services, content, and devices in the connected home ecosystem, especially as the growing complexity of the home network places new demands on providers and users. As we begin designing new home, network, and gateway service platforms, the four tenets of simplicity should form the bedrock of all new initiatives. Doing so will mitigate complexity and simplify the users' home entertainment experiences, increasing their enjoyment and securing their loyalty to the MSO both now and in the future.

Abbreviations and Acronyms

COAM	Customer Owned and Managed
HSD	High-Speed Data
HTML	HyperText Markup Language
IP	Internet Protocol
LAN	Local Area Network
MSO	Multiple System Operator
OpEx	Operating Expense
OTT	Over the Top
QAM	Quadrature Amplitude Modulation
RDK	Reference Design Kit
UI	User Interface
WPS	Wi-Fi Protected Setup