

The Importance of the Visual Smart Assistant to the Cable Operator and Pay-TV Solutions

New ways to add new ARPU and Sticky services to the TV and STB

A Technical Paper prepared for SCTE•ISBE by

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Introduction

Its time to rethink the living room and the connection a Cable Operator has with their customers. With new Voice and Visual experiences there is a new opportunity for an Operator to

- Have a deeper engagement with consumer and the members of the home
- Create new ways that consumers engage with their digital lives and digital homes
- Deliver new revenue generating services to the consumers living room and large screen TV locations
- Create a happy medium between the Operators customer and the services being pointed to consumers by companies like Google, Amazon, Microsoft, Apple, Facebook etc investing heavily in AI driven services to target the same consumers and households.
- Drive new paradigms in Customer Service and Problem resolution
- Enable new opportunities in adjacent market service delivery to the consumers netting the Operator payback for connectivity and visual services
- Take the first step on the journey to provide a Digital Personal assistant with useful presence in the home enabled by devices which are owned and operated by Cable Operators.

Taking one step back to remind the reader about the evolution of Smart Assistants and previous Papers presented at SCTE on the rise of the Smart Media Assistant device. A 6 for 1 device in one perfectly located ergonomic package. Replacing the STB in large screen rooms of the consumer home and extending the standard Video (VOD and Broadcast) services to now include 5 additional potential services

- Visual Smart Assistant which we will explore more in detail in this Paper
- IoT Hub including Presence detection
- Improved Audio with high end Soundbar SKU
- Voice Calling and Walkie Talkie services
- Augment or replacement from the standard RCU

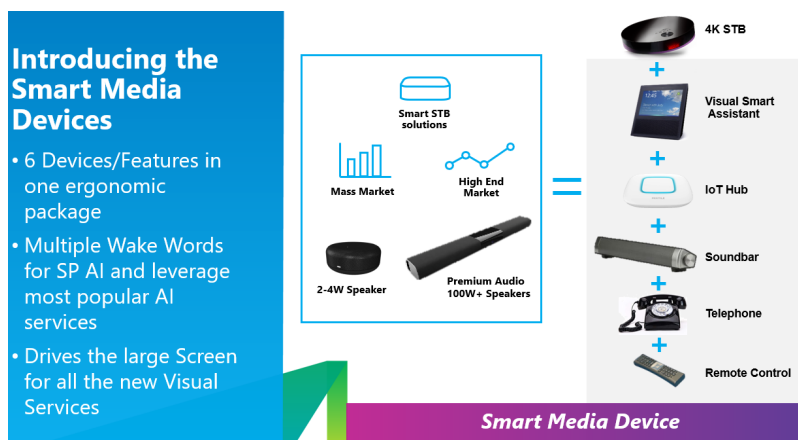


Figure 1- The 6 for 1 Smart Media Device

While the SMD is in its ramping phase as a key new Consumer and Operator device - no one can dispute that Voice driven Services and Voice driven Smart Assistants has found a new place in our homes as an essential piece of technology that has a number of benefits. Many Cable Operators have already

introduced ‘push to talk’ near field microphone technology into Remote Control Units (RCU) initially to provide a convenient way to navigate and select Video and Broadcast content. Some Operators have added new Natural Language driven Actions or Skills to expand on this first Voice input to drive other skills around the TV. One example is the skill to “Show all home security cameras” on the TV screen. These simple additions to content requests and video selection are proving popular with consumers as they are good ‘fit for purpose’ as the UI of choice for certain services.

And of course who could have failed to notice the rise of Alexa, or Google Home devices that have now improved voice input to a point where it serves an important role as a way consumers now interact with devices and their surroundings.

This paper however focuses on the second wave of Smart Assistant – the Visual Smart Assistant. Audio only Smart Assistants suffer the problem of having to use voice audio feedback to respond to all tasks. This is cumbersome, elongated and does not work for many action that require feedback as Graphics, Video or combination of audio and visual feedback. As many will have seen the Smart Assistants in the market have now added a new device type – one with an integrated small Touch Screen device. This class of device opens up a new dimension in engaging with AI assistants. It also now opens the opportunity to expand this genre of Assistant to the large screen in the most occupied rooms in the home. This then allows the SMD to replace the STB and bring in the 5 additional feature functions outlined below.



Facebook Portal

Alexa Show

Google Nest Hub

Figure 2 - Existing Small Screen Smart Media Devices

This paper will focus on exploring the types of Visual Services we should expect to see emerge in the home environment and the potential harmonization of Cable Operator Services with the Services offered by the above mentioned Visual Assistant leaders in the market.

Content

Lets take a look at what is currently happening in the home with devices and services addition. In particular with emphasis on the specific rooms where Large screen TV's are currently used. These room's typically are called Living Room, Keeping Room (next to Kitchen), Sitting Room, Family Room and typically are where the family congregate most of the time for ‘together’ activities, which often see them in front of the TV screen. While families are spending less time together and personal screen devices make it easier for kids to connect in other rooms in the home – there is still a TV/Screen at the focal point for the times families get together to eat, watch TV and generally spend their time together.

Operator supplied Devices have typically been constrained to the following three devices

- Gateway or EMTA/ONU and Wi-Fi Access Point
- Wi-Fi Extender
- Set Top Box

With some Operators now adding

- Smart Home Panel, IoT Hub and Smart Home Devices

Presently Operator Voice Smart Assistant and AI services have been mostly constrained to the addition of a remote control with near field microphone and the implementation of search and navigation for content. Typically using a single Advanced Speech Recognition System (ASR) and leveraging bought in Skills or actions or in a few cases extending Operator specific actions.

What the author is now suggesting is that this input method is going to be augmented with far field Microphone solutions – particularly located in the main large screen TV rooms of the house. Operators now have the chance to go straight to Visual Smart Assistants tied directly to the STB and TV combination.

Lets take a quick look at the 5 services current being offered by Cable Operators and how they ready for the next service phase of AI based customer engagement

1. Differentiating title:

1.1. Voice

Rapidly dropping in use. Landline is not being used as much as SmartPhone in the home. Its also being replaced by calling on Smart Speakers and Video Calling services. Consumers prefer to use untethered phones to talk so RJ-11 phones are being kept for backup and not for any real primary use. Use of RJ-11 phones higher in homes where occupants are above 60 years of age. Consumers now also prefer to call by name or persons image so Smart Phone UI or Alexa and Google calling services (saying Name) are also growing in popularity. Smart Speakers have also defined new ways to communicate with voice. Amazon Alexa in particular has

- Dropin – when the Smart Speaker receiving the call has authorized drop-in service from Calling Speaker the receiving device will open a direct audio or video link to the Caller without any action on the receiver side. The receiver device will signal the dropin opening with a sound and usually some led activity. This feature is used as a home intercom system and can also be used across homes. It also has real benefits for disabled and aging in place applications where the receiver of the call may not be able to physically answer with hands, voice or eyesight.
- Announcements – the ability to be able to type something from the Caller side and have it ‘announced’ as voice and text on the receiver side. Again, this feature helps to communicate with a home or a person and has large screen benefits as a notification engine.

1.2. Video

Year on Year decline for PayTV subscriptions – typically dropping by 1-2% per year. Video service less profitable than Broadband for Cable Operator but a very important sticky service that still resonates with consumers particularly for live events. The value of content is being eroded by SVOD OTT solutions and new OTA/FTA ATSC3.0 standard may also impact live broadcast on Cable

stickiness. MVPD's with the least churn have typically integrated the popular SVOD IP Sources at the metadata level and also implemented rich and modern UX for Video search, navigation and play. For consumers they will pay for simplicity and for all services they need on a single HDMI input. Additionally, its also clear that there is a requirement for the MVPD to offer at least 'push to talk' Voice input on the Remote Control Unit. The input method for Video is becoming the key to deciding which service provider you select for your video entertainment services. Cable Operators have been successful implementing good 'push to talk' remotes but this paper will recommend also extending this to far field microphone inputs in Smart Media Devices.



Figure 3 - The various input devices for Video Selection

1.3. Broadband and Wi-Fi

The superstar service at the moment with highest growth and margins. Also drives successful leasing of devices (Modems, GW and Extenders) in many Cable Operators. For Video delivery in particular the shift to all IP services will place pressure on both the access network and Wi-Fi in home especially with 4K and 8K bitrates. Wi-Fi in the home delivers the consumer experience and is critical to all home and future consumer applications.

1.4. Smart IoT

Still struggling to make its mark as a significant Cable Operator service. It is a high growth area and especially for Connected home verticals like Health. Irregardless of the monetization of Smart IOT services – it is a very sticky service and single applications like being able to voiceyou're your alarm, see your external cameras on the TV retain customers from switching to other service providers and losing their simple applications or having to relearn new ways to do things. Things are improving for Operator driven smart home services because of a number of new factors

- The Capex for the IoT devices has substantially dropped over the last 3-5 years and makes initial capital outlay for Camera, Thermostat and Light driven IoT services economical.
- More and more Operators recognize that the consumer has typically made a choice for one or more IoT ecosystem and the opportunity has shifted to be an aggregator of these 1-3 ecosystems that homes typically gravitate towards. Many of these IoT companies now also offer IoT s/w to integrate into Service Provider devices as is illustrated below. This is driving GWs to larger flash, DRAM requirements and making choices on protocols like ZigBee, Zwave and BLE.

Additionally there are initiatives underway to create Programmatic API's and Containerization models to allow for the dropping in of new s/w services including IoT. The Smart Media Device can also follow some of these trends for network based services to drive new applications on the Screen.



Figure 4 - New Containerized S/W services platforms

1.5. Mobile addition to bundle

Owning the consumer in and out of the home for connectivity and connectivity based services is a current trend where many Service Providers now also offer Mobile services from their own mobile cores and spectrum or in various MVNO arrangements. Currently, the mobile and smart phone device is the only real application and customer engagement platform. This platform allows the development of more converged services and allows the Operator to give tools to the consumer to manage their home devices, home Wi-Fi and other services. The applications on the smartphone also allow it to be paired to the home experience and can also support Voice Remote, RCU functions and also with appropriate profiles on the phone allow for Wi-Fi offload from LTE networks.

The device itself also is typically tied to a home member and its presence (Wi-Fi MAC registered on the GW, Wi-Fi beacons, BLE profile) can all help to identify the likely presence of 'person X' and be used potentially to correlate AI activities based on people presence in the home or the room.

1.6. The Next Phase on Consumer Engagement

This paper however is focus on the next phase of Operator supplied consumer device and services to create a deeper and immersive consumer engagement. To get that deeper consumer engagement there is a need for 2 way communication and new philosophies that extend beyond just the odd phone call from the consumer complaining about any fall in service or price issues. Its about finding ways to present your company in front of them in proactive and positive instances. Today there are a few choices for this

- Email and WebSite portals
 - Not engaging and non real time communication
- Cable Operator Smart Phone App. This App strategy is slowly emerging for every Operator. But it is a step in the right direction being able to leverage push notifications and other services of App/Smart Phone to be able to engage closer with customer in proactive mode
 - Allows device setup and troubleshooting

- Allows service check for outage
- Schedule a technician
- Etc

The next phase is to try and give a more home and immersive engagement experience using the large screen TV and Operator owned and managed Smart Assistant and aggregator of smart assistants strategy.

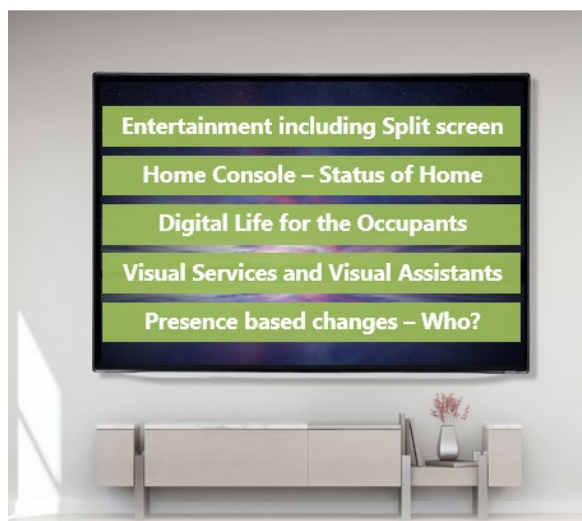


Figure 5 - The Living room Palette for Command and Control

Using the large TV canvas for notifications, Visual Assistant feedback, Virtual Assistant to come will provide a new level of contact and engagement between the Operator and their customers.

The SMD device will offer the demarcation point to allow for these new services to be displayed and communicated on the Large TV screen

- Entertainment including split screen
- Home Console and Command Center – Status if Home
- Digital Life Skills for the occupants of the home
- Visual Services and Visual Assistants
- Presence based engagement changes – “Who” is in the room

This new way of touching and engaging with the customer will have lots of new important improvements to both the operators relationship with customers and the potential to upsell new services and features with immediate access to consumer.

So how do we make this happen. The next section will outline the simple 6 step process to the introduction of this new level of consumer engagement with the Cable Operator.

2. The Six Steps to a totally new customer engagement

The following are the basic steps that the Operator should consider following

1. Introduce the Smart Media Device as the platform for next phase of customer experience engagement
 - a. Its initial introduction will be justified by the basic function of continued service for Video and Video UX
2. Select your Visual Skills path for Voice and Visual Assistant support
 - a. Leverage Alexa, Google or other consumer pull solutions for their Visual Skills
 - b. Decide on the number of Wake Words to support one or more backend services
 - c. Decide on how much you want to invest for Skills development for your own personal engagement with your customer
 - d. Decide what potential verticals you want to engage in or develop to extend your consumer engagement
3. Plan a shift from current customer service philosophies, tools and process and shift to AI based Self Directed self healing.
4. Move more to Far Field Voice Calling/Speaker Phone usage and away from the regular landline service.
 - a. Consumers are shifting towards different devices for communicating with each other. Leveraging Smart Phone and Smart Speakers more – and using Alexa and Google calling services
5. Add a camera option to the SMD to catch the trend for Video Calling driving current increase in home to home connection and communication.
 - a. Finally the right set of tools and services to unite families across their generations.
6. Drive more customer engagement with the data you can analyze from the SMD interaction and home occupants patterns of engagement – this can also help increase service sales and drive better customer NPS.

Lets detail each one of these steps in more detail.

2.1. Introduce the SMD to the home

Operators should evolve their home device and home network aspirations to create the following device and architecture.

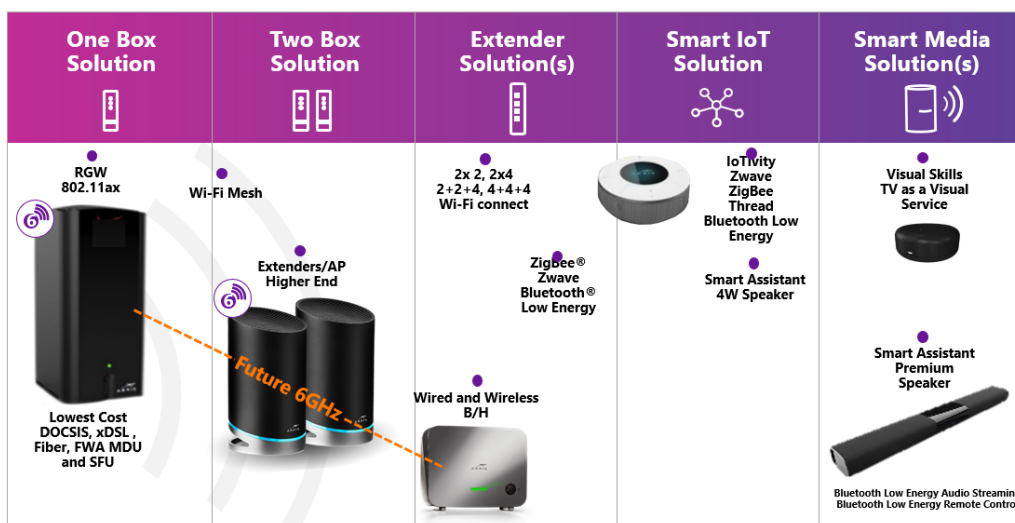


Figure 6 - Next Generation Home Architecture and Devices

As part of this architecture it assumes the addition of new Smart Assistant devices – Audio only or small LCD screen Smart Assistants but most importantly for this paper analysis – the Smart Media Device controlling the 65” Screen experience in the main occupancy areas of the home.



Figure 7 - Smart Media Device - High End and Main stream

So, for the first phase – replace your STB direction with the inclusion of the 6-for-1 SMD device to start your next phase of deeper customer engagement. This creates the device platform for Operator to have deeper data driven customer engagement from the screen, speakers and the sensory inputs to the SMD. It ensures that the consumer will continue to use Operator device to control the large screen devices in the home vs the TV companies. The demarcation and location of the device will also ensure that additional BLE (or even potentially ZigBee or Zwave) coverage can be given to the house but also most importantly a strong BLE presence in the room with the screens and SMD. This BLE demarcation point ensures reliable and robust platform for connection to

- Wearables
- Medical and Aging in place devices
- Sound Solutions using BLE

And also allows accurate presence detection of active BLE enabled Smart Phone devices.

(Note – as of writing there is also a strong trend and direction for Wi-Fi based motion detection – principally from Access Points or dedicated Wi-Fi circuitry. In theory the SMD could also be used to provide Radar telemetry to the room using Wi-Fi (in Soft AP mode) or even with BLE solutions).

This now starts the operators engagement to the Home Command Center – leveraging an immediate and visual feedback loop and engagement solution with the home occupants.

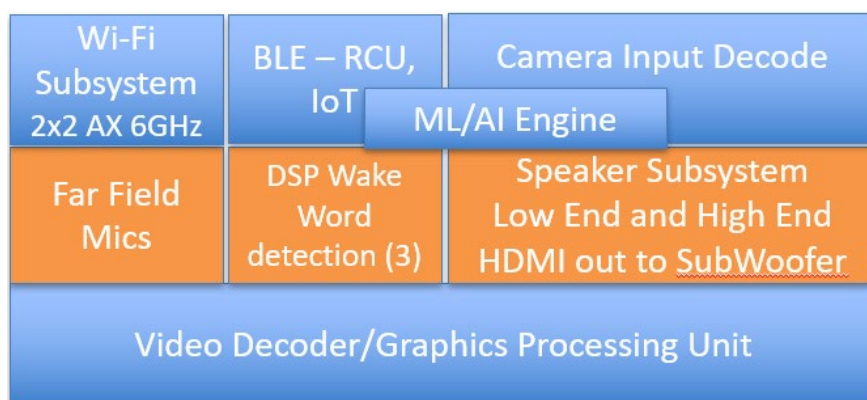


Figure 8 - Anatomy of the Smart Media Device

The Smart Media building blocks are outlined above and provide

- STB decode functionality and GPU – familiar to STB devices
- Wi-Fi for Broadband Connectivity – one point to note is that with 6GHz Wi-Fi solutions and clean spectrum to 160MHz – 2x2 Wi-Fi 6 6GHz solutions could be used for SMD device. One interesting area for further innovation could be the use of the Wi-Fi silicon in Soft AP mode or with dedicated circuitry to provide a Wi-Fi Radar or imaging function directly to the room.
- BLE – using BLE allows us to have concurrent use of the solution for Remote Control , Audio Streaming, IoT hub and potentially presence detection.
- Far Field Microphones – always improving to the level that 2 far field Microphones provides high wake word detection in STB form factors
- DSP and Wake Word detection software – for an Operator solution to aggregate industry and consumer Voice AI assistants like Google and Amazon the ability to wake on 3 wake words is desirable allow scope for ‘Ok Google’ ‘Alexa’ or other solutions and also the Operators own Wake Word as a differentiated value add solution.
- Speakers – as discussed earlier and in other papers – the Speaker systems range from mono 3W and 4W devices to higher end 100W+ speakers with SubWoofer attachment from HDMI out solutions. The market will probably require a high end, mid level and low end solution like most products in this category.
- Decoding Camera Inputs – potential optional element to silicon designs to allow realtime Video Conferencing to overlay the graphics by leveraging the SMD silicon to provide DSP functions on the in room camera in particular.
- ML/AI engines – while most of the ML and AI for processing will take place in the processor or the cloud there is a growing trend to have local DSP processing for Video inputs and audio inputs (someone has fallen, who is speaking) and have this done from the sensory inputs available in SMD with local processing but also supporting ML/AI Tensorflow or Caffe or other pipelines for processing the sensory data to actions.

This Hardware architecture then supports the evolution of a new software stack for the SMD that incorporates the existing elements of the STB (and associated middleware solutions) but also adds new s/W locks that conceptually layer into standard middleware and also have to aggregate different AI solutions into a converged solution on the SMD UX. Additionally, sprinkling in IoT hub solutions as well as allowing Skills and services to run from different Skills platforms and the Operators own Platform.

Key blocks include

- Support for different traditional Middleware solutions as well as integration of solutions like Android that pulls in the Google Assistant and Rich Responses solutions
- Addition of streaming OTT sources as applications, Launcher Applications and Remote UX Solutions
- Smart Layer additions comprising of Google Assistant/Rich Responses, Alexa APL, Other and logic to manage the multiple engines. Additionally any local ML/AI processing for Audio, IoT and Video inputs to the SMD and preparing data stream for TensorFlow or Caffe cloud engines.
- Backoffice elements for the Service Provider to co-exist with the third party AI assistants and run skills in their domains as well as specific Service Provider Skills
- Cloud elements including Service Providers own Cloud and associated connections to Google Cloud and Alexa AVS/AWS services hosting skills for those respective ecosystems.

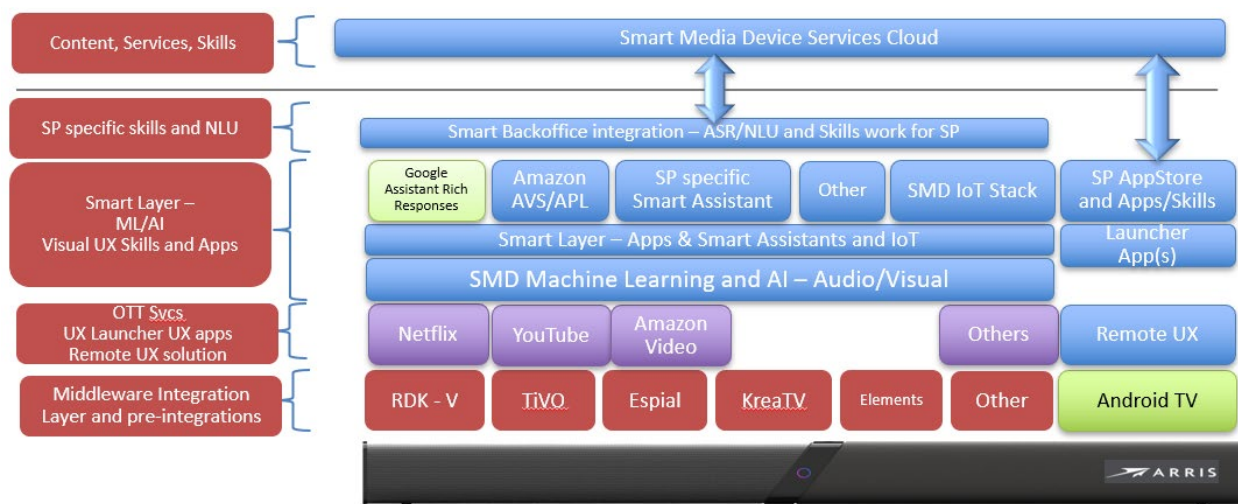


Figure 9 - Potential new Software Blocks for the Smart Media Device Runtime

The S/W framework for the SMD then provides the host frameworks and API's (in conjunction to Cloud services) to allow services like the ones illustrated below to be hosted in the SMD with inputs from Voice and RCU and outputs to screen and audio devices.

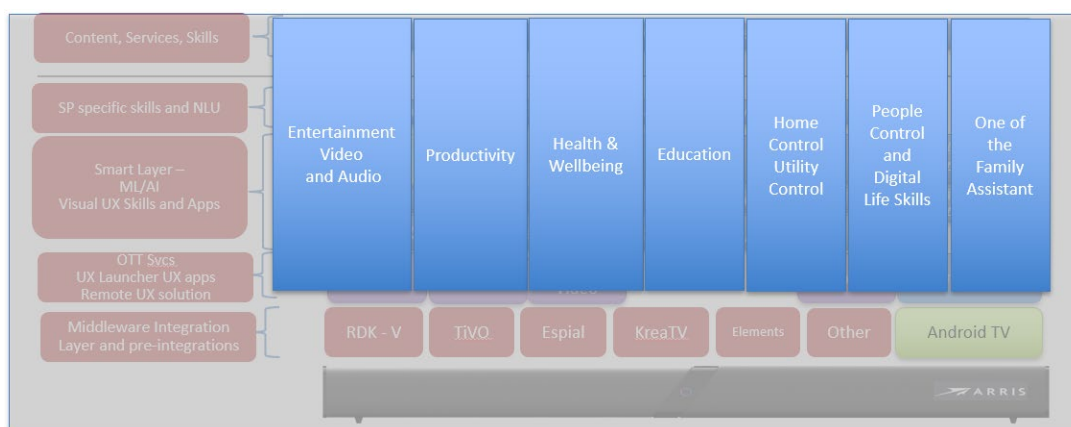


Figure 10 - SMD Software framework hosting these service types

These services will be detailed later in this paper but they are driven by the additional sensory abilities of the SMD – being a potential device that can

- Determine who is in the room
 - From spoken voice
 - From potential BLE association with the BLE hub of Smart Phone or wearables
 - From potential use of Wi-Fi or BLE subsystem for radar motion detection
 - From audio sensing (more than one person talking) and also being able to determine what is making noise from signatures (opt-in ability based on privacy settings of an SMD)
 - From the haptic use of an RCU – where each person holds and presses the RCU differently
 - From access to the SMD content, skills and services – determining favorite patterns and what different people are engaging with and how long they engage
 - And other correlative elements of RCU, SMD, Audio and IoT sensory information

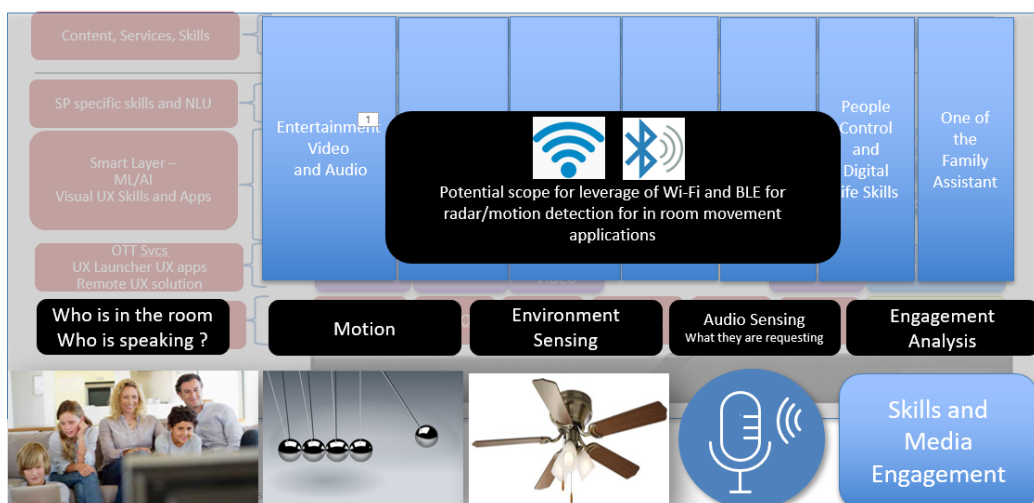


Figure 11 - SMD Sensory Inputs creating deep understanding of Room environment

2.2. Select your Visual Skills and AI Assistant path(s)

There is already strong momentum with Amazon and Google, Microsoft and Apple and others to develop AI Smart assistants. This evolution has now switched gears to Visual Smart Assistants. This is principally to get as close as possible to the way humans interact with each other (facial and visual clues and gestures) but also the best way for humans to absorb information. This is illustrated in the figure below for a simple Voice request and audio reply for the Weather over 10 days. Voice assistants will obey to continue to speak back the weather and can't see that you 'get it'. In the Visual Assistant Skills response a 2D view Card of the weather can be displayed and the Human can then absorb the information easier. "Its going to be hot most of the week"

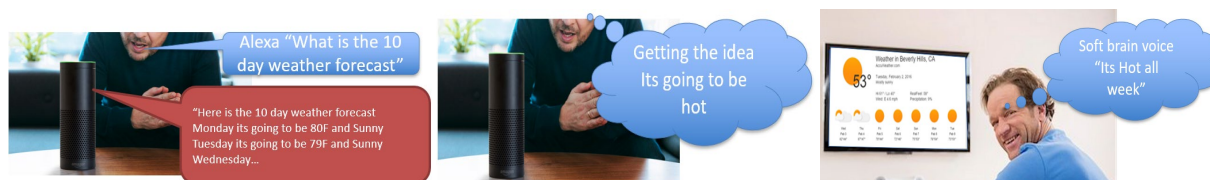


Figure 12 - Visual Feedback can often be better

The recommendation in this paper as has been expressed already is to create the Operator SMD with 3 wake words that can then evoke upto 3 assistants. There is still debate in the industry whether consumers will be confused with having a single device with different AI assistants or personas. The author's believe that this is not really the case as people already interact with multiple assistants during their daily lives often using Apple Siri on phone, Alexa for music speaker or other activities on home Echo devices and even some homes have both Alexa and Google Home devices. Add to this many homes also have X1 with the X1 voice remote from Comcast and you can see that like humans people understand that there are different assistants for different activities they want to do. This will also be made simpler with the development of Visual Assistants as on screen indications and eventually assistant avatars will clearly indicate the responder to the voice command.

Having implemented the wake word triggers adding the Voice Assistant services takes different forms based on the middle ware solutions

- Android TV Operator Tier makes it easy for inclusion of Google Assistant and related Visual Services like the present Google Rich Responses.
 - Alexa can be added as Android APK application
 - Specific voice AI and Visual reponses can also be added within the Android runtime
- RDK Video also allows the inclusion of Smart Assistants
 - Google Services can be added and the ASR and NLU functions accessed
 - Alexa Services can also be added
- Similarly for other middlewares and other Assistant, ASR and NLU solutions.

The support for Visual services on the TV and STB platform is rapidly emerging and increasing in new visual elements that can be rendered and presented outside browser environment. Browser's can also be used to present visual information and work continues in bodies like W3C to ensure consistency of Browser rendering on STB environments.

Amazon Alexa platform has introduced the Alexa Presentation Language about a year ago that has gradually started adding API's and new Visual elements – most recently adding a Video Element to allow visual skills to leverage Video elements (even video in video) in a consistent and optimized manner for STB and TV larger screen environments. The Figure below illustrates trivially some of the potential skills that can be leveraged on a large screen environment – from purchasing products in a rich graphical and video environment to playing audio feedback games like “Who wants to be a Millionaire” or “Jeopardy”. It also gives scope to start introducing an Operator avatar persona that can guide the home owner through services and interact on behalf of the Cable Operator.



Figure 13 - Example of Visual Services for SMD

The simplified architecture is shown below where the single SMD runtime can maintain services from multiple Cloud based AI , ASR and NLU services. Additionally the Service Provider skills can be added to the Skills databases of Alexa and Google and made accessible to other Operator solutions supporting Alexa or Google Assistant.

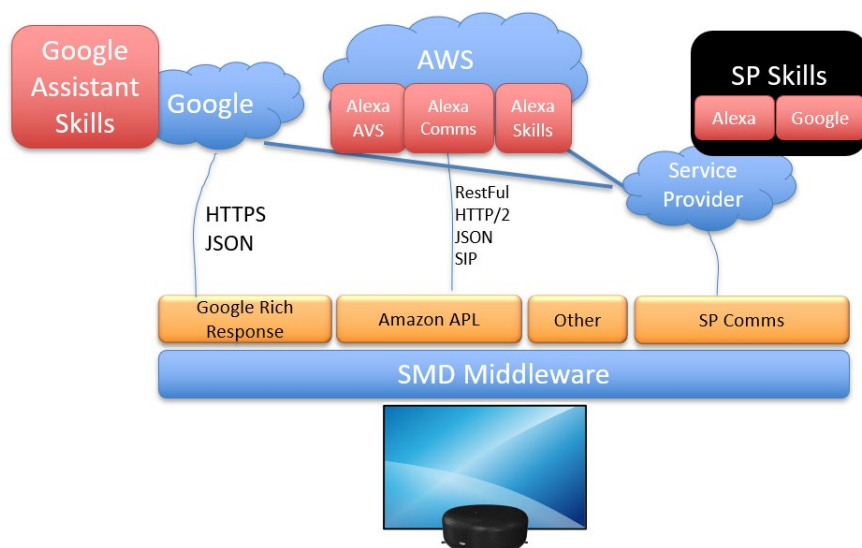


Figure 14 - Simplified Cloud interfaces to Operator and common AI solutions

A more detailed sample architecture for leveraging a Google Cloud service and Google Assistant Service Provider based solution is shown below.

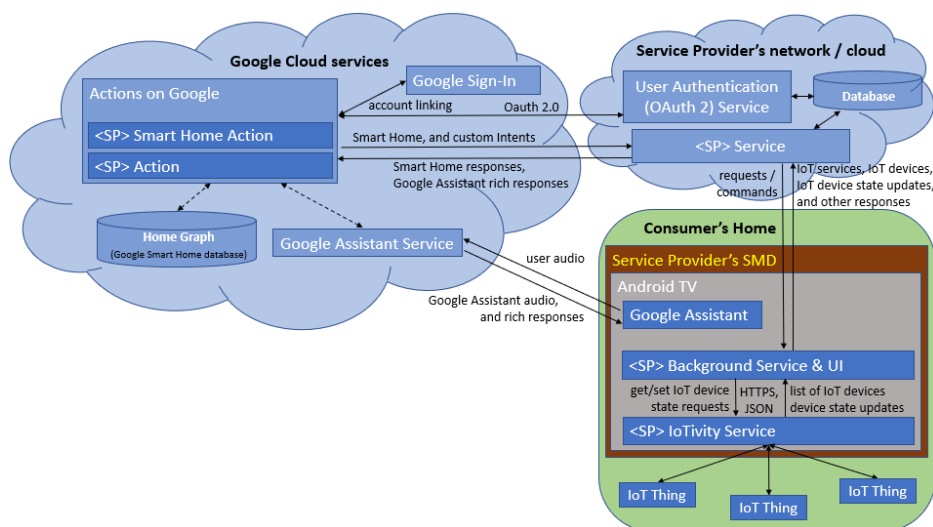


Figure 15 - SMD to Cloud Architecture for Service Provider to integrate Google Services

Similarly, a more detailed sample architecture for leveraging a AWS Cloud service with Alexa Voice Services for a Service Provider based solution is shown below.

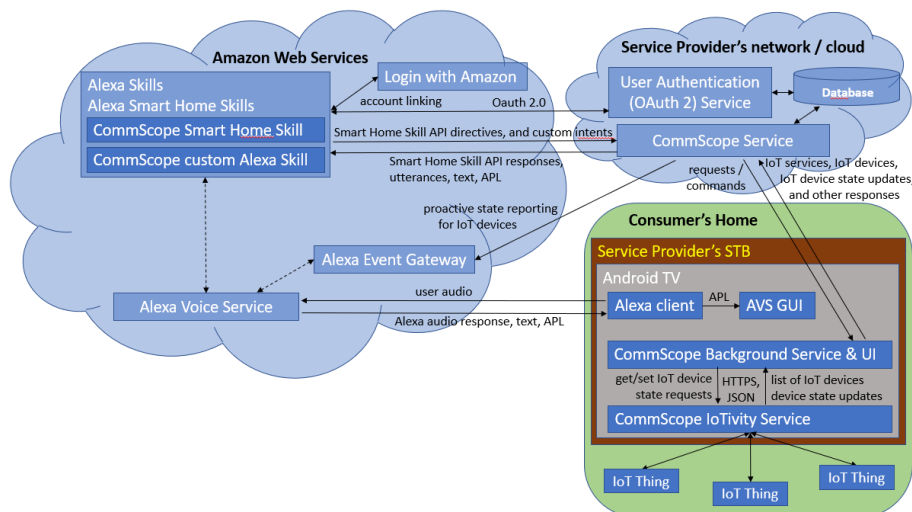


Figure 16 - SMD to Cloud Architecture for Service Provider to integrate AVS in AWS

There is a deeper level use of both Google and Amazon services including some of their IoT and ML/AI services that could also be done. See following two architecture diagrams detailing these additional elements.

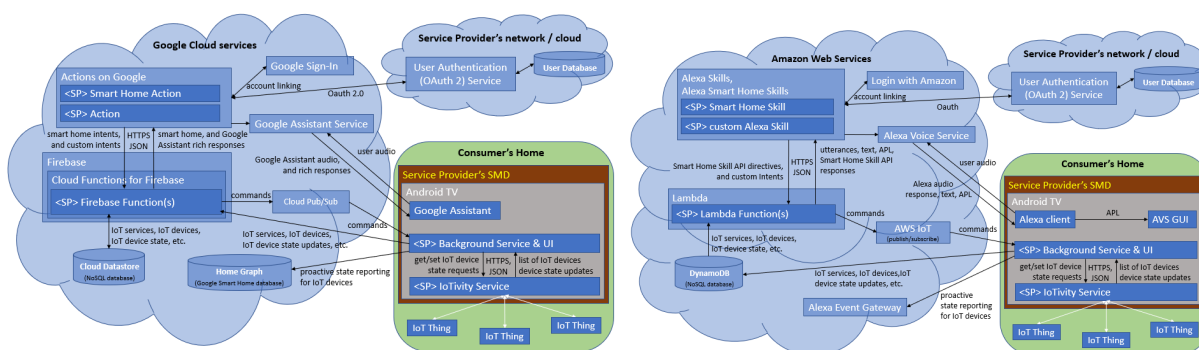


Figure 17 Leveraging Google and Amazon Cloud Services deeper

2.2.1. Today's Audio and Visual Skills are still basic but growing in sophistication

We are seeing the first versions of visual skills emerge on the small screen personal smart assistants. These skills were typically 'card' based and presented simple graphics in conjunction with audio feedback

Todays Visual skills are starting to form from existing Audio Skills



Figure 18 - Todays Visual Skills are typically simple card graphics

These UI elements work well for small screen and personal intimate engagement. The larger screen environment has more real estate to do more things and is also a potential multi person input and output device – as the TV is a communal device in the home. However, there is now huge opportunity for the Cable Operator to leverage the initiatives in these devices to insert their solutions using the Larger Screen in the main rooms of the home with the SMD platform. The figure below outlines the different philosophy of Visual Skills and Visual Smart Assistant on different screen types.

- **SmartPhone** – the most personal and mobile Smart Assistant device and used for confidential and personalized content. You check your financial information on screen this size and is locked with your PIN. You also have smaller screen real estate to show visual skills.
- **Tablet** – many of the same limitations as Smart Phone but can be a shared device so less personalized smart skills make sense for this device. Has larger screen and spends most of its time in a static position when being used.
- **TV/SMD** – static and communal Smart AI device. Used to show skills to more than one person or to run generic home or general skills on large screen. Large and growing larger screen canvas to put video, graphics and text optimally for best updates to home occupants.



Figure 19 - Skills for different size screens

As well as being Skills being suited to different communal or personal screen devices , the real opportunity for Visual Skills is to identify and develop ones that can be monetized. The majority of

general skills will be given away as foundation skills or leveraging some ad insert (different advertising paradigms for visual skills vs Apps and Video) and then a growing list of value add Skills that can be one time fees or recurring revenue opportunity. The highest value skills will not surprise anyone by being the often talked about Health and Wellbeing, Education, Utility Management and Aging in place. With standardized ways to access screen and sensory IoT information the SMD and the Smart AI engines now make these solutions

- Realizable in a standard manner
- Deployable at scale easily to SMD end points enabled with Visual Skills
- Capable of leveraging the other sensory devices (BLE etc) in the SMD and other associated IoT client devices.
- Leveraging Audio and Visual services for disabled accessibility options

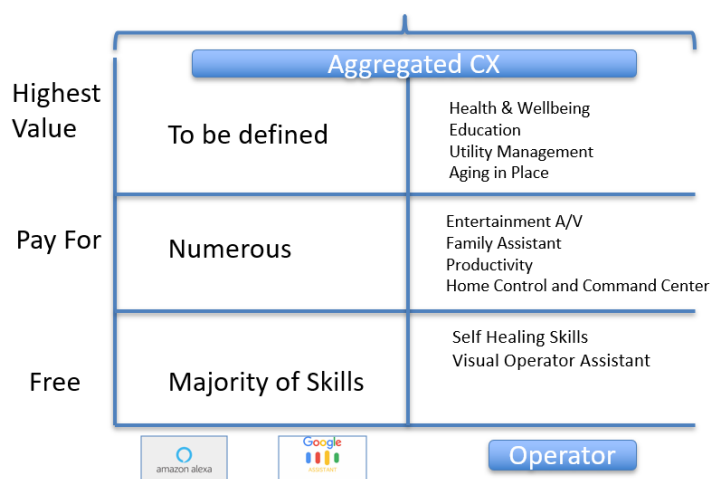


Figure 20 - Should the service provider focus on highest value skills

The following section tries to outline some of the categories that make sense for the Cable Operator to focus on for Skill acquisition or skills development or skills bundling.

Finally getting a platform to connect the consumer to services

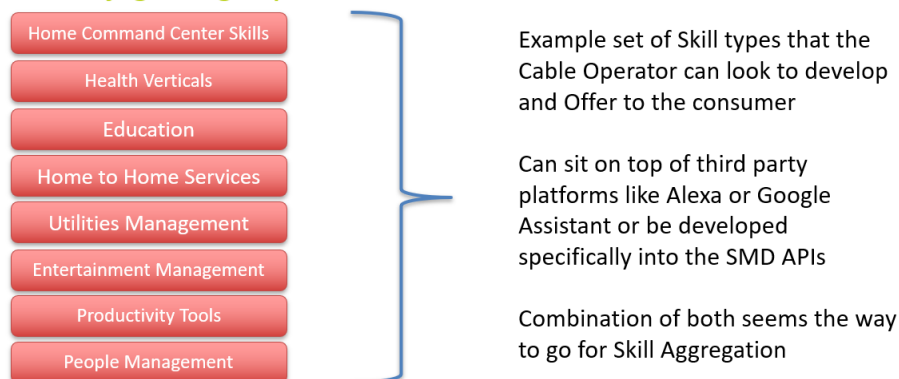


Figure 21 - Potential Skills Categories to develop and analyze for new revenue

2.2.2. *The Home Command Center Skills*

The fundamental thing the SMD and its capabilities offer is the ability to make the large screen TV the go to place for all home services , outputs and effectively the Home Command Center console.

An example of these potential skills is shown below. Skills can be rich in graphics and video and can take up full screen or with larger wall size OLED displays coming in the future can work in split screen mode – depending on skill types. They can also be just notifications overlaying the background video.

With communal skills and services in mind the TV Home Command Center Skills could be

- Home Security Center – display Home status , cameras on TV etc
- House To Do's and sync'ed individual calendars
- New Feeds
- Immediate access to anyone calling
- Leaving notes and reminders to each other – text and voice and video
- Status of connected home
- Self Healing and visibility into all functions in the home
- Scheduled maintenance events
- Consolidation of all media sources and catalog
- Etc

The TV screen is ideal to leverage for these type of notification and all activities in the home and is in constant view of the occupants. Countries like the US that keep their TV on all the time for background noise now have additional reason to do so , if it the TV is in standby mode the Skills can wake the SMD and screen using HDMI CEC mode.



Figure 22 - Examples of Home Control Center SMD Skills

2.2.3. Health and Aging in Place

One of the potential breakthrough skills for the SMD is in the health area and in particular Aging in place. This is not only a high revenue service for the Cable Operator but is an ideal application for a Skills Framework and SMD device. Aging in place is done typically in front of the TV and often the person has a better chance of navigating a simple remote interface or voice input to access services. The senior can also be difficult to connect to with hard of hearing and failing sight often part of the aging process. Typical Skills and Notifications could include

- Medication Reminders
- Calling notifications and Reminders on TV and audio
- Leveraging solutions like Alexa Drop in to be able to receive call without doing any physical or voice activity
- Feeling secure with security status
- Feeling secure with camera inputs to the TV
- Allowing access to the home with IOT IFTTT applications based on Camera doorbells and smart locks all driven from SMD Visual UX
- Showing the person their upto date health stats and logs
- Reminders for visits and doctors appointments
- Emergency contact speed dials with voice – using Help trigger words to invoke Help skills or emergency response.

The additionally sensory elements of the SMD including the BLE, Audio and other home IoT devices can all be used to create a more robust Aging in place solution as well as provide Skills that link the Video entertainment and broadband services to the Aging in place solutions. Examples include pausing Video playing until certain actions like taking pills are completed. Additionally, being able to directly communicate with the person in the room through the Audio and Video Camera for peace of mind care and checkup abilities



Figure 23 - Health and Aging in place skills

2.2.4. Education Skills

There are few additional services a homeowner, parent, billpayer will spend their last \$10 per month on – one such service is the improved education and grade reports for their Kids. Parents often struggle managing their kids education as they find it hard to discipline them to study, navigate course material and motivate them for improvement. We do know that Kids now engage better digitally and are comfortable using voice assistants. Couple that with the ability to leverage the large screen for an educational rich media experience pulling in a world of online education content its easy to see how Education SMD hosted skills could be a big winner for kids and parents alike. A couple of additional items worth also mentioning are the ability to link hard work from kids doing the allocated curriculum Education Skills with rewards for their efforts and scores and the ability to correctly pace a curriculum to the results observed from the kids. These are perfect applications for an Education Skills engine and while much of the online education content is not yet formatted to run as an Educational skill with associated tests (answers by voice or by click) the effort to translate to SMD skill is not high.

One can also imagine future AI driven virtual tutors that can pace and guide and prompt the student in 1:1 focussed educational skills making it possible for the student to catch up on class work or to get additional help on areas they struggle.

Other skills can include bringing in the online Report Cards systems many School districts offer for their students to the SMD screen and immediately accessible by voice command to visual skill. This will ensure that parents have a deeper and more immediate awareness of kids performance (they often don't check the online portals until report milestones) and then take immediate action to correct slides or some obvious difficulty with course and subject areas.

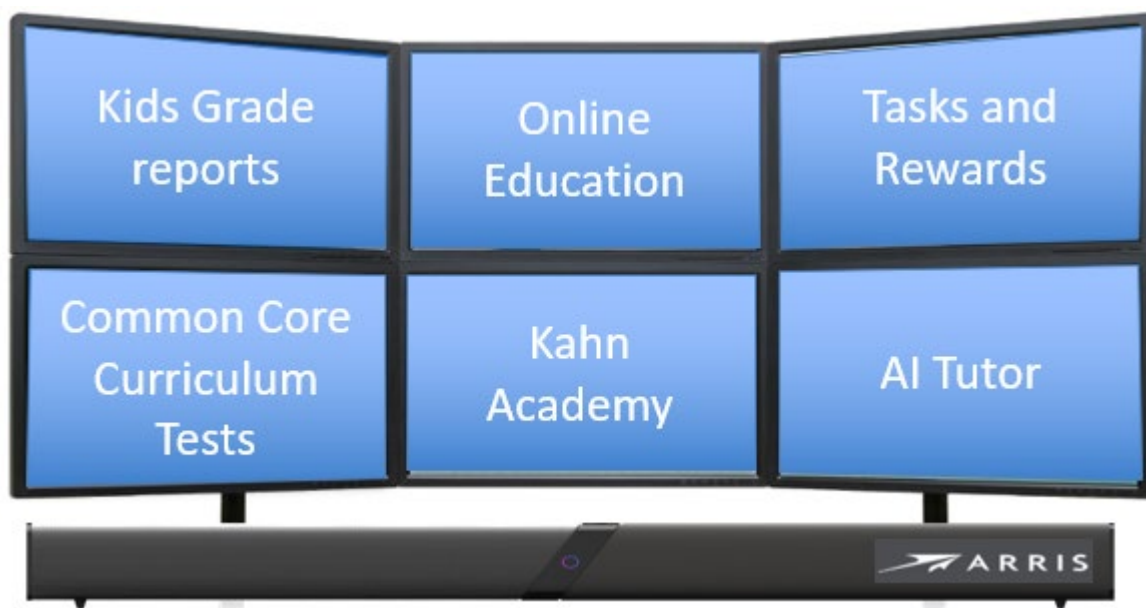


Figure 24 - Potential Education Skills

2.2.5. Home to Home and Room to Room services

Another group of Skills that can help to unify Homes through Home to Home Communication Skills and sharing. This includes

- calling, video and audio
- drop in and Intercom features
- Aging in place open lines
- Home to Home calling – voice activated
- Together TV applications – syncing Guide access and Video playing
- Ability to monitor second homes or lakehouse remotely

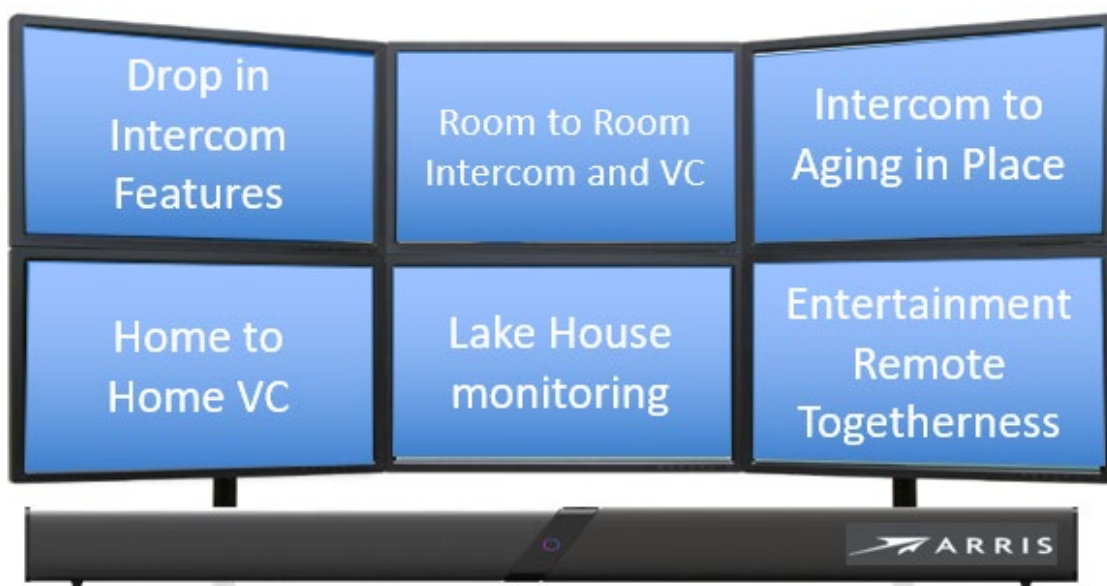


Figure 25 - Home to Home and Room to Room communication

2.2.6. *Managing home Utilities*

Saving Energy, Water and other utility costs is also a Skill that can motivate Home owners to understand their costs in a more granular and realtime manner that todays montly bill sticker shock. Skills can be developed leveraging existing online utility portals to aggregate information for the house as well as apply thresholds for immediate notifications or hints to go easy on Air Conditioning to make monthly budget targets for the household. More ‘just there’ accessibility to cooling being on in the basement when you assumed it was off. Future accessibility to solar charging and discharge parameters and even transfer back to the grid. With more and more smart devices in the home and their cloud connection being accessible to Smart Assistants this data can also be merged into the large screen visual dashboards. Also in the future with switchable energy sources the SMD Skills platform will allow offers to be made directly for lower cost energy deals for different time periods of day and month.

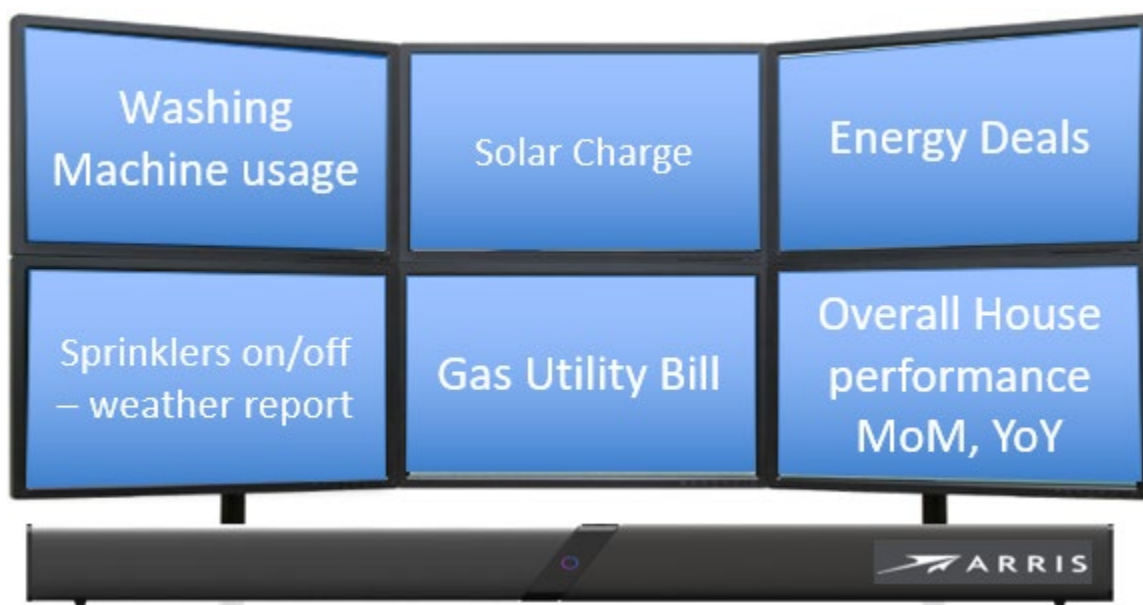


Figure 26 - Utility Skills - managing house costs

2.2.7. Gaming Skills

What is different about Gaming Skills vs Gaming applications. With the inclusion of Voice input and ASR the SMD can support a range of gaming solutions that support voice response vs joystick or other input media. Engagement with Voice is perfect for games like Jeopardy and “Who wants to be a millionaire” and other quiz shows. Equally new skills can also manage the screen real estate to provide multi screen gaming and watching gaming as well as notifications of gaming updates.

And the SMD is a perfect Karaoke machine offering the ability to do Karaoke with access to rich media Karaoke games and lyrics from cloud of songs. Even the ASR engines for Voice Skills can also be used to do song to text if the Karaoke song does not contain lyrics.

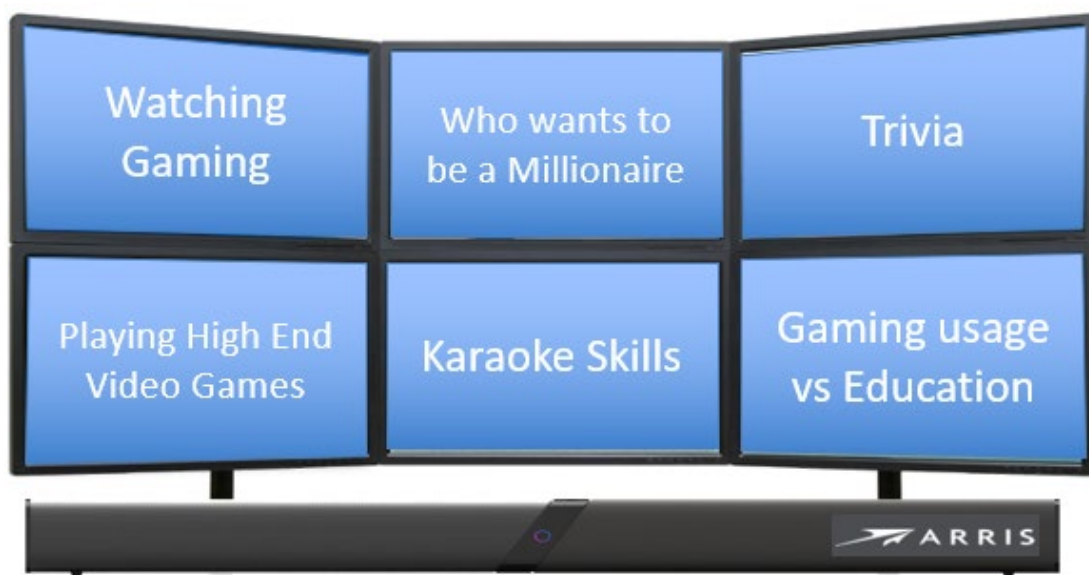


Figure 27 - Gaming Skills leveraging Voice

2.2.8. Productivity Skills

The SMD can also act as the Swiss Army knife for all the miscellaneous tools that are helpful when managing a busy house and the people that are in it ... Skills that support Household budget planning, prioritized emails and other messages, tracking the Uber on the way to your home, changes in Timetables for Train (before you go to bed) and basic utilities like unit conversions.

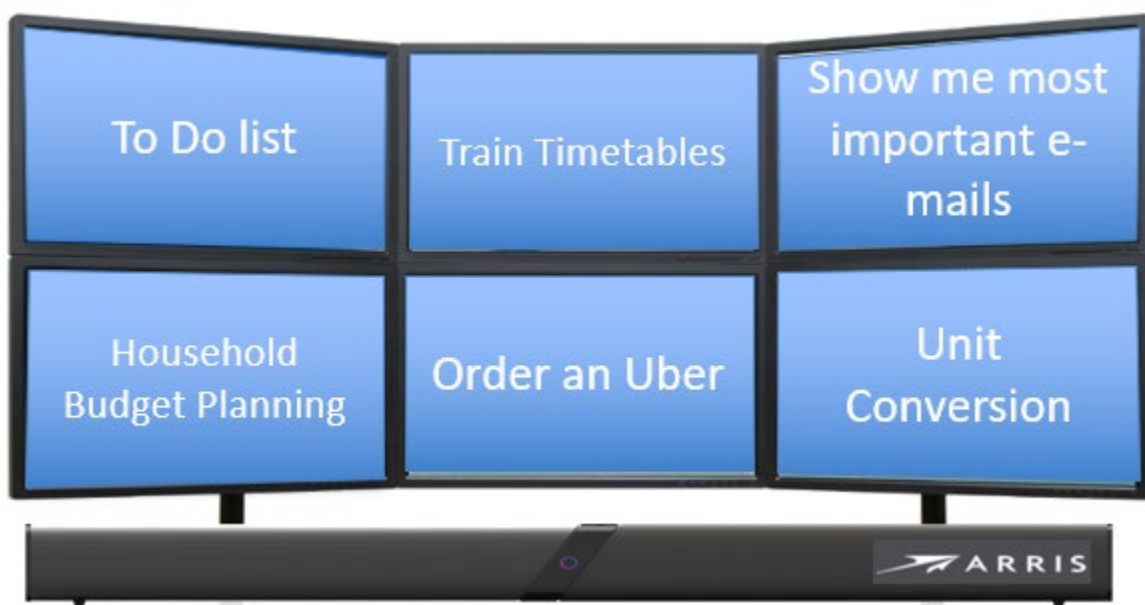


Figure 28 - Productivity Skills

2.2.9. People Management Skills

A home portal to the important digitally accessible information for the occupants. Including

- Immediate access by voice to Kids school work
- Profile management for parental control
- Who is doing what with what in the home – the answer to the kids ‘I’ve hardly used my tablet all day’
- Setting tasks and chores by voice
- Reminders and message boards to home occupants
- Motivational programs that encourage the family

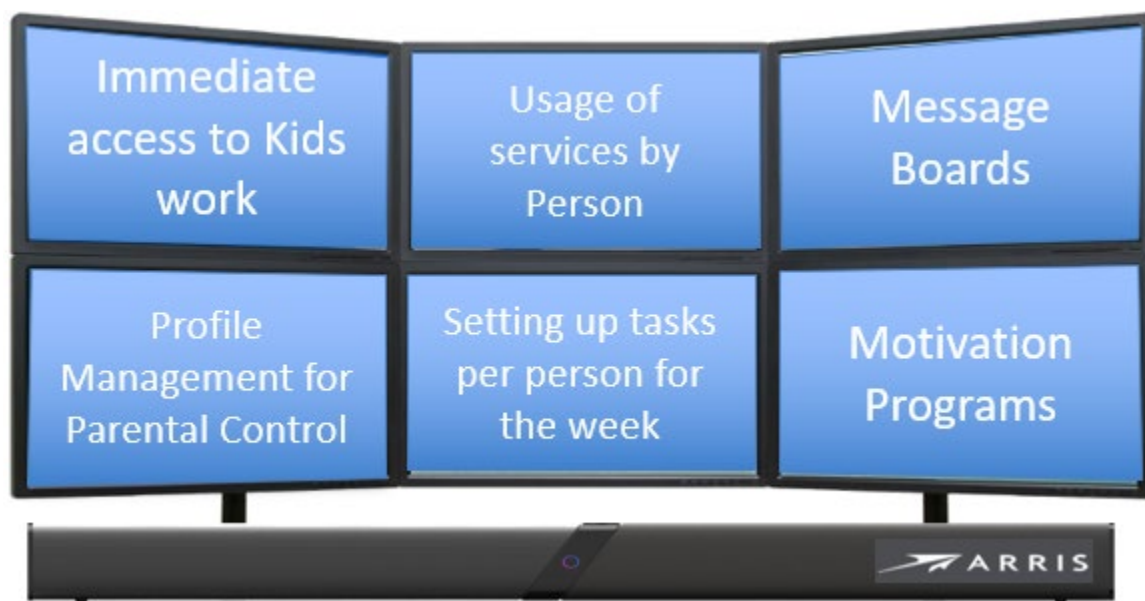


Figure 29 - People Management Skills

2.2.10. Security Skills – Physical and Cyber Security

A hugely important range of skills will be the ones that protect the home from Physical and Cyber security threats. These skills will provide the visual feedback on the screen via notifications , camera displays , sensors running low on batteries, faulty , stats of IP attacks on GW or modem that day , failed associations with Wi-Fi AP, currently connected devices in the home, assessment of security threat from those devices. The security skills will be designed to be simple and assuring and not too verbose with the 200+ Cyber security attacks on a typical household each day which are mitigated by Firewalls and other s/w running in the GW or Access point. We can envisage in the future the ‘Jarvis or Friday’ Assistant avatar giving us human friendly updates on our house, devices and other security end points.



Figure 30 - Security - Physical and Cybersecurity

2.3. Add the key Operator provided Skill – Customer Support Replacement – Self Directed Self Help

The primary skill that needs to be added by Operators for their customers is the migration of all initial engagements with the Consumer from a Visual Skill self help portal. Pivot the entire care system to leverage the SMD connection with the consumer with natural voice driving the engagement on troubleshooting, adding new services and general informational updates.

Start simple with notification engines on the SMD for Operator to Consumer messaging

- “You need a Wi-Fi extender as we have seen some degraded Wi-Fi performance in the home” – we are sending a device to you

Then add some AI chatbot engines to work with improved voice NLU response solutions in text and in voice feedback – towards full conversation engagement with a smart AI Assistant representing the Cable Operator in first customer engagement.



Figure 31 - Visual Self Help Assistant - and Skills

2.4. Communications Services – Calling from SMD , Video Conferencing from SMD

With the addition of microphone and speakers – the SMD becomes the best handfree telephone in the house. Not only that but it will allow the leverage of the Address Books of the Google or Amazon or Operator service that runs the Voice calling solution. This service goes far beyond the simple caller id implementations that have been done to date on STB systems and allow the incoming calls to be answered with just using your voice or the remote control RCU for the SMD. This improves handfree calling fidelity from the family to the grandparents and also to caregivers as we layer in on communications services with loved ones and caregivers in aging in place, disabled home occupants. It can also leverage features voice features like Amazon Dropin and Announcements providing a direct conduit to the home audio environment as well as allowing text to speech services for blind and poor sight occupants.



Figure 32 - Using the SMD to make and receive voice calls

With the addition of a camera – the SMD enabled TV platform can also be used for multi way discussions with caregivers and other remote learning or tele presence type solutions.



Figure 33 - Using the SMD to host multiway calling

With the ability to develop applications on the platform like Together TV where physically separated family members or friends can enjoy a movie synced to their viewing and also allow direct voice or video discussion with each other in a movie friendly skill.



Figure 34 - Using the SMD Skill to host multi home together TV solutions

2.5. Add a Camera to SMD and TV environment and UX

One of the longest running questions is should a video camera be included with the SMD experience. We know that users are more comfortable now with video cameras on their personal (Phone) and Tablet and Laptop devices and mechanisms exist to cover the camera when in private mode. The TV environment has been hit and miss (mostly miss) for the use of cameras. The STB also has not been a good demarcation for a camera due to its location challenges (in cupboard), behind TV etc. A couple of new propositions are being reviewed which will need to be tested for consumer acceptance

- Added Camera to the SMD via USB3.0 or HDMI interface. This allows the user to also physically remove the camera if they have privacy concerns.
- In a Soundbar form factor SMD. The size and location orientation of the SMD Soundbar could make it possible for a Camera to be located properly for armchair / sofa coverage. Of course such a camera would have a physical privacy shutter as well as s/w tools to validate camera in privacy mode.

Adding the camera will also allow another level of sensory coverage in the room and drive the rationale for putting video DSP for ML/AI analysis of high bitrate , high capacity video frames in the SMD. Equally though it facilitates video calling as well as Facial Recognition based parental control – which by themselves are good applications and skills that consumers will value.



Figure 35 - Add a camera when requested

2.6. Data Driven Customer Experience from the SMD and Home Sensory Network/Inputs

With the addition of the SMD and its sensory abilities (Presence, Service Engagement, BLE , Wi-Fi , Voice, Who is speaking, Audio sensory feedback, Time of Day, Haptics on remote control, camera image processing) a much deeper picture can be built up of the current environment, human status to allow a more focused and aware skill solution to drive deeper engagement with the consumer. This level of engagement has to be tempered with the right filters for privacy but in general the home owner and family members will see the value in this more tailored Customer experience from the Entertainment and Customer Care perspective. The inputs to all models of home modelling, human use patterns and anomaly detection can all be used to drive a better and more effective response from the actions and skills as part of the home learning process. These additional services we believe will be seen to add value to the occupants daily life and they will see this also reflected in the efficiency of any virtual assistant who gets to know the families habits, dislikes and likes so that the right entertainment packages , skills offers and other Operator supplied or curated services can be as effective and as high value for them as possible.

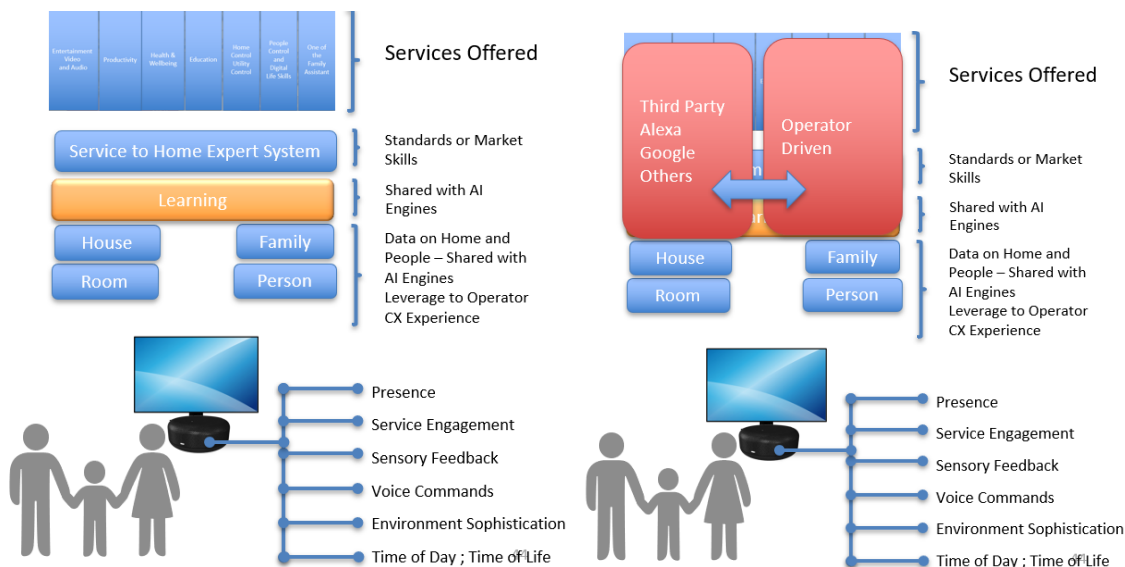


Figure 36 - Data driven Skills and Customer Experience

Conclusion

The Cable Operator has long seen that there are two 180 degree poles on their future business directions. At one pole end focus more on connectivity and the network delivery (the very bluntly term 'Become a dumb pipe'. At the opposite end of the pole – get a deeper engagement with the consumer on services beyond the Voice Video Data and Mobile packages of today. This next level of immersive engagement with the consumer has to put the consumer in control of pulling in all the next level of Smart Digital Life into their homes , securely and tailored to their pocket and lifestyle. As technologies like

- Smart Screens using flexible OLED get bigger and bigger to wall size
- Voice and Visual Assistants mature
- Sensory networks based on RF derived motion, Audion inputs and some visual AI processing get more embedded in the home and the AI/ML can use their inputs

A new level of sensory driven Customer Experience can be offered where the consumer will truly value this technology assist to their daily lives and for the additional sensory information they allow the return from it is clearly understood and utilized.

However, all this now starts with the switch from thinking about STB as a TV video decoder input and more as a device that will allow the software elements to grow to create this new data driven customer experience. This is now the era of the Smart Media Device and in 2019 we will see the first service provider devices launch with 2020 the year when more are deployed and announced. This will further drive innovation in Visual Skills to create this new input to action experience for the consumer.

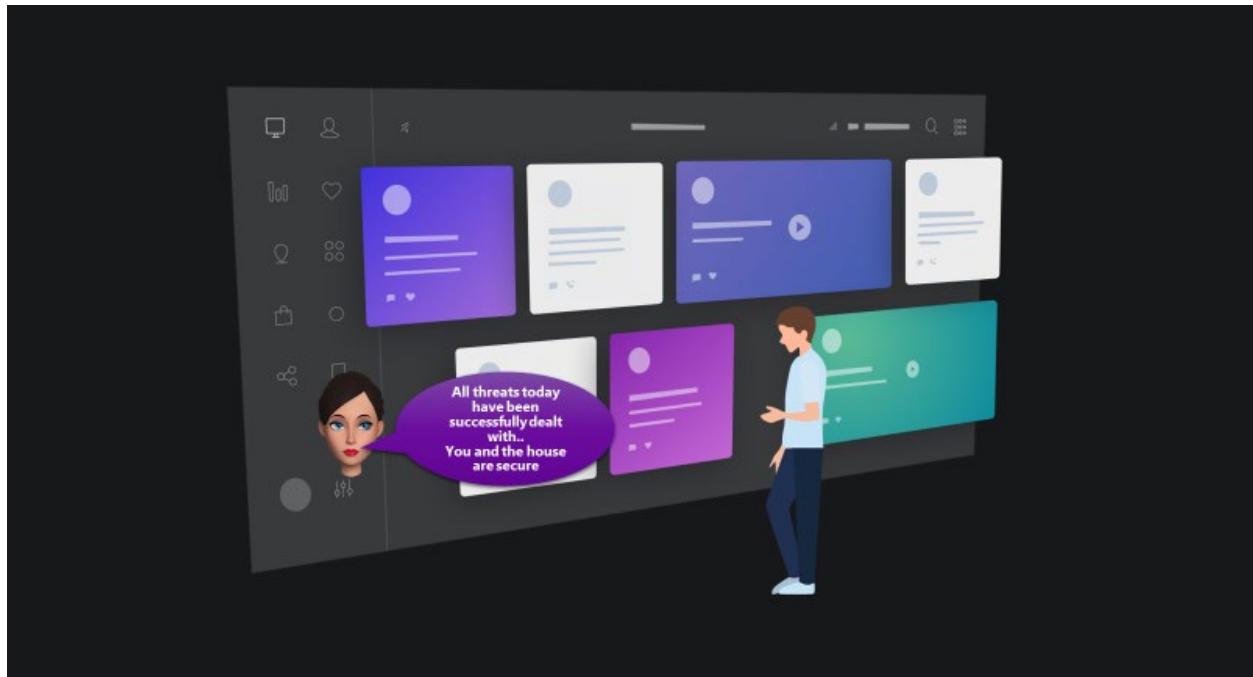


Figure 37 Future "All Wall" Command Center in main room in Home

New home network

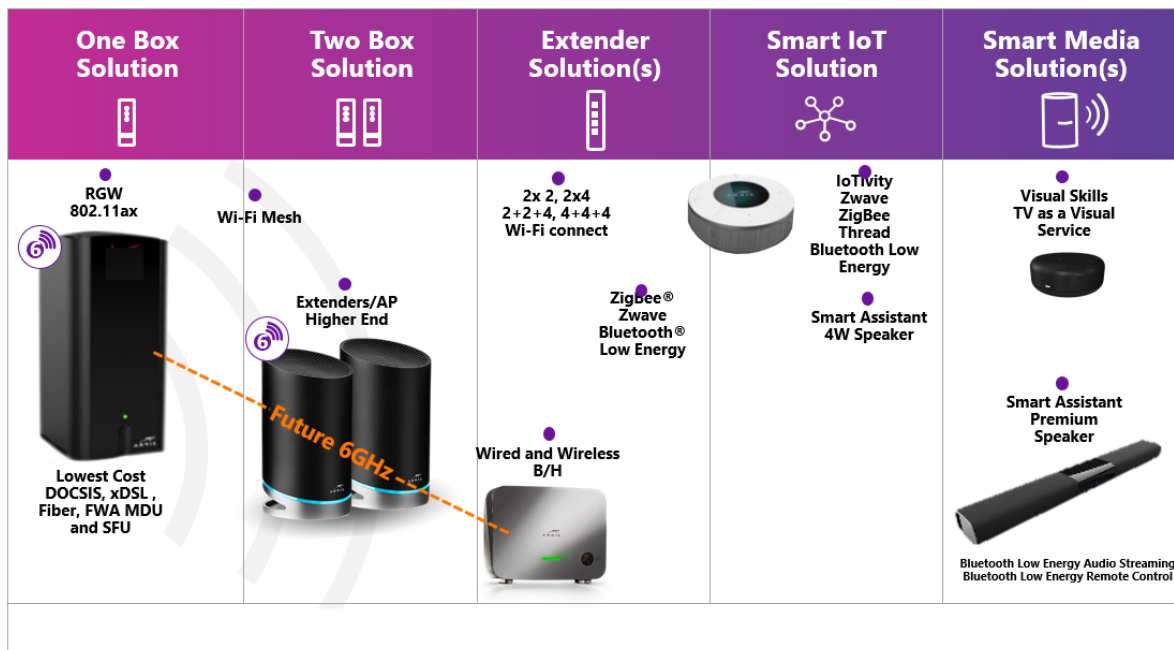


Figure 38 Potential Next Generation Home Architecture

Abbreviations

AP	access point
bps	bits per second
FEC	forward error correction
HFC	hybrid fiber-coax
HD	high definition
Hz	hertz
ISBE	International Society of Broadband Experts
SCTE	Society of Cable Telecommunications Engineers
STB	Set Top Box
SMD	Smart Media Device
AVS	Alexa Voice Services
ML	Machine Learning
AI	Artificial Intelligence
OLED	Organic Light Emitting Diode
HDMI	High Definition Multimedia Interface
BLE	Bluetooth Low Energy
RCU	Remote Control Unit
USB	Universal Serial Bus
IOT	Internet of Things
IFTTT	IF This Then That
UX	User Experience
CX	Customer Experience
UI	User Interface
ASR	Advanced Speech Recognition
NLU	Natural Language Understanding
APL	Alexa Presentation Language