ADAPT OR DIE:
WHY PAY-TV OPERATORS MUST EVOLVE THEIR VIDEO ARCHITECTURE

| INDUSTRY REPORT |

Harish Reddy – *Special Correspondent to Videonet. Harish has over 15 years of experience architecting, developing, and operating software solutions across numerous industries. He has spent the last 6 years consulting in the pay-TV industry on a variety of "Future of TV" issues.*

EXECUTIVE SUMMARY:

The video landscape continues to go through revolutionary changes and has become ever more competitive with more video consumption alternatives available than ever before. Traditional pay-TV operators are experiencing disruptive forces and to remain competitive, they will need to accelerate their innovations to meet the demands of their subscriber base.

This report is a culmination of market analysis and primary research of some of the leading / progressive pay-TV operators. In July 2014, Videonet conducted its "Planning for 2015" survey to understand some of the opportunities and challenges that operators are facing as they develop their video strategies during the pay-TV industry's transition to IP-based technologies. The results showed that pay-TV operators are well underway in their transition with a diverse range of both subscriber facing and back end infrastructure changes.

> " *There are so many projects in our pipeline that we have a hard time prioritizing.* "

The survey revealed that pay-TV operators are focused on initiatives to improve all aspects of their offerings based on four main areas in 2015: content, devices, experiences, and monetization. However, when asked to pick one specific focus area, operators overwhelmingly indicated a focus on initiatives to improve the subscriber experience.

Furthermore, the survey also highlighted that most pay-TV operators have begun to move forward with migrating their architecture towards a more cloud / virtualized architecture. The survey also indicated that in 2015, the vast majority of pay-TV operators plan to improve their content metadata and customer analytics capabilities.

Finally, one additional takeaway from the survey was that pay-TV operators have a vast set of activities planned for in 2015. Perhaps best stated by Thomas Helbo, CTO at Stofa, "There are so many projects in our pipeline that we have a hard time prioritizing."

Moving forward, pay-TV operators are facing one of the most transformational periods in the era of video. This report will help operators navigate through the changing landscape dynamics.

The remainder of this document will be divided into five sections:

I.   The Changing Landscape
II.   The Subscriber Centric Video Provider
III. The Video Architecture Evolution
IV.   Architecture and Operational Principles
V.   The Partnership Ecosystem

SECTION I: The Changing Landscape

The past 5 years has seen dramatic and transformative changes in video consumption. The emergence of free, transactional, and subscription alternatives to the traditional pay-TV provider have captured both mind and market share. Several examples highlight and remind us of this changing landscape:

1) 1 billion unique users visiting YouTube each month[1]

2) 100 hours of video uploaded to YouTube every minute[2]

3) 50 million unique customer relationships at Netflix[3]

4) 31 Emmy nominations for Netflix in 2014[4]

5) 20 new original programs at Hulu in 2013[5]

6) 6.62 Tbps of OTT video delivered at peak by Akamai during the 2014 World Cup final[6]

Supporting this changing landscape has been the evolution of the IP video delivery stack that continues to make the delivery of video outside of the traditional ecosystem easier. A sampling of technical changes include:

1) The mass adoption of smartphones, tablets, and other devices has put a video recorder and video player in the hands of virtually every consumer.

2) Last mile improvements in DOCSIS (e.g. CCAP) and fiber networks as well as the continued growth in LTE and Wi-Fi wireless networks has increased both the amount and ubiquity of bandwidth available for video consumption.

3) Technical improvements in the video delivery infrastructure in areas such as CDNs, adaptive bit rate streaming (ABR), and content encryption has supported the delivery of premium video content to devices of all shapes and sizes.

4) The emergence of the cloud infrastructure has facilitated the ability to create large, on-demand, and scalable infrastructures to ingest, process, and store video and create personalized experiences tailored to each individual.

In response to the changing landscape, pay-TV operators have launched multiple initiatives including the development of advanced IP and hybrid set-top boxes (STBs) as well as their own over-the-top (OTT) video offerings. However, as new service provider entrants become a part of our daily lives, continue to gain business and operational experience, and as the video delivery stack continues to improve, it is hard to imagine the competitive threat diminishing.

In fact, in a world where alternatives are just a "finger swipe" away, pay-TV providers will need to continuously innovate.

SECTION II: The Subscriber-Centric Video Universe

As the number of alternatives to traditional pay-TV expands, subscribers are in increasing control
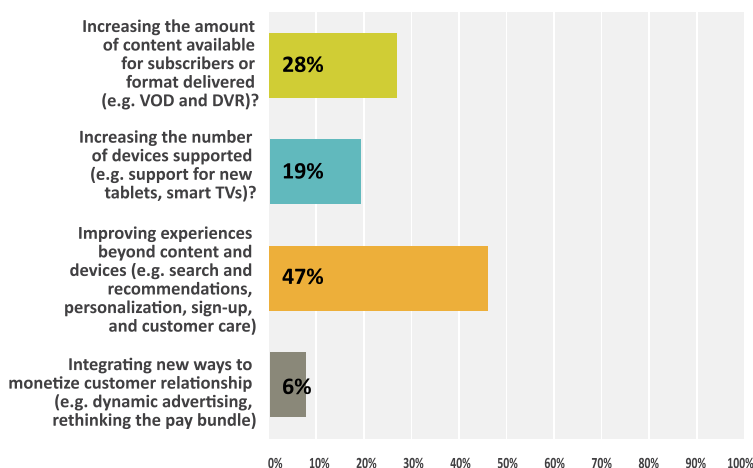
to pick and choose their video consumption options. Consequently, pay-TV operators need to become even more subscriber focused and provide the type of service that their subscribers demand.

One method for pay-TV operators to consider when examining the subscriber centric video universe and their offering is to break the video service into four components: (1) content, (2) devices, (3) experiences, and (4) monetization.
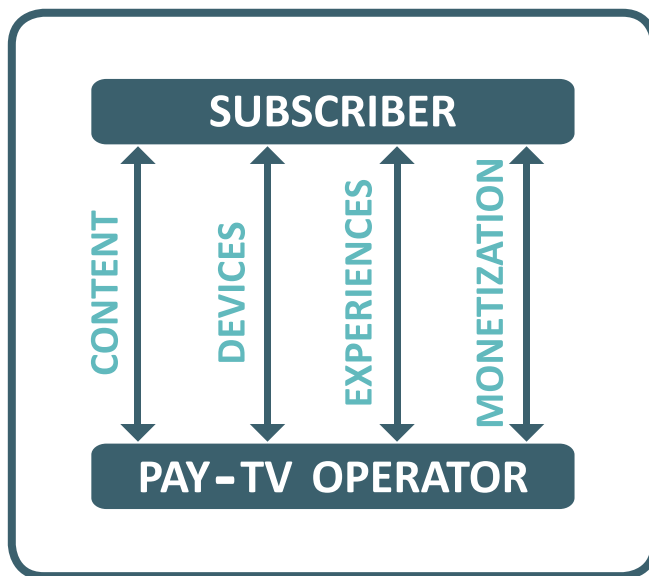
In Videonet's July 2014 "Planning for 2015" survey, leading pay-TV operators were asked to pick a primary focus area for 2015. Nearly 50 percent of pay-TV operators chose improving the customer experience.

For 2015, what part of the customer experience are you most focused on?

Increasing the amount of content available for subscribers or format delivered (e.g. VOD and DVR)?	28%
Increasing the number of devices supported (e.g. support for new tablets, smart TVs)?	19%
Improving experiences beyond content and devices (e.g. search and recommendations, personalization, sign-up, and customer care)	47%
Integrating new ways to monetize customer relationship (e.g. dynamic advertising, rethinking the pay bundle)	6%

Content

The last several years has seen notable changes in the market for video content. First, new entrants such as Netflix, Amazon, and Yahoo have entered the market. Second, negotiations between established free and pay-TV operators have become more complex and in some cases contentious. This is perhaps best highlighted by the 30-day blackout of CBS content for Time Warner Cable subscribers in August 2013 . These challenges have also occurred in discussions between pay-TV broadcasters and operators. One example that illustrates this is DIRECTV's decision to drop the Weather Channel for three months in 2014 during negotiations over pricing and content[8].

As content discussions are at risk of becoming more contentious, pay-TV operators will have to become judicious in the content they acquire and manage this against the other dimensions of the subscriber experience. To manage the increasing challenges of content negotiations, pay-TV providers will need to increasingly find and distribute the quality content that their viewers will enjoy, as well as understand the economic value that their broadcasters and content partners add to the subscriber experience.

> **"*Our TV product is supported on more than 400 different CE devices and whenever we make a UI change, we can make this available to our subscribers instantaneously.*"**

To do this, pay-TV operators will need to develop more intelligence about their subscribers. These insights will need to go well beyond understanding DMAs and zip codes and ultimately reach the tastes of each individual using its services. By developing deeper insights and more informed consumption clusters, pay-TV operators will then be able to develop a financial value of both existing and newly available broadcast channels.

Furthermore, these insights can then serve as an aid into more comprehensive content rights discussions around device, place, and time shifting rights as well as alternative monetization options.

As Thomas Helbo, CTO at Stofa, explains, "At Stofa, we rely on having major content available on-demand and on catch-up to entice consumers and keep them hooked on the service."

Devices

Virtually every game console, tablet, and smartphone sold today is capable of playing premium quality video and virtually every TV sold today is some sort of "smart" Internet enabled video playing device. By 2017, the number of OTT video capable devices will exceed the globe's human population . Undeterred by the already large number and variety of connected device options, Amazon introduced Fire TV in 2014 and Google and Apple continues to look for ways to deepen their presence in the living room and beyond.

As consumers become increasingly comfortable playing video beyond the STB and living room, pay-TV providers will need a formal strategy to deal with this highly fragmented device landscape. This strategy will start by determining if their content should extend beyond their own STB and if so, how.

At its most basic, pay-TV operators could just be an authenticator and support its broadcast partners. Alternatively, pay-TV operators could look to extend their own branded experience beyond the STB to unmanaged devices. Some pay-TV providers are thinking even further and have decided to eliminate the STB completely and embrace the CE vendor ecosystem.

For example, Dutch pay-TV operator Ziggo decided to develop a pay-TV solution that involved a cloud-based user interface and a thin-client on the CE device. As Eric Meijer, Senior Innovation Manager at Ziggo, explained, "Through this solution, our TV product is supported on more than 400 different CE

devices and whenever we make a UI change, we can make this available to our subscribers instantaneously."

Pay-TV operators that decide to extend their experience beyond the STB will then need to decide what content will be available (i.e. linear, VOD, or DVR) as well as work through the financial, technical, and operational issues for reaching these devices including:

- Content rights issues
- Device penetration rates
- Incremental operational and customer care costs
- Infrastructure costs such as content ingest, transcoding, piracy prevention, and encryption costs
- Initial and ongoing development costs

Experiences

As reflected in the survey, pay-TV operators are thinking beyond just their content and devices and looking at the totality of the experience they offer. From soup to nuts, pay-TV operators will need to provide a compelling experience. A series of basic customer use cases—ranging from onboarding to video playback experience—highlight the capabilities pay-TV operators will need to consider beyond just content and devices.

As Randolph Nikutta, Leader of New Media at Deutsche Telekom said, "The need for good experiences, such as providing good and quick access to content through search, recommendations, and personalization, will help define the attractiveness of product."

1) **Onboarding** - Ultimately, the pay-TV experience starts with the initial sign up and registration process. For example, can the subscriber simply use the service, do they need to register and pay on the Internet, or does the subscriber need to call the call center? Once registered, the next step is how the subscriber accesses content. For example, does the subscriber need to use a managed device or will any device do? Furthermore,

how is the device provisioning process managed? Do the devices self-provision, do subscribers need a login, access code, or call center support.

2) **Content Discovery** – As the volume of available content and consumption alternatives (e.g. linear, catch-up VOD, long-tail VOD, and DVR) continues to grow, most pay-TV subscribers still use the traditional linear electronic program guide (EPG). However, the subscriber's inability to find relevant content, whether it is sports, drama, ethnic, kids, or reality, is the equivalent of not having the content. To manage this, pay-TV operators must consider how to help and support subscribers find relevant content.

> " *Helbo sees their pay-TV service coupled with a total redesign of their user experience to engage the new "connected consumer" as the next key challenge. Helbo would like to build a "transparent EPG" so consumers instantly find what they want regardless of when it was aired.* "

3) **Customization and Personalization** – Beyond simplifying the process of content discovery, as we approach a world where every person has his own connected device, pay-TV operators will need to examine how they support letting their subscribers customize their experiences and how this experience is ported across devices. Whether it is segregating parent's, teenager's, and children's content, allowing subscribers the ability to create personalized profiles to indicate

preferred content, or providing a unique set of alerts, pay-TV operators will need to consider how to let subscribers tailor their experience to their personal taste.

4) **Video Playback Experience** – Once content is found and playback begins a subscriber's experience does not stop and operators still have opportunities to offer features and functionality. At its most basic, this includes the ability to pause, fast-forward, and rewind through content. Looking forward, pay-TV operators can offer more advanced features such as device switching, content location bookmarking, or content sharing. Additionally, operators can consider integration of the second screen experience whether through interactivity or content augmentation.

5) **Customer Care** – Supporting the entire subscriber experience is the pay-TV operators' approach to customer care. While pay-TV operators should do everything in their power to make the user experience as simple and delightful as possible, as pay-TV operators innovate and release new features, they will need to develop and manage communication channels to help the subscriber troubleshoot or become more familiar with additional capabilities whether through e-mail, social media, video tutorials, or direct human contact.

Monetization

Finally, pay-TV operators will need to continuously evaluate their approach towards monetization. As subscribers become increasingly aware and use "free TV" options from YouTube, the low price, no advertising, and subscription options from Netflix or Amazon, or transactional options from Apple and others, pay-TV providers will need to become much more deliberate and potentially innovative in how they monetize their consumer relationships. Potential areas that operators could consider supporting include rethinking the pay-TV bundle, how it packages features and functions, or the

adoption of more directed targeted advertising. Touching the pay-TV bundle has often been considered a third rail of the pay-TV industry and indeed changing the bundle might be challenging. However, as competitive options emerge that do meet the specific consumption needs of subscribers emerge, pay-TV operators may need to consider their approach to the bundle including offering "ad-hoc" access to certain content. Thinking beyond the bundle, as pay-TV operators migrate to a more IP-based architecture, they may also be able to consider how to integrate more niche-based content to satisfy their subscribers' interests.
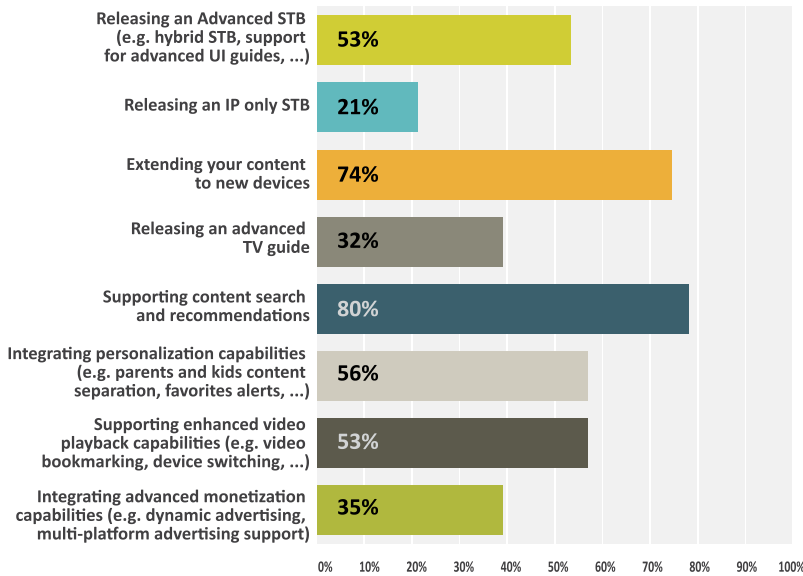
Beyond just the channel bundle, pay-TV operators may start to look at how they monetize various features and functions that they offers. For example, operators could consider improved ways to monetize its VOD or network PVR options by offering an ad-free version or by creating a service that is just an OTT offering.

Lastly, pay-TV operators should continue to investigate alternative forms of monetization. For example, as operators develop a deeper understanding of the type of content their subscribers are watching and also evolve towards next generation platforms, pay-TV operators will become better positioned to deliver more targeted advertising. Extending this ever further, pay-TV operators may be able to extend the subscriber's experiences even further by offering direct integration with e-commerce capabilities.

> " *The current TV platform is not agile enough. We need to be faster.* "

In Videonet's "Planning for 2015" survey, leading pay-TV operators were asked about specific planned customer facing initiatives they had planned for 2015. The results showed a great deal of variety of planned initiatives and no specific one was favored relative to others. That said, two specific capabilities stood out as operators looked into 2015: (1) Extending content to new devices and (2) Incorporating search and recommendations.

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For 2015, do you plan on releasing any of the following customer facing capabilities? (You can tick more than one box)

Capability	%
Releasing an Advanced STB (e.g. hybrid STB, support for advanced UI guides, ...)	53%
Releasing an IP only STB	21%
Extending your content to new devices	74%
Releasing an advanced TV guide	32%
Supporting content search and recommendations	80%
Integrating personalization capabilities (e.g. parents and kids content separation, favorites alerts, ...)	56%
Supporting enhanced video playback capabilities (e.g. video bookmarking, device switching, ...)	53%
Integrating advanced monetization capabilities (e.g. dynamic advertising, multi-platform advertising support)	35%

SECTION III:
Video Architecture Evolution

As pay-TV operators look forward, the laundry list of new features and functions on the roadmap is ever growing. Whether it is voice control, content recommendations, second screen synchronization, social media integration, new devices, personalized UIs, UHD/4K TV, download-to-go, or integrating new monetization opportunities, the list of potential new features and functions is seemingly endless.
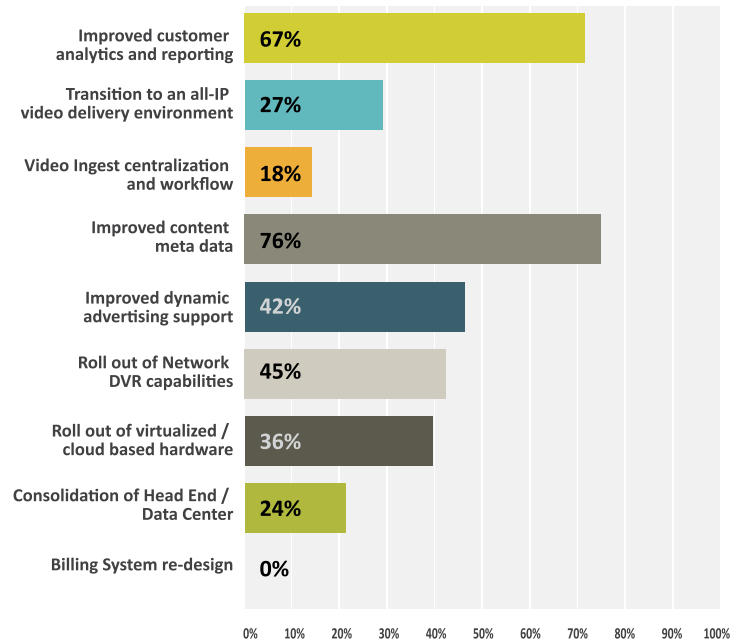
As pay-TV operators look to provide compelling content and experiences to an increasing number of devices, the current TV architecture is potentially limited in providing the desired functionality at the desired pace that business units want. As Nikutta at Deutsche Telekom commented, "The current TV platform is not agile enough. We need to be faster."

Consequently, in many cases, pay-TV operators will need to review their subscriber facing roadmap and develop a series of technical roadmaps to evolve their architecture into one that is more capable to meet today and tomorrow's competitive landscape. Everything from content ingestion, device registration, content discovery, ad insertion, video playback and even customer care and billing should be

under consideration.

In Videonet's "Planning for 2015" survey, leading pay-TV operators were asked about video infrastructure improvements that they had planned in 2015. Just like with customer facing improvements, the results showed that pay-TV operators had a variety of infrastructure initiatives planned; however, two specific areas stood out from the survey: 1) Improved customer analytics and reporting and 2) Improved content meta data

Do you plan on making any of the following video infrastructure changes in 2015? (You can tick more than one box)

Change	%
Improved customer analytics and reporting	67%
Transition to an all-IP video delivery environment	27%
Video Ingest centralization and workflow	18%
Improved content meta data	76%
Improved dynamic advertising support	42%
Roll out of Network DVR capabilities	45%
Roll out of virtualized / cloud based hardware	36%
Consolidation of Head End / Data Center	24%
Billing System re-design	0%

Furthermore, as pay-TV operators evaluate their technical roadmap and rethink their video architecture, they also have a unique opportunity to incorporate the emerging IP-based hardware and software solutions and become more software centric. By doing this, pay-TV operators have the opportunity to decrease their reliance on dedicated hardware and software components and begin to take advantage of some of the flexibilities in today's software architecture that allows for a more plug and play approach.

Some of the new hardware and software capabilities that have emerged include:

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1) **API / Services Driven Software Architectures** – As hardware speeds have increased, pay-TV operators can begin to look at an API-based approach to support all aspects of video delivery. By decomposing the video architecture into its components, developing them as individualized services, and then integrating them through APIs, pay-TV operators can move away from a monolithic code base and become more component and services oriented.

   At its most basic level, the concept of APIs and services can be thought of at the macro component level, such as encoders and ad splicers. However, this can then be further broken down broken down into more detailed components like video ingest management, metadata manage-ment, voice to data translation, or cus-tomer data management.

2) **Agile Software Development** – Part and parcel of the API / services approach, is the adoption of agile software development processes. There are many concepts involved in agile development that should be considered, including the role of storyboarding, continuous collaboration, and compressing requirements, development, test, and release cycles which can help to speed up the process of launching new features.
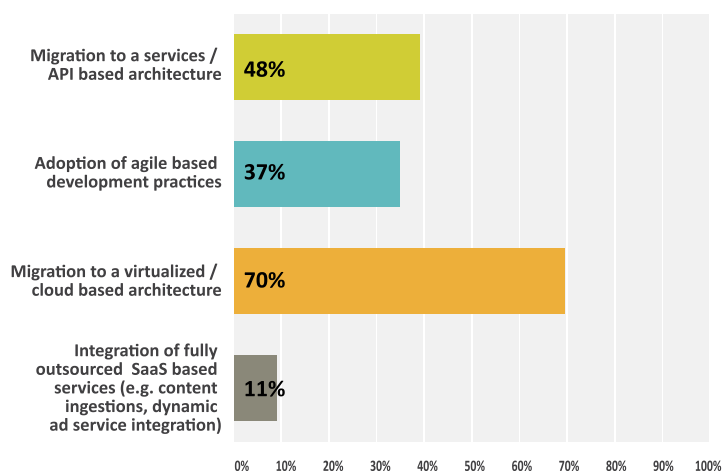
   However, taken a step further, operators that can integrate agile development with a decoupled API-based architecture can develop and release features into produc-tion more quickly through the support of parallel development and releases that then integrate through APIs.

3) **Hardware Virtualization** – Another benefit of increased hardware speeds is the ability to transition from dedicated to virtualized hardware devices in the video architecture environment. As more and more software is able to run on virtualized machines, pay-TV operators will be able to transition from specialized hardware to commoditized hardware in their data center.

4) **Elastic Cloud** – The availability of high throughput bandwidth supports extending hardware virtualization one-step further and allows pay-TV operators the opportunity to incorporate cloud and elastic cloud technologies. Through the use of the cloud, pay-TV operators can begin to reduce their reliance on specific facilities and integrate all of their facilities into a part of larger cloud architecture.

5) **SaaS Vendors** – Lastly, the emergence of software-as-a-service (SaaS) vendors, allows operators to consider completely outsourcing certain capabilities such as content management or search and recommendations to best-of-breed operators that can manage certain processes in their entirety. By integrating SaaS vendors into their video architecture, pay-TV operators have the opportunity to completely outsource certain functions.

In Videonet's "Planning for 2015" survey, Pay-TV operators were asked about planned technical architecture changes for 2015. The survey results indicated that pay-TV operators are actively moving forward with rethinking their architecture and that an overwhelming number of them have plans to migrate to a virtualized / cloud-based architecture.

As you look at improving your video delivery architecture, do you plan to introduce any of the following technical architecture changes to your business? (You can tick more than one box)

Category	Percentage
Migration to a services / API based architecture	48%
Adoption of agile based development practices	37%
Migration to a virtualized / cloud based architecture	70%
Integration of fully outsourced SaaS based services (e.g. content ingestions, dynamic ad service integration)	11%

The incorporation of the latest software and hardware architecture approaches has the potential to provide pay-TV operators several benefits.

1) **Faster Development Time** – by incorporating an agile and an API / component based approach, pay-TV operators can let multiple teams work in parallel, and integrate together through defined APIs. Through an API / agile approach, pay-TV operators can improve their development, release, and test processes and more dynamically release new features and capabilities.

2) **Easier Deployment and Future Extendibility** – as pay-TV operators transition towards virtualized hardware, operators will then be able to separate the hardware and software functions. For example, software operations teams will no longer be dependent on buying hardware and then having hardware teams install and operate it. Instead, teams will be able to simply provision devices on their own and release their code to a virtualized hardware device.

   This will then allow hardware operators to focus on developing a more gener-alized physical hardware architecture within its data centers and do monitoring and capacity planning on an aggregated basis.

3) **Focus on Core** – the emergence of SaaS vendors allows pay-TV operators the opportunity to completely rethink some parts of their video architecture and outsource entire aspects. Doing this will then allow pay-TV operators the opportunity to treat certain components as a complete "black box" and transfer entire portions of video operations to another party.

4) **More Efficient Hardware and Data Center Usage** – Through the use of virtualization and the elastic cloud, pay-TV operators will be able to better manage their overall hardware requirements and avoid overprovisioning as they will be in a better position to scale up and down services based on immediate demand.

5) **Software Defined Factories** – Thinking forward, eventually pay-TV operators could deploy software-defined agents. These agents could then monitor for certain conditions, such as content that needed encoding, spin up the necessary virtual machines to manage the entire process, and then spin down the process once completed.

SECTION IV: Operational and Architectural Design Principles

As pay-TV operators evolve their video architecture and incorporate the latest technologies and technical approaches to support enhancing their subscribers' experiences, one byproduct will be numerous changes in the operating models for pay-TV operators. For example, traditionally operators could look at and monitor video like a stream as it moved from hardware device to hardware device on its journey to the STB. However, as video increasingly is processed on virtualized devices that are deployed in the cloud and then delivered to unmanaged devices on unmanaged networks, traditional forms of video operations will need to evolve as well.

Furthermore, as pay-TV operators look to evolve their video architecture, operators should consider looking beyond solving for the immediate problem and also prepare to integrate new features and functions. As operators decompose their architecture and the underlying capabilities, they should consider evaluating their solutions and operational approaches across five architectural principles: flexible, scalable, reliable, secure, and observable.

Flexible

As pay-TV operators migrate to their next-generation video architectures, operators will need to ensure that they can quickly support new features and functions whether that means replacing or evolving various elements in their

video architecture.

The potential needs around flexibility can be seen at various points in the entire video delivery chain. For example, when ingesting content, how easily can content be re-processed to support a new bitrate or encryption scheme or when looking at devices, how quickly can an engineering group support a new device. Additionally, when looking at the UI, operators should consider how they incorporate flexibility such as supporting limited release UIs or A/B testing with minimal engineering effort.

Scalable

In addition to flexibility, operators should consider scalability in their next-generation video architectures.

Just like with flexibility, the need for scalability can be seen throughout the video delivery stack. For example, with regards to ingest, operators should consider how much content can be transcoded per day, how well the CDN can cache and deliver content, and how quickly these processes can scale based on needs.

Beyond the back-end infrastructure, pay-TV operators will also need to consider different extreme cases, such as situations when all subscribers are simultaneously watching the same content or conversely watching a unique piece of content. Operators will need to design, develop, and test for these extreme events taking into account issues around bandwidth consumption, simultaneous channel changes, or dynamic ad insertion.

Reliable

As delivery increasingly moves from highly managed to unmanaged networks and environments, and as the number of features and functions available to the user increases, developmental and operational complexities are bound to increase. In the face of an ever more complex environment, operators will need approaches to balance the need to be quick to market with delivering a high quality solution

that is always available.

To do this operators will need to proactively designs remedies for potential failure conditions into its system both during development as well as within production. Potential starting points include the adoption of "devops" engineering patterns that incorporate frequent release cycles with solid and automated unit and functional testing patterns as well as closer interactions between development and operational teams.

However, taking this further, as operators transition to a more virtualized architecture, where monitoring can become more difficult, pay-TV operators may need to be more aggressive and actively introduce failure into their systems to actually help increase uptime. One example of this is Netflix's approach with Chaos Monkeys[10].

Secure

As we look forward into next-generation architectures, pay-TV operators will need to become much more conscience of their revenue security model. Two examples of where this manifests itself are around how pay-TV operators manage their video content and how they manage subscriber intelligence data.

As pay-TV operators increase the amount of premium content available to unmanaged devices, security of its content will become increasingly important and the pay-TV providers will need to consider how it secures its content (e.g. meeting MovieLabs content protection guidelines for UHD content). For example, four issues pay-TV operators should focus on with regards to content security include:

- User Authentication – is the person accessing the content authorized to view it
- Content Encryption – is the content properly encrypted as it is delivered to the user's device
- Device Security – is the device properly secure to prevent improper access to the content once the content has reached the device
- Content Forensics – is content properly watermarked or fingerprinted so operators

can pursue illegal distribution of material

One of the benefits of the emerging advanced video architectures is an increasingly detailed understanding of the video consumption patterns of its subscribers. The ability to understand detailed consumption patterns will allow pay-TV operators to offer a more customized experience in ways not previously possible. However, as pay-TV operators collect more subscriber data, they will also need to become more sensitive to privacy considerations both in terms of the data that they collect but also with regards to how the data is used.

Observable

Lastly, pay-TV operators will need to develop the skillset to observe and measure their architecture. At its most basic, this means developing the appropriate dashboards and metrics to monitor and measure all of the video delivery components and ensure that the system is running as designed. For pay-TV operators, doing this will involve developing the ability to monitor the overall cloud infrastructure, the launched virtual machines and their uptime, and then the software and services running on the virtual machines.

Extending this further, operators should consider developing the operational capacity to automatically monitor capacity and the ability to then scale up and down services based on subscriber demand or leverage "spot instances" for non-time sensitive tasks. Part and parcel of this is the need for operators to develop the techniques to dynamically collect and examine system outputs such as log file data to examine for, identify, and remedy hidden anomalies within their architecture.

SECTION V:
The emerging partner ecosystem

As pay-TV operators move forward and plan their video architectures evolution, inevitably, they will need to find, identify, and select the appropriate solutions that fit their specific needs. To do this, operators will need to build an ecosystem

of partners who have the capacity to manage both the existing capabilities such as encoding, encryption, and ad splicing as well as newer capabilities such as recommendations, CDN vendors or UI specialists.

For example, Meijer explains, "At Ziggo, we brought together 15 different partners and because of our aligned goals, we successfully launched and continue to maintain our solution. Through this effort, today, a new subscriber can walk into a retail store, purchase a Ziggo enabled CE device and smart card, and become a Ziggo customer a few hours later."

As pay-TV operators work with potential partners, they should consider several factors when looking to develop an integrated solution:

1) **Capabilities to Meet the Operational and Architectural Principles Laid Out in Section IV (Operational and Architectural Design Principles)** – In other words, does the potential partner have a solution that is flexible, scalable, reliable, secure, and observable.

2) **Prior Experience Working and Integrating Together** – When looking to integrate various partners together, pay-TV operators should review whether the potential partners have a track record of working together as well as how well the various components will integrate together.

3) **Aligned Interests** – Pay-TV operators should validate that the interests of potential partners align and is mutually beneficial. Doing this can help pay-TV operators validate the existence of a true partnership and the ability for all parties to help and contribute during both the good and challenging phases of development.

4) **Long-Term Roadmap and Vision** – Lastly, pay-TV operators should understand the roadmap and vision of potential partners and validate that these will align over the long-term.

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CONCLUSION

The world of video has arguably gone through more changes in the last five years than in the prior 50 years. Video consumption has quickly moved from the living room, to the laptop, and to the smartphone and is more pervasive than ever before.

As competitors decrease the length of their innovation cycles, pay-TV operators will also need to aggressively move forward and develop an infrastructure that can continuously evolve to satisfy subscriber demands. The emergence of software-based solutions that can run on IP-based hardware is a critical step in supporting this. By transitioning to a more software-based architecture, pay-TV operators will be better positioned to speed their innovations cycles, manage capital and operational costs, and consequently, they will be better positioned to adapt to future requirements.

Beyond this, pay-TV operators will also need to develop an ecosystem of partners that can provide the required components to deliver a high quality experience. Whether their partners' solution is tightly or loosely integrated into the overall video architecture, pay-TV operators will have to find and integrate a set of solutions from various partners to create a complete solution.

Indeed, pay-TV operators that successfully evolve their architecture have a tremendous opportunity to lead the industry forward by creating unique and compelling experiences for each and every one of their subscribers. ■

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