Abstract: The broadcasting environment has been radically disrupted, facilitated by the digital convergence of technologies and ubiquity of broadband access. This promotes a move from ‘one-size-fits-most’ to a focus on the specific demands of individuals. In this new ecosystem, the service delivery platform (SDP), enabled through the cloud, creates an open infrastructure for web services to the TV or other connected media devices; in essence combining broadcast and broadband delivery of content and applications directly to the individual consumer. It leverages standards based web formats to create and deliver personalized, interactive content and services. The Hybrid Broadcast Broadband TV (HbbTV) standard now evolving in Europe is an example which illustrates the tremendous potential of this emerging technology for broadcasters. While enormously beneficial, these new services create immense challenges in managing content channels, service life cycles, consumer relationships, business models, and third party services. Interestingly, telecom providers have successfully met many of these types of challenges in their mobile services business over the last few decades by utilizing service delivery platforms (SDPs). This paper explores how a cloud-enabled SDP can support the ubiquitous delivery of rich, personalized entertainment services and content directly to the individual consumer’s device.

Key words: broadcast/broadband tv, cloud, service delivery platform.

1. INTRODUCTION

The increasing deployment of broadband networks is creating new opportunities to distribute high-value content to consumers in ways that transcend the traditional broadcast model: personalized, localized, on demand, on any device. Broadcasters must now take advantage of this next generation of distribution technologies to compete with the emerging over-the-top Internet distribution services such as Google™, Youtube™, or Netflix ™.

In this evolving model broadcasters can still take advantage of the fact that broadcast distribution remains, for now, the most efficient and accepted way to distribute content to a very large audience. The HbbTV Standard [1] being introduced in Europe now combines broadcast distribution with personalized, localized, on-demand content.

As broadcasters begin to deliver individualized services to consumers, they are faced with an entirely new set of problems. Management of consumer profiles, content adaptation for a large variety of devices, management of third party service relationships, and service life cycle management are just some of these problems. Historically, the telecom industry has addressed many similar types of problems over the last two decades during the creation and growth of mobile data services. Through this process, the service delivery platform (SDP) emerged as a proven infrastructure to manage content, services, and devices in an efficient and scalable way. In today’s environment, cloud technology is evolving into a solid base to deploy SDPs in a cost-effective manner with low entry cost, efficient operational capabilities, a wide range of utility services, and highly scalable capacity provisioning. This union of technologies, business models, and raw computing power now creates the potential for original and creative revenue streams which are yet to even be contemplated. The true value of a cloud-enabled SDP is the flexible, scalable, and light-weight footprint that enables providers to focus on their core business while remaining highly nimble and responsive to the rapidly shifting demands of the connected consumer.

2. DIGITAL CONVERGENCE ENABLES NEW DISTRIBUTION MODELS

2.1. Technical developments

Digital convergence can be characterized as the confluence of several developments. The Internet Protocol (IP) has become the dominant network protocol, broadband networks are becoming ubiquitous, and all content is becoming digital so that it can be transported over IP broadband networks.

The common use of the Internet Protocol has freed the content from specific distribution channels, enabling many paths from the source to the consumer; over cable modem connections, DSL or fiber networks, and mobile broadband networks. The dominance of the Internet protocol has created the demand for devices that specifically connect and access content, like set-top boxes, media centers, mobile devices, and IP-enabled TVs.

High-speed broadband networks with one-on-one access have not only created a new distribution system, but are also supporting interactive, personalized services on demand, virtually removing
many of the constraints inherent in traditional broadcast distribution. The number of channels is increasing rapidly, and new forms of content such as games and social applications are now mainstream. The emergence of mobile broadband is revealing an era of accessible content anywhere and anytime, creating both technical challenges as well as tremendous new business opportunities.

2.2. Business developments

The Internet has relaxed the tight linkage of content across the distribution channels like broadcast or cable networks. It is now possible for almost anyone to distribute content and applications to devices capable of accessing the Internet. This has led to alternate distribution channels, from on-demand Internet access and IPTV, to over-the-top distribution and new broadcast models. In this emerging ecosystem, different distribution paths supporting two-way interactions and feedback loops are finally enabled.

Examples of these new service types are Hulu™, YouTube™, Netflix™, Freeview™, Verizon FIOS™, or Vudu™. Undoubtedly, new service models will continue to appear, creating a period of great uncertainty for some time to come, until the winners of this struggle emerge.

While giving consumers new choices for content and services, this explosion of channels has led to a fragmentation of audiences which is has already started to erode the traditional advertising model. This has been clearly demonstrated by the significant shift of advertising spend toward online and digital presence. Now the possibility of focusing on a person rather than just a type of content stream brings advertisers one step closer to their ‘holy grail’. Personalized content access solidifies the promise of discrete targeted advertising bringing increased revenues in the future. But for now, many content distributors have to contend with the disruption of “broadcast dollars”, which are now being replaced by “Internet pennies”.

2.3. Hybrid Broadcast Broadband TV – an Internet distribution model for broadcasters

Adapting to these developments can be a challenge for broadcasters. When exploring the latest distribution channels, business models, and new types of content, it is critical to build on inherent strengths and competitive advantages. The high-quality content traditionally from broadcasters has created strong brand values. Fortunately, the existing content supply chain allows for the creation of premium content, and broadcast networks are still the most cost-effective way to distribute content with mass appeal.

Hybrid Broadcast Broadband TV (HbbTV) is a major European initiative to combine the distribution efficiency of the broadcast model for popular content with personalized, localized, and interactive content. It creates an opportunity for broadcasters to provide entirely new content, and to engage the audience individually.

Fig. 1 Overview of the HbbTV infrastructure

HbbTV creates a linkage between digital broadcast distribution and broadband content access by embedding hyperlinks, or Internet URLs, into the broadcast stream. When the viewer presses one of several color-coded keys on the remote control, the TV passes the URL to an integrated web browser which accesses the web site indicated by the hyperlink. Now the user can view personalized interactive content while remaining in the broadcaster’s content domain. Figure 1 shows an overview of the HbbTV infrastructure. Using standard browser technologies such as cookies, the broadcaster can customize the content to a given user. The additional content, and the interactions, can either be overlaid on the screen to customize the broadcast, or be accessed completely separate from the broadcast.

As HbbTV is built on well-known open standards families such as DVB and W3C, broadcasters will be able to use much of the tools and the content of their current content supply chain.

3. SERVICE DELIVERY PLATFORM: AN INTRODUCTION

The transition from one-way TV broadcast distribution into two-way, multi-channel interaction appears to be a truly disruptive shift for the content provider ecosystem. This is because of the fundamental move from a single standard, channel and device to a new ecosystem of standards and channels; all of which are intended to facilitate personalized, individual interaction accessible through a broad array of devices. This situation clearly presents many significant complexities. For example, individual on-demand viewing requires more service resources at the head-end, while the content must be adapted to the display and interaction capabilities of a diverse set of devices. Preferences and behavior must be recorded and maintained through individual user profiles. The service life cycle must be managed from the creation and development of new services to their introduction, execution, and maintenance, possibly differentiated by geography. And finally, 3rd party service providers must be integrated, linking their content as well as managing the business relationships.
The telecommunications industry has been facing similar challenges over the last few decades as the requirements for mobile data and applications have intensified. Telecom service providers have been required to manage an ever-increasing variety of cell phone types and content types, with new devices coming to the market all the time. Content types, spanning from ringtones to music downloads, video downloads, and mobile data applications, evolve in a rapidly shifting competitive landscape. New business models range from subscription to pre-paid, which now must include service partner bundling and advertising. Through this evolution, a powerful solution concept has emerged to manage all this content across these devices and services: the Service Delivery Platform (SDP) [2].

The SDP, shown in Figure 2, is a flexible integration platform that choreographs a wide variety of system components from which the services can be composed. One of its core architectural principles is the Service Oriented Architecture, which makes extensive use of web service interfaces to create a flexible ecosystem out of native and external service components. The SDP fosters the re-use of service management functions, such as presentation services, commerce, and content management across multiple content services. This way the platform becomes more manageable, each of its component services becomes more efficient, and it becomes easier to present a unified view of all services to consumers. At the same time, there can be a single linkage point to back-office operations, such as customer care, billing, and settlement with partners, as seen in Figure 3. The modular architecture of the SDP has proven to be highly scalable, which enables rapid response to customer demands, environmental conditions, and market changes.

This platform has been proven in the telecom industry to have many business benefits. Not only does it reduce the time to market for new services, but it allows organizations to be more nimble in generating new revenue streams through innovative business models and partnerships. The SDP supports personalization and customization of features in a way that is consistent across services while provisioning of a broad range of services across multiple network types.

Given the broad range of functionality, and the typical scale of deployment, a “native” implementation of a service delivery platform can be quite involved requiring a large amount of server resources. This has so far limited its use to large service businesses. Fortunately, another emerging technology, the “cloud”, creates a foundation on which an SDP can be implemented very efficiently and flexibly, allowing this framework to be used over a larger range of system sizes.

4. CLOUD COMPUTING AS AN EFFICIENT SDP PLATFORM

4.1. Cloud Computing Architecture

“Cloud computing” [3] is an effective, network-based method of provisioning computing and IT resources. Servers in the network provide shared computing resources that can be managed efficiently, to rapidly scale and optimize in a highly dynamic fashion.

Using hypervisors, cloud computing platforms create virtual machines on which service components can be deployed. These services can be assigned fractions of real resources, or multiple copies can be assigned to a large number of resources, leading to efficient resource utilization, and very high scalability. The virtual machines can be flexibly managed, moved between different hardware platforms, and scaled or made more resilient by instantiating multiple images. Dynamic provisioning supports rapid adaptation of resource allocation to changing demands. This is particularly important for workloads that vary broadly over the course of a day. Deploying cloud computing in large data centers and sharing the hardware resources over a broad range of workloads allows for higher utilization of resources, resulting in lower cost and overhead.

In the cloud computing environment, component services, such as metering, billing, user profile management or advertising management, are often standardized. This enables re-use, the rapid composition of component services to service
solutions, and the linkage of the service solutions into flexible, cost effective service ecosystems.

Cloud services are offered at various levels of the solution stack. At the bottom is the “Infrastructure as a Service (IaaS)” layer, providing virtualized hardware images. “Platform as a Service (PaaS)”, at the next layer, typically provides a computing platform and a solution stack. “Software as a Service (SaaS)” delivers application services over the network that users can integrate into solutions. Business services, finally, are complete end-to-end services, often linked into even larger ecosystems. Typically, a service delivery platform would be deployed either as SaaS or as a business service.

4.2. Cloud Computing Delivery Models

Cloud computing services can be delivered using various business models. An enterprise can acquire the hardware and software to build and operate its private cloud. In this case, cloud computing technology is used to make a standard data center operation more efficient. In a managed private cloud, the operation of the data center is outsourced to reduce the management cost. With a hosted private cloud the hardware and software are outsourced as well, and the cloud service provider operates all aspects of a dedicated data center on behalf of a customer. In a shared private cloud, additional economies of scale are achieved by sharing a large set of resources across multiple enterprises, providing each enterprise with a virtual data center. And in a public cloud, finally, anyone can “rent” a compute image, even for a short time.

For a service delivery platform, a shared private cloud is the ideal deployment model. While maintaining the economies of scale, it supports a degree of customization, robust security, improved reliability and discrete management of service level agreements. The low entry cost, with low capital expenditures and a pay-as-you-go model, is ideal for experimenting with new services, then rapidly expanding them as they become successful. The shared resources, high degree of automated operation and optimized IT infrastructure all lead to lower operating costs through reduced resource requirements.

5. SDP IN THE CLOUD FACILITATES THE INTERNET CONTENT ECOSYSTEM

Deploying a service delivery platform in a private shared cloud positions broadcasters to leverage an effective infrastructure at a lower cost with less risk in order to take advantage of the opportunities created by the digital convergence.

The SPD is an efficient, proven solution framework that can support a wide range of consumer services. The individual components of the SPD are managed as virtualized images on the cloud platform and linked together through web services interfaces. Sharing common service components like presentation, commerce, and personalization services across different consumer services saves cost while improving speed to market. The SDP can support many types of media services, including the web component of an HbbTV architecture. In addition to supporting the basic content service, it handles the supporting services such as user profile management, linkages to external content providers and advertising management systems integration. Figure 4 shows how an ecosystem of content creators, broadcasters, advertising services, distribution services, and consumer devices can be built in a cloud. The individual service components are instantiated in a cloud, and are linked through web services interfaces over a Cloud Service Bus.

![Fig. 4 Broadband content ecosystem](image)

The cloud-enabled SDP provides a consistent view of the services to users and system management alike, ultimately facilitating improved customer service. Because the supporting infrastructure is potentially being “rented” from a cloud provider, there is inherently less risk of capital exposure from acquiring, building, maintaining, and running a private cloud. Clearly to reduce the risk, however, it’s imperative to choose a proven cloud provider through proper due diligence.

5.1. Philips Net TV as an Example

Many market participants such as TV manufacturers, broadcasters, and content aggregators or distributors have started to experiment with various forms of this new ecosystem.

For example, the Philips Net TV system (see Figure 5) uses a service portal in the cloud as the entry point and navigation aid with a large ecosystem of web based interactive content services to complement the standard TV broadcast. The service portal allows users to select from hundreds of content sources. It helps users find content, select favorites, and pursue an enhanced TV program guide. Supported by advertising and preferred positioning of sponsored services, this service comes at no cost to consumers.

Using a web browser in the TV, the Net TV system makes it easy for content owners to create offerings for this service by enabling the re-use of the content supply chain and management system which were originally created for PCs on the Internet. Content owners need only to reformat their sites to adapt them to the “10 foot interface” of a TV, which supports a remote control for user interaction. The CEHTML
standard [4] used for the content format enables this functionality.

Many European broadcasters have adapted web sites to Net TV in order to deliver interactive content that is supplementary to their broadcast programs. Experiments with delivering “catch-up” TV have also started. Other examples of content services are on-line magazines, travel sites, games, social network applications, and user created videos.

6. SUMMARY

The digital convergence and wide spread availability of broadband networks have created a great set of challenges and opportunities for broadcasters. Fortunately, these same factors create the possibility to extend content reach and scope by linking one-on-one interactive and on-demand content to broadcast programs. The SDP delivers a proven foundation for addressing the new requirements arising from this transition, such as service execution and life cycle management, personalization, third party service integration, and billing where applicable. Such an infrastructure can be quite extensive and expensive, so the most economical way of deploying it is in the cloud. This allows content providers to get started with low entry cost, both from a capital and operating expense perspective. It offers scalability from small, low risk starts of experimental services to high-volume, fully functioning commercial services in potentially short periods of time. The SDP in the cloud accomplishes this by efficiently enabling the management of the great variability of the work load while providing high availability, scalability and security.

REFERENCES


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