BIG DATA MEANS
BIG OPPORTUNITIES
FOR TELEVISION

ANDY AFTELAK
VICE PRESIDENT AND DIRECTOR FOR
THE ARRIS APPLIED RESEARCH CENTER

BHAVAN GANDHI
SENIOR DIRECTOR, ANALYTICS & INSIGHT
FOR THE ARRIS APPLIED RESEARCH CENTER
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INTRODUCTION

The experience of watching television is evolving fast. Through the course of a few short years, we’ve seen changes in the methods through which television programming is distributed, and the ways in which it is consumed. We’ve gone from a scheduled, broadcast model to one of on-demand, time-shifted video delivery. We’ve seen television break free of the living room TV and find its home on a wide range of devices that can be taken virtually anywhere. And we’ve seen TV viewing behaviors change from the passive “lean back” experiences of yesterday, to today’s more interactive “lean-in” viewing.

Yet while the delivery and consumption of television programming has changed in diverse ways, one factor is emerging to bind them all together. Each of these changes brings with it a new opportunity to glean critical information on service delivery, viewing behaviors and the content itself. This is the age of Big Data enabled television.

As we enter this new era, there are several opportunities for service providers to exploit the many data points that are now available to them. The key is to determine which information is most important, and how to best aggregate, analyze and act on it to improve the user experience, increase system efficiency and make more profitable content decisions. This paper introduces several opportunities that await service providers at the intersection of television and Big Data, and provides key insights that can help them realize their near- and long-term business objectives.

DATA IS EVERYWHERE

There are numerous sources of data within the television delivery environment, and in order to produce actionable results, it must be collected in a number of key locations at every layer of service delivery. As each piece of content is delivered from its source to the customer premises, it touches several infrastructure platforms along the way - from encoders to the access network, all the way to set-top boxes and end user devices. Service providers must be able to capture critical data at each of these points along the content journey. And that requires instrumentation to be built into the many hardware devices and software components in the television delivery ecosystem.
In addition to capturing data on a host of physical devices, service providers must also apply instrumentation in the logical realm - at the network, video delivery, control and application layers. This means extracting data on the quality of video streams, understanding back-office operational systems, and applying data collection to the many interfaces available to subscribers.

A holistic approach to data capture ensures that every important dynamic related to the system, users and content can be treated as a viable information source. This requires the collection of an abundance of data, including interests in programs, genres and actors; recording and playback behaviors; viewing times and session lengths; multiscreen device types; streaming bandwidth consumption; infrastructure performance; and interface activities.

There is also an opportunity to collect data based on the dynamics of the content being delivered. This includes scene breaks, scene cuts, motion and faces, just to name a few. In addition, content is now appended with rich data in the electronic program guide on plot lines, actors, genres and ratings. And for most content, a written transcript is available in the form of Closed Captioning, which provides detailed clues as to what’s going on at a given point in time. In order to gain the most value from Big Data, the right information needs to be collected from within the service delivery environment.
But content specifics and data from the service delivery environment alone may not be enough. To truly understand the dynamics of their programming, service providers must collect data from the outside world. This means extracting key information from the world of social media. This can take the form of keywords that are trending, spikes in traffic during live broadcasts and content from industry influencers. By understanding what the outside world is saying about television content, service providers can complete the comprehensive picture they need to apply deep meaning to on-screen content, and more importantly – to act on this insight.

**MAKING DATA ACTIONABLE**

Once the right data has been collected, it is crucial to be able to make sense of it all, with the goal of taking action. This requires a modern, Big Data approach to the collection, organization and analysis of information. Rather than determining key performance indicators (KPIs) and capturing only the thresholds associated with them, service providers must instead collect and store raw data for events as they happen. This enables both real-time and batch analysis, which form the foundation for fast, intelligent decisions, and also allow a historical viewpoint to improve long-range planning.

The data may then be structured and organized within intermediate tables that make sense of the abundant data points that are collected. To turn this wealth of raw data into actionable information, a clear and customizable reporting system is needed. These reports provide details

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*Figure 3: The ARRIS architecture for television analytics and insight*
on both current activity and historical trends. Finally, by layering the right intelligence on top of these reports, it becomes possible to visualize the data and analyze it in a number of useful ways. With a business intelligence dashboard, service providers can cross reference multiple data points to derive deep meaning about their services, subscribers and content. An example of the comprehensive Big Data architecture for television can be found in Figure 3, and is explored in greater depth in a recent ARRIS technical paper\(^1\).

In order to act on this important data, service providers can adjust their service delivery ecosystems manually, making changes within their hardware and software infrastructure to optimize performance or better meet their customers’ needs. In more advanced implementations, service providers can automate these changes by leveraging a powerful API layer that can share information with other services, building new levels of responsiveness into their systems. In the section that follows, we review some of the many ways that service providers can act on data to improve television delivery.

**BIG DATA IN Action**

At the dawn of the Big Data television era, it is critical for service providers to prioritize their information-related objectives. These typically fall into three categories: optimizing the system, enhancing the customer experience, and improving the performance of content. By applying a Big Data approach across these objectives, service providers can achieve valuable gains.

When it comes to the television delivery system, every dollar counts. So it is critical for service providers to get the most out of their capital and operational investments – and Big Data provides a significant opportunity to do so. By collecting and analyzing the right information, service providers can understand how their systems are operating over virtually any period of time. For example, service providers can determine that streaming resources are being strained at certain times of day or that storage resources are nearing a threshold of maximum utilization. They might also use data to derive that their network is not ready to carry Ultra HD 4K content. This insight into system performance can help them more quickly identify and resolve service issues, more precisely fine-tune their operational systems, and more accurately determine where capital investments are needed.

Big Data can also help improve the customer experience. With new data on how subscribers are interacting with content, service providers can better hone their user interfaces and overall service environments to match their customers’ preferences. By understanding the uptake of new features, they can identify new opportunities for investment or modify their
offerings to increase usage. This can apply to features within the program guide, DVR service, multiscroll interface or on-demand offering. This new insight can help yield valuable targeted advertising and marketing opportunities based on user preference and behavior.

Through advanced media analysis techniques, service providers can determine when key plays occur during sports broadcasts or where relevant segments of a news broadcast can be found. This level of content-level analysis can form the foundation for new content curation offerings, where short segments from multiple programs can be packaged around specific user preferences.

Content intelligence can also help service providers ascertain where ad breaks reside - even in the absence of SCTE-35 markers. By understanding when these breaks occur, service providers can insert alternative advertisements in recorded programming beyond the C3 or C7 ad window. This can open new revenue streams based on existing content, especially when the ads are targeted to specific users or households based on an analysis of users’ previous content choices.

With newfound visibility into users’ preferences for and interactions with television programming, service providers can more accurately assign value to the content they purchase. And that means they are in a stronger position when negotiating content agreements with programmers. Once service providers know how frequently their users are tuning in, recording, playing back, and streaming a piece of content, they can begin to ascribe an accurate value to it, and gain new insights into the profitability of their programming on a much deeper level.

When combined, the benefits of Big Data can add up to more than optimized systems, enhanced experiences and improved content performance alone. Even more powerful opportunities arise when multiple data sets are stitched together to create high-value cross references. The ARRIS architecture for this advanced analysis, including an advanced Media Analysis Framework (MAF), is shown in Figure 4.

![Figure 4: The ARRIS framework for advanced analysis](image-url)
By drawing connections between the data associated with system performance, user activity and social media insight, service providers can begin to uncover the hidden opportunities behind their programming. For example, a historical analysis of these factors may reveal a correlation between a trending topic on Twitter, a spike in viewing activity, and an overloaded streaming server. This type of analysis has the potential to enable service providers to find new, more proactive indicators of pending performance issues by using Big Data in innovative new ways.

APPLYING BIG DATA TO NDVR

In a recent study of 26,000 subscribers using a real-world nDVR platform, ARRIS was able to gain key insights that represent valuable opportunities for service providers to improve their video offerings. A sample of the data revealed that - not surprisingly - most viewers were fast forwarding through advertisements during a given program, as indicated by the unique fingerprint of a scene change preceding a spike in fast forward commands as measured across the set-top boxes in the sample.

Even more interestingly, most of these users were found to be fast forwarding beyond the advertisements and into the programming, forcing them to rewind in search of the beginning of the scene. Many of these users were unable to time their playback with the start of the scene, and ended up watching the end of the last advertisement before the program resumed. This type of analysis can help service providers and programmers assign more accurate pricing to the various segments of an ad break.

Figure 5: Sample data on fast forward and rewind behaviors
Data analysis further showed that while recording behavior is highly variable, playback is far more uniform. This can help service providers determine the best applications for virtualized software and dedicated hardware infrastructure. In addition, the analysis established a pattern for peak recording and playback behaviors, depicting the steady growth in these activities over multiple months. This level of insight allows service providers to better plan their next-generation offerings, allocating the proper storage and recording resources to ensure they are aligned with subscriber needs. Furthermore, this analysis helps the service provider predict its capacity needs based on actual content consumption and service usage.
Finally, the data showed the pattern of subscribers recording content and viewing it within three days, establishing a linkage between the type of content and user tendencies to view it quickly. The analysis indicates the popularity of content on a much deeper level than has been historically possible, assigning value for the various content types in their libraries and bundles. In this case, the data indicated a strong preference for major live events.

Figure 8: Comparing recording and playback activities for multiple programs

Based on the nDVR example and the window into actual content behavior that Big Data presents, service providers are able to monetize their content more effectively than ever before. But this example only scratches the surface of what is possible when Big Data and television unite.

CONCLUSION

As Big Data takes on a greater role in the delivery of television services, the possibilities for optimizing the subscriber experience are virtually limitless. In this paper, we’ve reviewed several examples of the many benefits service providers can realize when the right information is collected, and the right systems for analyzing data are deployed. Whether it is improving the relevance of advertising, remonetizing content in new ways, proactively identifying potential service issues or better understanding the value of content, Big Data can mean big gains when it comes to television delivery.
When it comes to enabling this new era of information, the key for service providers is to think big. Rather than collecting a sliver of data based on a limited number of events and thresholds, service providers must gather, store and structure an abundance of raw information from within the service delivery environment and the outside world. Instead of choosing between real-time or batch processing, service providers can benefit by selecting systems that can perform both types of analysis. And getting the most out of data means deploying systems that can present information in a number of useful ways, and even apply automation to optimize systems in real time.

Perhaps most importantly is the need to apply television domain expertise to Big Data, setting strategies and choosing platforms that can maximize the unique information that can truly improve the experience for subscribers. By designing a Big Data approach that is based on the unique needs of the television delivery ecosystem, service providers can extend the value they deliver to end users, drive operational efficiencies that keep costs down, and extract more value from their video content.

MEET OUR EXPERT: ANDREW AFTELAK

Meet Andy Aftelak, Vice President and Director of the Applied Research Center at ARRIS. He leads the team that creates new products and services that are changing the way people enjoy multimedia, both at home and on the move. Through a series of technical leadership positions that have spanned a 20-year career, Andy has constantly leveraged his experience with modern communications systems, human factor processes and user-centric research to guide the development of advanced technologies. He received his Doctorate and Bachelor’s degrees in Electronic and Electrical Engineering from Loughborough University in England. A fellow of the Institution of Engineering and Technology, Andy holds 23 patents and has been actively involved in international standards bodies and industry forums.
MEET OUR EXPERT: BHAVAN GANDHI

Meet Bhavan Gandhi, Senior Director, Analytics & Insight for the Applied Research Center at ARRIS. He leads a multi-disciplinary team of researchers who prototype new interactive and converged media applications for the home and mobile markets. Bhavan is a cloud services and video expert who has successfully taken media-centric technologies from R&D to product impact. Part of his team’s mission is to understand how video delivery systems can be instrumented to collect actionable data and analytics that can provide more meaningful user interaction and drive network efficiencies. Bhavan is well versed in image and video-processing, as well as Big Data analytics, with 18 issued patents. He received B.S. and M.S. degrees in Electrical Engineering from the University of Illinois at Urbana-Champaign.

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