

## Moving to the Media Cloud

Viewpoint paper

# SUCCCEED

in today's consumer-driven environment.

Consumers increasingly expect and demand content anywhere, anytime, and across a dazzling array of media and devices. To compete and succeed in this environment, organizations of all kinds need more efficient, cost-effective ways to create, store, manage, share, and deliver digitized content. For many, cloud capabilities tuned specifically for media and entertainment requirements may be the solution.





## Table of contents

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Media consumption is changing .....	1
The media cloud solution .....	4
Architecting the media cloud .....	5
Benefits of the media cloud .....	6
HP and Intel cloud capabilities.....	6
Cloud on the horizon: a real-world example .....	7
Conclusion .....	8
Contributors .....	9

# HP and Intel examine key trends affecting broadcast and cable networks, telecom carriers, and other content-oriented players. We explore the functional and technical aspects of a media cloud and the measurable benefits of this approach.

## Media consumption is changing

The challenge now is to get ahead of that change and to meet the consumption requirements of the future.

The rapid growth in mobile phone usage, Wi-Fi WiMAX and broadband availability—fueled by the advent of next-generation networks (3G, Multimedia Broadcast, and Multicast Services [MBMS]), Fiber to the Home, converged devices, advanced compression, and streaming technologies—has dramatically changed how consumers touch and use content.

Today's consumers use social networks, Internet-based television and radio, streaming and on-demand video, mobile music and applications, and personalized or user-generated content. They are increasingly willing to sample and consume both new and traditional types of content online and on-the-go. This is creating an explosion in the digital multimedia content being made available. In fact, industry estimates suggest that by 2015, up to 500 billion hours of content will be available for digital distribution.<sup>1</sup>

Moreover, consumers increasingly expect and demand anywhere, anytime access to content through a dazzling and growing array of devices—from televisions, digital video recorders (DVR), in-home entertainment systems, PCs and laptops, tablets, mobile phones, portable media devices, digital signage, and in-car entertainment systems. As examples, by 2015, there will be 1 billion mobile video customers.<sup>2</sup> And 15 billion devices will be able to receive content over the Internet.<sup>3</sup>

We see these megatrends as continuing the ongoing revolution in “TV” viewing habits. Long gone are the days when a few dozen program streams delivered via broadcast “channels” would suffice. The future is not going to be the 500 channels envisioned in the early 1990s, either. Instead, we see an evolution to a media world that's a combination of TV, movies, music, games, and information services, clustered around four broad customer experiences:<sup>4</sup>

- **The Informative Experience**—With media in digital form, examination and analysis of its content is no longer limited to human eyes. Computers can now “watch” video and autonomously detect and recognize people and other content. If you consider there are some 500 billion hours of content, it is clear that it will take a sophisticated, cloud-based multimedia analysis search capability to discover and locate the material of interest to one individual.
- **The Ubiquitous Experience**—People increasingly want the option of enjoying their chosen media content wherever and whenever they want it. Besides driving the obvious requirements for higher performance, higher availability, and more mobile network access, it will also drive requirements for storage and delivery of content suitable for transport over different network types and complex rights management.

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1 iSupply, YouTube, 2008

2 ABI Research, Mobile Video Services, 2010

3 IDC, ICT Outlook: Recovering Into a New World, #DR2010\_GS2\_JG, March, 2010

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4 *Screen Future: The Future of Entertainment, Computing, and the Devices We Love*, B.D. Johnson, Intel Press (to be published)

- **The Personalized Experience**—The concept of “channels” is rapidly dying. First, with the video cassette recorder (VCR) and even more so with the digital video recorder (DVR), consumers no longer need to be at home at a specific time on a specified date to watch the desired content: “Appointment TV” is a thing of the past. Traditional TV networks are increasingly making their content available for streaming online, even for high-value content such as primetime series and the World Cup. The amount of content being made available is overwhelming the traditional electronic program guide (EPG). Consumers increasingly will want to watch their content when and where they choose on the device they choose.
- **The Social Experience**—YouTube and Skype have demonstrated that consumers are not satisfied with passively watching studio-created, one-way content. Consumers also wish to share and interact socially with others. This takes place in forms both real-time and interactive (e.g., Skype), and via personal publishing (YouTube, blogs).

### **Rattling the value chain**

Those tectonic shifts in content form and usage are creating both challenges and opportunities across the communications landscape. They affect content providers including cable operators, satellite companies, and telecommunications firms, as well as media and entertainment companies, over-the-top players (such as Amazon, Apple TV, Google TV, and Netflix), publishers and information services, and a growing array of commercial and industrial companies of all kinds. In fact, these changes will impact literally any company that uses images, audio, video, or digitized content in any form and that relies on a network to enable those capabilities.

The growth in digital media is also driving real change. More and more content is either created in or converted to digital formats. That building wave of electronic material is creating complex new storage, management, and delivery challenges. As the familiar channel model for the delivery of content has collapsed, ad revenues from traditional sources continue to erode. Convergence continues in many levels—both among IT, telecommunications, and media and entertainment organizations and in the hardware, software, and services used to create, manage, and disseminate digital content.

Looking across those content providers, we can see clear similarities, distinctions, and competitive overlaps. All must deal with the general effects of the worldwide economic slowdown, while at the same time adjusting to a number of industry- and niche-specific trends.

Looking across the value chain of media use and consumption—from content production through content management and distribution, to the management of the entertainment experience and enterprise-level concerns—a number of clear trends emerge.

The service areas of key telecom service providers, for example, now overlap those of leading cable operators by some 96%, and most players now compete directly in many regional market segments. For video products, cable subscriptions are down, while telcos have gained video market share. Just the opposite has happened in U.S. high-speed data and voice, with telecom carriers losing ground to cable operators.

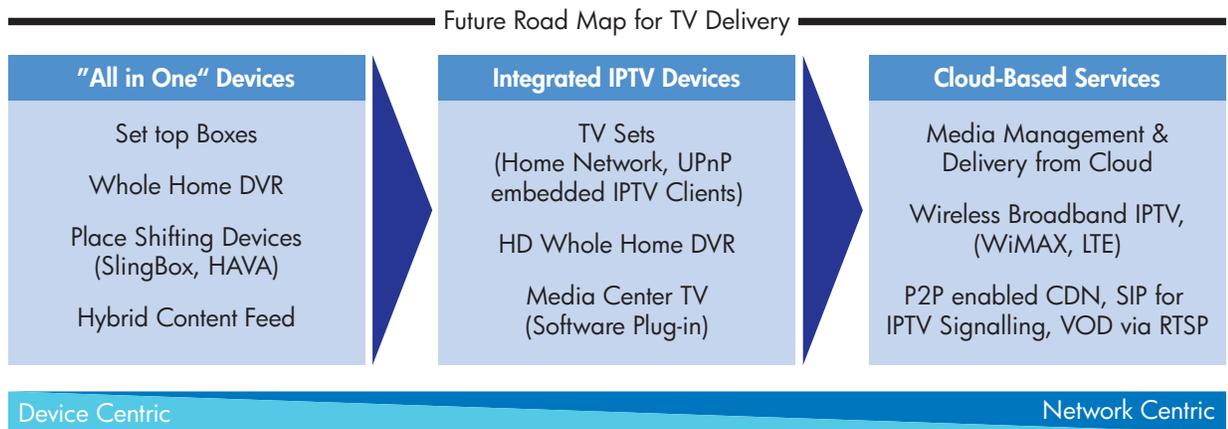
Cable operators are feeling real pressure from telco carriers and from powerful Internet-based competitors, and have seen erosion in both their customer base and bottom-line performance. In response, the cable industry is pursuing a number of forward-looking initiatives. One is the TV Everywhere effort to create revenue streams when consumers view television content online. Another is the growing use of Remote Storage DVRs (RS-DVR) to shift content storage from the home to a centralized storage center, giving consumers more functionality and greater flexibility in where, when, and on what device they access that content, enabling ubiquitous and personalized experiences. Industry analysts have estimated continued strong growth in the sale of DVRs, as measured both in market share and as a percent of overall storage capacity.

Together, these trends and forces exert tremendous pressure on players across the communications spectrum. Content is the unifying factor. Virtually any organization that delivers content across a telecom, cable, satellite, or enterprise network will be affected by the accelerated need for change.

Content is the key; the network is the enabler; and the emerging generation of cloud-based solutions will be the fabric upon which this new era of content will be built. Some of those solutions are direct responses to the escalating cost of localized storage and functionality.

The cost of deploying and managing DVR-based set-top boxes (STB) continues to rise. As of 2009, the average STB cost USD 160, required a USD 450 house call for deployment, and added another USD 10 to 15 each for additional features such as multiple tuners, whole-home DVR, and multiroom video distribution support. While data storage costs are decreasing, the industry spends an average of from 40 to 45 cents per GB for STB-based storage. All told, the cost of deploying and managing a STB exceeds USD 600 for most service providers.

**Figure 1**  
Future road map for TV delivery



As DVR usage grows, so will those costs. Industry observers predict that by 2015, the number of DVR subscriber households in the United States will grow to 53 million, or 44% of all television households. In that same timeframe, managed services-based video on demand will reach 66 million homes, or about 54% of TV households. By the end of 2015, more than 89 million U.S. homes will enjoy broadband access.<sup>5</sup>

Aside from the deployment costs involved, while DVRs go a long way in helping provide the personalized experience in the home, even a whole-home DVR provides no value to mobile video services consumed with devices outside the home. So increasingly, there will be the desire to drive that functionality into the cloud and virtualize it to provide anytime/anywhere delivery of a specific program.

The growth in digital media is also driving real change. More and more content is being either created in or converted to digital formats, and that building wave of electronic material is creating complex new storage, management, and delivery challenges.

As the familiar channel model for the delivery of content has collapsed, ad revenues from traditional sources continue to erode. Convergence continues in many levels—both among IT, telecommunications, and media and entertainment organizations—and in the hardware, software, and services used to create, manage, and disseminate digital content.

**A shift to the edge**

Analyzing these fundamental changes, HP and Intel foresee a fundamental shift in how content will be delivered in the future—from today's device-centric model to a more practical and efficient network cloud-based approach. (See Figure 1.) The advent of cloud-based services will spur two additional and important changes: the shift of intelligence away from the network core and toward the network edge, and a similar movement of storage and some functionality away from the home and toward the network edge.

In response to these changes, carriers are deploying multiple delivery platforms, multi-room DVRs, HD DVRs, and devices to support time- and place-shifting. They are also working with television manufacturers to create universal plug-and-play (UPnP) solutions that function as fully featured media centers.

Just as those macro changes are forcing changes in many fundamental business models, digitization is pushing many firms toward new methods of producing, managing, storing, and delivering content. Companies simply cannot hope to push a new generation of digital content through the same previous-generation pipes and joints. Adapting to newer-generation pipes can present its own challenges, such as the delays and buffering that occur when network congestion or changed channel conditions require a shift in encoder parameters and video resolution.

<sup>5</sup> On-Demand Quarterly, MAGNA, June, 2009

Any company that runs or depends on a network should be—at the very least—investigating the requirements and possibilities of the media cloud.

Cable providers that run complex networks and have intimate connections to subscribers are interested, because they seek ways to reduce customer premise equipment costs, to control truck rolls, and to improve subscriber satisfaction. Telecom service providers and others are racing to provide the time- and place-shifted capabilities today's consumers demand, and to do so across the three-screen (and tomorrow's n-screen) device universe.

Given those realities, companies across this communications spectrum must find new ways to create, store, share, and manage digital materials. Some have tried to cobble home-grown solutions. Most are seeking more advanced tools and methods.

The age of content has arrived. The winners in this new media-centric world will be those who learn to better create, share, manage, and deliver digitized materials.

## The media cloud solution

A rapidly maturing addition to information technology capabilities, cloud computing allows flexible, highly scalable services to be delivered and consumed over the Internet on an as-needed basis. Cloud computing is already opening new ways to source, deliver, and govern a growing range of information, content, and communications technology services.

As such, the cloud holds very real promise for communications service providers, cable and broadcast firms, production companies, media outlets—and virtually any organization that creates, stores, and disseminates digital content.

But not just any cloud will do. To meet the unique requirements of content-oriented organizations, HP and Intel believe cloud computing must provide a number of specific capabilities. It must enable ubiquitous delivery across three screens—and the future's n-screen universe—of live and on-demand content. The cloud must function to distribute and deliver content, and to store and manage subscriber documents for service providers. Using universal plug-and-play standards, this approach should also allow clients to quickly and efficiently discover content within the cloud.

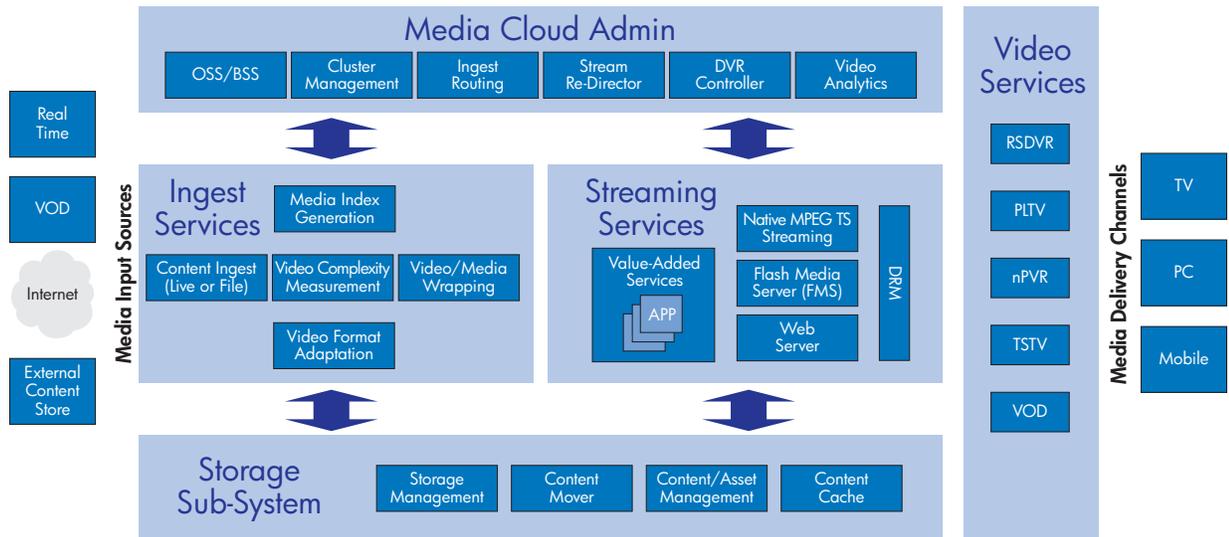
A workable media cloud consists of several key elements.

- **IPTV**—As operators move away from traditional delivery methods, cloud-based computing provides the service delivery and middleware capabilities needed to provide live and on-demand video over IP.
- **Three- and N-Screen Delivery**—The cloud is also ideally suited to meet the evolving, multi-screen expectations of today's content consumers. Clients can access the cloud for live, on-demand, and real-time content transcoding, streaming management, and multi-screen workflow management services.
- **Time and Place Shifting**—Consumers expect content to be available virtually anywhere and at any time. Cloud-based services can support robust and affordable time- and place-shifting capabilities, with remote storage and network-based DVRs, advanced content and asset management, and storage as a service (SaaS) solutions.
- **Value-Added Services**—Organizations of virtually any kind can also access cloud-based services for content delivery network (CDN) and for plug-and-play content discovery. The inherent flexibility of the media cloud allows targeted ad insertion on a national, regional, local, or even personalized basis.
- **Personalized "Channel"**—Consumers today make use of a combination of the heuristic learning capabilities of TiVo devices and Web searches to locate the content they want. They want a service with which they just register their preferences, that makes use of metadata reading and video analytics to find the content they want.
- **Video Analytics**—Video analytics are used to search and index video streams, both archive and real-time. As the fastest growing data type on the Internet and in storage, video can be far more useful, effective, and efficient when analyzed correctly.

To drive the progression of these four elements, service providers, cable operators, media firms, and others should also seek a core set of media-oriented cloud support capabilities. Crucial media cloud support services include:

- Storage and infrastructure management
- Cluster and grid management
- Workflow automation
- State-of-the-art capabilities in a multitenant cloud environment

**Figure 2**  
Media cloud architecture



## Architecting the media cloud

HP and Intel believe that to be effective, a cloud must be designed to meet stringent and very specific design requirements. Figure 2 depicts a logical cloud architecture for media companies. As shown in Figure 2, the cloud consists of five primary elements:

- Cloud administrative services including OSS and BSS, cluster management, ingestion routing, stream direction, DVR controlling, and video analytics for meta data generation (for EPG and surveillance).
- Ingest services, such as live or file content ingestion, video complexity measurement, wrapping, and format adaptation. Ingest services accept media input from a wide range of sources, including real-time and on-demand video, Internet-based content, and external content storage.
- Streaming services including native MPEG TS streaming, web and Flash media servers, digital rights management, and various value-added services.
- Video services, to manage video on demand (VOD), RS-DVR, Pause Live TV (PLTV), Network Personal Video Recorder (nPVR), and Time Shifted TV (TSTV). Video is then flowed across media delivery channels to televisions, PCs, and mobile devices.
- Storage subsystems for content cache and movement, storage, and asset management.

## Design considerations

A cloud must be able to deliver content via multiple pathways, including STB-based television, cable-card-ready TV, desktop computers, and mobile devices. It should provide reliable support for multiple tenants, allowing multiple system operators (MSO) and service providers to take advantage of common and economic infrastructures and software components.

By making services available in a hosted environment, a well-designed cloud allows tenants to share operational costs and to use plug-and-play integration to quickly and easily add new applications, while minimizing the impact on service delivery. Those qualities allow cloud services to be selected based on their functional utility to subscribers and consumers.

A media cloud must be elastic. To meet the changing needs of multiple tenants, the cloud infrastructure must be capable of machine counts ranging from the hundreds into the thousands, and should include data storage capacity exceeding the 100 PB range. Cloud architecture should allow capacity scaling through quick, cost-effective additions or removals of servers and other storage elements.

Cloud technology should, of course, deliver high-efficiency, low-latency content caching, streaming, transcoding, and delivery from various edge locations. It should also support fast and effective site-to-site replication and synchronization of content.

Disk I/O subsystem speed is crucial—and by using next-generation processors, SAS interfaces, solid-state drives (SSD), and other advances—today's most advanced solutions can achieve exceptional disk I/O performance. Given the many systems and memory subsystems that constitute a robust media cloud, any workable solution must also provide efficient power utilization.

The cloud should protect content with advanced identity and privacy management techniques, ensuring that content is secured during ingestion, storage, and play-out. Network utilization and security can be optimized with methods such as soft-routing-based firewalls, which serve to isolate clients in shared, multi-tenant cloud environments.

Finally, by incorporating today's most sophisticated availability and fault tolerance mechanisms, a well-crafted media cloud will provide both fail-proof reads and writes and automatic recovery in the event of a system failure.

#### **Future possibilities**

Given those current capabilities, how might the media cloud evolve? In the future, the cloud may function as a digital assembly line for the production, customization, and marketing of digital content of all kinds. Content providers might go directly to cloud technology providers, as we have already seen with the relationship between YouTube and MSNBC.

The cloud could support a range of new capabilities such as just-in-time media and marketing and, increasingly, intelligent and audience-specific messaging. Service providers will likely use asynchronous replication to support subscribers as they move in a more geographically diverse global environment.

Those are just a few of the possible variations on the flexible media cloud environment.

## **Benefits of the media cloud**

By adopting a service-oriented cloud computing approach, organizations can realize a number of measurable advantages. The media cloud:

- Provides edge-based intelligent management of infrastructure, content, and services designed specifically for service provider and media environments
- Supports the consistent, efficient service management and content delivery from multiple wireless, data, TV, and special-access networks to three-screen and emerging n-screen devices of choice
- Also supports efficient home-to-core content flows
- Drives service and offer differentiation with personalized time- and place-shifted content delivery
- Maximizes in-place network investments

- Harnesses more powerful processors to measurably boost STB performance, lower the cost of storage, and extend STB life expectancy
- Opens new, long-term revenue streams by supporting targeted, 1/1 local advertising insertions across multiple service networks and the deployment of next-generation advertising products and tools
- Creates a more agile, cost-effective environment for media production, collaboration, and dissemination
- Takes full advantage of oversubscription quota system
- Uses industry-standard, easily inserted modules to support fast and affordable capacity scaling and seamless upgrades to next-generation services and functionality
- Incorporates advanced architecture, servers, and processors to lower power consumption and to reduce infrastructure, operational, and maintenance costs
- Makes the most of sophisticated service delivery capabilities to accelerate time-to-market for new services, even across multiple networks

## **HP and Intel cloud capabilities**

Together, HP and Intel have built an intelligent media cloud solution that enables content-driven organizations to deliver video and other content to a growing array of clients, devices, and screen types. This next-generation media cloud and associated systems take full advantage of industry-standard platforms to provide exceptional flexibility, economy, and scalability.

The solution uses the latest HP DL380-G7 and HP DL580-G7 servers with Intel® Xeon® processors 5600 and 7500 series.

Intel Xeon processor 5600 series automatically regulates power consumption and intelligently adjusts server performance according to application demand, maximizing both energy cost savings and performance. Intel Xeon processor 7500 series-based servers can dramatically increase performance, efficiency, and reliability and offer the industry's highest virtualization performance and support for more virtual machines per server.

These multiprocessor systems incorporate increased memory and Intel® QuickPath Technology to establish high-speed interconnects between processors and memory. In addition, 10 GB Intel® Ethernet Network adapters provide increased throughput and overall system performance. Intel® Solid State Drives (Intel® SSD) drive increased performance in critical areas of the media cloud.

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Network loading can be reduced, and customer quality of experience (QoE) can be enhanced when content is streamed to Intel® Core™ processor-based clients implementing video post-processing algorithms. Video post-processing can be especially powerful when used cooperatively with cloud-based video encoder enhancements. Also, the use of Scalable Video Coding (SVC) in both cloud and client allows for very efficient, low-latency, post-encoder adaption of the data rate to real-time network conditions. This can reduce cloud storage and data management requirements and power consumption, since only encoding is needed for multiple different pipes. In the future, joint source-channel coding (JSSC) may be added for higher efficiencies, and no-reference objective video quality may be used to improve measurement performance.

HP and Intel have long been at the forefront of cloud computing research and development. HP has worked with Intel and leading R&D authorities to create a global cloud computing test bed to drive collaborative research on the management of cloud computing data centers and applications.

HP continues to collaborate with selected partners to refine and develop a wide range of cloud-related technologies and capabilities, including communications as a service (CaaS), video streaming, outsourced solutions, and comprehensive integration capabilities.

## Cloud on the horizon: a real-world example

Consumers once gathered to watch programming at a set time and from a single screen. But those days are gone.

In the age of social media, more potent mobile devices, and expanded wireless and wireline network capacity, viewers increasingly demand anywhere, anytime access to content on a growing array of screens. Research shows a 70% increase in mobile subscribers accessing place-shifted content on mobile phones, smartphones, and computers and a 32% increase in time-shifted, in-home television viewing habits.<sup>6</sup>

It comes, then, as no surprise that content creators, media planners, and network operators are seeking ways to satisfy next-generation content expectations.

One promising advance—the remote-storage DVR (RS-DVR)—takes the set-top DVR concept of recording and playing back digital content to a new and higher level. RS-DVRs provide managed, network-based storage and play-out of broadcast content with quota management, live TV pause, and other advanced capabilities. The RS-DVR approach supports seamless content delivery to multiple screens and the addition of advertising, real-time transcoding, and other value-added services during delivery.

Content-driven organizations can use the RS-DVR model to create new revenue streams, to manage capital and maintenance costs, and to create opportunities for new geographic, OTT, and multiple-screen service offerings.

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<sup>6</sup> Nielsen Company research statistics.

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## Conclusion

Content-dependent organizations of all kinds are struggling to produce, store, share, and distribute massive new volumes of digitized material. They serve consumers who now expect content to be readily available at any time, in any place, and across a growing multitude of devices and media.

Forward-looking organizations are now using advanced media cloud capabilities to better manage content across the value chain. The power and flexibility of cloud computing support sector-specific solutions for telecom service providers, cable network operators, and media and entertainment firms—and for virtually any company or agency that uses or shares digital content.

A media cloud can be deployed to reduce both capital and operating costs, and to extend the useful life of in-place infrastructure. The cloud can be used to reach new market segments, to drive long-term revenue, and to introduce productive new advertising strategies. Organizations can use cloud-based capabilities to enhance customer service, satisfaction, and spend.

In the coming content-driven world, smart companies are moving their media to the cloud.

## Contributors

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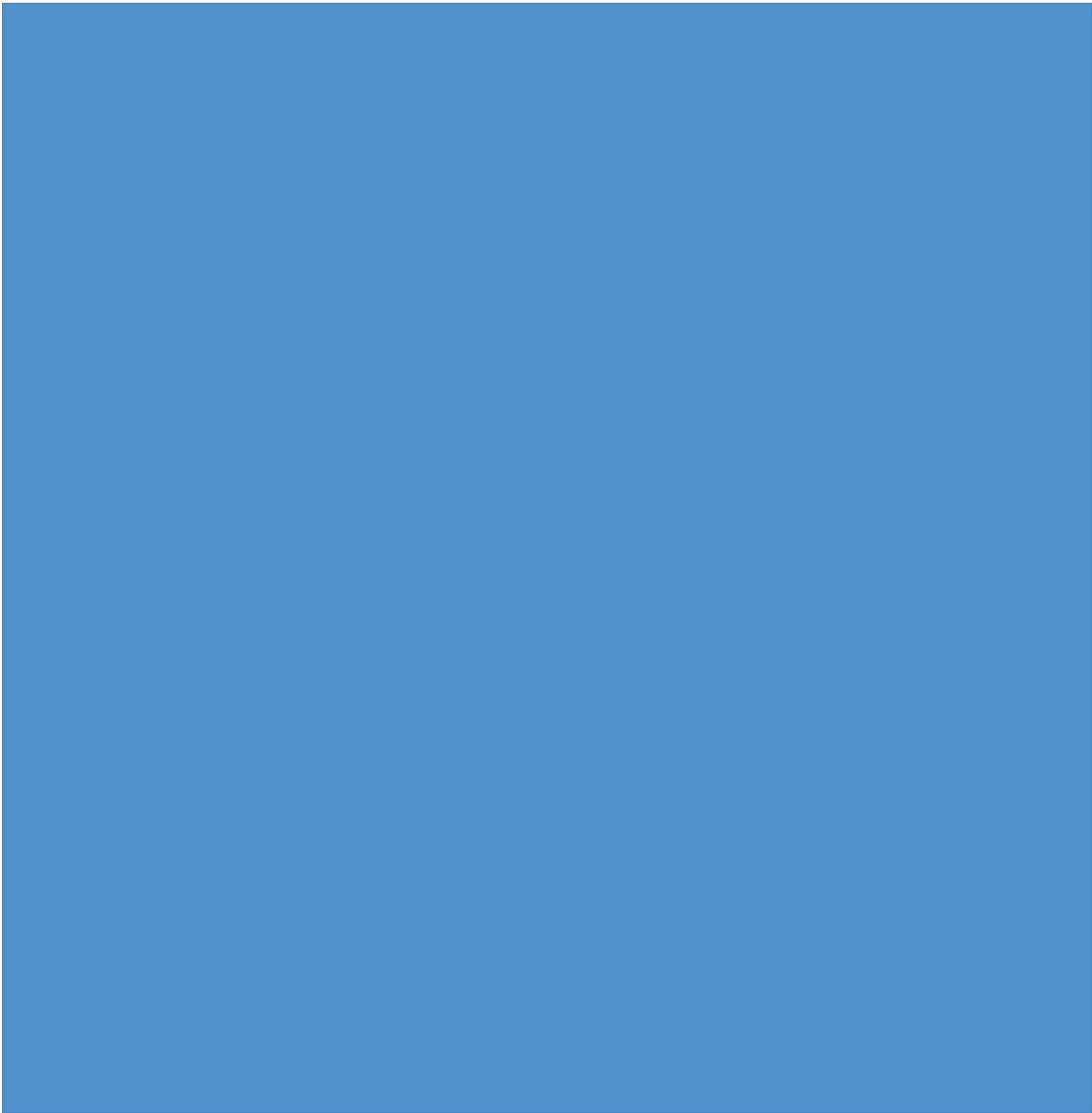
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