

Cloud Computing in Media and Entertainment

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ABSTRACT

Cloud computing has revolutionized the dynamics of the entertainment business by making accessible the tools and infrastructure required for efficient content creation, management, and distribution. It is reshaping content creation, distribution, and consumption. Cloud computing in the media allows new ways of creating, managing, and broadcasting media content more effectively. Along with easy collaboration, sophisticated workflow, and data management, cloud resources have prevented huge data losses and generated high-quality content. The adaptive nature of cloud offerings makes it a perfect choice for the M&E industry that is currently looking for ways to address the emerging global shifts in media and entertainment patterns. This paper examines the various roles of cloud computing in the media and entertainment sector.

KEYWORDS: *cloud, cloud computing, media and entertainment (M&E), M&E industry*

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INTRODUCTION

The entertainment sector is a huge umbrella term involving a large number of sub-industries devoted to entertainment. It is the industry that always provides fun, entertainment, enjoyment, and amusement to people. It includes but not limited to television programs, movies, broadcast, radio, books, video games, and special events wherein live streaming of content is seen. The US media and entertainment industry is the largest in the world and accounts to one-third of this industry [1]. Figure 1 shows a typical media and entertainment live event [2].

Cloud computing has become a game-changer, offering seamless access to data anytime, anywhere. As technology evolves, cloud technology becomes increasingly crucial in driving innovation across industries, from aviation to healthcare, gaming, technology, and finance. Cloud computing has revolutionized business operations, and the media and entertainment (M&E) sector is no exception. With the rise of cloud computing, innovations in the entertainment industry have come to the fore. Cloud computing has also revolutionized the way we listen

to music and podcasts. The cloud makes media processing faster, more efficient, and more accessible.

CLOUD COMPUTING BASICS

Cloud computing represents a newly emerging service-oriented computing technology. It is the provision of scalable computing resources as a service over the Internet. It allows manufacturers to use many forms of new production systems such as 3D printing, high-performance computing (HPC), industrial Internet of things (IIoT), and industrial robots. It is transforming virtually every facet of modern manufacturing. It is innovating, reducing cost, and bolstering the competitiveness of American manufacturing [3]. Figure 2 shows the symbol for cloud computing [4]. Some features of cloud computing are displayed in Figure 3 [5].

The key characteristic of cloud computing is the virtualization of computing resources and services. Cloud computing is implemented in one of three major formats: software as a service (SAAS), platform as a service (PAAS), or infrastructure as a service (IAAS). These services are explained as follows:

SaaS: This is a software delivery model in which software and associated data are hosted on the cloud. In this model, cloud service providers offer on-demand access to computing resources such as virtual machines and cloud storage.

PaaS allows the end-user to create a software solution using tools or libraries from the platform service provider. In this model, cloud service providers deliver computing platforms such as programming and execution.

In the **IaaS** model, cloud service providers can rent manufacturing equipment such as 3D printers.

Just like cloud computing, CM services can be categorized into three major deployment models (public, private, and hybrid clouds) [6]:

- Private cloud refers to a centralized management effort in which manufacturing services are shared within one company or its subsidiaries. A private cloud is often used exclusively by one organization, possibly with multiple business units.
- Public cloud realizes the key concept of sharing services with the general public. Public clouds are commonly implemented through data centers operated by providers such as Amazon, Google, IBM, and Microsoft.
- Hybrid cloud that spans multiple configurations, and is a composed of two or more clouds (private, community or public), offering the benefits of multiple deployment modes.

These services and models are shown in Figure 4 [7]. Cloud computing finds application in almost every field.

CLOUD COMPUTING IN MEDIA AND ENTERTAINMENT

Modern technology has leveled the playing field between large enterprises and upstarts, unlocked new opportunities, and intensified competition. With these changes, consumers expect more from media and entertainment companies. Consumers are fast changing their preferences towards digital media channels with the rising on-demand content being consumed through Internet-connected devices—their phones, smart TVs, tablets, computers, set-top boxes, gaming consoles, and digital media players, as compared to more traditional forms of media such as TV, print, and radio. Providing on-demand content to the consumer at such speed has necessitated media and entertainment (M&E) companies to move away from legacy productions systems. The adaptive nature of cloud offerings makes it a perfect choice for the M&E industry that is currently looking for ways to address the emerging global shifts in media and

entertainment patterns. The adoption of a cloud-based ecosystem can help these companies find success in this dynamic technology landscape [8]. Cloud computing in media and entertainment industry will totally transform the landscape, enabling creators to deliver top-notch content and even invent new forms of entertainment. Figure 5 shows a representation of cloud computing in the M&E industry [9].

Cloud technology has become an essential tool for many businesses. The demand for cloud computing in media and entertainment has been increasing because it is commonly used. The scalability, flexibility, and other advanced features make it easy to have a stable and scalable infrastructure. By using cloud computing, M&E companies are developing new and better ways to quickly and efficiently deliver rich content to a fine-grained targeted audience.

APPLICATIONS OF CLOUD COMPUTING IN MEDIA AND ENTERTAINMENT

Cloud computing and AI have changed the media and entertainment industry forever. Cloud computing can help shape the future landscape of media and entertainment.

The media and entertainment industry can use cloud computing in various ways. These include streaming, audio recording, asset management, archive storage, etc. Common areas of applications of cloud computing in M&E industry include the following [10]:

- *Media Streaming:* Traditional TV has become obsolete. Viewers now want the freedom to watch what they want, when they want it. This is possible due to smart TVs, media cloud processing, and streaming services. Streaming services and streaming media have changed how we watch TV, movies, and videos. Media streaming is the linchpin of how we consume media today. Over-the-top (OTT) streaming services allow media companies to provide content directly to customers over the Internet, eliminating the need for a system operator. Media streaming is a way of delivering media over the Internet in real time. Unlike downloads, where you wait for the whole file, cloud based streaming lets you start playing right away. The media streaming services, through cloud computing, can scale and deliver high-quality content on multiple devices.
- *Targeted Advertising:* Through cloud-driven ad platforms, media outfits can precisely target their advertising campaigns with unparalleled accuracy. By analyzing user behavior patterns, demographics data points, and content

consumption trends, marketers can tailor their ad strategies for enhanced engagement levels, leading to better returns on investment. Cloud computing can help shape the future landscape of media and entertainment. If you are thinking of getting into this vibrant industry, understanding how cloud technologies can be leveraged is paramount for success.

- *Cloud Media Processing:* Cloud media processing involves the manipulation of various media content, incorporating video, audio, and images. The aim of audio, video, and image processing is the conversion of these files into different formats so that they can be used efficiently and smoothly. Cloud-based image processing refers to running information through computerized algorithms so that we can analyze the image and discover meaningful insights from it. Image processing requires substantial storage and cloud image processing fulfills this need by providing extensive storage space and processing capabilities. This is the reason for the gaining popularity of cloud-based image processing. Video processing is primarily a sequence of images. However, the resulting signal is still a video stream.

BENEFITS

Cloud computing can offer countless benefits for a business of any size. It has the power to revolutionize various aspects of the M&E industry. By harnessing cloud computing capabilities, companies can offer personalized and immersive encounters to their audience. One of the major benefits of the cloud in the media and entertainment industry is how it enables global content delivery. Companies can now serve content to users worldwide in multiple formats. Organizations can go directly to the consumer, without compromising security. Other benefits of cloud computing in media and entertainment include the following [11,12]:

- *Scalability:* Cloud platforms are designed to be scalable. Cloud computing scalability matters because it ensures consistent performance during peak usage periods, maintaining user satisfaction. Cloud platforms offer on-demand and flexible resources, allowing media companies to scale up or down as needed. This allows services to never go down during sudden traffic spikes during the release of some popular show or event. This is crucial for handling fluctuating demand and ensuring seamless streaming experiences.
- *Personalizing Experiences:* This is one of the mainstays that have revolutionized the whole aspect of video streaming. Cloud computing

enables over-the-top (OTT) platforms to harness data analytics, offering highly personalized user experiences. This personalized content not only enhances user engagement but also improves satisfaction by delivering more relevant and appealing content suggestions, keeping viewers hooked and driving higher retention rates. Figure 6 shows personalizing experiences on screens [11].

- *Reduced Costs:* Building an on-premise infrastructure to support the high performance, high-resolution media files is cost-prohibitive. Not only must companies invest in server and storage hardware, but they must also pay for employees to manage the large data centers. Moving to the cloud allows organizations to tune up their big data storage strategy in a cost effective way. No hardware is necessary when using a cloud solutions provider. Rising costs in other areas of the industry can be offset by deploying a more cost-effective cloud solution.
- *Collaboration:* Cloud-based platforms facilitate collaboration among teams, regardless of location, enabling remote work and efficient project management. Cloud platforms facilitate seamless collaboration across worldwide teams, which is particularly beneficial for media projects requiring international cooperation. Image processing has made it possible for teams to work in real-time collaboration, thus allowing smooth work on any visual project and even collaboration across locations. Photographers and designers can now start or continue projects from anywhere, enhancing flexibility and fostering collaboration throughout the creative process.
- *Flexibility:* Cloud computing offers a great deal of flexibility. M&E companies need flexibility in storage configurations to move files quickly, whether in the cloud or on-premise. They need the ability to seamlessly adjust storage requirements based on specific use cases. Entertainment companies can scale up or down their use of cloud-based services as needed without having to make any major changes to their infrastructure. With the ability to adjust storage from any location, entertainment companies can gain the flexibility they need to operate cost effectively.
- *Meeting Customer Expectations:* Consumers expect high-quality digital content. They expect to access what they want when they want it. For media companies, the ups and downs of customer expectations make it difficult to plan storage requirements. Since viewership can change in

seconds, using the cloud in the media and entertainment industry provides a scalable solution that is agile enough to meet changes in real time.

- *Enhanced Security:* Speed and security are the two most important elements for the media and entertainment industry. With more digital assets being stored in multiple locations, cybersecurity becomes a crucial part of business continuity. Cyberattacks can bring operations to a halt, so cloud storage platforms should have a strong security posture. Cloud computing offers stronger security measures, such as encryption and multi-factor authentication, which help safeguard valuable media content from unauthorized access and cyberattacks.
- *Sustainability:* Cloud providers that utilize renewable energy contribute to greater energy efficiency, making cloud computing more environmentally friendly than traditional data centers.
- *Global Reach:* Cloud hosting facilitates global distribution with instant availability. It makes it easy for content producers and streaming platforms to reach audiences worldwide. This expands audience bases, driving growth opportunities beyond traditional boundaries. Cloud-based streaming services and content delivery networks (CDNs) ensure content is accessible worldwide with minimal buffering and latency.
- *Low Latency:* In the broadcasting industry, high streaming performance with minimal delays and downtime is crucial to meet both user experience and expectations of the advertiser. On-premise servers are located on the media company's premises, while cloud media servers can be anywhere in the world. This way, cloud-based content providers can deliver media that streams to viewers using the closest best server, which reduces latency and improves user experience.

CHALLENGES

The M&E industry has to go through multiple challenges. Firstly, entertainment involves live streaming of content. To seamlessly stream content, media companies have to spend a lot of budget on bandwidth and other data management resources. Secondly, the traffic is unpredictable. When a video goes viral, you can expect millions of hits within minutes. So, media companies should be able to instantly scale up resources [1]. Another important challenge in the entertainment industry is personalization. While the vast majority of

organizations in the media and entertainment industry are aware of the data explosion, few are adequately prepared to address the challenges. Other challenges include the following [13,14]:

- *Storage:* Data size is quickly outpacing storage space in the media and entertainment industry, and object-based storage can play a pivotal supporting role to help companies meet growing challenges. The media and entertainment industry is generating denser data types than it ever has before, and the density is accelerating at a rapid pace. Every day, media producers are creating more 4K and 8K content to meet the consumer demand for a better visual experience, but this trend exponentially increases storage costs for the companies that must preserve that content. As the industry continues to innovate and create, storage will play an integral role in helping digital assets be properly preserved, secured and accessed. Companies that are not up-to-speed on advancements in storage technology are facing major challenges because data growth in the media and entertainment industry shows no signs of slowing down. Organizations need to start looking at storage solutions that can carry them into the future. Figure 7 shows growing adoption of cloud storage by media and entertainment [15].
- *Remote Working:* This a major challenge. Companies adopting widespread remote working during the pandemic were surprised by just how productive their teams were despite being at home. Intelligent transition and application of cloud managed services not only enable innovations but also address challenges of remote working like loss of data, poor content quality, etc.
- *Security:* Like many other branches of technology, security is a pressing concern in cloud-based computing. Security risks for cloud replicate those found in everyday activities with mobile devices, home computing, work compute environments, and daily life. M&E organizations have significant concerns about data security in the cloud, including the lack of native security services, backup/disaster recovery tools, and adequate security training for staff. They also worry about potential cloud security breaches and data loss or theft. Unauthorized access or piracy are possible with video streaming. Technologies for digital rights management (DRM) can be used to prevent material theft and guarantee that only authorized users can view the video.
- *Sensitive Data:* This is another major concern. Sensitive data is defined as information that, if

disclosed, misused or accessed without authorization, could result in harm, discrimination or adverse consequences for the individual to whom the data pertains. Organizations operating with highly sensitive data (in the cloud or on the ground) should consider encryption to prevent unauthorized parties from accessing it.

- **Cost Management:** Spending can be a significant challenge. Be certain your financial officers are prepared for the sometimes rapidly changing cost structures and “bring them along” in the process. Predicting and managing cloud costs can be difficult, especially with unpredictable usage patterns and potential over-provisioning or under-provisioning of resources.
- **Expertise and Training:** Finding the right experts to help with cloud implementations can be challenging. A lack of skilled personnel with experience in cloud computing and security can hinder cloud adoption and implementation. The skills gap is one of the biggest challenges for cloud computing technologies. These individuals are hard to find, sometimes hard to engage and can be costly to employ.
- **Vendor Lock-in:** Organizations may face challenges transitioning to different cloud providers if they become overly reliant on a single vendor's services. Businesses using cloud computing are ill-advised to become dependent on a specific single vendor, making it difficult to switch providers should something unforeseen occur.
- **Complexity:** Cloud computing can be complex, especially for businesses new to the technology, requiring a significant investment in time and resources to learn and implement cloud solutions. Be prepared for a lengthy startup period and engage a solutions architect who is experienced in what you do and with various cloud provider solutions. Integrating cloud solutions with existing legacy systems and workflows can be a complex and time-consuming process.
- **Network Dependence:** Reliant on a stable and reliable Internet connection for access to cloud resources, which can be a challenge in areas with limited bandwidth or network outages.
- **Compliance:** Navigating complex regulations and ensuring data privacy and residency in the cloud can be challenging for M&E companies.
- **Interoperability:** Ensuring that cloud-based systems and services can effectively interact with

legacy systems and various tools within the M&E workflow can be a challenge.

Some of these challenges are shown in Figure 8 [14].

CONCLUSION

Cloud computing has significantly impacted the media and entertainment industry, offering solutions for content creation, distribution, and management. A firm's open-mindedness towards the adoption of cloud computing will give it a strategic advantage in such a dynamic and competitive environment. The time is now for the M&E industry players to join the bandwagon and deliver content the way consumers are demanding. M&E companies are increasingly eyeing the cloud platform to achieve their production, distribution, and archiving goals. With the aim of reducing IT operational costs and providing anytime and anywhere accessible high quality content will trigger the adoption of cloud solutions by media and entertainment firms globally. More information about cloud computing in the media and entertainment industry can be found in the following related journals:

- Journal of Cloud Computing
- IEEE Cloud Computing
- IEEE Transactions on Cloud Computing
- International Journal of Cloud Applications and Computing
- International Journal of Cloud Computing and Services Science
- i-manager's Journal on Cloud Computing

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Figure 1 A typical media and entertainment live event [2].



Figure 2 The symbol for cloud computing [4].

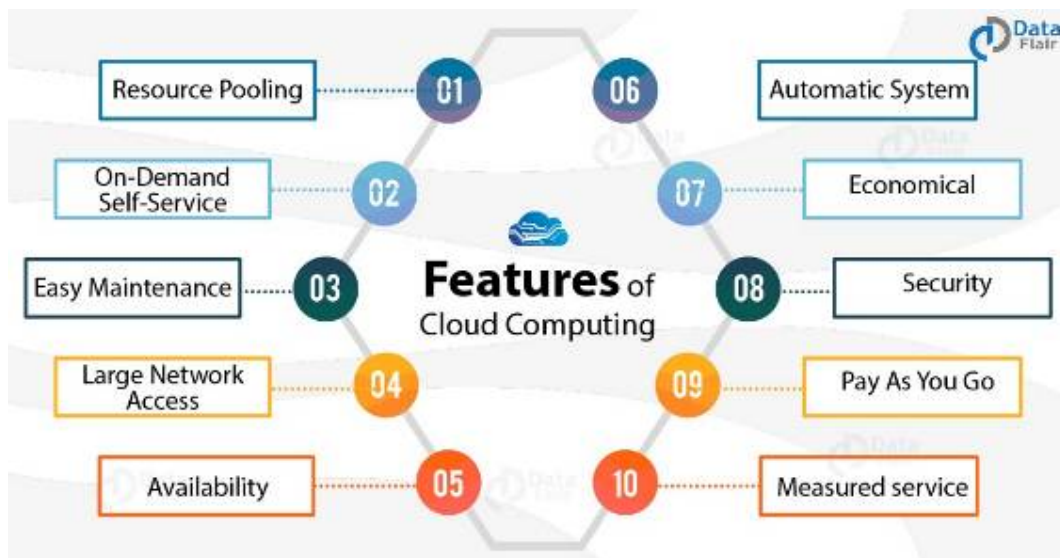


Figure 3 Some features of cloud computing [5].

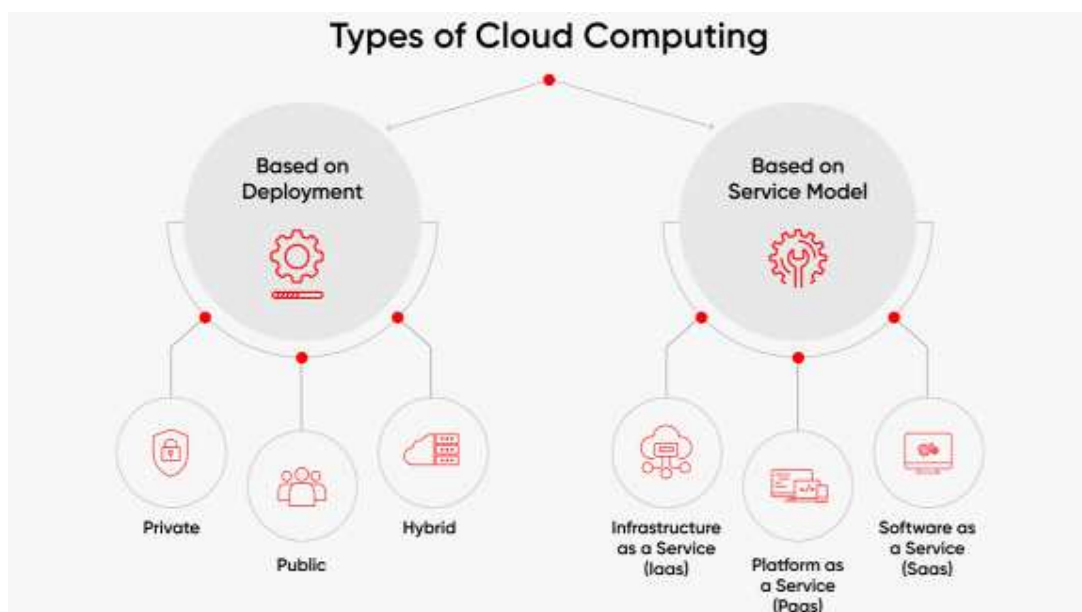


Figure 4 Cloud computing services and models [7].



Figure 5 A representation of cloud computing in the M&E industry [9].

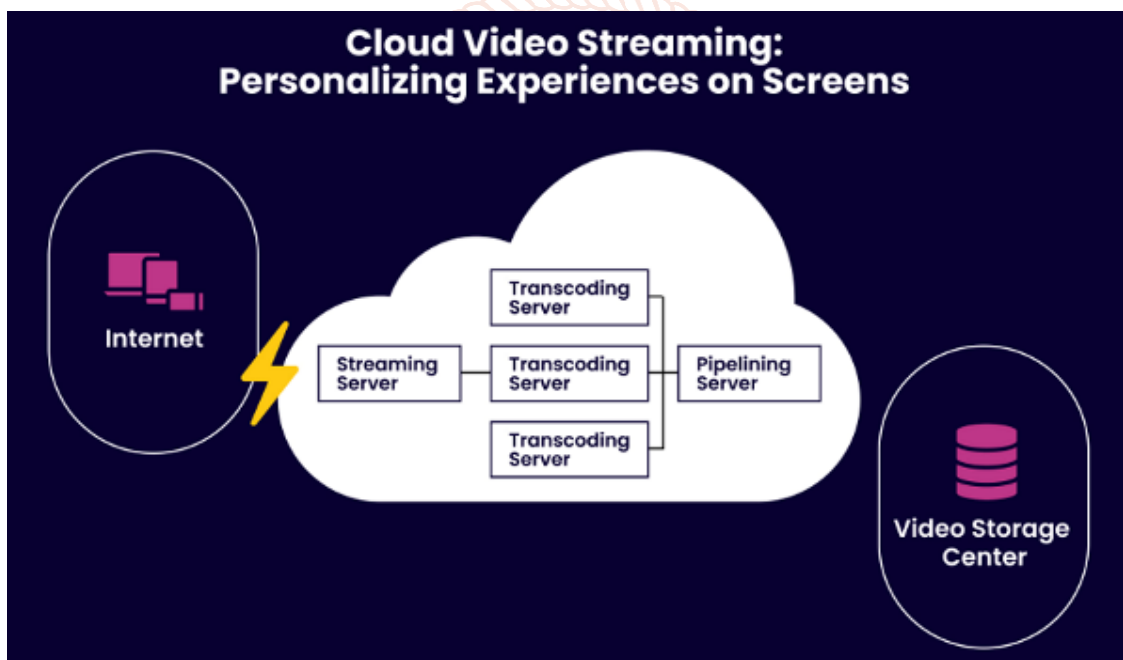


Figure 6 Personalizing experiences on screens [11].

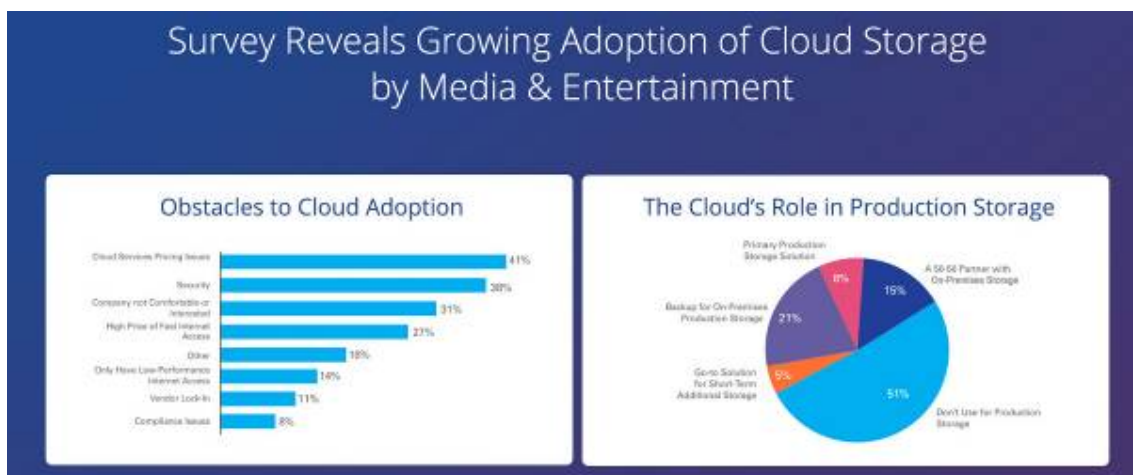


Figure 7 Growing adoption of cloud storage by media and entertainment [15].

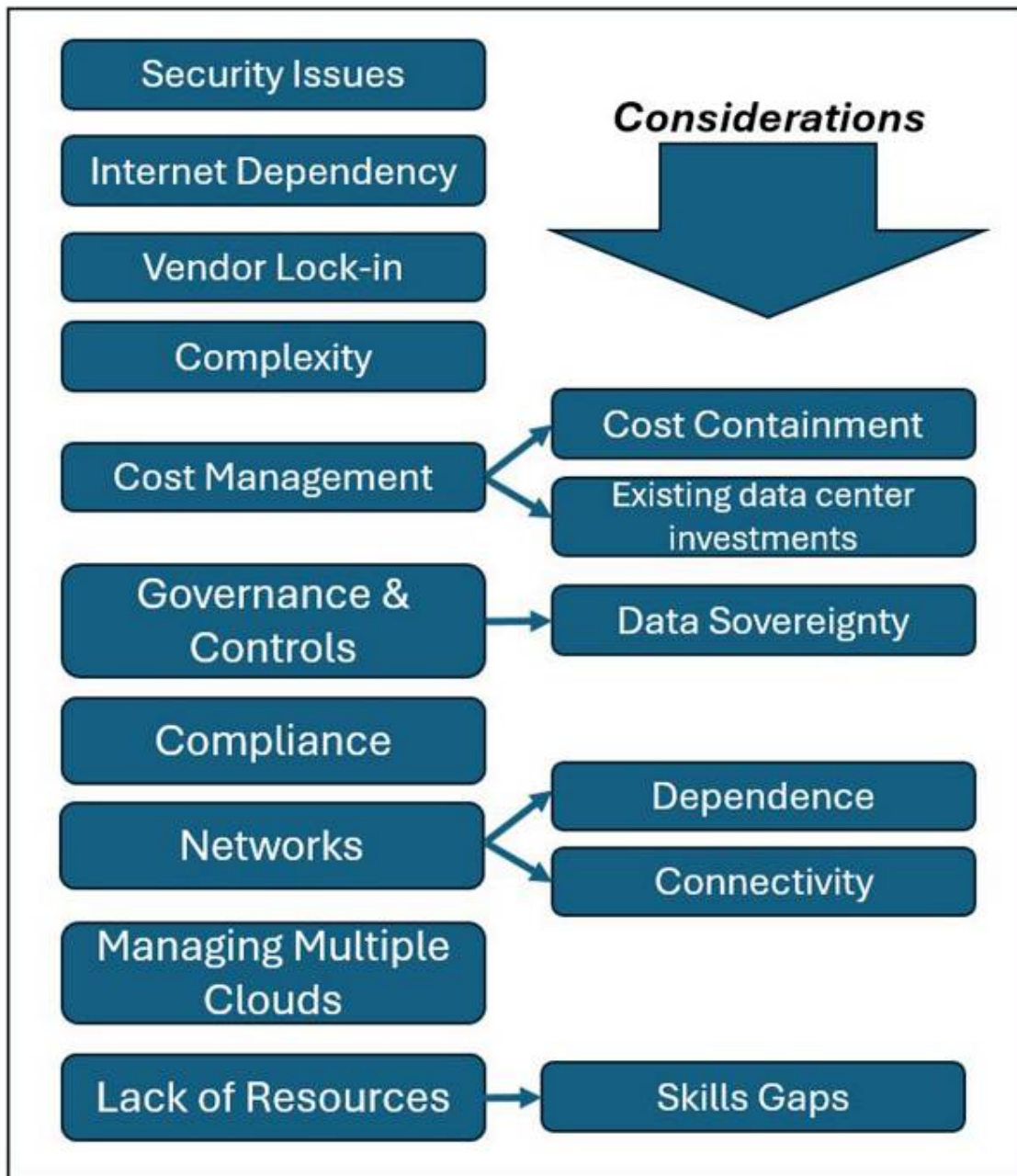


Figure 8 Some challenges of cloud computing in M&E [14].