Chapter 7
Cloud Computing in Tourism

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ABSTRACT

With rapid growth and development in technology, cloud computing has become a dominant platform for small businesses as well as major enterprises. Cloud computing streamlines the overall delivery of services and resources, helps keeping the costs in control, and global business is set for a huge change in the way businesses are done. The substantial transformation over the past few years has evolved tourism industry towards Tourism 3.0, where the consumers can easily connect to travel websites and interact by sharing their experiences. This considerably influences the perceptions, expectations and decisions both the actual as well as and potential travelers. This provides sufficient reasons for the tourism industry players to adopt and adept themselves with the latest advancements in the information technology, and the adoption of cloud computing is key in this regard as it provides easy access to a web platform that offers more productive, efficient, and competitive services to promote tourism as a vehicle of sustainable development.

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INTRODUCTION

With rapid growth and development in technology, we find that cloud computing has become a dominant platform for small businesses as well as major enterprises. Cloud computing streamlines the overall delivery of services and resources, helps keeping the costs in control and significantly reduces the deployment complexities. Cloud is taking over all areas of business and technology from marketing, sales, computing, e-commerce, tourism, hospitality and technology corporates. Global business is set for a huge change in the way businesses are done and organizations operate, with cloud computing integration.

The substantial transformation over the past few years has evolved tourism industry towards Tourism 3.0, where the consumers can easily connect to travel websites and interact by sharing their experiences. This considerably influences the perceptions, expectations and decisions both the actual as well as and potential travellers. This provides sufficient reasons for the tourism industry players to adopt and adept themselves with the latest advancements in the information technology and., the adoption of cloud computing is key in this regard as it provides easy access to a web platform that offers more productive, efficient and competitive services to promote tourism as a vehicle of sustainable development.

Since cloud computing is making inroads in other industries, there is hardly any surprise that tourism industry which employs 1 in 12 people in the world and generates 5% of the global GDP, has also seen the possible benefits of going on the cloud to develop tourism across the world by helping them apply these emerging technologies to improve business efficiency and innovation through cloud-based solutions, including productivity and collaboration tools, instant messaging and e-mail, video conferencing and distance training solutions, customer relationship management, enterprise resource planning, and development and application platform tools etc.

This chapter provides an overview of Cloud computing and its role in tourism sector.

CLOUD COMPUTING

"Cloud computing is a model for enabling, convenient, on-demand network access to a shared pool of configurable computing resources (e.g. networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction. This cloud model promotes availability and is composed of five essential characteristics, three service models, and four deployment models." Also, "Gartner defines cloud computing (hereafter

referred to as "cloud") as a style of computing where massively scalable IT-related functions and information are provided as a service across the Internet, potentially to multiple external customers, where the consumers of the services need only care about what the service does for them, not how it is implemented.

Cloud is not an architecture, a platform, a tool, an Infrastructure, a Web site or a vendor. It is a style of computing. Much architecture can be used to support its implementation and use. For example, it is possible to use cloud in private enterprises to build private clouds, but there is only one public cloud based on the Internet (Bento & Bento, 2011). Senyo, Effah and Addae (2016) and Senyo, Addae and Boateng (2018) define cloud computing as "the delivery of IT Infrastructure and applications as a service demand to individuals and organisations via Internet platforms". Subsequently highlighting that it is more than information service from the view put forward by Gartner (date insert). The differences among those who have put forward definitions stem from the fact that it is hard to integrate the large number of features and characterising it from one single perspective (Elazhary, 2019). Elazhary (2019) puts forward that Cloud Computing must be considered in having a number of subset of features a shared view of that Buya, Yeo, Venugopal, Broberg and Brandic (2009) consider of a provision of virtualised computers and linked within the paradigm of the Internet.

Cloud Computing hence is an Internet based computing where virtually shared machines provide software, infrastructure, platform, resources and hosting to customers on pay-as-you-use basis. This provides users and customers an opportunity to dedicate their focus on their core business and not on the administration of various facilities. Cloud computing customers do not own the base infrastructure but this is rented from the cloud service provider who further takes care of the administration and maintenance of end to end sources. And additionally providing an optimum capacity management. One of the most popular technologies in cloud computing systems that provides an on-demand network-based access to subscribers for the metered usage of an easily accessible and secure collection of remotely available information technology (IT) enabled resources and capabilities including network, servers, storage, applications and services (Armburst et al., 2009).

Further, Cloud Computing is used as a way to increase the capacity or add capabilities dynamically without investing in new infrastructure, training new personnel, or licensing new software (Sharma, Al-Badi, Govindaluri & Al-Kharusi, 2016).This computing paradigm seeks to deliver computing services similar to utility services such as water and gas (Buyya et al., 2009; Sharma et al, 2016). Furthermore Cloud Computing provides limitless flexibility, better reliability and security which enables new trends in industry and the organisations within this to customise their services and also data of a higher availability without much worry (AMD, 2011).

CLOUD COMPUTING IN TOURISM

Tourism has become one of the fastest growing economic sectors over the last number of years (Tesyla & Ponomarev, 2016) needless to say as an industry it needs to keep abreast and in tune with the latest technologies. It was estimated via the United Nation World Tourism Organisation (2016) the number of tourist's arrivals and using the world wide web to book holidays has increased by 4.6% (or by 52 million people) for the year of 2015. At the same time, the significant development of information technologies, especially via the cloud, introduces a new paradigm -smartness to all spheres of human life (Buhalis & Amaranggna, 2014).

From a tourism perspective the combination with cloud computing, human cooperation and Internet-of-thing technologies, can improve the effectiveness of tourism resources management throughout the destination and provide what can be called "smart tourism destination" (Buhalis & Amaranggna, 2014; Gretzel, Werthner, Koo & Lamsfus, 2015; Tesyla & Ponomarev, 2016). Furthermore, it also enables tourism organisations to use the cloud as a key resource as a management system that interface's holding large amounts of data with wide scope providing a geographic information service (Wang, Luo, Lin, Zhang, Wang & Luo, 2016). This enables businesses to interact with their consumers in a two-way process enable B2C by having the cloud.

Coming with the cloud age, more and more services are published every day (Zhou, Fang & Chen, 2012). Some of these are developed for end-users as web-based software, such as remote notebooks. Others are deployed as web services that interact with requesters agents, such as weather forecast services (webservice, 2012) and also translation web services (Zhou et al., 2012). Cloud computing also helps to address one of the weaknesses in the use of mobile systems creating greater accessibility to tourism destination management and also engaging B2C at a finger touch anywhere. The Cloud allows the delegation of some processing and storage tasks for tourism organisations that previously were held by other platforms with limited capability (Guerrero-Contreras, Rodríguez-Domínguez, Balderas-Díaz & Garrido, 2015). Therefore, it allows the tourist to gain access to a greater level of information that is held in the cloud.

Cloud computing builds on the established trends which have already given the IT platforms a new shape, over the years. But with cloud computing, we get additional advantages of cost benefits, faster deployment, high efficiency, lesser complexity, minor administration requirements and efficient capacity management and this all prove to be a boon to today's IT industry, with everyone looking for these advantages in business and service delivery. What must be remembered that tourists are unique in that their activities are highly constrained by space-time budget (Zhou, Xu & Kimmons, 2015). Therefore, gleaning information about a distant place before

travelling becomes an important task (Zhou et al., 2015) and because of this type of technologies they can take a virtual visit gaining the information. Also, they can experience elements of the destination through the virtual visit.

Virtualization adds on to the hardware flexibility and makes software deployments and redeployments easier and more efficient, without actually being connected to a specific physical server. It makes the data center more dynamic in which resources can be deployed and assessed more effectively. This effectiveness further has a positive effect and ensures optimum use of storage and network resources in meeting the technical and business demands in a cost effective way. As the application deployment becomes independent of server deployment factors, applications become more scalable. Virtual machines have become common and widespread units of deployment and result in minimal administration complexity among service providers and developers, at the same time adding the advantages of scalability and more flexibility. This is coupled that through the cloud platform management, the hardware resources can be integrated by using this approach so that they can virtualised to deploy the function server template production, start, stop, delete and recover resources, real-time monitoring of the entire computer platform performance and log reports and other functions (Wang, Luo, Lin, Zhang, Wang & Luo, 2018).

WEB 3.0 IN TOURISM

In the era of the Web 3.0 this task is not daunting because many tourism websites such as homeandabroad.com and tripadvisor.com, to name a few, provide information about popular places (Zhou et al., 2015) allowing consumers substantial information. The substantial transformation over the past few years has evolved tourism industry towards Tourism 3.0, where the consumers can easily connect to travel websites and interact by sharing their experiences. This considerably influences the perceptions, expectations and decisions both the actual as well as and potential travellers. This provides sufficient reasons for the tourism industry players to adopt and adept themselves with the latest advancements in the information technology and., the adoption of cloud computing is key in this regard as it provides easy access to a web platform that offers more productive, efficient and competitive services to promote tourism as a vehicle of sustainable development.

With the computation paradigm shifting from single machine to cloud computing, the impact of effective and efficient data management becomes imperative. Because there are many forms of cloud computing that must be adjusted to the unique demands of tasks and customers, several successful cloud resource management architectures have made huge inroads (Zhou et al., 2015) in the tourism industry more recently. Since cloud computing is making inroads in other industries, there is hardly any surprise

that tourism industry which employs 1 in 12 people in the world and generates 5% of the global GDP, has also seen the possible benefits of going on the cloud to develop tourism across the world by helping them apply these emerging technologies to improve business efficiency and innovation through cloud-based solutions, including productivity and collaboration tools, instant messaging and e-mail, video conferencing and distance training solutions, customer relationship management, enterprise resource planning, and development and application platform tools etc (Hinze & Voisard, 2003).

More and more travel itineraries are nowadays being booked through websites and online advertising carried through various search engines and social media portals thus adding extra value to the products and services at a very affordable cost. The same model has been followed by England-based Thomas Cook Group plc which is one of the world's leading leisure travel groups with sales of £8.9 billion ($13.7 billion) and 22.5 million customers, and is already using cloud computing through its service provider Accenture which will design and implement an infrastructure that integrates the company's separate European IT structures into a single group organization drawing on public and private cloud technologies to help transform its IT operations, processes, methods and systems to provide a platform for the efficient growth of the business. Its service provider has partnered with Cisco and Lufthansa Systems where Cisco will provide network infrastructure while Lufthansa Systems will be involved with IaaS (Infrastructure as a Service) components.

Infrastructure as a Service (IaaS) is the delivery of computer hardware which might include servers, networking equipment, storage media, and data center space, as a service. It may also consist of the delivery of operating systems and virtualization technology equipment so as to manage the resources. IaaS customer rents the facilities from the cloud provider rather than buying, installing and maintaining on their own within their own data center. And the cloud feature which plays a dominant role this way is pay-as-you-use model. And it provides a lot of flexibility to the customer for demanding and negotiating the facilities as per their very requirement which saves a lot of cost and wastage of resources, which in itself is a huge benefit. Another feature which plays a major role in the success of IaaS is scalability, so the applications and resources can be scaled up and down based on the need and environment being used, this gives customer a lot of room for making their operational decisions and hence keeping costs within control.

With the distinguished features it has, the customer and provider can negotiate and decide on the service levels. Service Level is an agreement between both the parties which they agree on for the availability and demand of resources and services. For example, if the provider assures that services on the provided facilities and resources will be available for 99 percent of the time, the contractual agreements can be signed based on such factors. Considering an industry wide trend, we find that organisations with research based projects find IaaS as most suitable service

model. So cloud computing providers can offer the testing infrastructure for the scientific and medical researchers which is beneficial for such organisations, who do not otherwise deal with computer and networking infrastructure, this not being their core business area. Similarly other organisations can benefit by renting a certain kind of hardware or infrastructure for which they assess that they can save on costs as well as expertise.

IaaS model changes the way developers deploy their applications. Instead of spending time with their own data centers or managed hosting companies, they can just select one of the IaaS provider, get a virtual server running in few minutes and pay only for the resources they use. From a technology viewpoint the IaaS type of cloud offerings have been the most successful.

Infrastructure as a Service providers use the virtualization feature of cloud computing provides virtual servers containing one or more CPUs, running several types of operating systems and a wide list and choice of software stack. In addition to this, IaaS provides storage facilities and networking facilities as well, which are the key components of an infrastructure. IaaS offerings can be distinguished by the availability of the cost benefit ratio to be experienced by customer end applications when transitioned to the cloud. The most relevant features would be physical location of data centers, types of user interfaces, consoles and APIs to access the system, hardware capacity design, choice of virtualization platform and operating system types and different billing methods.

Since Cloud computing changes IT into a service, its products can be used throughout the entire distribution chain in tourism industry from the tourists, travel agents, tour operators' airlines, catering companies and all other suppliers. The flexibility aspect enables the companies to purchase services on Internet as and when they need service time and no longer required to purchase equipment like traditional organisational settings. It can help Information Centre Staff to calculate ROI easily. Using cloud computing service, customers no longer need to invest large sums of money for equipment investment and consider equipment depreciation, and hence no longer need to worry about the potential investment risks involved. They only need to pay rent fees monthly or annually. And there will be benefits with that pay-month (Keun et al., 2007).

The on-demand, self-service, pay-by-use nature of cloud computing is also on the base of established trends. The on-demand feature of cloud computing helps to maintain the performance and capacity aspects of service-level objectives. The self-service feature of cloud computing also allows user-base to create flexible environments that are extendable. And the pay-by-use feature of cloud computing may take the form of equipment leases that ensures a minimum level of service from a cloud provider. Another significance of the self-service, pay-by-use model is that applications tend to have composable nature by assembling and configuring

appliances and open-source software as much as they are programmed. Applications and architectures will be more advantageous towards achieving the benefits of cloud computing when they can be reused or redeployed to be able to make use of standard components and features. Similarly, application components should be considered to be composable by configuring them with the features to make them consumable easily. This does need a simple, easy functions and well-documented APIs. Building bulky, immovable applications is now a thing of the past as the library of existing tools that can be used directly or tailored for a specific use becomes ever larger.

The fluctuating nature of tourism business makes it highly challenging to manage the resources. The providers in the tourism distribution chain need to scale up resources during peak season and scale down resources during lean seasons which are further influenced by the location and culture of the destination as well. It is not financially viable to purchase infrastructure and manage it equally all days. The cloud based infrastructure enables them to conveniently and effectively manage highly scalable resources while paying only for hours used.

MOBILE COMPUTING IN TOURISM

Mobile computing is another area of cloud computing that must be discussed in particular in its advantageous use in tourism. Although the word *mobile* typically refers to smartphones, it's applicable to all programmable, portable, and wireless and conveniently held devices, but not limited to tablets, pads, smartwatches and laptops (Elzahray, 2019). With regards to them being used in tourism the advantages of such devices is that they can be used anywhere at any time. It is also predicted that 2025, each human being will own an average of six mobile devices summing up to 50 billion more devices (Bhullar, Mancilla, Nijjar & Teixeira, 2014).

Mobiles and especially smartphones have applications that allow ease of accessibility making cloud computing so much easier enabling a great deal of resourcing. Such applications have been and are being used for mobile tourism (m-tourism) such as the location –aware iTravel (Yang & Hwang, 2013) application which provides information relevant to each tourists location by allowing peer to peer (P2P) exchange of ratings of tourists places among tourists mobiles in close proximity (Elzahary, 2019).

The new application and the numerous emerging computing paradigms which have mobile cloud computing (MCC), cloudlet computing, mobile clouds, mobile IoT computing, IoT cloud computing, the Web of Things (WoT), the Semantic WoT (SWoT), the Wisdom WoT (W2T), opportunistic sensing, participatory sensing, mobile crowdsensing, and mobile crowdsourcing enable m-tourism to reach a wider audience greater than ever before.

SMART TRAVEL PLANNER APPLICATION

From tourist's perspective, the Android-based phones are providing smart travel planner application accessed through mobile devices hosted on cloud infrastructure for the travellers all over the world. The smart mobile travel planner applications tend to provide a dynamic view of the locations, e.g. ranking of hotels or places, feedback on a point of interest and integrated with popular social networks so that the tourists can have easy access to the actual feedback from the previous users.

The electronic tourist guide system (Trip@Cloud) as mobile cloud computing application provides easy access to the cloudy information in a seamless manner and this information needs not to be over the user's mobile device, but will be downloaded to user's device according to the current location and the Internet status connection. Therefore the partitioning is done for the data to be sent to the mobile device. Also, it can help to reserve hotels or book a cab and provide location based services though such applications are still emerging to be widely adopted.

Further, cloud computing services also helps the tourism enterprises to stay ahead of their competitors by providing high quality quick, efficient, and reliable services through handling huge traffic. It not only provides platform for the tourists to easily search volumes of data but also provide efficient data management solutions to the tour operators to design standard as well as tailor made tour packages including all the flight bookings, local transportation, accommodation reservation and catering etc.

Like others, online security is one of the important consideration for travel business also due the fact that the latest trend in tourism is about booking the services with credit and debit cards which involve the transfer of sensitive information thus need to be processed through secured gateways which need to be monitored and updated on a regular basis and cloud based service provide highly secured networks specially engineered and maintained to offer a robust network that is simple to use, efficient, reliable, and highly secure.

Thus a cloud-based service not provide the travel and tourism enterprises with the flexibility to create highly intuitive software solutions but that too at affordable prices where the website visitors can access various applications and book related services from anywhere using any mobile device or PC thus clearly implying that the businesses that embrace the cloud will stay ahead of the competition.

In m-tourism for example, Mitchell, Rashid, Dawood and Alkhaldi (2013) proposed a Hajj management system in which every pilgrim is provided with a RFID tag identification system. RFID readers placed in strategic locations are used for tracking pilgrims interacting with the tags and sending the information to a centralised server (Elazhary, 2019).

Nitti, Pillion, Gusto and Azorti (2015) proposed cloud based architecture for sustainable m-tourism in smart cities. The architecture is formed of four layers. The

lowest layer is the physical layer, which is followed by a virtualisation layer, this was so that ideally, every IoT device in the physical layer has a virtual counterpart. The following layer is the service layer which is responsible for servicing the upper most application layer. Sensors are then placed at the entrance of each POI to estimate queue waiting time. Each tourist specifies the desired POI's through a smartphone application, and the system responds by solving an optimisation problem to determine the best order of POI's in the visit and the right transportation, based on real transportation data, so that each POIs is visited only once and in the shortest time (Cormen, Leiserson, Rivest & Stein, 2009).

SMART TOURISM DESTINATION

There have also been scenarios describing the interaction of computing units in a cloud based system to provide support for a tourist smart destination (Teslya & Ponomarev, 2016). The smart destination is formed by software services and local community members in a human cloud. Tesyla and Ponomarev (2016) put forward two types of actors to be overviewed in accordance to the human-computer cloud conception used for smart tourism destination support; human and software based computing units. Human units present all people resources that are involved in content creation. These can be further divided into two categories (Tesyla & Ponomarev, 2016).

1. *Contributor* is a content manager that belong to the local community. The content includes geotags, objects, descriptions and photos of objects, and discussions about visited destinations. Contributors are often volunteers that are working with geographical information and create new content, edit and moderate existing content. Tourists also may contributors while they provide reviews while they provide reviews, photos and discussion.
2. *Tourist* is a consumer of smart tourism destinations. The tourist sends a request about a destination and receives response with found solutions to help tourist in decision making. Solution can include recommendation about interesting places and objects in the location, extend context information, transportation recommendations, etc. Tourists can leave feedback about destination. In addition, cloud provides communication platform where tourist may discuss visited or viewed destinations with other tourists of with contributors.

The above discussion clearly highlight through their discussion is that the cloud is allowing SMART Tourism destination management through the accessibility with the cloud. It must be also acknowledged that tourists with this type of technologies

can create also create travel stories of their own using the cloud which can be shared on new media platforms such (Zhou et al., 2015) Instagram, Pinterest, as many others. Giving that tourists have the opportunity to post most of their stories from mobile applications, it is expected to surpass the web application (Kurdi & Alnashwan, 2017) where there is a decline. Most importantly, "travel" is the seventh most downloaded app category on Apple app store in 2016 (Apple, 2016). What is becoming clearly prevalent today that many mobile applications help travellers in deciding their destinations and selecting places to visit in these destinations by showing customers' reviews, visitors' ratings, blog posts or friends' recommendations. However, there is still a need for mobile applications that provide more options allowing for more customisable tour plans (Kurdi & Alnashwan, 2017).

CONCLUSION

Practically, every business organization does recognize the value of Web-based interfaces to their applications, whether they are made available and processable to customers over the public Internet, or whether they are in-house systems that need to be made accessible only to the authorized employees, partners, suppliers, and consultants. The advantage of Internet-based service delivery, of course, is the availability of the applications with broader options, from anywhere and anytime, for customers, end users or in-house employees. While at the same time, organisations, realise the need and ability for secure communications as well, which is achieved by using thorough mechanisms like, Secure Socket Layer (SSL) encryption along with strong authentication, bootstrapping trust in a cloud computing environment demands wise considerations and parameters of the differences between enterprise computing and cloud computing. When goes with a proper approach and a well architected and laid out plan, Internet service delivery is in fact more flexible and secure for all businesses in small to large enterprises. Hence, it still is building on the already established trends but in a more robust and advanced ways and ensuring wider availability and security with additional features of cloud computing. In today's world, availability of high end applications from almost anywhere without the breakdown of services is the most vital factor for every business provide security is also well-built in the features to ensure data security.

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KEY TERMS AND DEFINITIONS

Cloud Computing: A model for enabling, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction.

Infrastructure as a Service (IaaS): Is the delivery of computer hardware which might include servers, networking equipment, storage media, and data center space, as a service.

Tourism: Is the phenomenon of movement of people from place of origin to some other destination for leisure, enjoyment, relaxation purpose, involves temporary stay and spend money there which has been earned at the place of origin and come back to original destination.

Virtualization: Virtualization adds on to the hardware flexibility and makes software deployments and redeployments easier and more efficient, without actually being connected to a specific physical server.

Web 2.0: It is the second stage of development of the Internet, characterized especially by the change from static web pages to dynamic or user-generated content and the growth of social media.

Web 3.0: Is the creation of high-quality content and services produced by gifted individuals using Web 2.0 technology as an enabling platform.