

# Assignment One James Beard

*by James Beard*

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**Report**  
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**Network Programmability**

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## **Abstract**

This report aims to discuss and present answers to several questions around changes in the networking industry and those who work in the industry. These questions include discussing the impact that cloud computing has had on the networking industry, how job roles in the networking profession have evolved to meet the challenges of the cloud and how the use of RESTful Web services has helped facilitate these changes. Additionally, why software-defined networking has been widely adopted in the industry even though it has meant adapting the role of network engineers. The final question discussed is why standards such as JSON and REST have been selected and utilised. Finally, the author will evaluate the report in the conclusion section, where he will discuss the sources, findings, and answers put forward in the previous sections.

## **Section Two- How the shift towards cloud computing has impacted the industry.**

In this section, the author will discuss the shift towards cloud computing and the impact that it has had on the industry. The large shift towards cloud computing has had a huge impact on many aspects of the networking industry. A brief report from ESG discusses how a previous report from them suggested that 78% of midmarket companies, a company that employs 100 to 999 employees and enterprise organizations, a company that employs 1000's people or more, actively use public cloud services in their businesses [1].

One such area where cloud services are being used in the networking industry is Infrastructure as a service (IAAS), as Azodolmolky, Wieder, and Yahyapour discuss in their report, they discuss that cloud computing does not necessarily depend on visualization, there are in fact several cloud infrastructures that are built using virtualized servers [2].

The use of software-based virtual switches and virtual ethernet ports is another new addition to the networking industry, being used by networking professionals. The advantage to virtual switches over physical switches is that according to Azodolmolky, Wieder and Yahyapour Virtual switches do not have to necessarily run network protocols or treat all ports the same as some are connected to virtual ethernet ports [2].

ESG and the image below suggests that 38% of organizations have implemented WAN links and data centres to help create a seamless network that allows employees to access company documents and resources onsite or while offsite [1]. When considering the uncertainty and change environment that people find themselves in, the ability to use cloud services to access resources as well as using cloud services to create and use virtual machines is vital in the networking industry and the task of maintaining connectivity in the modern world.

Another impact that cloud computing has had on the networking industry is Routing optimization. As discussed by Borovick and Mehra, there has been an enormous increase in media content and videos stored and sent around the internet in the last decade. The document goes on to mention the importance of video and video communications in businesses. This is more apparent this year where everyone's ability to travel has greatly been restricted, causing not just businesses but many aspects of communication to result in video conference calls instead of face to face. The document suggests this can be detrimental for network professionals who must ensure that there is the bandwidth to deal with the demand and that latency is kept to a minimum [3]. This is just the first part of this problem, as network professionals have also had to consider how networks scale, prioritise, and recognise video as it travels around the internet and the cloud [3]. They then have to ensure an optimal service with regards to the parameters of the user's location, device, and their reachability [3]. Then finally ensure that the network can support a diverse and large number of devices, as larger businesses will have many people using multiple internet-capable devices simultaneously [3]. If for example, an enterprise network fails to keep up with the demand of the network and latency and buffering becomes a major problem then potential clients could become disinterested in a company and take their business elsewhere, employees will not be able to complete tasks effectively and the blame will roll down to the IT department, specifically the network engineers.

### **Section Three- How the job role of network professionals has evolved to meet the technical challenges of the cloud.**

The introduction of cloud computing and cloud services has meant that the job role and duties of network professionals have greatly changed over the recent years. Today network professionals must have a much better understanding of software, programming and other technologies than was required before. This is also suggested in a report by the Cloud Industry Form [4]. In the report, they discuss and question organisations on how the introduction of cloud computing has changed the role of network professionals. The reports suggest that today network professionals do not just need a deeper understanding and knowledge of technology but also that network professionals need to have innovation on their mind constantly and to be always thinking about new and innovative ways to improve the organisation and about 30% of organizations asked, believe that the role of network professionals has become more complex in recent years. [4].

Some of the major selling points of cloud services include virtualisation and using virtual machines to complete tasks. Additionally, using cloud storage sites to store data and information to save the user's device memory. This data still needs somewhere to be stored, meaning the cloud does require physical hardware. This hardware includes multiples servers working together as a data centre to store the applications and data [5]. The cloud also requires networking devices to ensure that

the clients can reach the servers and applications successfully [5]. The challenge for network professionals is that they must now adapt to the ever-growing demand on the servers, data centres, switches, and routers, as the cliental using the cloud services counites to grow. For many networking professionals in businesses that have begun to shift to and provide more cloud services, their role will require more managing of traffic and managing resources [5] as well as maintenance, configuring and troubleshooting of devices to ensure the continued success and growth of the service.

#### **Section Four- How RESTful Web Services have been used to facilitate these changes.**

In this section, the author will discuss some of the ways that REST API web services have helped network professionals with the transition. This section will predominantly discuss how REST API has helped facilitate the changes needed to achieve the tasks discussed in the previous section. According to IBM, API for many is the best way to for companies to access cloud computing services [6] and RESTful API is very popular amongst developers, as it is considered to be flexible and versatile [6]. RESTful API is the interface into the management information tree that is used to allow the manipulation of the model state [7]. The REST interface can also be used by the APIC CLI, GUI and SDK, this means that the information being sent and used to configure devices comes from the REST API. As mentioned previously as cloud service and the internet, in general, grows the ability to use REST API as part of a program to write and deliver commands automatically to network devices will greatly aid networking professionals to complete their role. The REST API can also provide an interface from which network professionals can see statics, faults and events happening [7]. The REST API can also provide push-based event notification, meaning that an event can be sent through a web socket when a change is made to the management information tree [7].

#### **Section Five- Why software-defined networking has become so heavily adapted by industry, despite meaning an adaptation to the job role of network engineers.**

In this section, the author will discuss why software-defined networking (SDN) has become so adapted by the industry and what it means for the future of networking as well as what it means for network engineers.

Firstly, a software-defined network is a network designed to allow network management tasks to be completed much more efficiently and easier than traditional methods [8], as well as allowing for network innovation thanks to flexible interface controlling the behaviour of the entire network [8]. This belief is also backed up by a survey by Kreutz and co who also believes that managing a network is much simpler, easier to introduce, create abstractions in networking and help ensure the evolution of networks [9]. SDN consists of three parts, an SDN controller that acts as the brains of the network by allowing a centralised view of an overall network [10]. The second part is southbound API, they send information to the networking devices

(switches and routers) on the network [10]. The final part is the northbound API, the northbound API activates services and talks to applications in the network [10].

Another reason to explain why network engineers and the industry has begun to shift towards SDN is that although it has meant that network engineers have had to learn a new skill and improve on skills around programming, it does reap many rewards for adopting the new style of networking. According to a publication by Cisco, they argue that adopting the controller-based architecture and SDN gives the industry and networking engineers the following rewards:

- **Ability to optimize the network:** The use of programmability greatly allows network engineers to program their networks to respond more fluidly to ever-changing conditions. Network engineers can use programming skills to optimise their resources and automatically adjust to network changes, this allows for the network to run at greater speed and efficiency. SDN allows for more efficient and easier scalability of a network, depending on the demands of the organizations [11].
- **Greater OpEx value:** The ability for network engineers to complete more tasks with the same time and effort as the traditional methods of configuring network devices thanks to automation. This means that operating expenditure is lowered in enterprise networks which is a great incentive when considering that operating expenditure can equate to twice that of capital expenditure [11]. When considering that employers are going to want the best return of work and time efficiency from their employees, it important the network engineers of tomorrow are well versed is using SDN to make them more attractive to employees.
- **Greater speed and faster rollout of services:** The traditional method of configuring devices was to do them one by one singularly and if a change was needed every network device had to be changed individually, with the SDN automation a network application can configure the desired change to all the desired networking devices simultaneously, in a matter of minutes [11].
- **Simplicity:** Although programming is often not network professionals favourite activity and often does not come easy to network engineers, the use of a process called abstraction by the controller makes things easier and more transparent for network engineers, as it handles and translates the policies and rules behind the scenes [11].
- **Better analytics:** A digital network allows for better analysing of the network by the network engineers. The ability for network engineers to view deeper data and gain faster insights into the data and information of the network allows them to build a more agile and secure network as well as allowing them to learn from the data and adapt the network to ensure efficiency and quality of service [11].
- **Accuracy and reliability:** Similar to the previous point if an individual manually changes and reconfigures routers individually they are all but certain to make an error, such as giving an interface an incorrect IP address or misconfiguring an IP route, this could have dire consequences with data not being able to reach their targets while the network engineers aim to figure out

where the error is. If the information is only entered the once with a network application there is far less chance an error will occur [11].

### **Section Six- Why standards, such as JSON and REST have been selected and utilised. Specifically, consider interoperability.**

In this section, the author will discuss why standards such as REST and JSON have been selected and utilised in the industry. Firstly, JSON or Javascript objection notation is a data format widely used in programming and applications, due to it being the most widely used standard for document stores and widely used with REST API for Request and response purposes [12]. REST is a standard widely used for hypermedia, this is because REST architecture style defines a set of rules for how to define hypermedia systems that have widely been adopted by programmers and helped guide the design and development the web into what it is today [13].

Interoperability is a portion of the handling of data collection, this includes guaranteeing the correct classifications and standards are utilised to record and gather data from the very start or the people entrusted with gathering the data have worked and cooperated with other organizations to define how to gather and store the data. The most fundamental requirement of interoperability is the ability to publish data in digital formats [14], as previously mentioned JSON is considered to be the most popular and widely used method for document stores meaning it should work very well with interoperability. This is just one example of interoperability, people who work in the researching or other professions when analysing is vital will be more interested in and the ability to analyse, compare and group datasets [14], however, the ability to analyse the comparability and coherence of data does require that the data be published conforming to the standard definitions, methods and classifications across organizations and countries. This is vital to ensuring that data can be accessed and used by others for technical and legal purposes and ensuring interoperability can be achieved [14].

### **Section Seven- Conclusion.**

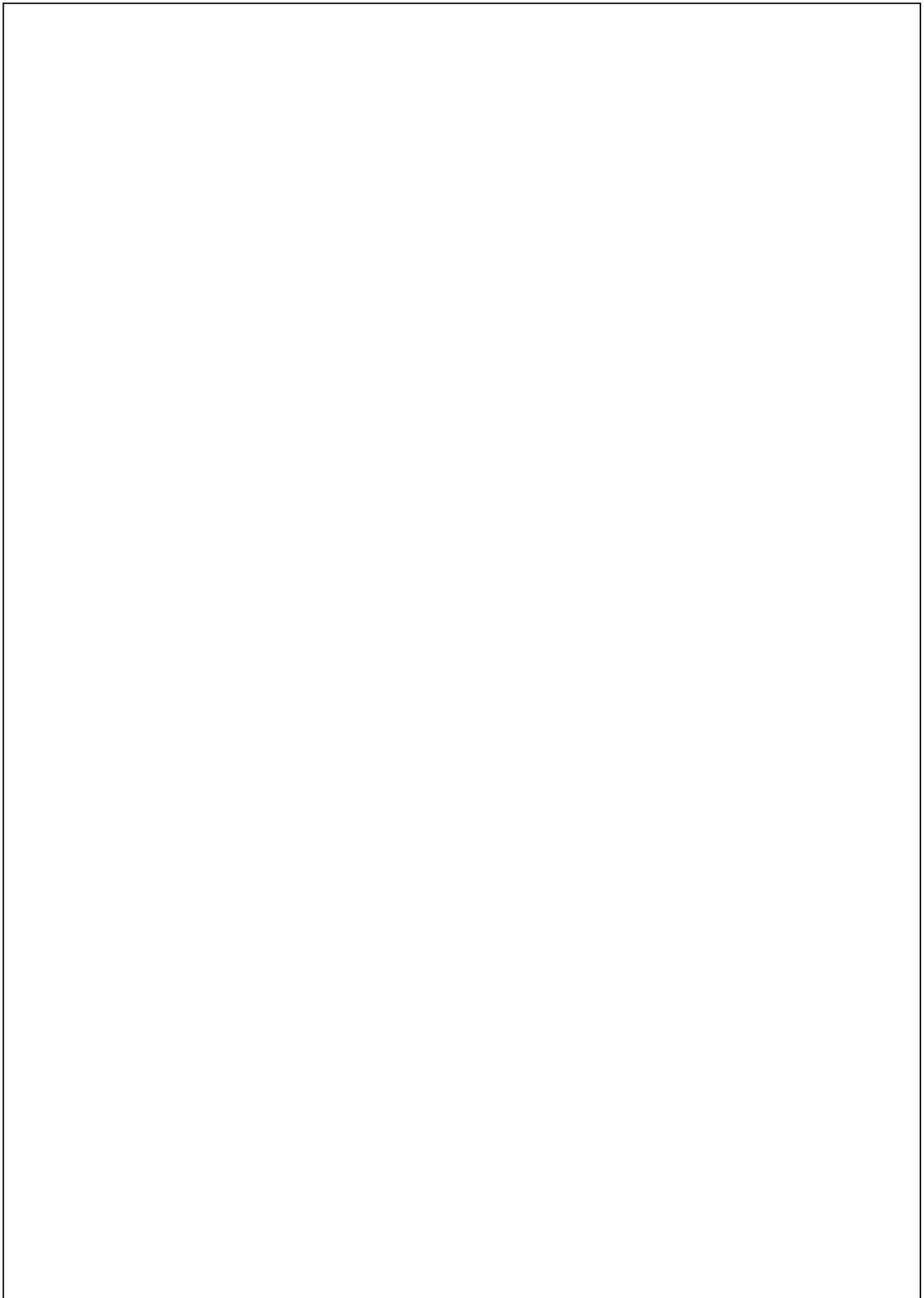
To conclude the changes to how the IT industry works in regards to the ever-growing use of Cloud computing as well as continued growth in the IT industry, in general, will mean that more traffic will be sent across the networks, this coupled with other aspects including virtualisation and SDN will mean that the network engineers will have to evolve their role to include more software and programming skills. The network industry is, however, no stranger to change, as mentioned by Cisco, in the last 20 plus years, the network industry has had to adapt to the transfer from circuit switching to packet switching, the change from ATM and frame relay to Ethernet and adapting to the wide use mobile devices on networks [11]. Software-defined networks and cloud computing is just another thing the industry must adapt to as it becomes more widely adopted in the industry, or risk being left behind. As though

these new skill requirements may be an annoyance or issue in the short term for network professionals, these skills do however wield the possibility for greater management and control of networks in the long term and will be required for a successful career in the network industry.

## Section Eight.

### References

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# Assignment One James Beard

## GRADEMARK REPORT

### FINAL GRADE

92/100

### GENERAL COMMENTS

#### Instructor

**Engagement with Literature Skills (40): 36**

**Knowledge and Understanding Skills (30): 28**

**Cognitive and Intellectual Skills (20): 19**

**Transferable Skills for Life and Professional Practice (10): 9**

A very nicely-written and well structured report. Good use of literature, appropriate sources selected. This is work of a high quality and an impressive submission for a level 5 student - very well done, James.

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