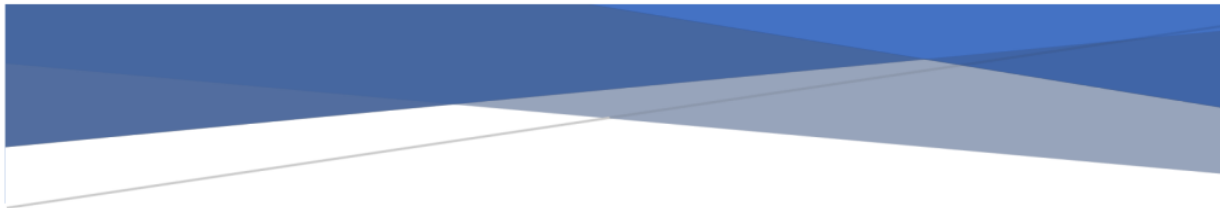


Assignment 1 Report

by Mikolaj Michalski

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NETWORK PROGRAMMABILITY

Assignment 1:

Networking and Cybersecurity

Mikolaj Michalski (1900885)
1900885@student.uwetsd.ac.uk

Table of Contents

1. Introduction	2
2. Cloud computing.....	2
2.1. What is cloud computing?	2
2.2. How cloud computing has impacted the industry?	2
3. Network professionals	2
3.1. How network professionals have evolved to use the cloud?	2
4. RESTful Web Services.....	3
4.1. What are RESTful web services?	3
4.2. How RESTful web services can be used to help Network professionals?	3
5. Software defined networking in industry	4
5.1. What is software defined networking?.....	4
5.2. Why software defined networking is becoming so heavily adapted by industry?	4
5.3. The adaption to the job role of network engineers.....	4
6. Different selected standards that have been utilized.....	5
6.1. Why REST and its interoperability?.....	5
6.1.1. What is REST?.....	5
6.1.2. How REST is utilized?	5
6.2. Why JSON and its interoperability?	5
6.2.1. What is JSON?	5
6.2.2. How JSON is utilized?	5
References	7

1. Introduction

In this report I will be covering cloud computing and the impacts it has had on the IT industry. Network professionals and how they had to adjust to the cloud changes. This report also covers RESTful web services and how they can be used to help network professionals. This report goes over Software-defined networking and why it's becoming so heavily adapted by the industry. Finally, this report covers the selected standards that have been utilized with cloud computing and SDN and their interoperability.

2. Cloud computing

2.1. What is cloud computing?

Cloud computing is the delivery of computing services such as storage and applications through the internet on a pay as you go service. This is in place so there are no charges or fees for anything you have not used Using google as an example [1], they say there are no upfront costs as well as no termination fees when using these services. Making this a very customer friendly approach especially when you get to try the whole thing out for free.

2.2. How cloud computing has impacted the industry?

The impact that cloud computing has on the industry is much more drastic than one may think. For the majority of smaller businesses, cloud computing might be the best way to go and grow. This is because small businesses can get all the functionality from several technology systems at a dramatically reduced price [2]. In simple terms, cloud computing has had a positive impact on the industry.

Overall, [3] it helps increase their profit as well as achieve set business goals. This also leads to companies preferring using the cloud services over getting cutting edge IT resources in their own company. At the end meaning they continuously rely on cloud services rather than their own infrastructure. Another impact is security. Security is no longer placed on the company but the cloud vendor. This can free up a lot of time as well as save money. [4] There is no longer the need to train and support an IT department dedicated to security alone as all of it can be done by some patches and bug fixes made by the cloud vendor. Finally, another great impact is the ability to access files anywhere. This allows for good collaboration of many businesses all through the cloud. The files can be accessed at any time and can even be restricted to a limited group. This can even improve or speed up group projects or meetings due to efficiency.

3. Network professionals

3.1. How network professionals have evolved to use the cloud?

With the cloud computing wave, there has been serious stress placed on network professionals. This is because cloud computing has brought some challenges alongside its usability. One of the challenges that a network professional will come across will be the security issues that come alongside the cloud. Although, as stated previously this can be fixed by the cloud vendor, it can still cause a lot of trouble for the company. When moving customer data or any sort of private data to the cloud, the company runs the risk of having the data lost or stolen. In any terms, the company promises to keep all private data safe. [5] For network professionals the fix to this is encryption.

Several different encryption techniques can help overcome the issue of data being stolen [6]. The provider would be encrypting the data on their end and can then decrypt whenever needed.

Another significant challenge would be migration. Just like the security challenge migration causes some security issues. However, the main challenge is moving the application to the cloud. The challenge only appears when moving an existing application to the cloud. [7] Migrating to the cloud usually involves replacing the traditional hardware found in the data centre. Some of the main challenges consist of Security challenges, slow data migrations and the worst of them all being application downtime.

Finally, network professionals had to be trained to learn new software [8]. The network professionals must be able to now understand how to secure and manage the cloud to ensure everything is reliable. As well as know what to do if the cloud could potentially go down or when they come across any errors. Without this the network professionals will not, be able to do much in a business that has transferred to the cloud as most of the hardware technology has now moved to the cloud.

4. RESTful Web Services

4.1. What are RESTful web services?

RESTful web services or otherwise known as Representational State Transfer, are built to work the best on the web. When using the REST style, functionality and data are considered as resources which now are accessed using something called Uniform Resource Identifiers (URIs) usually links on the Web. These different resources are all represented by documents and are acted upon by using a set of well-defined operations. For example, the style that REST uses is designed to use a stateless communication protocol. [9] This typically uses HTTP. In this style, the clients and servers exchange the representations of resources by the interface and protocol that is used.

4.2. How RESTful web services can be used to help Network professionals?

REST comes with many advantages for networks. Because of this REST can help network professionals in many ways depending on how the professionals plan on implementing it. APIs allow network operators to define their automation architectures with ease, due to the depth and flexibility that they offer. One of the ways RESTful web services can be used to support network professionals is with service provisioning [10]. Service provisioning is the process of setting up some sort of service for a customer, which in a network could be a server, intranet etc. In networking terms, you could say Network provisioning is a type of service provisioning as it provides the user with a network that they can access. Service provisioning is often seen as a difficult task, this is where RESTful web services can help. RESTful web services can aid in tackling this sort of issue.

To further explain, NGNs are something called Next-generation networks. These are often packet-based networks that are capable of provisioning consistent and popular services to the end-users of the network. [11] RESTful web services are being used more as a technology for service provisioning in the NGNs. This is becoming an alternative to something called SOAP-based web services. While SOAP-based web services are considered modular applications, RESTful web services are defined more of a network architectural style made for distributed hypermedia systems such as the World Wide Web. While RESTful web services show significant potential for service provisioning NGNs there can be some issues that can hold it back. Overall, it seems to be the better alternative if the professional knows how and what things need to be done to make it work.

5. Software defined networking in industry

5.1. What is software defined networking?

Software-defined networking is a technology that can change the approach to network management. With software-defined networking, you can provision, manage, and even program networks much more efficiently. In this type of approach, the underlying network infrastructure is abstracted from the applications. [12] SDN allows you to pick in programmability and automation across campuses, WANs, and data centres. SDN got developed out of the need to automate, scale, and optimize networks for applications that can be provided through things such as an enterprise datacentre, VPC or some service like a public cloud. The benefits of SDN for networks and IT operators are very significant and therefore hard to ignore when making a network.

5.2. Why software defined networking is becoming so heavily adapted by industry?

Software-defined networking has several benefits when creating networks. The benefits work best for both networks and the IT operators through network visibility, automation and being controller-enabled. [13] One of the additional benefits comes from the ability to programmatically automate network configurations. This alone is a massive benefit as it saves a huge amount of time for anyone who must go and configure these devices. However, along with this benefit, there is also the increased scalability and reliability which IT operators can have a great time using in the networks. Scalability is always good to have as at anytime the network may need to increase in size.

Another benefit that software-defined networking brings along with it will be increased flexibility and speed for changing the network operation to enable an application or address a task of sorts [14]. This allows the network engineers to have an easier job when having to change something within the network or even when having to address any of the tasks.

Another benefit of software-defined networking would be the centralized visibility of the network topology. There is also the visibility of network elements and their operation across the network infrastructure. [15] This makes it far easier for anyone involved with tinkering with the network, as they can have a clear vision of what is always going on around the network. It makes it easier to work out how the network could be scaled as well as if there are any changes needed that could improve the overall network.

Finally, another benefit to software-defined networking will be the central configuration. With this, everything can be changed within the network from one place without needing to move. Managing the network can be done by network engineers without the need to go around checking every device. Monitoring the way the systems work, the way that the network is operating is also able to be seen. Services can be delivered from the same place. Finally cloud automation anything to do with the cloud can also be done giving a great advantage for network engineers that have the correct skills to program and use the applications that are given to them.

5.3. The adaption to the job role of network engineers.

Now onto the adaption to the job role. Network engineers will have to change the way of approach when coming to do some work in networking especially with SDN. [16] This is because of the way that software-defined networking works are mainly through automated applications. This means that for the network engineers to adapt to the new way of work in networking, they would be required to go through training to learn how to use the software. They would also have to learn to

understand more programming as the applications allow automatic network configuration. The network engineers would then program what needs to be done within specific devices and would leave the automation to the rest of the work.

6. Different selected standards that have been utilized

6.1. Why REST and its interoperability?

6.1.1. What is REST?

REST is an engineered style for bringing standards between the computer systems on the web, allowing it to be easier for them to communicate with each other. To summarise, REST is a style of client-server application that works around the transfer of representations of resources all through the requests and responses [17].

6.1.2. How REST is utilized?

REST is utilized in both cloud computing and SDN in different ways. With the vast number of APIs to choose from, the RESTful APIs follow the SOA model and are often used by software that uses XML or JSON for integration purposes. For cloud computing, the use of RESTful APIs is a solution for the remote consumption of data processing devices. When dealing with globalization it is essential to use REST APIs as a business to try gain a foothold in the industry or market. [18] With the remote/mobile workforce, the cloud helps businesses realize there are new priorities. However, for the cloud to be used effectively the organization needs to understand the difficulty of cloud computing as well as the needs of using the cloud service provider API solutions.

For software-defined networking, REST is used through something called Northbound APIs. Northbound APIs in SDN are used to interact with the controller to explain to it how to configure the devices. REST is one of the more common API technologies that is used for the Northbound interface. There are six constraints that an API must follow to be RESTful and these points are put in this place to maximise the independence, scalability, and interoperability of software interactions.

6.2. Why JSON and its interoperability?

6.2.1. What is JSON?

JSON or otherwise known as JavaScript Object Notation is an open standard file format and data interchange format. It is a very common data format in a diverse range of applications. Which it can often serve as a replacement for languages like XML in AJAX systems. [19] JSON is a lightweight format that is used for storing and transporting data. It is self-describing which makes it easy to understand. JSON is often used when data is sent from some sort of a server to a web page. JSON is a type of text format that is language independent but uses conventions that can be familiar to the programmers of the C-family [20].

6.2.2. How JSON is utilized?

Due to JSONs popularity, it is supported by many applications. SQL databases have native support for JSON data as well as NoSQL databases also have support for JSON. Because of this, there is interoperability between JSON and cloud computing. This means if someone is to use a JSON API within cloud computing it would be supported for a lot of different applications making it very useful to have. Therefore, JSON can use RESTful APIs to be used effectively with cloud computing especially with networks this could allow for easier automation and usage if the network engineers understand programmability. Those are some of the ways that JSON can be used, [21] additional ways can consist of using JSON web tokens as well as requesting and transferring data to and from web pages.

Finally, JSON also has its uses in SDN. [22] The overall uses being data exchange. While the IoT service logics are also encapsulated using JSON.

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Assignment 1 Report

GRADEMARK REPORT

FINAL GRADE

76/100

GENERAL COMMENTS

Instructor

Engagement with Literature Skills (40): 30

Knowledge and Understanding Skills (30): 24

Cognitive and Intellectual Skills (20): 14

Transferable Skills for Life and Professional Practice (10): 8

A good report overall, with a good range of sources used.

In a few places, your narrative is uncomfortably close to the source material - be careful to paraphrase fully.

A significant portion of your sources are of high quality. A few are certainly weaker than the rest - so to push for the higher marks, try to eliminate these for future work.

PAGE 1

PAGE 2

PAGE 3

PAGE 4

PAGE 5

PAGE 6

PAGE 7

