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Using cloud databases for Wifi customer configuration data

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Contents

1	Introduction	1
1.1	Context	1
1.2	Motivation	2
1.3	Goals	2
2	Literature Review	3
2.1	Computer Networking	3
2.1.1	Historical context	3
2.1.2	Market data	4
3	Software Defined Networking	5
3.1	Introduction	5
4	Problem Description	6
4.1	Problem Definition	6
4.2	Proposed Solution	6
5	Work Plan	7
5.1	Future Work Plan	7

Introduction

1.1 Context

Public and private access to the internet is a basic necessity in the modern society. In a modern setting, the rising requirements that exist in supporting users with mobile devices and their own computers must be met, in order to provide a stable and secure platform to ensure connectivity across different locations, devices, and more. In this context, managed Wi-Fi networks are defined as a way to deploy networks that are optimized in order to meet the specific requirements of users/ applications.

As we see the proliferation of these systems, due to increasingly demanding environments, the market for managed Wi-Fi systems is planned to reach \$1.7 billion in 2018. This raise in market is related to the distribution of the enterprises, where they are composed of several smaller locations, often lacking specialized IT staff that have strong networking capabilities, or even just the infrastructure is not suitable to installing these complex systems.

The creation of the As-A-Service model comes in consequence of these previous factors. In this specific case, the development of managed Wi-Fi as a system following the Infrastructure-As-A-Service (IAAS) mentality has allowed for the removal of investment in large WLAN infrastructure, related not only to the maintenance, but also the planning, operation, and installation of the service, allowing to transfer the cost to a trusted third-party.

The previous paragraph shows a brief introduction to the motivation that lead to several companies to try to develop and support these sort of services. One of them, and the main proponent of the theme of the dissertation is Berlin Institute for Software Defined Networks - BISDN, and this research integrates a trial system that is being implemented, and we aim to solve one of the problems they faced during the road to productisation.

This document serves as an introduction to the future work to be developed in the dissertation. The organization of this report is as follows: in chapter 2, the state-of-the-art of similar mechanisms and a bibliographic revision is done; in chapter 3, the specific details of the problem are presented, and we start

detailing some aspects that should be featured during the development of this dissertation; then we try to define a possible work plan, by defining a timeline, and approach to the development of the final product.

1.2 Motivation

By analyzing the current market offerings of large scale Wi-Fi solutions, we can see that the most offerings have a non ideal solution to cover the need of constant access to the internet, either by supplying a system that is not well optimized to cover the entire use cases, or by providing a system that isn't scalable, of fixed configuration, and that needs large, specialized IT teams that aren't always available due to several constraints.

The issue of user information, in the scope of these networks, is a sensitive one. The storage and manipulation of this data should be used in the most secure way, to safeguard their privacy, and there should be safeguards in order not to lose the entire data.

In this case, the theme of the future dissertation is proposed, to develop a tool that, in integration with larger systems, can provide a way to solve this problem.

1.3 Goals

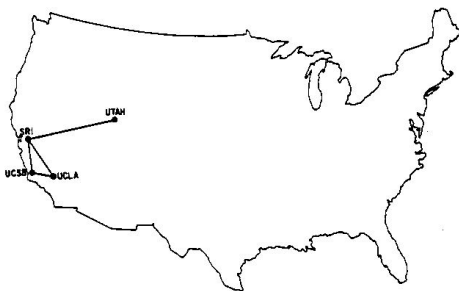
During the development of this dissertation, we aim in exploring the possibility of using cloud technologies to store, in a secure and redundant way, customer configuration and session data, to be used while deployed into large scale managed Wi-Fi systems already in testing. Our main goal, should feature an analysis of available cloud database solutions, and choose the better platform to suit our needs. It should also feature an in depth analysis of session information in a Wi-Fi managed network. By combining the two, we aim to propose a solution for a problem in deploying public Wireless LAN, the management of several users.

Literature Review

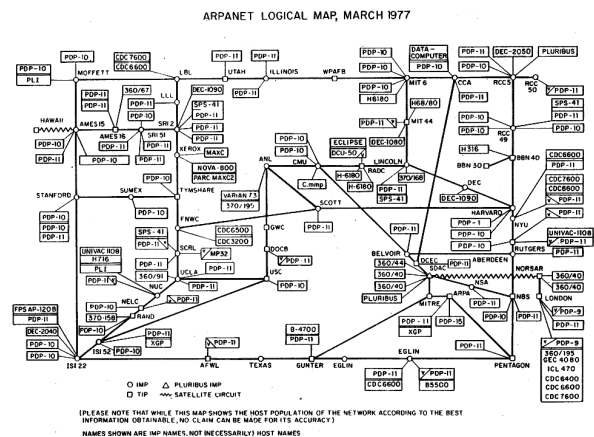
2.1 Computer Networking

2.1.1 Historical context

A computer network is a way to transfer digital information from point A to point B, via an established link between the two. In the early days, the demand to create an interconnected network of data sharing appeared from academic research and military needs, and since the introduction of these innovations, many American universities started to join in the this network, called ARPANET.



(a) Early ARPANET schematics, appr. 1969



(b) More sites connected to the ARPANET, September 1977

As the advantages of having an interconnected network of computers became clearer, and with the surge of some others, such as CYCLADES, the french investigation research network, the need to connect the existing networks was rising, and that was one of the first steps of creating a global network, later known as the Internet. Some of the essential mechanisms that can still be found to this day were also developed in the ARPANET, like FTP and e-mail.

One of them was introduced in 1981, RFC 793 [?], and with it TCP was "invented". The main motivation for this development was the introduction of an end-to-end, connection oriented, and reliable

protocol that allowed for the standardization of several different protocols. Also in this document, the definition of a OSI model, like the one that is prevalent today, or the definitions of reliability, are present, and continue to be relevant until today.

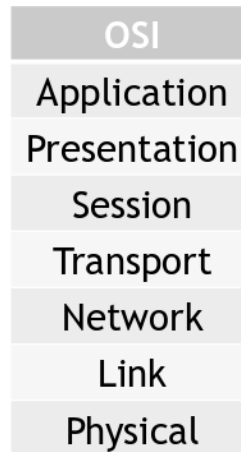


Figure 2.1: The current OSI model

One

2.1.2 Market data

By continuing to evolve and increase in both functionalities and users, the Internet as we know it is a global network, encompassing several protocols, and allows for instant communication of people around the world. A report indicating this evolution allows for some interesting conclusions about the state of the Internet market until 2021. This forecast was developed based on data originating from projections made from some Telecom and Media groups, direct data collection, and some estimates.

Global IP traffic As the report mentions, the monthly traffic, per capita, in 2016 is around 13 GB, and in 2021 is projected to be at 35 GB

Mobile devices traffic While today wired devices still make up for the majority of IP traffic, in 2021, traffic originating from Wi-Fi and mobile devices should account for 63 percent of the total traffic

Smartphone/ PC traffic By comparing the predicted evolution of smartphone/ pc traffic, the trends indicate that smartphone traffic should exceed fixed PC traffic.

The previous points while obvious estimations, show a clear evolution in the way that Internet is usually accessed, and that is the

Software Defined Networking

3.1 Introduction

Problem Description

4.1 Problem Definition

The previous chapter in finding the existing work done in the field of managed Wi-Fi systems serves as an introduction for this chapter. Following a proposition from BISDN, a Berlin based company that deal with Software Defined Networks, the proposed problem is the implementation of a cloud database solution to save customers session data in a safe and redundant way.

In the initial stage of the solution for this problem, the research on the state-of-the-art consisted in the definition of the requirements of managed networks, and researching the various possible technologies to better get a sense of the scope of the work. We define then the basic requirements that need to be met, and along with the previously noted requirements, the establishment of a stable connection, a secure system, to ensure users privacy and a redundant storage of information.

4.2 Proposed Solution

The proposed solution is a feature that is capable of meeting the above presented requirements, and correctly integrate the already existing system done by the company. The specific technologies to be used are to be continually researched, and to be further explored when starting the work on the thesis.

Work Plan

5.1 Future Work Plan

- Sept 5-30: Analysis of session information in WiFi managed network (a mix of AAA and WiFi data).
- Oct. 1-31: Understanding OpenStack swift as well as other (public) cloud database interfaces. Creation of a structure of customer data.
- Nov. 1-30: Implementation of a redundant customer data storage
- Dec. 1- Jan 20: Performance evaluation, documentation of results.

References

- [1] Julius Schulz-Zander, Carlos Mayer, Bogdan Ciobotaru, Stefan Schmid, and Anja Feldmann. OpenSDWN: programmatic control over home and enterprise WiFi. pages 1–12. ACM Press.
- [2] Anisa Allahdadi, Ricardo Morla, Ana Aguiar, and Jaime S. Cardoso. Predicting short 802.11 sessions from radius usage data. In *Local Computer Networks Workshops (LCN Workshops), 2013 IEEE 38th Conference on*, pages 1–8. IEEE.
- [3] Lalith Suresh, Julius Schulz-Zander, Ruben Merz, Anja Feldmann, and Teresa Vazao. Towards programmable enterprise WLANS with odin. In *Proceedings of the first workshop on Hot topics in software defined networks*, pages 115–120. ACM.
- [4] Vladimir Mateljan, D. Cisic, and D. Ogrizovic. Cloud database-as-a-service (DaaS)-ROI. In *MIPRO, 2010 proceedings of the 33rd International convention*, pages 1185–1188. IEEE.
- [5] Nick McKeown, Tom Anderson, Hari Balakrishnan, Guru Parulkar, Larry Peterson, Jennifer Rexford, Scott Shenker, and Jonathan Turner. OpenFlow: enabling innovation in campus networks. 38(2):69–74.
- [6] Yishan Li and Sathiamoorthy Manoharan. A performance comparison of SQL and NoSQL databases. In *Communications, computers and signal processing (PACRIM), 2013 IEEE pacific rim conference on*, pages 15–19. IEEE.
- [7] Franco Callegati, Walter Cerroni, Chiara Contoli, and Giuliano Santandrea. Performance of multi-tenant virtual networks in openstack-based cloud infrastructures. In *Globecom Workshops (GC Wkshps), 2014*, pages 81–85. IEEE.
- [8] Seppo Hätönen, Petri Savolainen, Ashwin Rao, Hannu Flinck, and Sasu Tarkoma. Off-the-shelf software-defined wi-fi networks. pages 609–610. ACM Press.
- [9] Jon Postel. Transmission control protocol. Published: Internet Requests for Comments.
- [10] Zuhra Khan Khattak, Muhammad Awais, and Adnan Iqbal. Performance evaluation of OpenDaylight SDN controller. In *Parallel and Distributed Systems (ICPADS), 2014 20th IEEE International Conference on*, pages 671–676. IEEE.
- [11] Alexander Shalimov, Dmitry Zuikov, Daria Zimarina, Vasily Pashkov, and Ruslan Smeliansky. Advanced study of SDN/OpenFlow controllers. pages 1–6. ACM Press.
- [12] Ian F. Akyildiz, Ahyoung Lee, Pu Wang, Min Luo, and Wu Chou. A roadmap for traffic engineering in SDN-OpenFlow networks. 71:1–30.

REFERENCES

REFERENCES

- [13] Claus Pahl. Containerization and the paas cloud. 2(3):24–31.
- [14] Rohan Murty, Jitendra Padhye, Alec Wolman, and Matt Welsh. Dyson: An architecture for extensible wireless LANs. In *Usenix annual technical conference*.
- [15] Sherif Sakr, Anna Liu, Daniel M. Batista, and Mohammad Alomari. A survey of large scale data management approaches in cloud environments. 13(3):311–336.
- [16] Alexandru Boicea, Florin Radulescu, and Laura Ioana Agapin. MongoDB vs oracle – database comparison. pages 330–335. IEEE.
- [17] Robin Hecht and Stefan Jablonski. NoSQL evaluation: A use case oriented survey. In *Cloud and Service Computing (CSC), 2011 International Conference on*, pages 336–341. IEEE.
- [18] Jan Medved, Robert Varga, Anton Tkacik, and Ken Gray. Opendaylight: Towards a model-driven sdn controller architecture. In *World of Wireless, Mobile and Multimedia Networks (WoWMoM), 2014 IEEE 15th International Symposium on a*, pages 1–6. IEEE.
- [19] Seppo Hätönen, Petri Savolainen, Ashwin Rao, Hannu Flinck, and Sasu Tarkoma. Off-the-shelf software-defined wi-fi networks. pages 609–610. ACM Press.
- [20] Roberto Riggio, Tinku Rasheed, and Mahesh K. Marina. Poster: programming software-defined wireless networks. pages 413–416. ACM Press.
- [21] Sakir Sezer, Sandra Scott-Hayward, Pushpinder Kaur Chouhan, Barbara Fraser, David Lake, Jim Finnegan, Niel Viljoen, Marc Miller, and Navneet Rao. Are we ready for SDN? implementation challenges for software-defined networks. 51(7):36–43.
- [22] Rajdeep Dua, A Reddy Raja, and Dharmesh Kakadia. Virtualization vs containerization to support PaaS. pages 610–614. IEEE.
- [23] Rajdeep Dua, A Reddy Raja, and Dharmesh Kakadia. Virtualization vs containerization to support PaaS. pages 610–614. IEEE.