KUNGLIGA TEKNISKA HÖGSKOLAN

Market Analysis for CheesePi

I&E Thesis at KTH Royal Institute of Technology as partial fulfillment of Master's degree at EIT ICT labs Master School

Author: Sagar Sharma

5/18/2016

Supervisor: Terence Brown

Co-supervisor: Serdar Temiz

1. INTRODUCTION

The minor thesis is going to discuss on the final degree project's business and innovation part in the company's context which is the Swedish Institute of Computer Science (SICS). In this section, the focus area of the final degree project, its process framework phase, and previous work are going to be discussed.

2. MOTIVATION

Internet is global network providing variety of information and communication facilities, consisting of interconnected networks using standardized communication protocols [1]. Internet had its origin in US government as a research project to link high power computers and eventually erupted as commercial success [1]. An Internet service provider provides services for accessing the Internet [1]. From a research perspective a dominating study has been done on the quality of service such as network parameters like delay, jitter and bandwidth, but these are not of any concern to the end user. The perception of quality is influenced by all system elements such as network, equipment, protocol, environmental and sociological factors [2]. Often the quality of service may not be satisfactory from a user's perception because of the various factors such as network congestion, server speed, hardware/software configuration etc. Having a high speed connection does not always guarantee the advertised speed as the quality is affected by various network parameters. Sometimes the Internet service provider promises certain quality of network such as speed, but there is a need to deliberately measure the consistency of the performance over a period of time. As the Internet traffic increases, so does the need to monitor the quality of services provided by the service provider in order to improve their service and give a better picture of the actual quality of hired service[3].

The goal of the Internet quality measurement is to understand the characteristics of Internet and identify the factors affecting the quality of service. The CheesePi project considers the Internet as a utility just like electricity, water and gas and aims to objectively characterize the services the users

obtain from their home Internet connection. CheesePi uses an easy to operate device such as RaspberryPi [4] will be installed to estimate the quality of service. The data collected is objective measurement of quality of connections ensuring the privacy of customer. Feedback to the user will be provided via mail digests, real-time display on a HDMI device, LAN website or via a quality portal website hosted at SICS. The project also provides a dashboard running locally on the device to check the quality of Internet connection.

3. POSITION

In the previous sections, the importance of Internet quality measurement has been discussed. In a severe competitive environment it is important to understand the current market and its trends along with the sustainable service provided. This will help in distinguishing a company/organization from the rest in the market. It is also important to understand what different is a company/organization offering from the one which is already available in the market. To understand the current market trends of the Internet quality monitoring, the study demands in depth analysis. Currently, the project is in prototyping stage [5] and also testing some features.

Fig. 1: CheesePi Dashboard

4. ORGANIZATION EMBEDDEDNESS

CheesePi is a project of Swedish Institute of Computer Science (SICS) Swedish ICT. SICS is a leading, non-profit institute carrying focussed research in strategic areas of computer science and the project is an open source project. SICS will be a mediator between the user, ISPs, and internet Regulators by storing the measurement results in a central server.

5. LITERATURE REVIEW

In this section we discuss in general about the market description, trends, customer segments, customer benefits and unique selling proposition.

5.1 MARKET ANALYSIS

The goal of market analysis is to analyse the attractiveness of a market, to understand its opportunities and risks involved to determine the strengths and weaknesses of a firm [6]. By considering the opportunities and risks involved in the market, it gives an individual an idea to how to operate the business. It helps in determining the characteristics unique to the particular market. It describes the current state of industry and projections based on data rather than guesswork [7]. Knowing the market's needs and how it is currently serviced provides you with key information that is essential in developing your product/service. Although the quality of the product is critical, your development of the best product on the market will not necessarily correlate with the most sales. A marketing analysis is the assessment of the target population, competition and needs for marketing that product or service [8]. There are multiple dimensions of market analysis such as market description, market trends, customer segments, benefits and USP [9]. Market analysis helps to prepare to enter a new market and launch a new product/service.

5.2 MARKET DESCRIPTION/TRENDS

Market description helps in defining the current market of the product/service which is being offered. It also helps in focussing at global, national or regional market. Market description helps in analysing if the focussed market is growing and if yes, at what rate. Market trends are one of the

best ways to analyse the market. Noticing the market trends helps to plan for changes and take advantage of the positive changes [10]. Trends allow traders and investors to capture profit. The trends can be short termed or long termed and the flow from one price to other caused profits or losses [11]. One should also identify the political, economic, social, technological and legal drivers of the market. [12]

5.3 CUSTOMER SEGMENTS

Customer segmentation is a process of breaking the customer base into groups of similar characteristics in relevance to marketing such as age, gender, interests, location etc. [13]. It helps in maximizing the value of each customer in the business by allowing marketers to approach each customer base in an effective way [14]. One of the key aspects of customer segmentation is to understand customer's preferences and needs. Customer segmentation also allows better customer experience and customer retention. Since the goal of marketing generally is to maximize the revenues, segmentation helps in staying ahead of the competitors in the existing market. An important aspect of segmentation is to know how to put a customer in a group and how is the group targeted.

5.3 CUSTOMER BENEFITS/VALUE PROPOSITION

The purpose to analyse the customer benefits of the product or service that is being marketed is to understand the results which are being delivered to the customer and what the customer specifically asked for. Customer benefits also help in educating the investors and customers about the product or services which are being offered. What problem does a feature solve? What does the feature mean to customer? What other features could be useful to the customer? Answering similar questions help in determining what benefits the customer may have buying the product or service [15]. An unhappy customer will likely become a repeat customer if the issues/problems the customer is facing has been rectified [16]. People are willing to spend their time and money where they are valued.

5.5 UNIQUE SELLING PROPOSITION

When entering an existing market it is important to differentiate the product or service that is being offered with the product or services already existing in the market. Unique selling proposition is factor presented by marketers so as to why their product is different or better when compared with others [17]. An USP helps to understand what you have that the other competitors don't have. A successful marketer clearly offers something that other competitors don't offer. In order to have unique selling point, one can't attempt to be known for everything and it is one of the common mistakes.

6. RESEARCH QUESTION

What are the current market description and trends, rationale for attractiveness for the CheesePi?

7. CHEESEPI

American video use is increasing rapidly with 70% of broadband users under the age of 35 getting some of their TV from online sources [18]. Internet has now become a utility just like water, food, gas and electricity and CheesePi considers Internet as a utility. CheesePi aims to characterise the services user experience from their home Internet connections. However the quality of service of Internet may vary from service to service. Measurement of such connections is crucial, not only for the end users but also from the Internet service provider's point of view. Information about the quality of service of Internet helps the service provider to gain more knowledge about their networks to predict, solve problems in the network. This also promotes healthy competition between service providers. CheesePi uses small, quiet, always-on, low-cost and powerful devices such as RaspberryPi and these devices are becoming popular amongst hobbyist and enthusiast. The boards are priced between USD 20 to USD 35[4]. By running CheesePi on RaspberryPi, even a non-expert user can measure the quality of Internet at the user’s home. CheesePi uses this hardware to measure the quality of service of Internet, although the quality of service of Internet can be measured using an application, because to run an application for months it would still need a

machine that is running the application and it is desirable to use devices consuming low power and cost effective such as RaspberryPi. Also a common hardware platform gives greater consistency of data collected.

Ian Marsh Ph.D. and Liam McNamara Ph.D. senior researchers at SICS wanted to explore the opportunity (large user base). Users do not prefer any personal data to be monitored, hence CheesePi only monitors the network characteristics of the internet connection of the user and no personal data is monitored.

8. MARKET ANALYSIS

8.1 MARKET DESCRIPTION/TRENDS

The industry in question of CheesePi is that of Internet quality of service monitoring. Modern communication has evolved drastically with increasing demand of internet communication worldwide including rural areas. With rapid rise in the number of users of internet, followed by network congestion there are few fallouts every subscriber has to face and even the telecom operators. Telecom operators are continuously seeking different methods to optimize the network so that they have more satisfied customer base. Monitoring the quality of internet helps in managing the risks involved in network failure and problems in real-time. Today the telecom providers, communication service providers and enterprises are transforming from network-centric operations to service-centric operations based on customer interaction as customers are ones who help in defining the changes based on their feedback [19].

8.2 MARKET VOLUME

The telecom service assurance market size is expected to grow from $3.18 billion in 2014 to $4.59 billion by 2019, at an estimated Compound Annual Growth Rate (CAGR) of 7.6% [19]. The number of internet users has increased tenfold from 1999 to 2013, with current Internet user base of about 3.2 billion with Europe alone contributing 19% as of July 1, 2013 [20]. The worldwide

broadband subscription in developed countries is about 27% of the entire world population which is 7.2 billion and Europe contributes to about 28% of subscribers of the 27% worldwide subscribers [21].

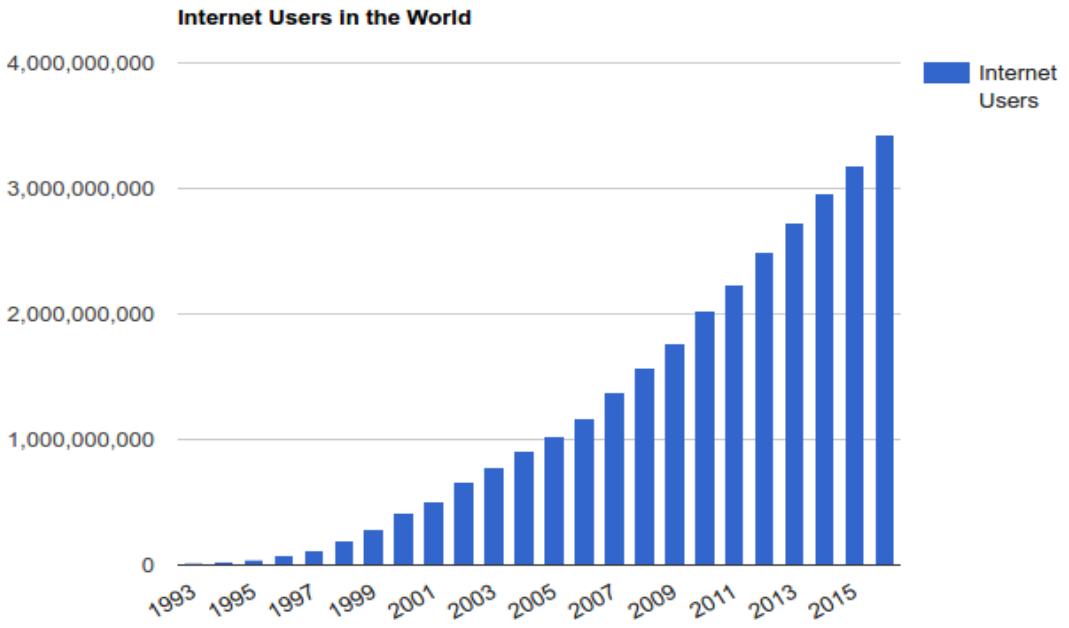

Fig. 2: Number of global Internet users per year since 1993.

Generally, the Internet quality of service is identified by regulators at national level in collaboration with the Operators and consumers. The growing base of increasing subscribers is creating a parallel need for robust internet quality monitoring systems for the subscribers and the users. Continuous improvements will help in fixing the problems or issues the user is facing. The desire to live well with complex conditions such as network service quality deterioration, data loss and high network traffic will spur the demand for qualitative monitoring of the networks. Telecom providers are especially interested in monitoring the quality of service of internet provided so that when need comes they can exactly pin-point the service failures based on the geographical location [3].

8.3 COMPETITOR ANALYSIS

Since Internet quality monitoring is not a new market, so it is important to understand the competitors and how different CheesePi is from the existing competitors. Initially majority of the quality monitoring was done by Internet Service Providers (ISP's). Many online websites also tell

about the current quality of service of Internet but is not very informative and only tells about current quality of service of internet. The major competitors of CheesePi are categorized as following.

No.	Companies/ Organization	Drawbacks 1	Drawback 2	Drawback 3
1	SamKnows[22]	Periodic data collection when user does not using the Internet. (User has no control)	Biased on information collection	Distribution of white box with preinstalled measurement tools installed
2	Netbeez[23]	Periodic data collection (User has no control)	Focus on enterprises for user base	Revenue streams include subscription fee
3	SpeedTest[24]	Only measures the quality when the user wants to test the performance	Not much information regarding the quality of service of Internet	No dedicated device for monitoring the quality.

Table 1: Competitor Analysis for CheesePi

As we can see that CheesePi overcomes all these drawbacks. CheesePi outsmarts the competitors by offering unbiased, 24/7, periodic data collection (providing the user to control the measurement), focus on home users and if the user already has a RaspberryPi or Odroid, they can directly flash the image from the website [25] for free of cost. Moreover the CheesePi analysis is done by

esteemed researchers at SICS with utmost passion to learn more about the Internet quality of service.

8.4 MARKET TRENDS/DRIVERS

- Growing subscriber base of Internet users as there will be approximately 3.4 billion users by July, 2016 [18].
- Interest shown at National level by regulatory boards such as Swedish regular Post and Telecom Authority [18].
- Internet Service Provider's (ISP's) interests to strengthen the quality of network for more satisfied customers and real-time measurements [3].
- Development in digital connectivity to benefit market growth.
- Emerging need to not only assess the broadband quality but also to verify service offers against contractual agreements [26].
- Federal Communications Commission (FCC), the national regulator in the United States, has launched a campaign to use the measured data to study and compare the broadband offerings by different service provider [26].
- The Office of Communications (Ofcom) has already framed broadband policies on the basis of measured data of the quality of service [26].
- To increase the awareness amongst the end users.
- Technology improvements.

9. RATIONALE FOR ATTRACTIVENESS

9.1 VALUE PROPOSITION

Problems associated with that of current network congestion has a direct impact on the quality of service. This has a direct impact on the ISP's with lack of awareness of the network quality and is greatly impacted by events such as boxing matches, football matches, live broadcasting of performances across the world. CheesePi does not aim to solve the problems of network congestion

or any other problems but in fact helps to understand the why's of the problems and understanding the quality with respect to various parameters. CheesePi can display the history of measurements up to two month with active/inactive internet with an easy to use dashboard. CheesePi also allows the user the freedom to choose when to measure the quality of service.

The following key features of CheesePi highlight the benefits of the system:

1. Easy to use dashboard.
2. History of measurements up to two months with active/inactive Internet as the data is stored locally.
3. The image of CheesePi can be downloaded for free from the website.
4. The cost of the device is very cheap (USD 20 to USD 35), quiet and yet powerful.
5. Easy to install and the steps to install CheesePi provided on the website.
6. Services being offered are free of cost to the user.
7. No private information of the user collected and information only about the network is collected.
8. Real-time display of the quality of service of internet.

9.2 MARKET RESEARCH RESULTS

From the market research we see that there is big market for proposed offering. Following were the insights we got from interactions without target customers: Regulatory, ISP's and end users.

CheesePi is in collaboration with the Swedish regulator Post and Telecom Authority (PTS) with the responsibility to monitor competition and consumer issues in Internet. PTS is concerned with increasing broadband connections performance metrics and is seeking a more interactive approach to measure and compare the performance metrics [18].

The ISP's such as SUNET said that it would be interesting for them as they face the problems of network congestion, overloading and other technical problems. By having a network of CheesePi which continuously monitors the quality of service for a subset of end users they have more information about the quality of service of internet in a particular geographical location in

real-time and if any problem is reported they can act immediately. It can also help in identifying the attacks on the network based on the patterns from the previous data.

We had interaction with end user as well at the open-house at SICS, where we presented the current work of research within CheesePi, most of the users had a positive feedback regarding the CheesePi. Many users reported if they had poor quality of service of internet they blamed the ISP's for not provisioning the promised internet quality but they had no historical data to show to the ISP's. Moreover, during the popular events such as boxing matches, football matches, Eurovision etc. the users reported deteriorated quality of service. With the availability of CheesePi they could better understand their quality of service of Internet.

These interactions helped us to find out the areas at which we could improve based on the suggestions. As many of the users are not well affiliated to the technical terms we use, we are working to provide a dashboard with more quality information to the user in such a way that they understand the data they see. We are currently working on pre-installing the images of CheesePi and ship it to end user so that the user does not have to go through the process of installing the operating system. CheesePi is trying to improve the product iteratively and explore even more possibilities in near future.

9.3 USP

The key advantages of CheesePi which encompass to form unique selling proposition include the following;

1. Unbiased round the clock network quality monitoring data for a duration of two months.
2. Display of measured values even in the absence of Internet.
3. Free services to end-user.
4. Real-time information to the ISP's.

10. SWOT ANALYSIS

SWOT (Strength, Weakness, Opportunity and Threats) analysis helps an organization to identify internal factors like strength and weakness and external factors like opportunities and threats which are key elements to make a business successful.

Strengths of CheesePi: CheesePi can store and display the unbiased measurement data of the quality of service up to 2 months with/without active Internet connection to view the display.

Weakness of CheesePi: No hardware distribution as of now and command line installation maybe not so easy for non-experienced users of Linux. Also CheesePi is focussed only in Sweden.

Opportunities of CheesePi: Long term relationship between service provider, regulatory and end users for larger data set availability.

Threats: Technological improvements may lead to well defined and already characterised metrics of the networks.

11. FUTURE WORK

As mentioned earlier, CheesePi is a mediator between user and ISP's and ISP's generate the revenue streams to the CheesePi, we are required to have large user base from different geographical locations. To achieve maximum user base CheesePi is planning to ship pre-installed CheesePi hardware to the user free of cost attracting more users. The users can be educated that the devices can be used for other hobbyist projects and recreational purposes. Also CheesePi is planning for more interactive dashboard for the users to understand the quality of service of internet.

12. REFERENCES

[1] Wikipedia, ‘https://www.wikipedia.org/’

[2] Mirjana D. Stojanovic, Marijana M. Vukasinovic and Vesna M.Radonjic Djogatovic ‘Approaches to Quality of Experience Management in the Future Internet’

[3] Gabriel Hourton, Gabriel Del Canto, Javier Bustos and Felipe Lalanne 'Crowd-Measuring: assessing the Quality of mobile Internet from end-terminals'

[4] Raspberry Pi ‘https://www.raspberrypi.org/’

[5] A guide to Prototyping new ideas, ‘http://www.nesta.org.uk/sites/default/files/prototyping_framework.pdf’

[6] Market Analysis, ’http://www.netmba.com/marketing/market/analysis/’

[7] How to write Market Analysis, ‘http://articles.bplans.com/how-to-write-a-market-analysis/’

[8] Conduct a Market Analysis, 'http://www.cultivatingsuccess.org/instructors/SSFR%20Readings%202011/5.8_Market_Analysis.pdf'

[9] What is Market Analysis, ‘http://pestleanalysis.com/what-is-marketing-analysis/’

[10]What Market Trends are Affecting Your Small Business? 'http://www.m4bmarketing.com/market-trends-small-business/'

[11] 4 Factors That Shape Market Trends, 'http://www.investopedia.com/articles/trading/09/what-factors-create-trends.asp'

[12] Chair for Entrepreneurship and Innovation Management, Prof. Dr. Jan Kratzer, 'https://isis.tu-berlin.de/pluginfile.php/262706/mod_resource/content/1/150430%20VC%20Market%20Analysis%20-%20Susanne%20Perner.pdf'

[13]Customer Segmentation, 'http://searchsalesforce.techtarget.com/definition/customer-

segmentation'

[14]Customer Segmentation, 'http://www.optimove.com/learning-center/customer-segmentation'

[15]How to Determine the Most Desirable Benefits for your Customers, 'http://www.businesswebfactory.com/your_marketing/marketing_analysis/customer_benefit_analysis'

[16]The Cost-Benefit Analysis of Delivering Great Customer Service, 'http://www.business2community.com/customer-experience/the-cost-benefit-analysis-of-delivering-great-customer-service-0388846#mCCUkCTuJgEEUrXZ.97'

[17]Unique Selling Proposition (USP), 'https://www.entrepreneur.com/encyclopedia/unique-selling-proposition-usp'

[18]Liam McNamara, Ian Marsh, Sverker Forslin, 'CheesePi: A Raspberry Pi based measurement platform'

[19]Telecom Service Assurance Market by Software (Probe System, Fault Management, Service Quality Monitoring, Network Monitoring, and Workforce Management), Service, Deployment Type (Hosted, and On-Premises) & by Region - Global Forecast & Analysis to 2019

[20]Internet Live Stats, 'http://www.internetlivestats.com/internet-users/#trend'

[21]ICT Facts and Figures – The world in 2015, 'http://www.itu.int/en/ITU-D/Statistics/Pages/facts/default.aspx'

[22]SamKnows, 'https://www.samknows.com/'

[23]Netbeez, 'https://netbeez.net/'

[24]SpeedTest, 'http://www.speedtest.net/'

[25]CheesePi, 'http://cheesepi.sics.se/'

[26]Vaibhav Bajpai and Jürgen Schönwälder, 'A Survey on Internet Performance Measurement Platforms and Related Standardization Efforts'