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Implementing a service software to relieve waiting line frustration

Master's Thesis

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Abstract

Service companies have used waiting lines as a way of buffering the constant flow of providing a service for a long time. The introduction of hurdles, line numbers, time based appointments and virtualization have all worked for better and faster service, but the problem of long waiting lines has so far not been solved. The subject of this work is a startup company which has built a queue management service that enables smartphone users to wait in line remotely.

The startup team to which I belong has built a product around the promise of allowing people to use the waiting time in their own terms. Therefore making the the issue of long period between request for service and actual service less important from customer perspective. By developing a minimum viable product for validating the market we have discovered that the customer pain of long queues does not convert into service provider's pain: the combination of long waiting time, recurrence of the wait and option for replacement are rare combination that exists only on theoretical level. This work will concentrate on the findings on introducing new technology of remote queuing to the market and the specifics of waiting lines and the conditions where this technology would be most adaptable.

This study maps out all the methods the team used for introducing the technology, all the findings and the conclusions that were made during the process. By testing different methods a model was developed that describes the problems of introducing new technologies that require personal hardware support from both parties in the context of physical services.

Eestikeelne kokkuvõte

Teenindusettevõtted kasutavad optimaalse teenindusmahu hoidmiseks erinevaid viise füüsilistest piiretest kuni ajaliste reserveeringuteni. Käesolev töö käsitleb kaugootamist võimaldava järjekorrasüsteemi turuletoomise protsessi tehnoloogiliste uuenduste kasutuselvõtu kontekstis. Kaugootamine võimaldab nutitelefoni abil võtta järjekorranumbreid distantsilt ja saabuda teeninduspunkti vahetult enne teenuse ostutamist, muutes radikaalselt viisi, kuidas maandada klientide vastumeelsust ootamise ees. Töö kirjeldab toote arenduse käigus kasutatud meetoteid, tegevusi, avastusi ning järeldusi turule sisenemise võimalikkuse ja toote täpse sihtrühma kohta.

Vaadeldud on järjekordade liike, käitumist, ooteaja ennustamist, järjekorraseadmete ostjate ning müüjate olemasolevat turgu ning üldist valmisolekut uuendusteks. Eri meetodite kasutamise tulemusel jõuti mudelini, mis kirjeldab takistusi kaugootamise tehnoloogia kasutusevõtul.

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INTRODUCTION

1. Terminology

This work introduces the terms service providers and customers. Both can be described as customers; however, in this paper, service providers are referred to as *clients* and their customers as *customers*. When I talk about people I refer to general public that may include both groups.

As this thesis is based on an actual business case that is still in development and the information can be used for competitive advantage, the names of products and companies are used only when it does not pose any threat to their respectful owners and the work would not be publicly available in a digital form until the product has already established a presence on the market.

2. Waiting as a business issue

As described by Seawright, Sampson & Wanamaker (2008), there are various aspects why customer waiting negatively impacts service firms and the most important of them is the psychological impact because of the indirect costs it creates. Decreased likelihood of repurchase, negative word of mouth, and remuneration demanded by unhappy customers are all caused by a long wait (Houston, Bettencourt & Wenger, 1998). One implication of psychological waiting costs is that the importance of actual customer wait times is subordinate to the primary concern of perceived wait times. Perceived wait times may differ significantly from actual wait times, with the difference being defined as “wait perception bias.” (Seawright et al, 2008)

Some researchers have developed guidelines for lowering wait perception bias, thus decreasing the psychological costs without having to increase service capacity. ESII, a French customer flow management provider, for instance, describes the problem as follows (ESII, 2012): “The drawbacks of waiting can be eased or even removed by making it active and\or entertaining: thus when we speak perceived waiting; we can try to put in equation the customer satisfaction under the shape S = P - I (Satisfaction = enjoyable Perception - Inconveniences) with S as can be negative (and thus become Dissatisfaction) according to the levels of P and I.” By their understanding, eliminating the inconveniences will create customer satisfaction sufficient for enjoyable perception of the service.

Maister (1985) published eight principles that influence
customer perception of actual wait times:

1. Unoccupied waits seem longer than occupied waits.
2. Pre-process waits seem longer than in-process waits.
3. Anxiety makes waits seem longer.
4. Uncertain waits seem longer than waits of a known duration.
5. Unexplained waits seem longer than explained waits.
6. Unfair waits seem longer than equitable waits.
7. The more valuable the service, the longer people will be willing to wait.
8. Waiting alone seems longer than waiting with a group.

Although the Maister's model is widely accepted because of its strong face validity, there are also studies which propose that customer perception about the wait will not be helped by the change of perceived wait. E.g. Katz (1991) did an empirical study about bank customers, examining how a service firm might improve customer satisfaction with waiting in line. They collected customer opinion data shortly after customers had completed their bank transactions and found that customers tended to overestimate how long they had waited in line. In an attempt to improve the customers' perception about the waiting experience, a display with electronic newsfeed was installed in an attempt to occupy customers' time. They also installed an electronic clock to help customers accurately observe the length of time they waited for service. The study found later that neither of these interventions affected customer satisfaction with the waits, although customers estimated their waiting times more accurately after the installation of the clock. He also found that customer satisfaction was inversely related to customer perceptions of waiting time. As much as we would like to remove the feeling of anxiety or dissatisfaction with changing the setting at the wait area, it still all comes down to physical time being lost during the whole event and there the main criteria is the personal perception.

Several researchers (Cronin & Taylor; 1994; Teas, 1993) have shown that the satisfaction depends primarily on the customer's perception of service performance rather than on the disconfirmation between perception and expectation. This relationship can be shown in equation:

Satisfaction = f (Perception).

Here the Perception means the customer's perception of actual performance, implying that perception and "objective" actual performance are not one and the same (ibid).

According to Davis and Heineke (1998), the perception is also largely affected by how much time people have at their hands. People in no rush indicated the differences between the predictive value of actual wait, perceived wait, and disconfirmation as being very small.
People taking time from their daily obligations perceived the duration of wait as being twice that of the actual time of wait. When in a rush, the perception of waiting time is a much better predictor of satisfaction than the actual wait time. Also, for both groups, the coefficient for actual wait was larger than for either perceived wait or for disconfirmation, indicating that actual waiting time has a stronger influence over satisfaction (ibid). Therefore, the most important factor to improve customer satisfaction is reducing the actual wait.

3. Types of customer flow management

Queue management is aimed at organizing people in the queue area. That removes the need for managing the queue by a staff member or by the people themselves and it provides business intelligence about the optimal need for staff during the day. Service can be provided to customers in many ways, by facility arrangements, queue types and service order. The following descriptions lay out the main characteristics of different queuing situations.

First, service facility arrangements can be divided by how the waiting occurs
(Fitzsimmons, 2006):

1. Self-serve: parking lot;
2. Servers in series: cafeteria;
3. Servers in parallel: toll booths;
4. Staged: Supermarket: Self-serve, first stage; parallel servers, second stage;
5. Mixed: Hospital: Many service centers in parallel and series, not all used by each patient.

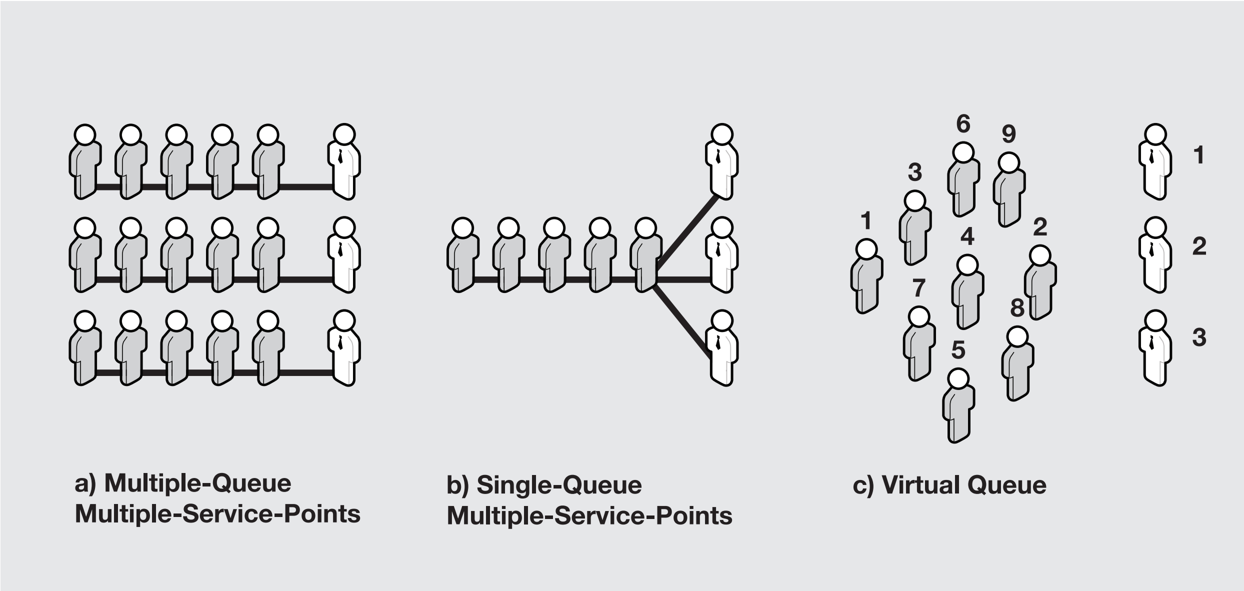


Figure 1: Types of waiting line setups

Then, there are differences in how the queueing can be organized. Waiting lines are divided as linear queues and virtual queues (Q-MATIC, 2008). In linear queues the customers wait physically in a line/queue. This is the oldest and most common way to manage queues and waiting. Linear queues can be divided as:

1. Single-Queue-Single-Service-Point (SQSSP);
2. Multiple-Queue-Multiple-Service-Points (MQMSP) *(Figure 1a)*;
3. Single-Queue-Multiple-Service-Points (SQMSP) *(Figure 1b)*.

In virtual queues *(Figure 1c)* customers are not confined to any particular waiting spot and hence they are not aware about position they have in the queue relative to other individual customers. Also, the difference can be in the way how people are arranged in the line. They can be served either in static First-Come-First-Serve order or dynamically, based on individual customer attributes (priority, emergency).

The existing solutions for having less customer pain caused by waiting can be divided into four main groups (Fitzsimmons, 2006):

Animate: Disneyland distractions, elevator mirror, recorded music

Discriminate: Avis frequent renter treatment (out of sight)

Automate: Use computer scripts to address 75% of questions

Obfuscate: Disneyland staged waits (e.g. House of Horrors)

A more structured way of queuing is by appointments, where a queue is divided into time-slots. This option is widely used for professional services that take more that 15 minutes to perform and have a predictable duration: hairdresser, dentist, repair services, consultants. The problem of appointments is cancellations: if a customer chooses not to show up, the next customer will not fill the empty slot. Cancellations are reduced with customer identification: for making a reservation you are asked to say your name. As many service companies do not use electronic devices other than mobile phones, the booking is mostly done using calendar books to write down people's names. If you are a returning customer, you will take care that you keep your appointments, as the service provider may refuse to make a reservations in your name in the future.

One external factor that removes physical waiting lines is virtualization of services, as many physical services are replaced with e-services. For example, as 75 percent of Estonian citizens are satisfied with the e-services they use and the satisfaction is higher with services that are used more, it makes sense to suggest that the most public services will be virtualized in the near future (EMOR, 2012)

On the other hand, there is myriad of services that cannot be virtualized: healthcare, food, repair or cleaning for example. As this work concentrates on non-virtual services that need some assistance on managing their customer flow, there is enough evidence that waiting will be a relevant business issue as long there are physical services. As the convenience of physical services will be more and more compared with e-services, the duration of wait will become more articulated quality factor.

4. Estimating the wait

The way to make estimations about waiting time started with research by Agner Krarup Erlang when he created models to describe the Copenhagen telephone exchange (Sundarapandian, 2009). The ideas have since seen applications including telecommunications, traffic engineering, computing and the design of factories, shops, offices and hospitals, and are in general referred to as the queuing theory. By Sundarapandian, a "Queueing theory is the mathematical study of waiting lines, or queues. In queueing theory a model is constructed so that queue lengths and waiting times can be predicted. Queueing theory is generally considered a branch of operations research because the results are often used when making business decisions about the resources needed to provide service." (ibid).

As it was discussed before, many contributors to customer dissatisfaction are not related to shorter waits: keeping people informed, entertained and busy while waiting makes people less frustrated about the wait. The problem that cannot be solved with existing technology is how to enable people to use the waiting time without being in near proximity to the service. One option for this would be to make a valid prediction about the waiting time and another would be to create a remote communication between service provider and its customers.

The accuracy of waiting time estimation has been improved over time by using more complex calculations, but those calculations do not help to estimate the wait for any individual service instance. I will give a rough explanation to the problem. Lets say we have 10 people waiting for a service that takes on average 10 minutes to perform. On average, the estimation for the last person would be that she will be served in 90 minutes. In real life, however, no actual service takes exactly 10 minutes, it may take from a minute to half an hour. Figure 2 describes the dynamics of waiting lines from the estimating standpoint.

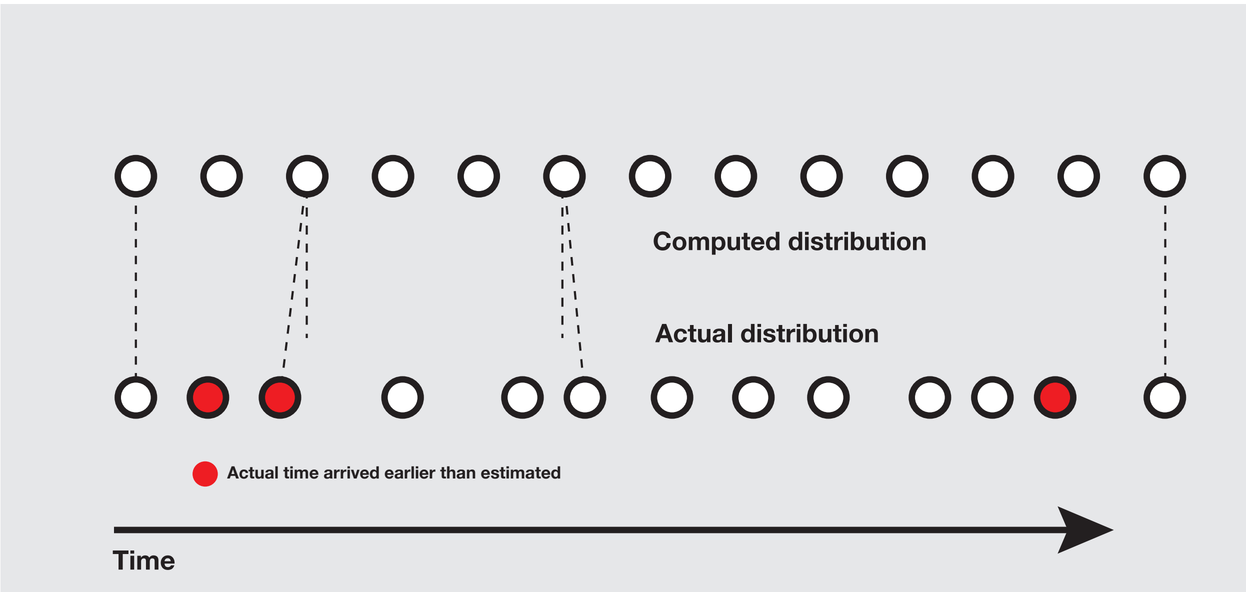


Figure 2: Comparison of computed estimations for waiting times and actual waiting (Author's description)

If there has been a long delay caused by one customer, all the following customers will be affected and they have to wait longer than predicted. What is even more critical, if some customers are called earlier than expected, then the following customers may miss their turn because the line moved faster than it was predicted (as described on Figure 2). On a larger scale, the deviations may cancel themselves out (the third call after 1 minute and 19 minute service sessions comes in 20 minutes, but the second call came 9 minutes earlier than expected) and the long time prediction may even be true, but every irregularity has consequences for their nearest followers and that can only be solved with updating the estimation. And that can be done with technology, which allows everybody in the waiting line to receive exact prediction about when they would be called for the service.

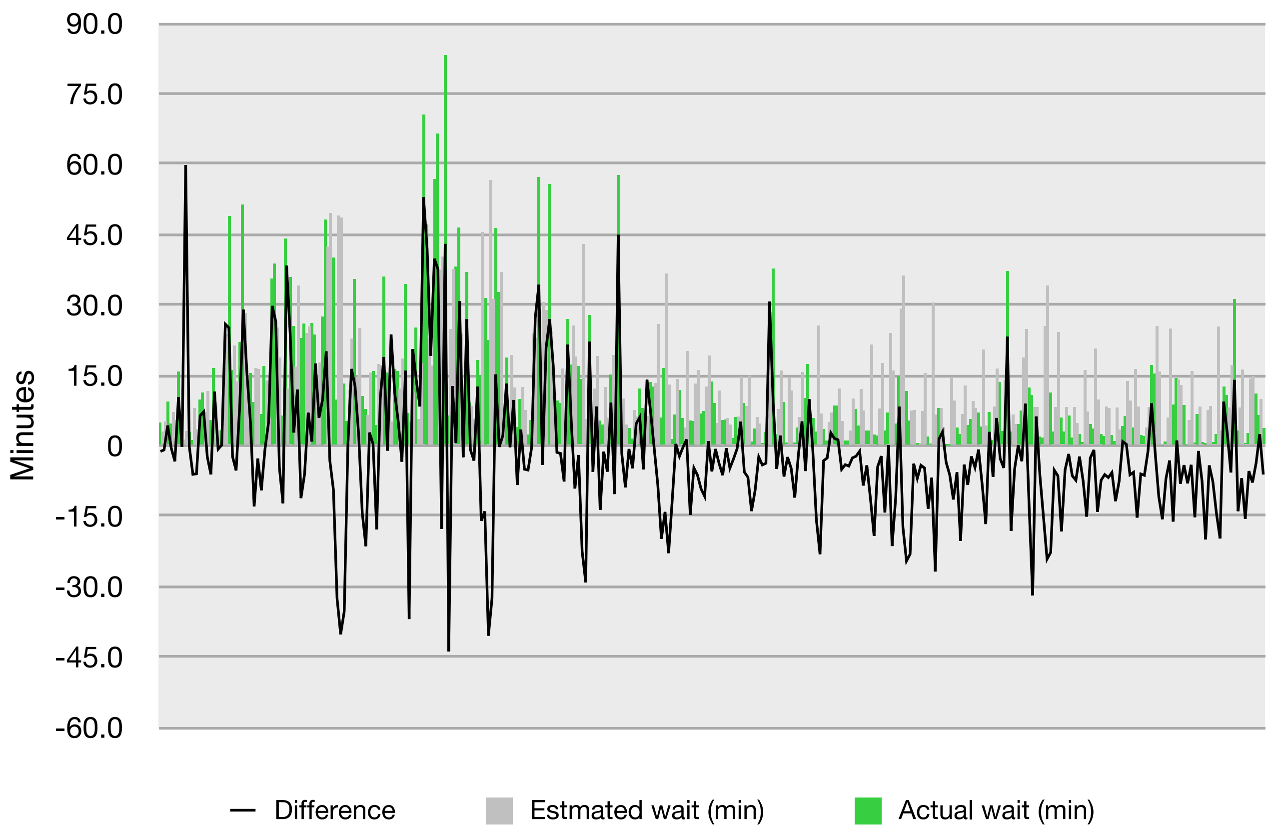


Figure 3: Variety in estimated and actual waiting times in Malaysian dental office service provision, February 2013 (n=397)

Figure 3 represents real queue behavior of a dentist practice in Malaysia who are using our product with name entry tickets. The comparison of initial estimations and real waiting time shows huge variety as the data is not modeled on arrival rates: if the service takes 20 minutes and person arrives 3 minutes before the next customer is called, there will be a 3 minute estimation and 3 minute wait. As the subject here is making an accurate estimation, the graph clearly illustrates that without making corrections to initial estimation the waiting time would remain safely off the mark.

5. The concept of Remote Queuing

The introduction of remote waiting lines to service points where people wait for longest was the initial goal our team wanted to solve. Research shows frustrating waits occur in many different occasions, such as when registering a car or renewing a license, checking out at a retail store, registering at a hospital or a clinic, checking in for an airline flight, ordering at a fast food restaurant or deli counter, sending a package or buying stamps at the post office, making a deposit or getting a withdrawal at the bank, registering a room at the hotel or renting a car *(Research conducted for NCR Corporation by Opinion Research Corp, 2006)*. Many of the mentioned institutions already use ticket based queuing systems, which help people to stay organized, but do not ease the pain of waiting. As many of those institutions are located in large mono-functional buildings in isolated areas, that pain of long waiting is amplified even further due the lack of alternatives to passive wait. For example, neighboring businesses might benefit from the main attraction's long waiting lines as you can see many small business specializing in catering people in line with high margin food products or similar.

The concept of remote queuing is not yet used for describing physical queues as the technology is still in the introductory phase. From the IBM WebSphere product manual, "to a program, a queue is remote if it is owned by a different queue manager to the one to which the program is connected." (IBM Corporation, 1999)

In this work the term is used to describe a situation, where a person can obtain a queue ticket remotely using personal smartphone. The benefit of this technology is following:

1. Seeing the real situation at the venue helps customers to make a decision about joining the queue beforehand, eliminating tickets that are taken in the current system just to realize that there are currently too many people waiting and the customer does not show up.
2. If customers take the ticket remotely you enable them to have a ticket before their arrival, making their wait shorter.

3. Customers are being informed about the advance of the queue, helping them to arrive at the right time while being absent for rest of the time.

Figure 4 illustrates the customer journey in a regular queue and Figure 5 illustrates the customer journey with remote queuing. First, the traditional customer journey (Figure 4). The journey includes two exit points, one is at arrival, when a person sees the overall situation at the venue and second is when the wait gets longer than expected and they cannot wait for longer. In general, customer stays at the venue for the whole time.

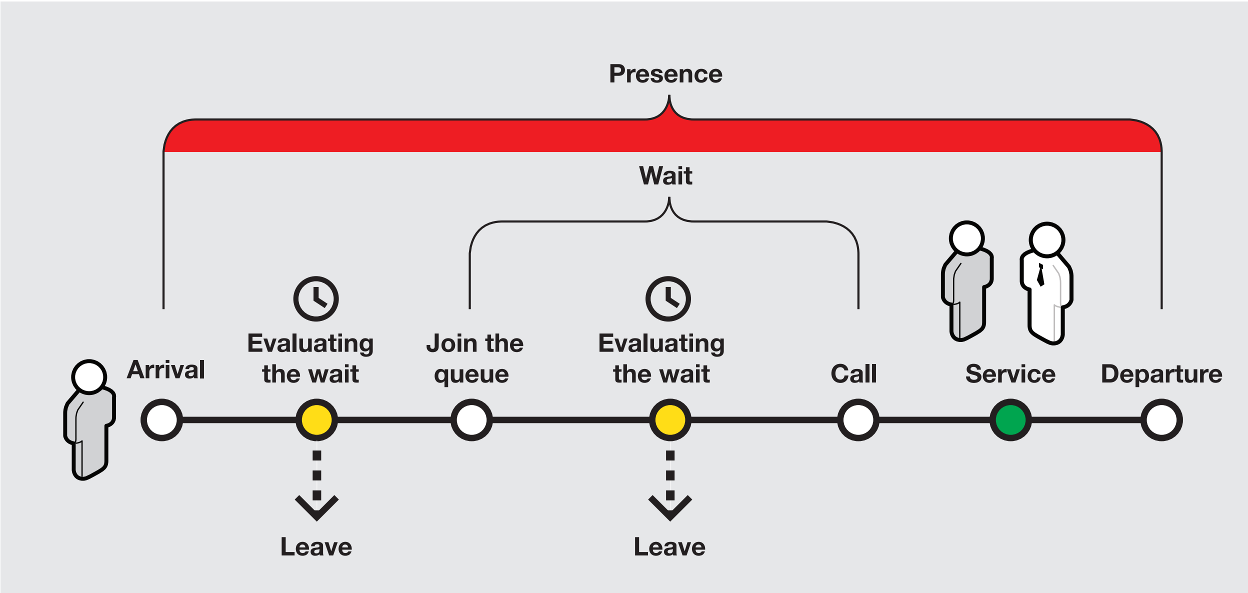


Figure 4. Traditional customer journey

The alternative is remote queuing, where people arrive at the venue only moments before they are called *(Figure 5)*. This model takes advantage of the technology, which enables customers to queue up remotely and therefore the arrival occurs much later.

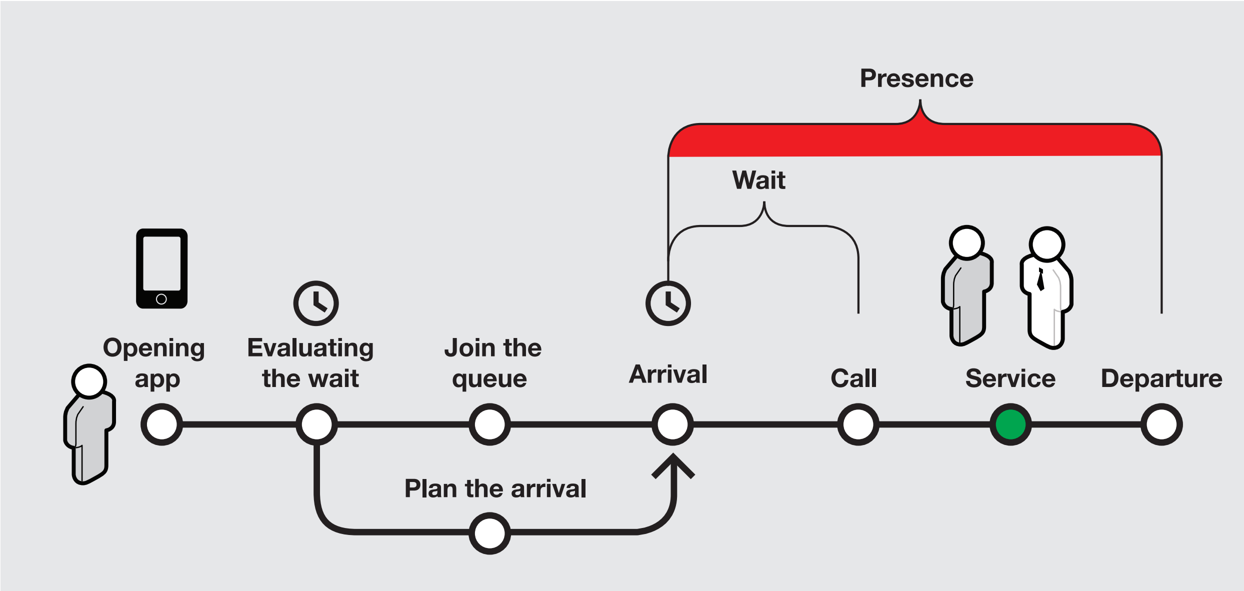


Figure 5. Remote queuing customer journey

On Figure 5 the customer can plan their arrival according to the current waiting time and use the time more efficiently. This is made possible with connecting queue management software with a mobile app that stay connected through the whole time. If a customer chooses to leave the queue before their turn, the system will know about it and informs other customers about the wait, so the queue will be updated even without people being present. This illustrates the main difference between two technologies and why this product needs engagement from both sides, the service company and its customers.

6. Introduction of technological innovation

The principles of lean manufacturing, pioneered in Toyota Corporation by Taiichi Ohno and Shigeo Shingo are the foundation for Lean Startup methodology, coined by Eric Ries (2011). The Lean Startup is about defining the productivity and progress of a company by understanding its customers needs. Often companies accidentally build something nobody wants, so their performance cannot be measured by being on time and on budget. The goal of a startup is to figure out what customers want – and are willing pay for – as quickly as possible. As all innovative products face market resistance, they have to put the learning ahead of development, with an emphasis on fast iteration using customer insight.

In the case of the product discussed in this paper, the initial idea was validated by a huge interest by general public, by the press and different industry awards, creating the conditions for enthusiasm that overwhelms many technology startup companies. By applying the knowledge about running an efficient startup company the next step was to validate the client with the minimum viable product and find the most effective way to bring this technological innovation to the market.

7. Queuing on Innovation Adoption Life Cycle

The **innovation adoption lifecycle** is a sociological model developed by Bohlen, Beal and Rogers at Iowa State University, building on earlier research conducted there by Gross and Ryan. This model describes the adoption or acceptance of a new product or innovation, according to the demographic and psychological characteristics of defined adopter groups. (Bohlen & Beal, 1957)

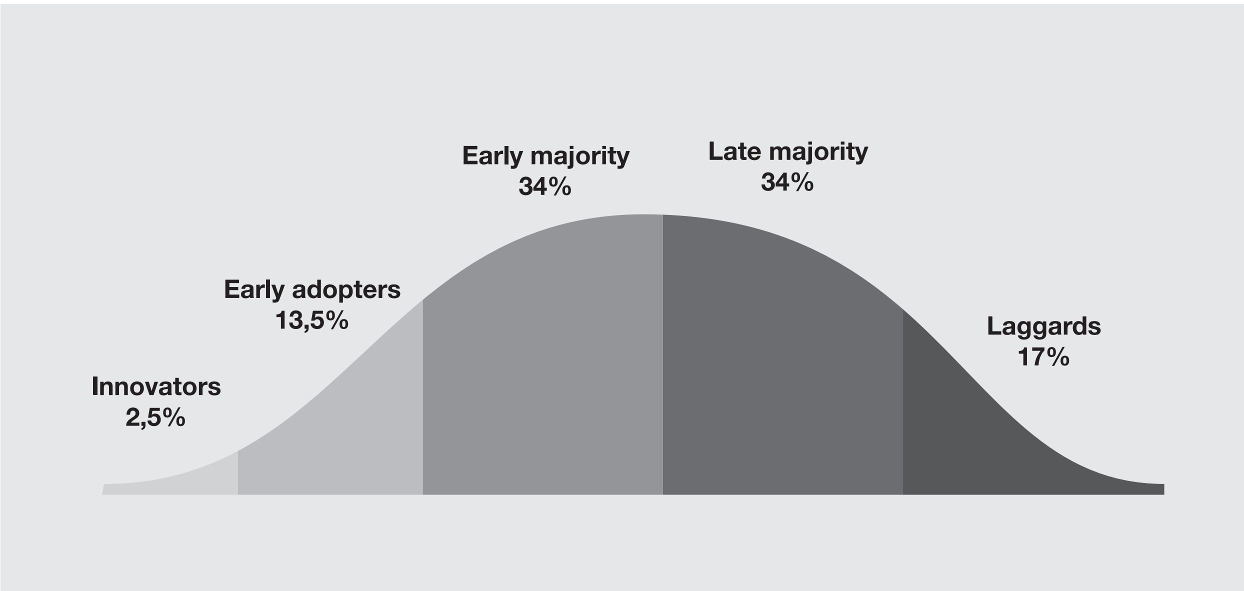


Figure 6. Innovation Adoption Lifecycle (Bohlen & Beal 1957)

The innovation adoption lifecycle model, shown on Figure 6, describes the adoption or acceptance of a new product or innovation, according to the demographic and psychological characteristics of defined adopter groups. The process of adoption over time is typically illustrated as a classical normal distribution or "bell curve." The model indicates that the first group of people to use a new product are called "innovators," followed by "early adopters." Next come the early and late majority, and the last group to eventually adopt a product are called "laggards." (Bohlen & Beal, 1957)

Moore (1999) proposes a variation of the original life cycle, suggesting that for discontinuous or disruptive innovations, there is a gap or chasm between the first two adopter groups (innovators/ early adopters), and the early majority. As these gaps represent resistance to technological innovation, it is important to know the fundamental shifts in attitude when a technology meets the next group.

The following scheme places all the current innovation in waiting lines technology on the technology innovation lifecycle. The scheme does not include additional features such as feedback or profiling (asking questions for faster customer profiling and cutting service time), it only describes technologies directly related with waiting function. When I compare the behaviour of different user groups described in the theory with queuing product, you can observe correlation between the market behaviour and technology innovation level.

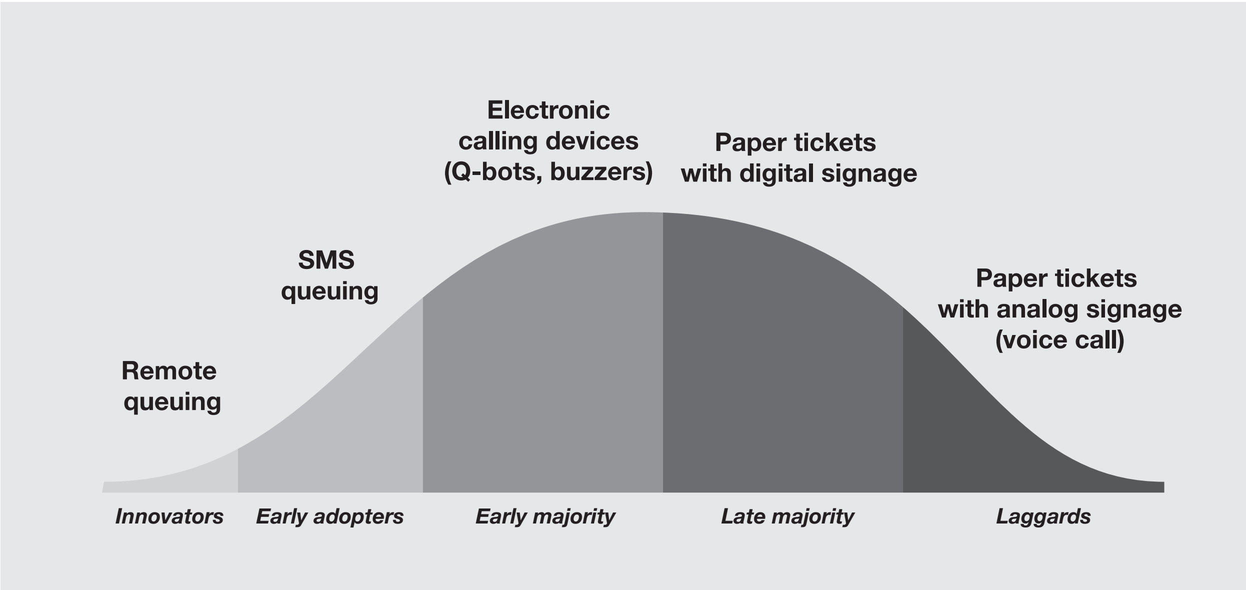


Figure 7. Proposed model of Queuing Technologies on Innovation Adoption Lifecycle

As it is illustrated on Figure 7, the remote queuing is currently embraced by innovators, but to get the approval from majority it has to overcome the fear of new technology which is an issue for late majority and the laggards, who are representing majority of public services across the world. The concept of remote queuing is currently entering the phase of early adopters: the technology is available, but has not been used in the initial context of public services and other venues, where people hate to wait. By applying the principles of Lean Startup methodology the product is developed toward validating its customers with the Minimum Viable Product (MVP) which is sufficient to prove customer's growing interest in the product. As said by Ries (2009), "Lean thinking defines value as providing benefit to the customer; anything else is waste."

8. The virality of digital products

The popularity of high tech companies comes from the fast scalability because their goods can be distributed without establishing infrastructure first. The virality of apps, social media products or web tools takes the benefit of internet connection and personal hardware, which both are user end investments. To get the same virality for products that have a physical environment as part of the full product you have to establish a market, where this product can be seen and used by new customers.

The market for high tech products can be defined by following features (Moore, 1999):

- a set of actual or potential customers
- for a given set of products or services
- who have a common set of needs or wants, and
- who reference each other when making a buying decision.

If two people buy the same product for the same reason but have no way they could reference each other, they are not part of the same market. That means the product will spread faster if it would be implemented by several businesses at once. Also, the most difficult question from the virality viewpoint would be: how the customers would know in advance that a business uses a product that will help you to benefit from remote access to service line? This chicken and egg problem, where customers would join if venues would be already be in the system and vice versa is something that has to be solved before any viral elements can be introduced. We could promote the product in social media (clients could be asked to tweet about the product, for instance) but as the service owners don't usually have a common set of needs and wants with other businesses, they are not connected in social media and therefore the messages are seen by their followers, who will use the service regardless the availability of a waiting line product.

9. Two-sided networks and business model

Remote queuing brings together service companies and their customers into two-sided network, which also can be called a platform. A platform's value to any given user largely depends on the number of users on the network's other side, so it can become valuable only if there is demand from both sides. For example, video game developers will create games only for platforms that have a critical mass of players, because developers need a large enough customer base to recover their upfront programming costs. Players, at the same time, favor platforms with a greater variety of games (Eisenmann, Parker, Van Alstyne, 2006), in order to attract both sides one is often subsidized to get a customer base that is attractive for the other side.

For the product described in this work the decision was made to charge service companies and subsidize their customers on the smartphone app. The business model used is SAAS (software-as-a-service), where clients do not get an ownership of the product but an access to it. It is a good model for developers as it provides control over software versions as you can release modifications without the need to support previous versions, which creates problems with installed software. Also, as this platform is functional only when both sides are present, the web service with customer login is the most easiest way to guarantee the availability of the service using the advantages of cloud computing.

During the first interviews the cost of the product was never the issue as the central topic was missing features. As the product became more solid, there was also an instance, where the competitor was using different business model, not charging the clients for the product but customers for skipping the queue. That model was one of suggested directions for our product in the early days but we chose to stick with the initial plan until the product was ready enough to be tested with different ways of asking money for it.

As the question about customer side monetization was intriguing enough, a survey was set up to test the claim that people would be willing to pay for getting ahead in the line and how much they would pay for it. 134 persons in Estonia replied to the web questionnaire which was distributed in March 2013 in social media. There results showed, that people are most willing to pay for public services (hospitals, car registration centers: 57%), open air events (queuing for food or attractions: 66%) and transport (airports: 60%). Most noticeably, they would refuse to pay for commercial services (banks, telecoms: 19%), but also for sightseeing and post office. 50% of the responses described themselves as not getting annoyed by the wait and 38% percent would leave the queue, if the wait becomes too long. 42% would replan their visit for more peaceful time and 33% would find another provider. What is interesting is that only 5 people mentioned that they will express their feelings to the service staff, once again illustrating the fact that people tend to express their resentment by not having their business with companies that have long waiting lines.

The results of the survey showed that service lines can be monetized as at least every third person would pay for getting ahead in the long wait. What still needs to be tested is how conveniently this can be done and if so, how people actually will act.

10. User side obstacles in market adaptation

The market for any software is limited by the availability of hardware it runs on. Remote queuing can happen only if all customers have an internet connected mobile phone or in another word, they have to be mobile broadband subscribers. In 2011 there were about 55.1 mobile broadband subscribers per 100 inhabitants in the developed world, this number is estimated to rise to 74.8 subscribers. At the same time, the same numbers for developing countries are 8.2 and 19.8 respectfully, making the global average 29.5 mobile broadband subscribers (ITU Statistics, 2012).

Even if the number of subscribers rises to 98 mobile broadband subscribers per 100 inhabitants, that is still not sufficient to be usable without alternative way of maintaining the ticket and that means that the market for remote queuing is limited to companies or queues, that offer a service only to mobile broadband users. If a service company wants to use remote queuing for its customers, they have to know what kind of mobile phone their customers have. Since that information has relevance only for companies that are offering products or services related to personal communication devices, that information is not collected by most companies, making the conditions for introducing remote-queuing-only product extremely difficult.

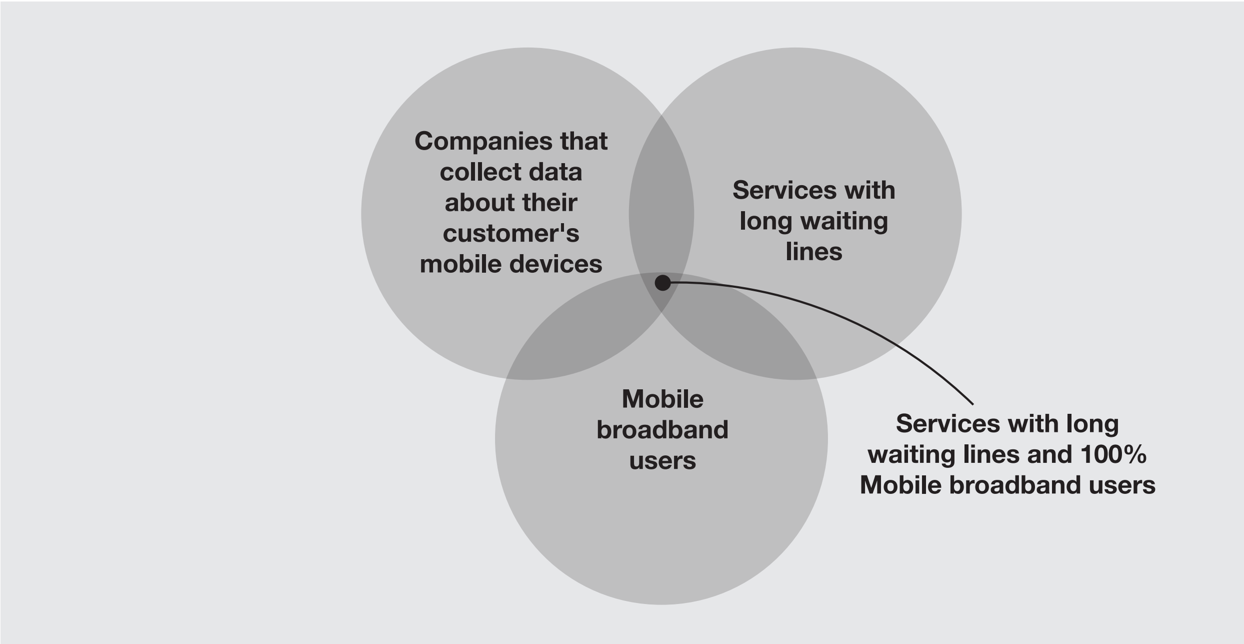


Figure 8: Technological requirements for initial products market fit

Figure 8 illustrates the suitable conditions for the general idea of the product. As all technologies will experience some transition phase before being accepted by general public, we planned to introduce the technology as a supplement to existing customer flow management systems. The first step was to build an understanding about the existing business.

11. Sales of queue management systems

The sales of high tech equipment is organized by different combinations of manufacturers, resellers and clients. According to Moore (1999), the most prominent schemes are following:

• Direct sales: Manufacturer is in direct contact with the customer.

• Two-tier retail, using distributor and retailer layers.

• One-tier retail. superstores, fulfill both the wholesale and retail functions in a single entity.

• Internet retail, optimized for consumer offers that do not need significant configuration or support.

• Two-tier value-added reselling. For products that are too complex for retail, the two-tier model continues to work when the customer-facing role is played by a VAR. They operate normally within the confines of a single city.

• National roll-ups. From time to time the market makes a move to “roll up” local VARs into a nation-wide chain.

• OEMs (Original Equipment Manufacturers). This is at least a two-tier transaction, beginning with a direct sales force selling to manufacturers, who then integrate the purchased product into their own systems, and sell the systems on to the customer. If the OEM product is bought through industrial distributors and sold through retail or VARs, there can actually be as many as four tiers to this channel.

• Systems integrators: project-oriented institution for managing very large or very complex computer projects.

Queueing or customer flow management systems are sold mostly with direct sales or using two-tier value-added reselling. The worlds leading customer flow management company Qmatic has 13 subsidiaries around the globe and 100 partners that sell their solutions worldwide. Nemo-Q, its competitor, handles everything ranging from ordering, inventory management, marketing and development to manufacturing and delivering. The competition is quite transparent and limited to few key players who all have built long relationships with service companies. In order to compete with market leaders you need either find a niche for which they cannot cater or have a proprietary product they cannot copy and sell to the market directly or in cooperation with them.

Remote queuing, in theory, should be appreciated by clients as it enables to serve customers with a shorter actual wait and enhances customer perception about the service. Queuing is seen as one of the critical components of a service, especially if there is competition for limited numbers of customers. Now I will start to test those theoretical statements in practice.

EMPIRICAL STUDY:
IMPLEMENTING A REMOTE QUEUING PRODUCT

Next I will be describing the steps we took validating the concept of remote queuing in reality. The initial hypothesis was that remote queuing is a technological innovation that is appreciated both service companies and their clients, and to prove that claim you have to actually build a product. As every business case is higly contextual, I will only discuss steps and findings that serve any relevance to similar situations, that is development of a technological product that manages people in real physical environment.

The aim of my study is to understand the conditions where remote queuing would be implemented by service companies. That requires validating the customer need, access to the market, feasibility of the the technical solution and viability of the business model. The study is layed out as sequence of steps, each taken on the findings of the previous one and it concludes with description of product/market fit for remote queuing based on my learnings.

12. Step 1: Building a working prototype

As the product would create the most value for long queues at public services we suggested that the fastest way to the market would be to integrate it with hardware that is commonly used in Estonia by the service companies. If we could build the product that could be tested on live environments without causing any disturbance for existing customers, then we could soon introduce it to smartphone users visiting that business, expand it to all businesses that have a similar hardware and then, gradually, the smartphone app would replace the physical tickets with virtual ones.

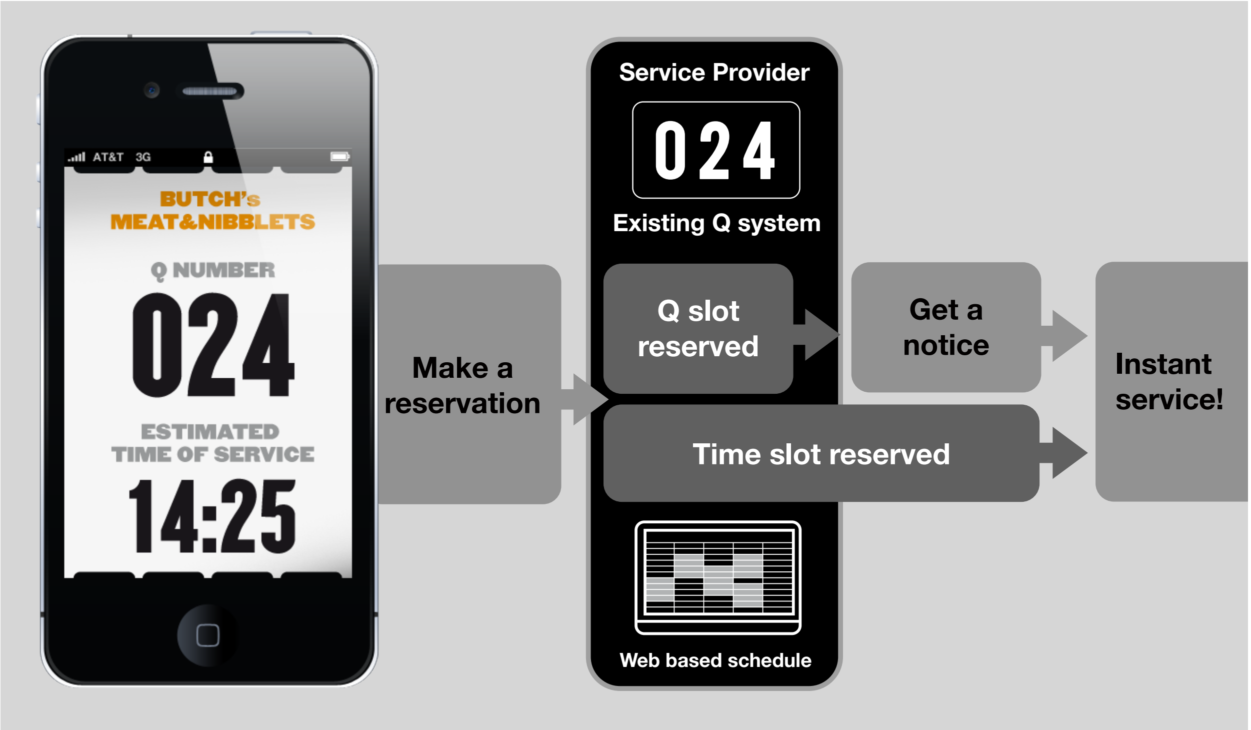


Figure 9: Initial product concept

Figure 9 shows the initial product concept that I presented on August 26 2011 at Garage 48 Tartu, a three day long hackhatlon. The idea was to connect smartphones into existing queue management system or with web based booking environment. The smartphone screen view bears the resemblance with paper queue tickets and holds additional information about Estimated Time of Service (ETS). The idea was executed into working prototype by our team in 48 hours, connecting smartphones with existing queuing machine.

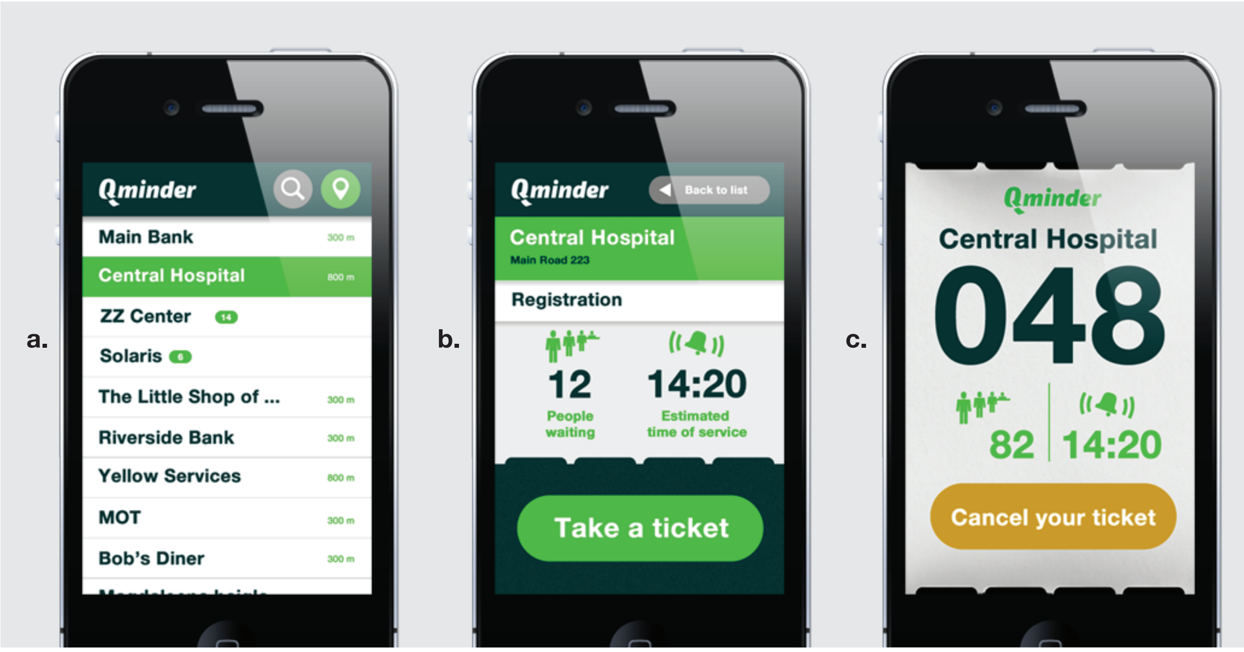


Figure 10: Main steps of mobile application

Figure 10 shows the main three steps in the customer end mobile application. Fig. 10a shows a list of nearby venues that are using the system. On the top bar there are icons for Search and Map functions. Search function enables users to enter a name of the venue that is not listed or it is located further from the search range. The application lists venues that are in a ten kilometer range or the closest 30 venues to ensure that the displayed list does not contain locations that are too far nor the list is too long that users cannot easily find the one of their interest. The Map function helps users to see venues on a map, which helps if you know the location of the venue but not its name. The venues are sorted by proximity and the distance is also displayed (right column). If there are several venues at one location (shopping mall) they can be grouped into a sub-list.

If a user makes a selection in the Venue List (Fig. 10a), then the application displays Venue Details (Fig. 10b). There are fields for venue name, short description which are entered into the system by Venue Manager (discussed later), the field for selected waiting line (discussed later), the actual Number of People Waiting and Estimated Time of Service. The screen has two function buttons, Back on the top right corner (following the iOS Human Interface Guidelines[1])

1 http://developer.apple.com/library/ios/documentation/userexperience/conceptual/mobilehig/MobileHIG.pdf

and Take a Ticket at the bottom. If the user chooses to take a ticket, a Ticket will be displayed (Fig. 10c). The central element on the ticket is the line number, ticket also has the Name of the venue, the Number of People Waiting and Estimated Time of Service. As the aim is to make the application universally usable, the textual descriptions are replaced with icons. The Ticket also has a Cancel Ticket function, which can be used if a user chooses to leave the queue.

As the initial idea was to integrate mobile application to existing queue management system, the interface for venue manager was made just for demonstration purposes (Fig. 11).

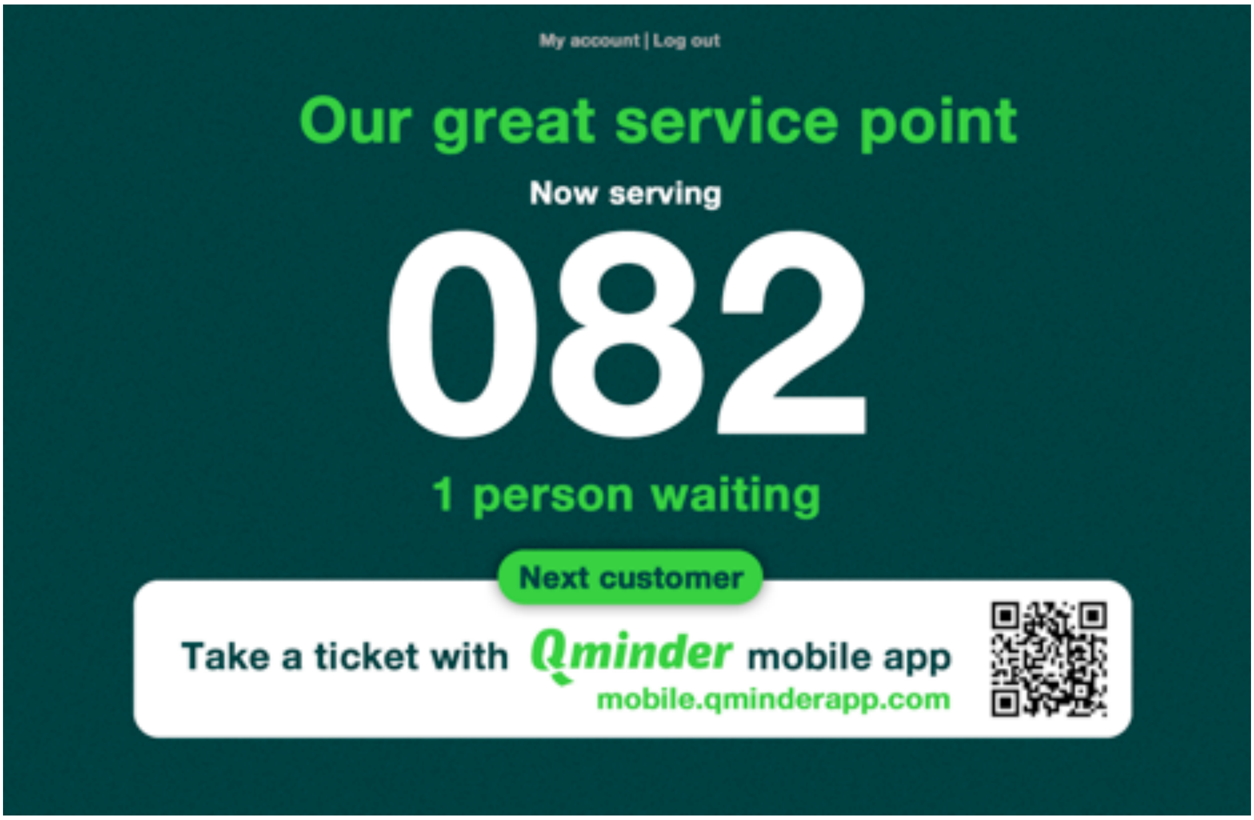


Figure 11: Venue manager demo interface.

The screen on Figure 11 shows the queue manager end of the service. It was used for demonstrating the app for potential customers. The screen displays Venue Name, Currently Called Line Number and Number of People in the Line. The Next Customer button allows to demonstrate how the app reacts to the change on the screen. QR-code on the screen allows people to open a HTML5 page to take part of the demonstration with their personal device.

13. Overview of queue management product

Next I will give an overview of functional elements in a queue management product. I will be discussing virtual queues as they are using numbered slots for organizing customers instead of calling from physical waiting line.

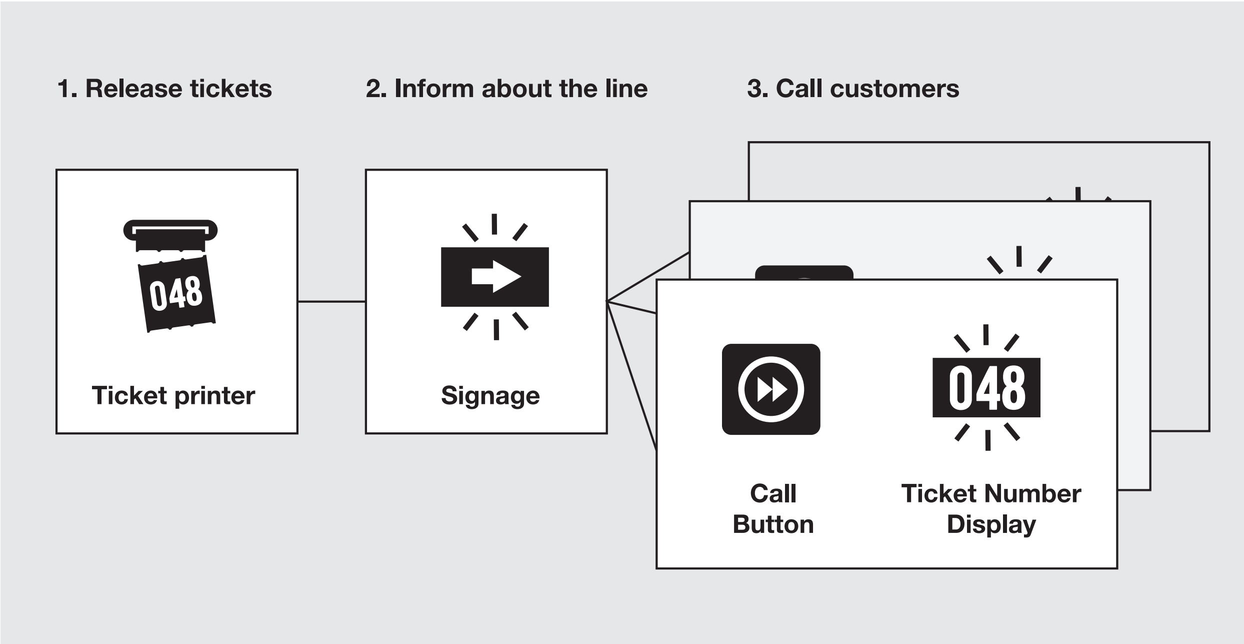


Figure 12: Basic concept of Virtual Queue Management Product.

All virtual queue management systems include three essential features: taking customers into a queue (release tickets), inform them about the line and call customers (Fig. 12). If the venue is small and all service points are all clearly visible, the Signage and Ticket Number Display are usually the same device. Also, there can be a set up, where numbers are displayed on each service point and there are set ups, where central monitor displays all numbers and directs into numbered service points.

The next layer of complexity comes with the ways the lines are organized. The simplest version is to have one desk serving all customers, but mostly the queue management has either multiple lines, multiple desks or both (Fig. 13). As our initial plan was to integrate the mobile application with existing queue management systems, we had to support all the features that current systems have.

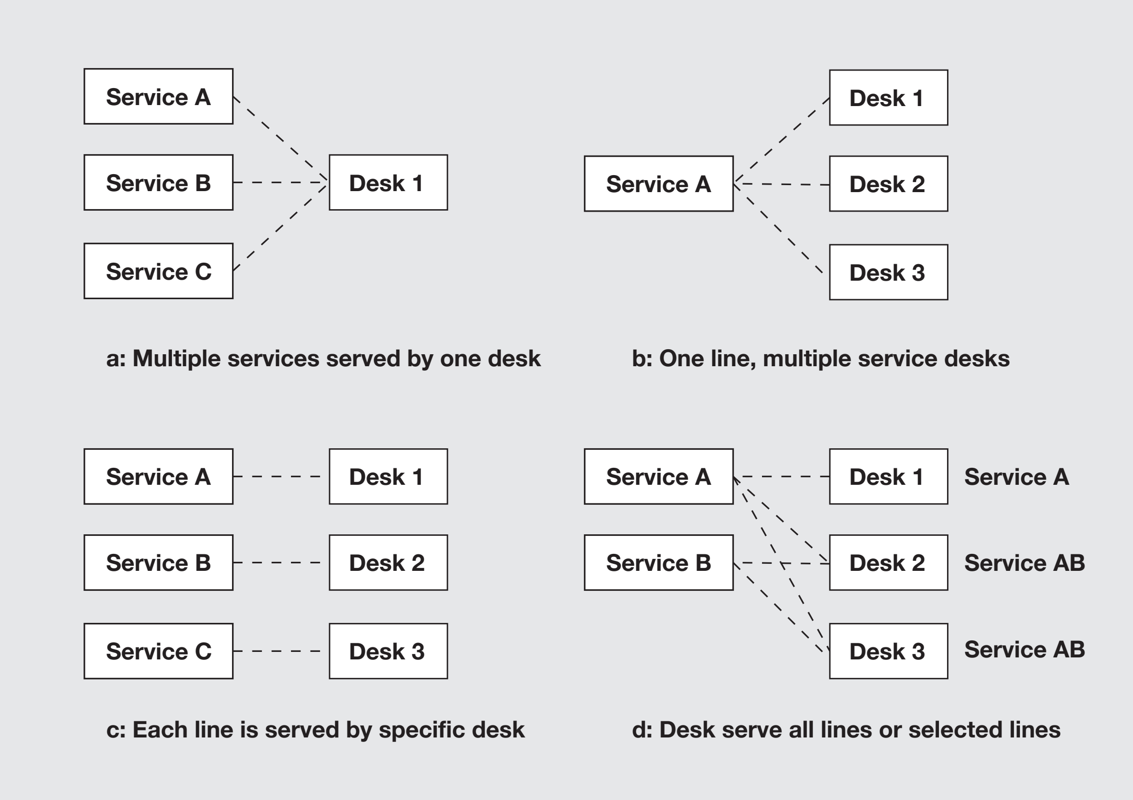


Figure 13. Scenarios of queue management of virtual lines

First step toward compatibility with existing systems was introducing multiple line function into mobile application. The solution was to extend the List View (Figure 14) with Venue Header, which creates a smooth transition between List View and Venue View, shown on Figure 11.

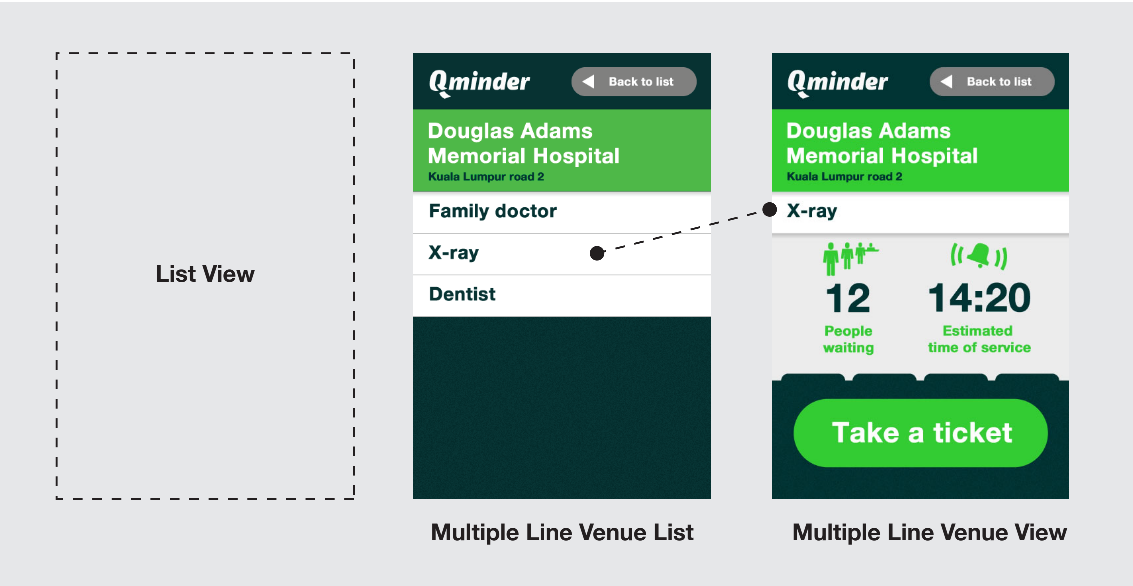


Figure 14. Multiple Line Venue feature in mobile application.

14. Step 2: Scenarios in mobile application for real life situations

Remote queuing can provide better customer experience if it allows customers to take tickets remotely and be informed about the changes in the waiting time. As it was discussed, the most critical situation is when the waiting time gets shorter than expected and the customer cannot be informed about the change.

The most foreseeable situation is when customer cannot maintain internet connection with our service. In these conditions the customer will see a special Offline Ticket (Figure 15), which will appear automatically if the device cannot establish a connection with our service. In Figure 16 I lay out different situations that can occur and how the mobile application is designed to react.

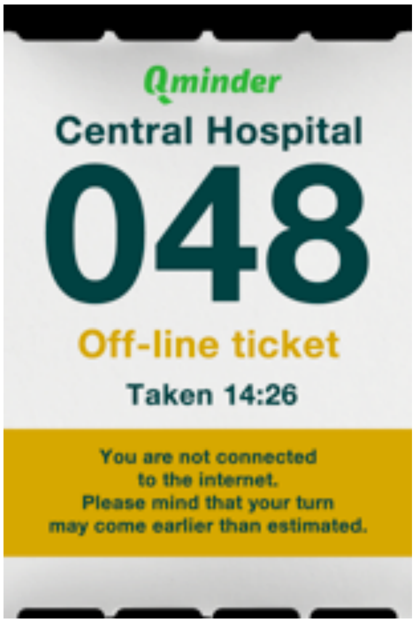


Figure 15: Offline Ticket screen

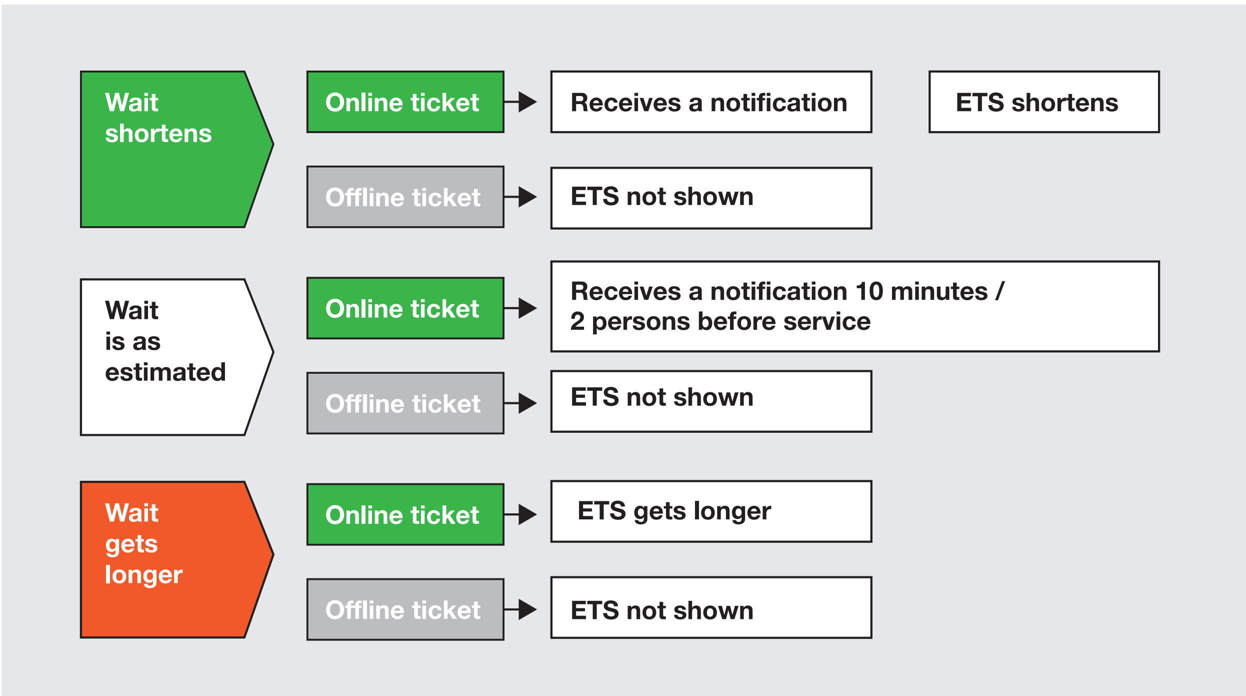


Figure 16: Scenarios for mobile application behavior in different Estimated Time of Service situations and network availability

The mobile application is designed to send a push notification if the wait is less than 10 minutes or there are only 2 persons ahead, whichever comes first. The design of the ticket changes when a person is called (Fig. 17), making the urgency more obvious in situations where there are no other signs in the environment to confirm the call (signage, sound, blinking number etc).

Figure 17: Calling ticket screen

There are several other features that could be added to the application (time slot booking, feedback, identification), but from the usability perspective it is more important to guarantee that all people that used the mobile app got their service without any problems caused by the mobile app.

15. Step 3: Venue management tool

The next step in product development was to create a web based venue management tool.
In that environment, shown on Figure 18, users could enter and manage:
- Their User Name and Password;
- The exact location of the service venue (used for calculating the user's distance from the venue);
- The Name and Details of the service venue which is displayed in the mobile application;
- The Opening Hours used for disabling venues when they are not operational (nights and weekends);
- And they could also use the web tool for Serving the Line (as shown on Figure 11).

This management tool enabled users to set up the product on their own, using their computers, tablet computers or additional displays for running the service.

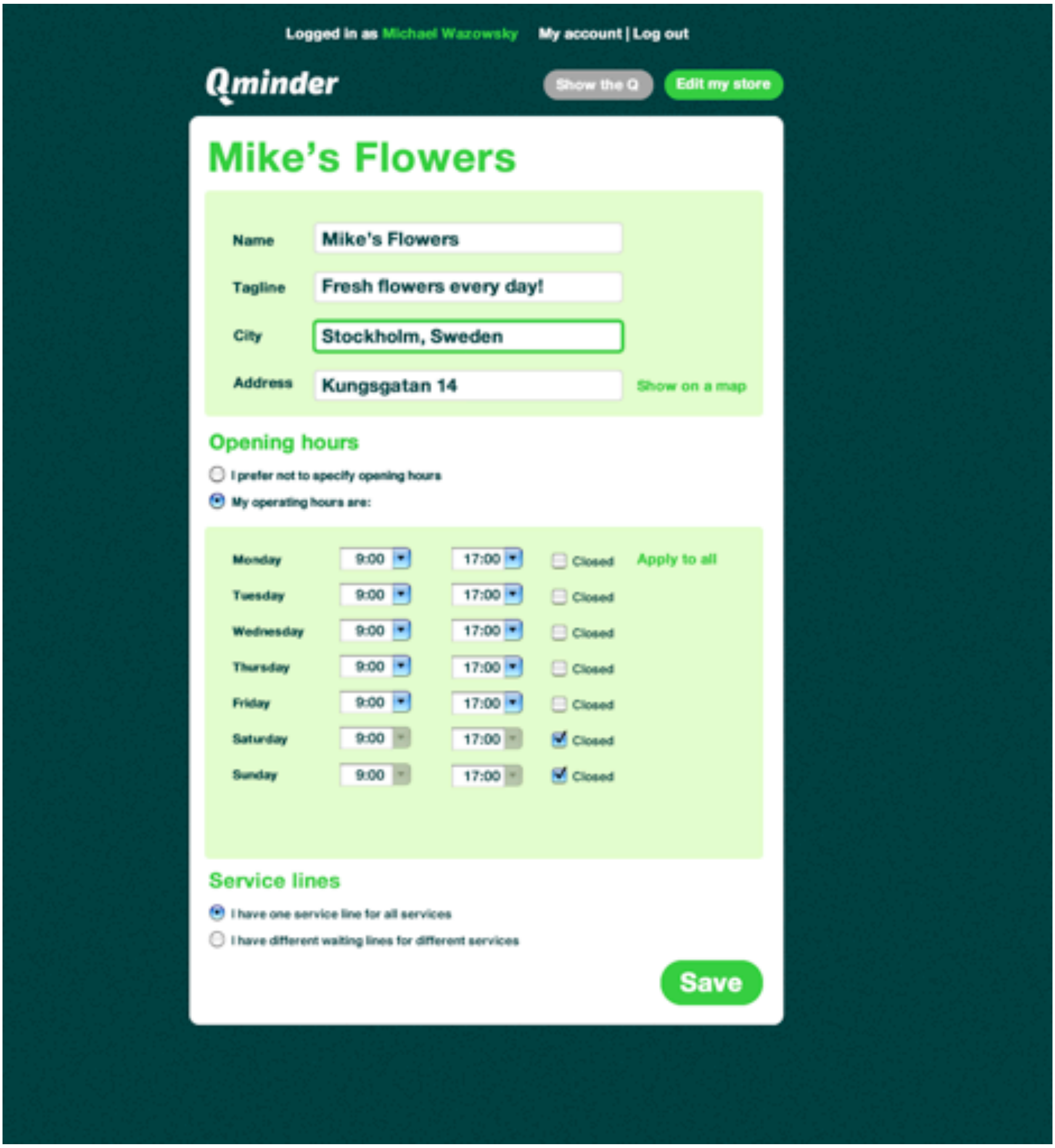


Figure 18: Screen from venue management tool

As this development process is presented here in the chronological order, I will add here a Product Development Timeline (Figure 19) as it was planned in September 2011. In addition to what is discussed in this work, the team also plans for creating integration with Point-of-Sale software Erply (www.erply.com) and booking system, as it was part of the initial idea. At that time the team did not plan for any kind of hardware support as it was planned to be a web based software that introduces remote queuing to all service companies.

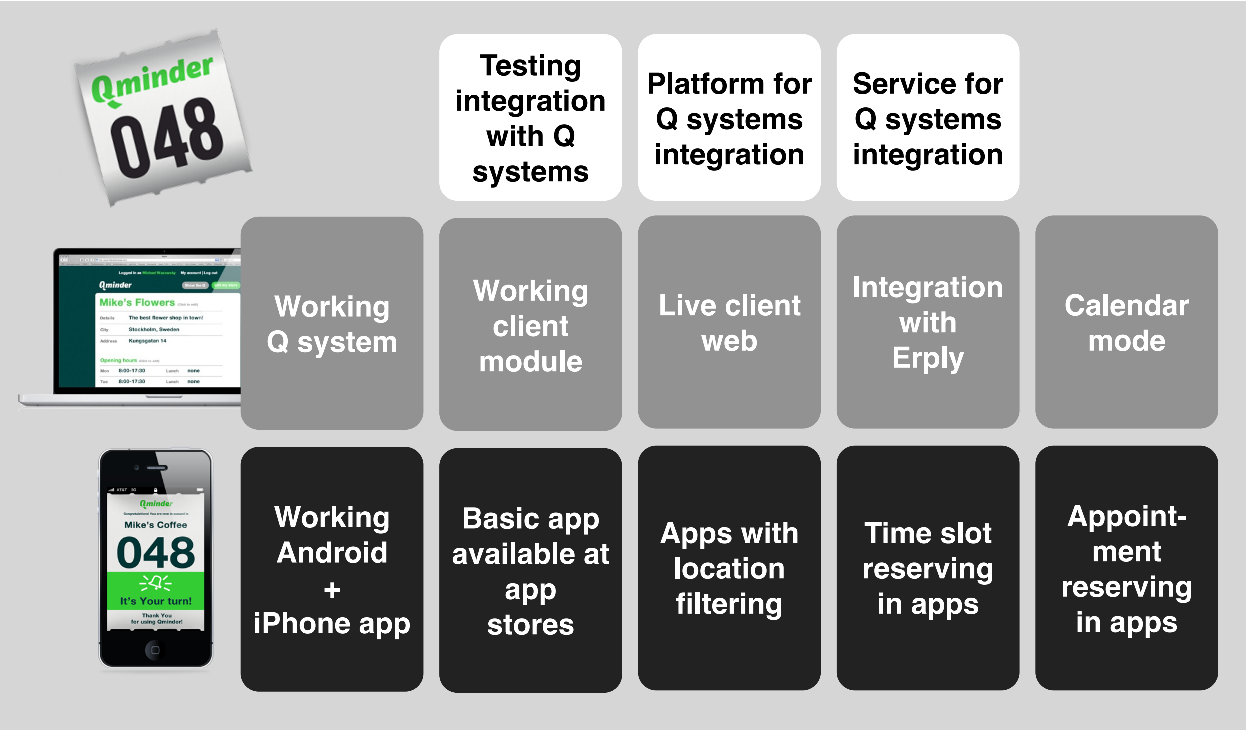


Figure 19: Product Development Timeline in September 2011

The Timeline on Figure 19 illustrates the plan for further development regarding different components in the system. The emphasis is on building features for software that will mostly remain hidden in physical service environments and therefore we saw our role more as an enabler not as a provider.

16. Step 4: Testing the integration with existing hardware

The hardware is mostly rented and/or maintained by local value-added reseller (VAR). We built a relationship with the company who then arranged us a meeting with a queue management system manufacturer. During private conversations with company executives we learned that their interest in our product is not for existing hardware as for the next generation of machines, providing them a sell-in argument for the new equipment. Also, the possibility of displaying information about public waiting lines could be seen as a disclosure of business intelligence which might act as a competitive disadvantage. That means, if one service provider can be compared with another based on waiting time, they might prefer not to make that information public.

Based on our experiment, we found the method of entering the market using integration with existing systems not viable for the following reasons:
- existing hardware runs on proprietary software, which is manufacturer's intellectual asset. No other company can build integration on their platform and no other company can benefit from their distribution network.
- End customer product was not recognized as viable business idea for service providers, causing questions about feasibility, security risk and monetary value.

In the words of Moore (1991), "to enter the mainstream market is an act of aggression. The companies who have already established relationships with your target customer will resent your intrusion and do everything they can to shut you out. The customers themselves will be suspicious of you as a new and untried player in their marketplace. No one wants your presence. You are an invader." Our naive intention to start cooperating with existing companies was indeed met with doubt and contempt from their part.

17. Step 5: building a non-smartphone ticketing

After our minimum viable product was rejected by the hardware company, we could not test the product as a supplement to existing set up in real service situation. The product had to be developed into self-standing system using common hardware, and it has to be usable for all customers that any service company has, only after that we would see how it works in real service situations.

As it was discussed previously, companies do not collect information about their customers communication devices so the requirement from all the companies we contacted was the service availability for all customers. From total amount of 134 respondents to our survey (discussed in Business model section, chapter 10) in March 2013, 79% percent of respondents use smartphone with data connection, 3% use it without data connection and 18% use mobile phones. When talking about smartphones without data connection we also have to include, for example, tourists, who refuse to pay for expensive data roaming and are visiting venues with long waiting lines.

That information supported our hypothesis that people without smartphones in most cases do have a mobile phone and therefore we can use SMS messages to provide similar service as they would receive using our smartphone app. From the service provider side we only had to introduce a input device, most probably a tablet computer, where people can tap in their mobile number and be invited to the system.

Figure 20 shows the screen, which can be used for taking tickets with smartphones or mobile phones. The screen displays currently served number (to provide information for customers who may wait for their turn close to the screen), the number of people currently waiting, estimated time of service and information about the smartphone app. If a customer chooses to take a ticket by SMS message, the on-screen keyboard can be used for entering their number.

Figure 20:
SMS ticket screen.

To manage the rising complexity, the Venue management tool was also developed into a product called POS (Point of Service) to distinguish managing side from the actual service screens. At this point we had following functional screens:

- Line monitor: displays the number on one service desk, no interaction with the screen *(Figure 21, left)*;

- Overview monitor: displays all current calls in the system, no interaction with the screen *(Figure 21, right)*;
- SMS ticket screen, allows customers to enter mobile number.

Figure 21: Line monitor (left) and Overview monitor (right) screen layouts.

Figure 22 demonstrates a service venue set up using our software and common hardware. At this point the product started to develop into full platform, providing all necessary components for organizing a queue. We started to instruct test users how they can set our product up using their own hardware. The proposal was that the system can be used where service person already uses a computer for work, all you have to add are screens that show the queue number (easy to set up with second monitor using Extended Desktop feature that allows to display different content), tablet for mobile phone users and additional information about the smartphone app (we provide A4 sized poster PDF file).

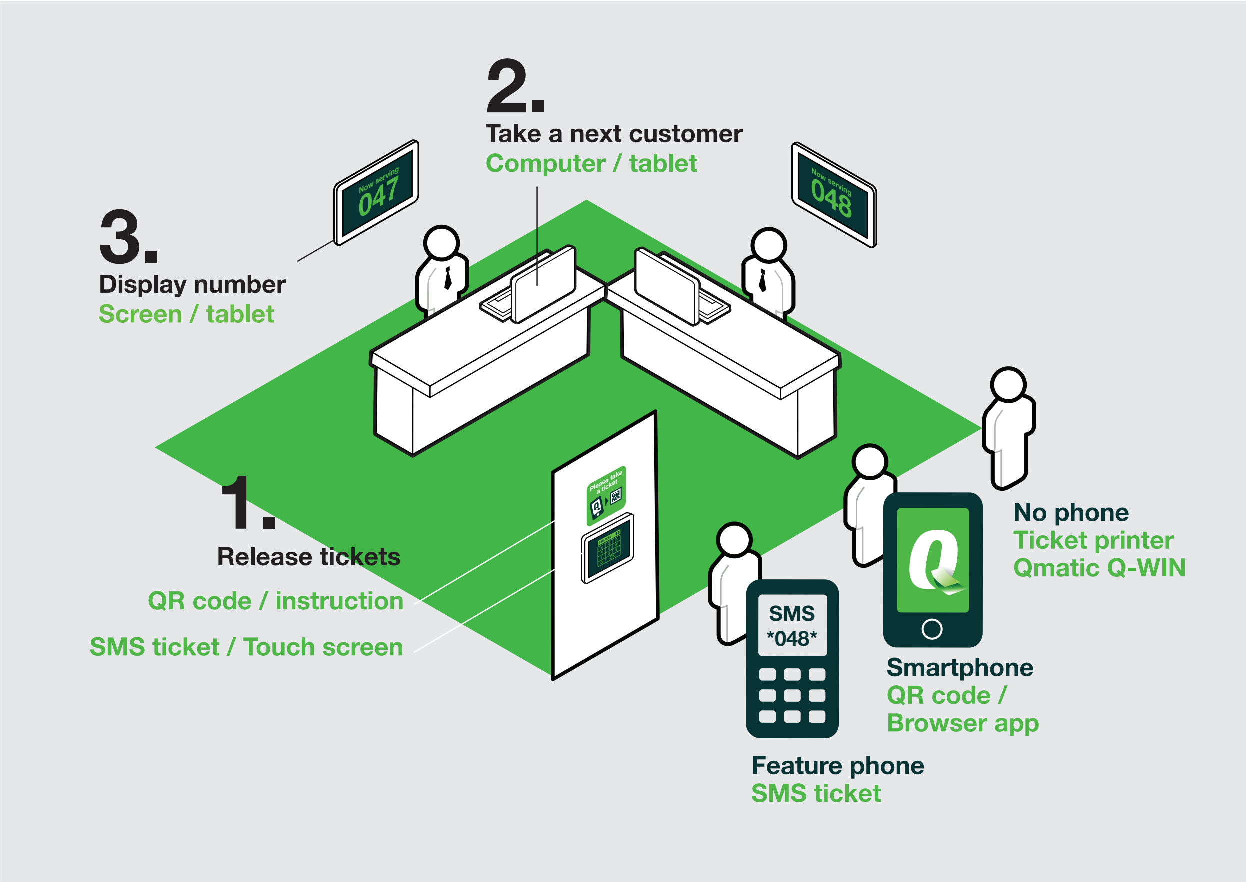


Figure 22: Queuing system overview (excerpt from marketing materials)

We tested the system with SMS tickets on board in barber shop in Rio de Janiero, Brazil, where our assistant instructed customers how to use the system and collected feedback about their experience. We found out that they were experiencing up to 2 minute delays in receiving text messages, which can occur in densely populated city environments. As this happened in a first trial, we saw that the system has to have alternatives for the channel and also a possibility to reorganize customers in the line if it has to be corrected. The success of the trial was that all people with smartphones arrived on time for their service, proving that the main feature of the product can be used in real environment. We also discovered that some people did not carry any phone with them, which disproved our hypothesis about covering all customers with phones and smartphones.

18. Step 6: Testing the vendor channel

Although the interest from line management system company was not sufficient to continue our investigation in that direction, we became aware that many vendors were interested in having a less-expensive and technologically advanced alternative to current product offering. The main concerns for them was that the product had to have all the features of current systems have: paper tickets for clients and statistics of usage. We approached several vendors across the world to get feedback on how our product could be installed to their clients venues. Vendors conducted several interviews with different companies, giving us the feedback that they are not able to sell it without clearly articulated client need.

Here is the feedback from resellers on why the product cannot be sold to different client groups:

1. Small businesses, private doctor offices:
- usually the customer flow does not exceed manageable amount.
- many customers are elderly people without a smartphone or even a mobile phone, for them the new system can create more problems than it solves.

2. Banks, telecom, cable companies:
- Central policy does not allow to engage in business relations with startup companies.
- There are strict rules and requirements for suppliers in any field, especially the client satisfaction related ones (many years in business, proven track record, minimum revenue references,…)
- Some are developing their own version, tailor made, locally with home IT
- Some wait to get the developed version from the central
- Security risks (banking)

3. Governmental entities (electricity, healthcare):
- Any purchasing decision over a relatively low amount is to be decided on tenders, they are not free to spend money especially long-term financial decisions are strictly ruled (lots of paperwork and time, decisions made by committee, internal solution plan, feasibility studies, minimum of 3 offers)
- Political influences and corruption issue about big amount purchasing.

The feedback concluded that the product offering was not mature enough to be offered on mainstream market and the small businesses did not recognize the problem of long queues.

Based on the feedback we described the criteria for product that can be sold through vendors:

1. New technology has to support existing client or customer behavior.
2. New technology has to be less expensive than existing.
3. New expected customer behavior (taking tickets remotely) has to have real life proof like existing users, product demonstration is not sufficient.

Our intention to build only the mobile app and supporting integration software was proven not to be the minimum viable product for entering the mainstream market, so the next step was to choose a method for validating clients from non-mainstream markets and build a setup that will support their business.

19. Step 7: Expanding the target group

By getting in-depth understanding of how the queuing systems are sold and distributed to most prominent candidates and what are the product's limitations compared with existing systems, we made a decision to map out a wider selection of possible clients we could approach. Following criteria is set to help finding customers among service companies that have the issue of customer pain. They might currently use existing solutions or not, the most important thing is that they can easily recognize situations, where they have dealt with customer on the rush or complaining customers.

Many businesses that are facing problems with customers cannot be helped by improved waiting lines: migration to virtual services, replacing their physical service points with call-in service, website or e-shop. Some companies may have issues in hidden part of the service (production, delivery, operations), therefore their investment into improving the waiting line does not improve the perception of service quality.

Following list of criteria is based on our interviews with several people and observations about the conditions where the inconvenience of installing our remote queuing product is lesser than the convenience it produces.

Criteria for perfect product/market fit for remote queuing product:

1. ***Service is provided on the spot by a person:*** this principle states that the physical service cannot be easily replaced by a virtual service. Although people wait a lot, for example, at the postal offices, the rate of closing the redundant postal offices exceeds the effect any improvement on service quality may bring. For instance, half of the US 32,000 post offices were under consideration for cutting the service in 2011 while over 2000 were permanently closed (Levitz, 2011). So therefore our focus should be on services that cannot be substituted with a digital version.

2. ***"Service time may vary"*** is a principle that makes predicting impossible without correcting the estimation over time. This is the advantage of our product over predecessors.

3. ***"Need for service is recurring or accidental":*** this means that the service has to be used more than once and the need for service may appear at busy times. The return visits have a crucial role for pre-installed mobile application, as the customer has to remember to use the app for queue ticketing. Unplanned visit is where people appreciate time saving most as the time spent on service has to be taken from their previously planned activities.

4. ***"Service has monetary value"***: this principle sets condition that service companies should appreciate the cost of the innovation as the benefit for having less customers turn away because of the wait.

5. ***"Customers see convenience as important differentiator between competitors"*** is relevant when the service provider has competitors and the service experience is important factor in decision making.

6. ***"Waiting in normal conditions takes more than 15 minutes on average"*** and

7. ***"Service line is for the same day"*** set the criteria when the product is superior over the alternatives. If customers are not waiting longer than 15 minutes on average the service provider does not have a problem of prolonged wait. If the waiting order will continue the next day then the service probably uses scheduled appointments and this falls out of the product focus.

There are many services that may fit into our criterias, starting from fitting rooms, auditions, locksmiths and car wash to trade fairs, theme parks or tourist attractions. One considerable aspect that limits the use of existing queue management systems is the cost of equipment and maintenance. By making it more affordable we could reach companies that currently are not using any electronic queue management equipment.

One way of cutting the costs would be setting the service up with generic hardware. Tablet computers and SmartTVs have been affordable for couple of years already and their price is in steady decline. Also, there are companies providing accessories for tablet computers, helping with installment. Our product was optimized for self-installation, as it helps to keep the price of the product down and make it affordable for small services

20. Step 8: Connecting devices with tablet application

The necessary step toward self assembly was to introduce a pairing application that connects all screens into one system. We developed a tablet application called Connect, that allow users to choose a role for a device and then pair it with the venue management tool POS.

Figure 23: Monitor Pairing screen of Connect

With Connect you open the app on a tablet, choose the role for this device (Line monitor, Overview monitor, SMS ticket screen, Name ticket screen, Paper ticket screen) and receive a pairing code (Fig. 23). When you enter this code in Devices section of POS (Fig. 24), the system connects the new device to work with the product. As the product is a web service, all devices in the system have to be connected to the internet. By using wireless connection the physical set up of the system is much more convenient than by traditional wiring.

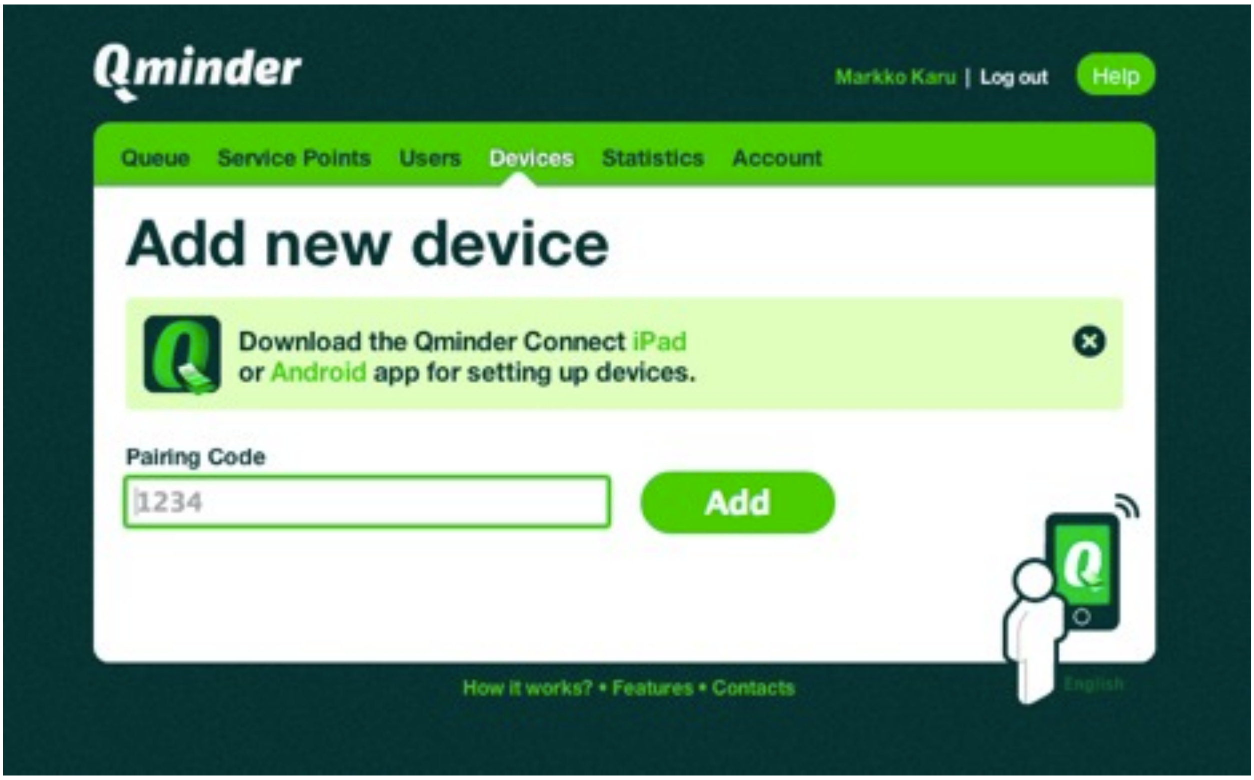


Figure 24: Pairing dialogue in POS.

21. Step 9: Name based queuing

To overcome the problems with people without smartphones and the delays in SMS messaging in overcrowded networks, we developed name based queuing. Here you can serve customers without any hardware from their side, they only have to enter their name and the system will display both name and the line number.

For customers we created a screen *(Fig. 25)* where they could enter their name and get a ticket. The tablet can be set up with Bouncepad frame (http://www.thebouncepad.com/) that limits the user input only to ticketing screen and secures it against possible theft.

Figure 25: Line manager view with open Add Ticket dialogue box. (Photo: Bouncepad)

Now we had also two different scenarios of how to display line information: numbers and names and only names. On Figure 26 you can see an Overview monitor that does not show any numbers as they carry no informational value for customers that did not receive any ticket. I will discuss the issues of Overview monitors later, when I lay out all the components and combinations that may occur.

Figure 26: Overview monitor with Name tickets.

This feature turned out to be the most elegant as now you could set up a full product using generic screens and it does not require any hardware from customer side. Also, there are several instances, where our product is used for queues not described by our product/market fit criterias. A professor in Australia said, "*it's a fantastic app. I teach at The Central Institute of Technology, Perth Western Australia. At the end of the term many students need my assistance, often at the same time. I used (the product) by loading the web page on the lecturers computer in a Mac lab. Only one student download your app on their phone. The others walked to my computer and entered their name. Very handy indeed.*" Another user from Sweden explained that they are using it to avoid "plowtalk" in the podcast: "*So we are sitting in Skype (five guys) and everyone wants to talk, and often we are all speaking so that it makes no sense for the listeners. Your system is the resolution. We're using the browser and your system to queue ourselves when we have something to say! And me, the host, are administrating the queue and presses forward the next "talker".*" Those two uses are really different from the initial idea but this is what mostly happens with technological novelties, they just find their users from most unexpected places.

22. Step 10: collecting data about service companies

The best way to track places where the product would be appreciated would be tracking venues using the concept of crowd-sourcing. Here is a description given by Daren Brabham (2008): "Crowdsourcing is Coined by Jeff Howe and Mark Robinson in the June 2006 issue of Wired magazine (Howe, 2006f), the term crowd-sourcing describes a new web-based business model that harnesses the creative solutions of a distributed network of individuals through what amounts to an open call for proposals: "Simply defined, crowd-sourcing represents the act of a company or institution taking a function once performed by employees and outsourcing it to an undefined (and generally large) network of people in the form of an open call. This can take the form of peer-production (when the job is performed collaboratively), but is also often undertaken by sole individuals. The crucial prerequisite is the use of the open call format and the large network of potential laborers. (2006a: 5)."

As it was discussed before, the customers do not express their resentment with prolonged wait as they have no means for doing so. By providing customers a product which makes their wait less stressful, they will start proposing it to venues where they think the same product should also be used. As we physically could not put together a suggestive list of possible candidates where people experience prolonged wait, we decided to use existing database of service companies. The most used platform related with service venues is Foursquare, where people can indicate their whereabouts and share their experience they had. By building the integration with this platform we were able to start collecting customer feedback without setting up a service point on our own. If the customers start voting for our system we could use that information for that they have customers who are willing to use our system at their service point.

The integration with Foursquare can serve product introductions in two ways. One is that companies that are using the product, can offer the waiting function for all Foursquare users who check in at their venue, taking advantage of it's large user base. Another benefit is that customers can point out services which should have remote waiting available, picking them from Foursquare list. There is a downside, too, that Foursquare database has also a lot of user created venues that will never be used for waiting lines: "Scan the list of nearby venues in almost any neighborhood in New York and you'll see venues with names like "Driving in circles looking for parking" and "I would kill for your apartment." (Jeffries, 2012). Also, large majority of venues are not managed by the companies, out of over 10 million businesses on Foursquare only a 750 000 venues are claimed by their owner (Quora, 2013).

Figure 27: Crowd-sourced map of venues indicated with our Foursquare integration (Source: author)

Since the integration with Foursquare on 20 March 2012, users have pointed out 1280 venues, with the most voted venue receiving 35 votes (Figure 27). Since the trial was arranged without any promotional support we can suggest that the data was generated by the enthusiast and does not serve as an argument for businesses to introduce the new system, however it proved the principle that we have a channel for capturing customer pain if that becomes the main obstacle for adaptation. As Foursquare has become dominant platform for connecting physical venues with smartphone users, it creates synergy for any application that uses physical location as the main filter.

23. Step 11: Developing the product on client feedback

As our primary target for remote queuing were the service companies already using some queuing systems, we had to be able to cater their existing needs and behaviours. Most companies gave us positive feedback about the product but asked for specific features that they currently use or would like to have (which would then justify their investments into new set up). Also, in order for them to even consider testing our product, it had to have all the components of the existing queue management products. The initial idea to have a smartphone app that can be added to existing system unfortunatelly ended up building a system that uses smartphone app only as additional feature.

Figure 28 lays out all the elements of the product we had to develop to be able to go further with testing the system in real service environments. Tickets can be released with ticket printer, text message, entered name or with smartphone app. Customers can be called and managed through tablet or a desktop computer, using one or serveral desks and one or several lines. Line numbers can be displayed using one screen per each desk or one screen for multiple desks. All devices are easily paired with the system using Connect tablet application (available for Android and iPad). The system releases statistics about the service times and line capacity.

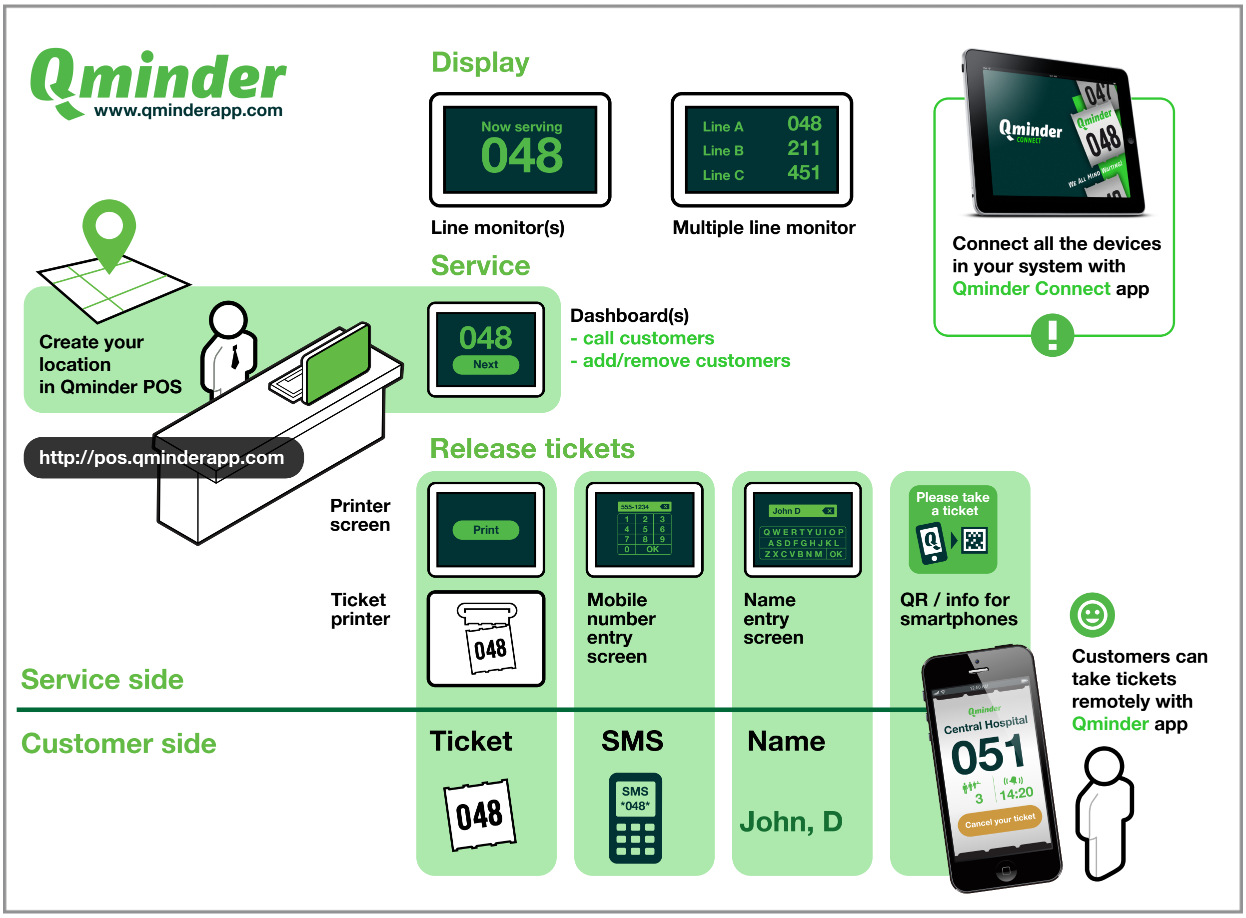


Figure 28. Product overview in marketing materials

During the developmet process we have made several iterations from Overview monitor as different set ups require different information to be emphasized on the screen. Our current monitor runs on SmartTV (Figure 29) as this device uses wireless internet and also supports applications (we have developed a version of Connect especially for SmartTV platform), which makes connecting the device into system really convenient.

Figure 29: Overview monitor with two columns for ticket and desk number on Smart TV

Paper ticketing has been the biggest differentiator between industry players and queuing startups, looking for ways to revolutionize the way people wait for services. It has also been an important component in building relationships with distributors, whose income is more or less dependent on hardware sales and maintenance – having a specific hardware is essential component that the product could enter the mainstream market using existing relationships.

Figure 30: Paper ticket screen on tablet screen and a printed paper ticket.

We have built a relationship with ticket printer manufacturer, supporting their existing printers and also new models, which already have a touchpad screen for user input (and therefore are a perfect for queuing set up). Figure 30 shows a hardware set up that consist of a ticket pinter, Bouncepad tablet holder and an iPad with Connect installed. To support a printer we had to develop a printer dialog where we define the width and orientation of the paper so the program can create an image of the ticket, which will be sent to the printer.

Coming to a market with a self-assembled queue management product did create some interest toward the product, there are about five companies around the world that use the product on regular basis and the number of testers just passed the 1000 users line. What the product still misses, is a proof of a target group that would buy the product the way we planned.

24. Step 12: Statistics

Customer flow management is a trade-off decision for most businesses. The manager must balance the cost of providing faster service (more staff, larger facilities) against the cost of waiting. Most companies do not operate with limited resource like Eiffel Tower or the painting of Mona Lisa, where there is constant overdraft of people waiting for the service, so they have to keep the waiting lines as shorter to stay in business.

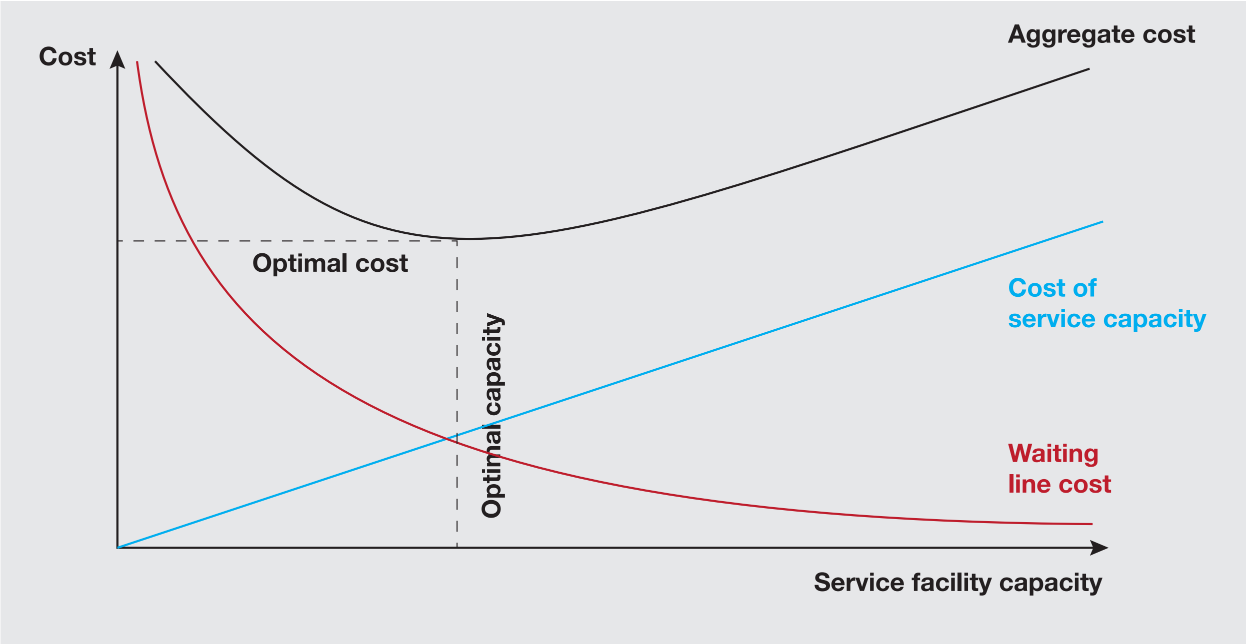


Figure 31: Service capacity versus waiting line trade-off.
(Source: www.ateneonline.it/chase2e/studenti/tn/6184-7_tn06.pdf)

Figure 31 illustrates the dynamics of how service provision is balancing between having optimal number of staff to balance the amount of customers. The optimal capacity point is where the service staff is constantly busy and the customers do not have to wait longer than it seems reasonable. Having long waiting lines may be a good option from staffing perspective but it is causing customers to leave without service and taking their business with them. Having short waiting time may cause service staff being idle and therefore causing unwanted costs. Therefore, for business perspective the information about waiting and service times can be even more valuable than ticketing system in itself.

Our next step was to build a statistics module to our POS, taking another issue off the negotiation table. Our system registers the arrivals and service calls for each customers, from that data the managers can see how long people are waiting for the service on any given moment and plan for better staffing in the future (Fig. 32).

The system can also send out messages if the number of people in the line exceeds some limit, which can be valuable information e.g. floor managers at the supermarket can immediately allocate another person to the meat counter if there are more people waiting than on average.

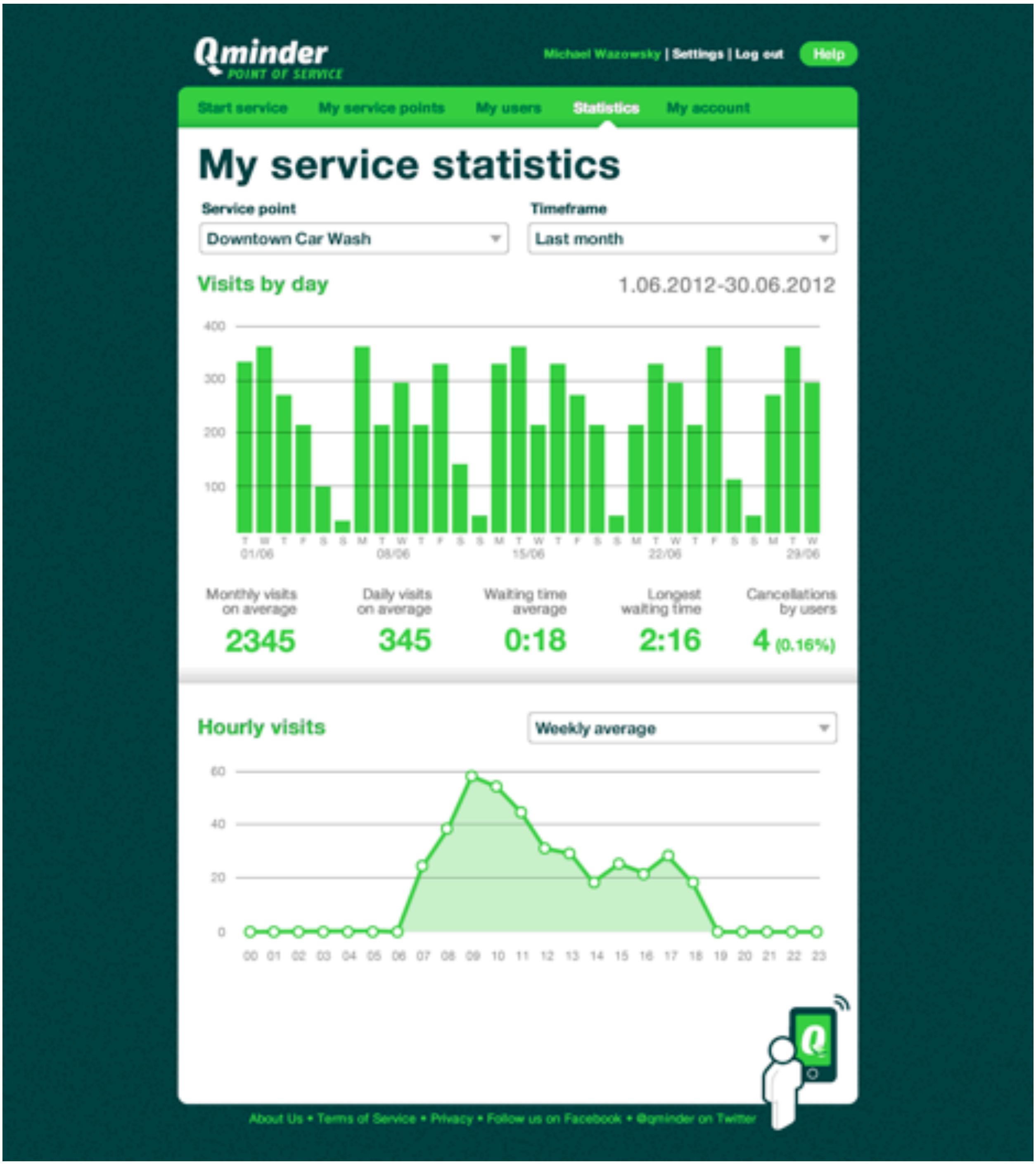


Figure 32: Basic statistics screen from POS.

25. Step 13: Priority customers

Customer prioritization is a condition where people are served based on the urgency of the matter or their relationship with the service provider. As with statistics, this feature is more related with business side of the service and being able to provide special treatment to some of the customers helps companies to reach their business objectives.

This feature grew out of the name based ticketing – if customers could join the line only by entering their name, the same could be done by the service provider. This ability was often missed in our initial trials, where we had to override the initial line order to satisfy the actual customers who accidentally took part of our product testings. Also we discovered our first test uses that the system has to be more flexible from manager side so they could make hidden rearrangements or call priority customers first.

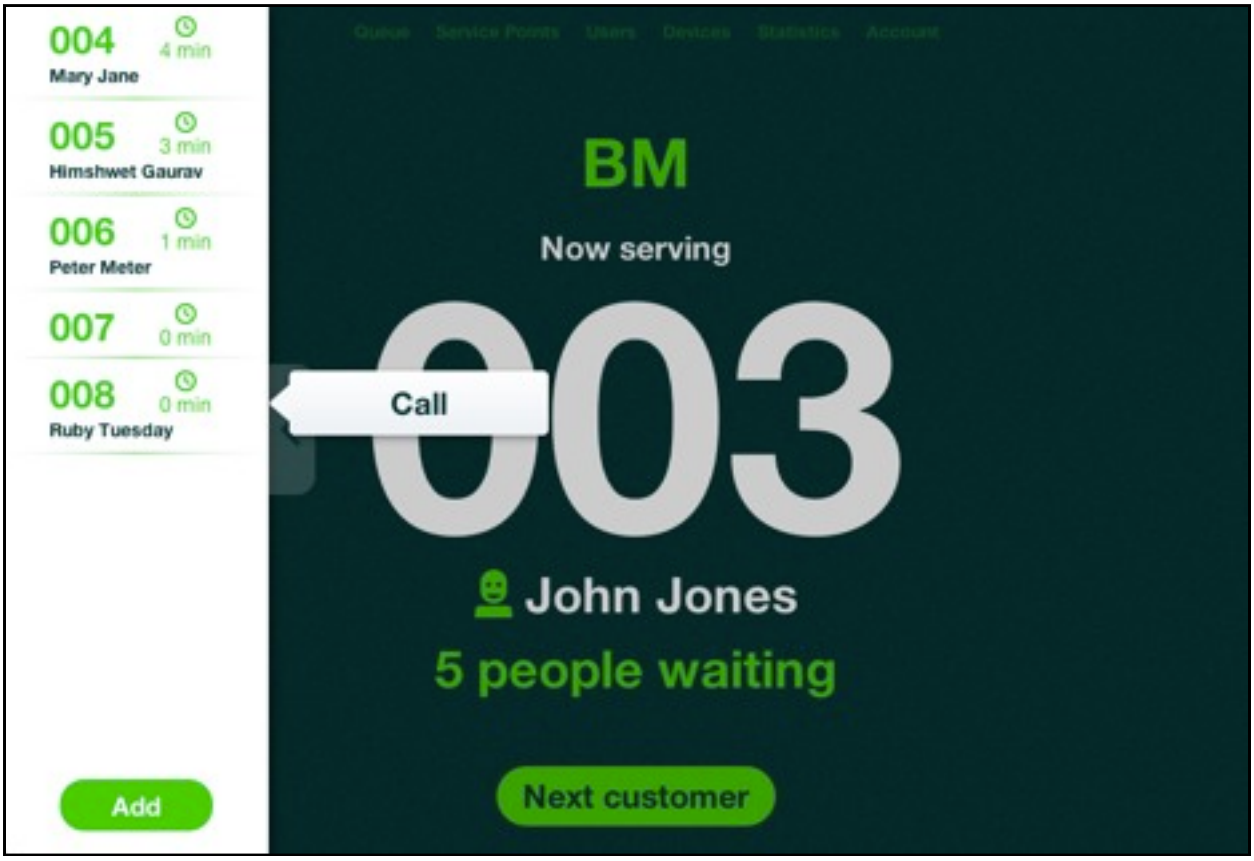


Figure 33: Line manager view with open Ticket Drawer and custom Call button

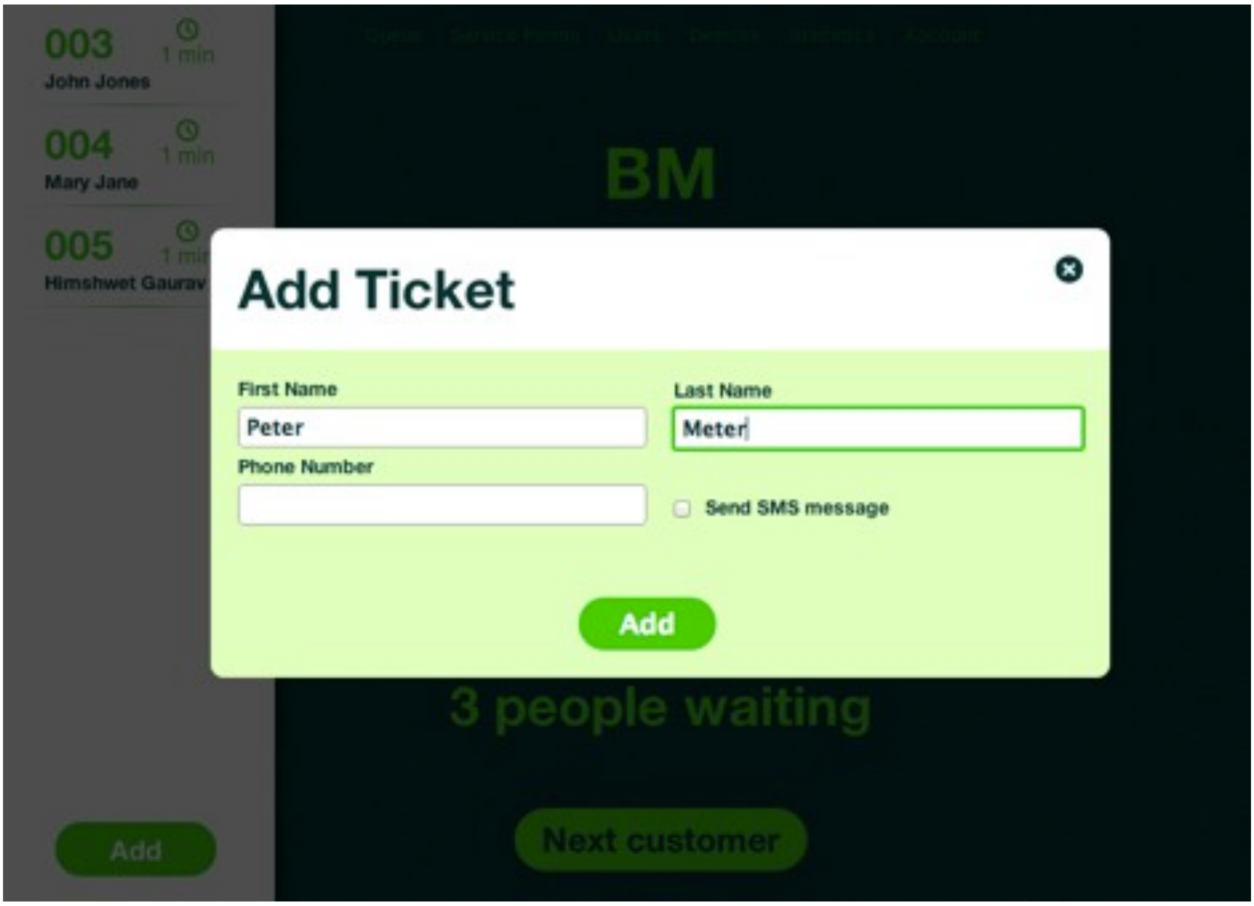


Figure 34: Line manager view with open Add Ticket dialog box

The Figure 33 shows the venue manager screen with Ticket Drawer feature. There the manager can see the list of active tickets, the length each person have waited and their name if that is inserted. Tickets taken with mobile devices can be shown on device if asked, so the phone number is not shown in the list. By clicking on any ticket, a popup Call button will appear, which allows venue manager to call any customer, overriding the initial order. On Figure 34 is seen the dialog box which opens when user has pressed the Add button, shown on Figure 33.

Identifying customers in the line rises a set of privacy issues which we would avoid as much as possible. In another hand, some services like banks and hospitals operate only with identified customers, therefore the identity of the customers will be stored only by request of the service provider. The benefits of identifying customers are faster processing by having customer history at hand (Fig 35) before the service and shorter waiting if the customers are served by their business priority.

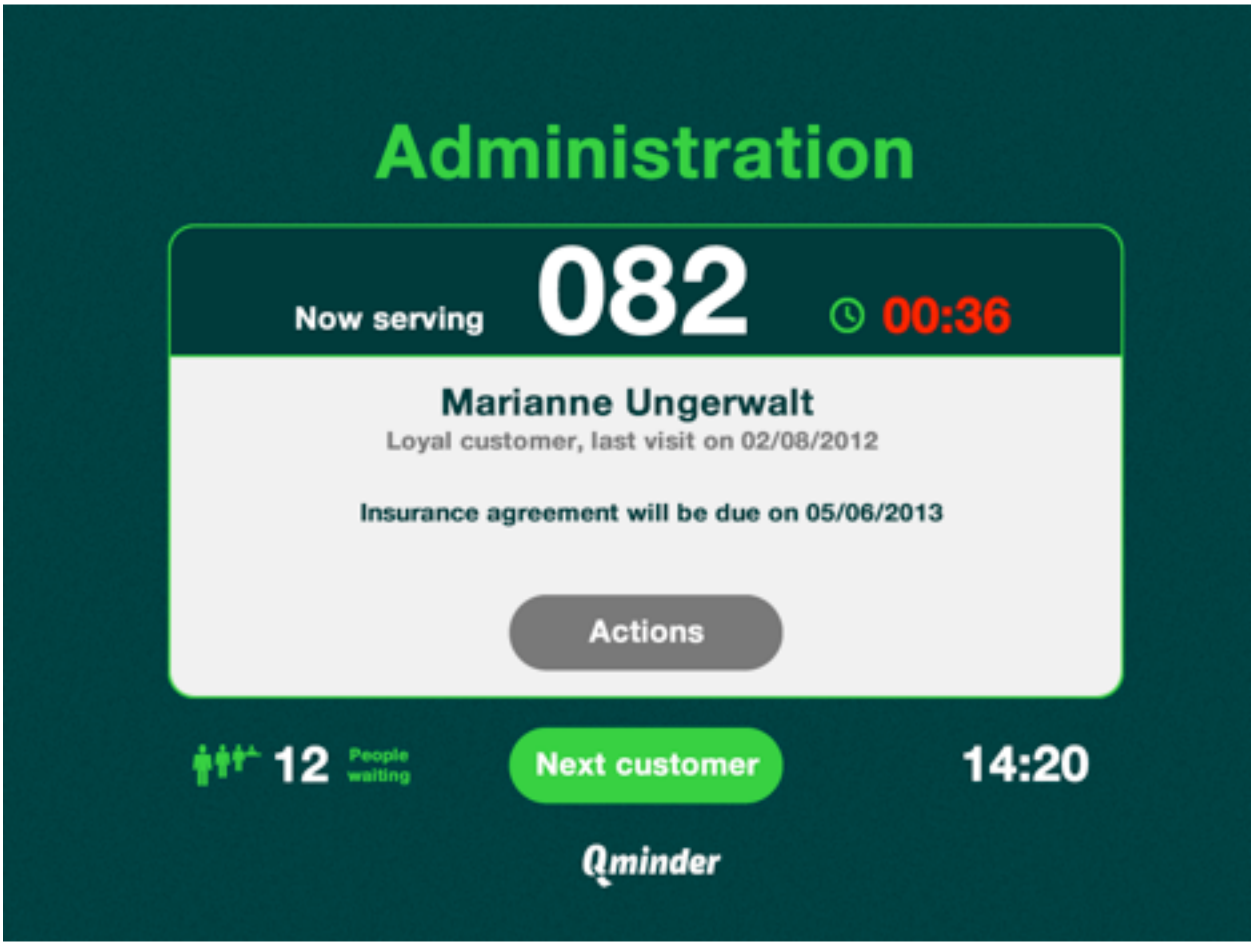


Figure 35: Line manager view with Identified Customer Dialogue box.

26. Step 14: Localization

Making applications available in local language has proven to be a successful way to maximize your earnings on a global market, especially in Asia. For instance, in China, 80 percent of paid applications in 2012 support Mandarin, the percentage for applications that support English in China is 69 percent. (Van Agten, 2012). To minimize the impact of localization, the product uses icons to express concepts (number of people waiting, estimated time of service), although many vendors raised this as an issue. As the product is a platform which connects companies with its customers, using a local language is the basic courtesy any service should have. Currently the product is available in English, Thai, Hebrew, Hungarian, Estonian, Latvian and Danish. The introduction of any language did not create substantial change in the traffic, although the feature did add another layer of credibility in the eyes of early and late majority clients.

27. Market limitation: Non-computer aided services

We chose a tablet computer as a platform for all our software development, mainly for the reason that we had to validate our client needs first. There are several businesses that do not use computers by default in doing business: barbers, repairman, waiters. In addition to customers, we also had to solve the problem for businesses where service staff does not have a personal computing device or their hands might be unsuitable for using computers or screens: they wear gloves, their hands are wet or dirty. Usually in these situations the calls are managed with special buttons that are robust enough to be used with gloves and easy to clean. Our experiences with established market was that companies that already use some systems would like to have different features added to their existing systems, although they would not replace the existing hardware because of that. The transition from software platform to full solution platform is one possible option if the existing hardware or the lack of existing hardware remains an obstacle to product introduction.

28. Finding the business motivation for implementation

Most frustrating waits, based on the number of votes by survey respondents, occur in the following situations (Research conducted for NCR Corporation by Opinion Research Corp, 2006):

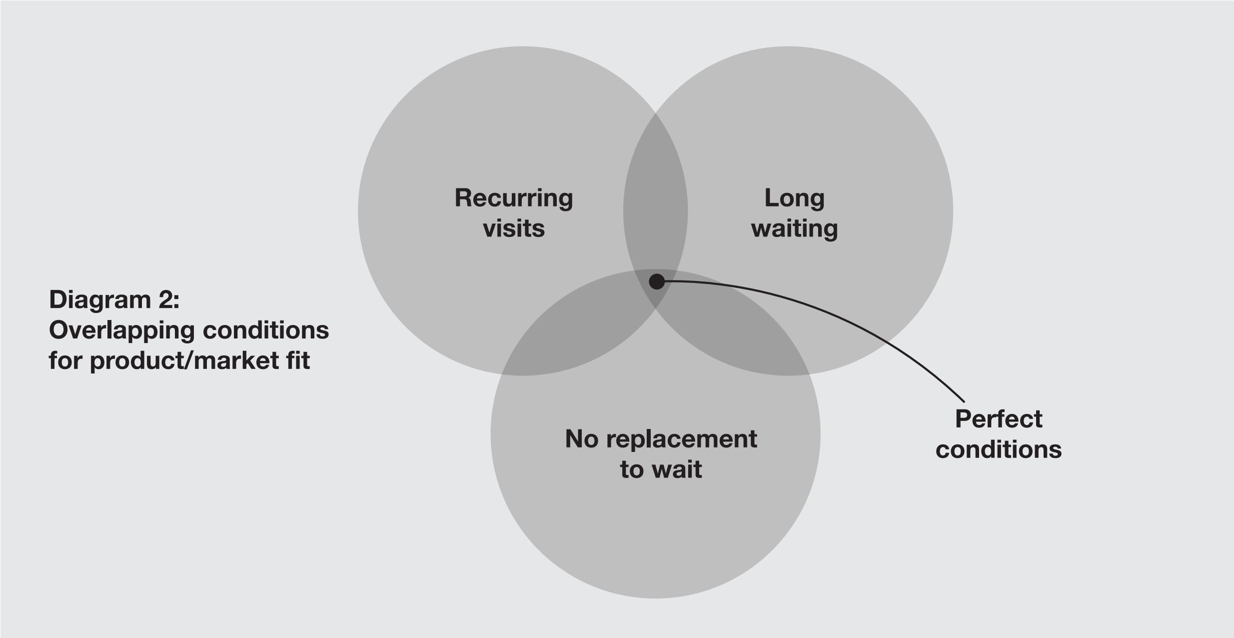
1. Registering a car or renewing a license.
2. Checking out at retail store.
3. Registering at a hospital or a clinic.
4. Checking in for an airline flight.
5. Ordering at a fast food restaurant or deli counter.
6. Sending a package or buying stamps at the post office.
7. Making a deposit or getting a withdrawal at the bank.
8. Registering a room at a hotel.
9. Renting a car.

I would compare now those situations with our conditions set for perfect product/market fit.

	Car register	Retail store	Hospital	Airflight check-in	Fast food counter	Post office	Bank	Hotel check-in	Car rental
Service is provided on the spot by a person	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Service time may vary	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Need for service is accidental	-	-	Y/N	-	-	-	-	-	-
Need for service is recurring	-	Yes	Y/N	-	Yes	Yes	Yes	-	-
Service has monetary value	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Customers see convenience as important differentiator between competitors	-	Yes	-	-	Yes	-	Yes	Yes	Yes
Waiting in normal conditions takes more than 15 minutes on average	Yes	-	Yes	Yes	-	-	-	-	-
Service line is for the same day	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 1: Longest waiting lines compared with product fit criteria (Data: Author / NCR)

As you can see in Table 1, even the most problematic queues do not have a perfect match with our described product criteria. Although the product can become handy in all of those businesses since they all experience fluctuations in customer flow or temporary delays in service provision, the average wait in normal conditions is where their need for product becomes obvious. For instance, we have been collecting customer outcries in social media, where they complain about their experiences and the Car Registration Centre has been the most often cited place. Our random visit to local Car Registration Centre resulted in 14 minute waiting time, which means that in order to prove the necessity for change we have to be able to demonstrate the problem at any given moment. That illustrates the essence of the problem at hand: customers experience the long wait occasionally and if they do, the experience does not translate into direct consequences. Figure 36 is illustrating the situation where this pain becomes evident so that the service companies would be motivated to go throughout the inconvenience of adaptation to new technology. Companies with long waiting time but one-time visitors are often not incentivized to make a change unless they see changes in the visitor count. In this group you have tourist attractions but also one-time services, for example. The third option is that companies have recognized their long waits and have replaced the need for physical service with e-service or call



center or they already are using some existing customer flow solutions.

Figure 36: Overlapping conditions for product/market fit.

Press Ganey (2009), an american consulting company specializing in health-care services, found that the average patient waiting time in hospital emergency department in the United States is about four hours. At the same time, an average American visits hospital's emergency department once every four years. This notion becomes relevant when we try to understand the issues we faced when communicating about customer's pain about waiting lines. In the following table I have listed different venues with their average waiting time and how often a person visits it. The data is based on interviews and observations as it is not publicly available nor presented as industry averages. However, the tendencies that become apparent in the comparison do not change even when the estimations are corrected by doubling the values. The recurrence is given in probability percentage in a month: once a week gives 400% probability and once every two months 50% probability (Table 2).

	Recurrence	*Probability of recurrence (100% equals once in a month)*	*Waiting time (minutes)*
Car register	Once in 5 years	2%	120
Retail store	Every week	400%	15
Hospital	Once in a year	12%	120
Air flight check-in	Every three months	33%	20
Fast food	Every two weeks	200%	20
Post office	Every two months	50%	50
Bank	Every five weeks	80%	30
Hotel check-in	Every 6 months	16%	30
Car rental	Every 10 months	10%	40
First aid	Once in 4 years	2%	240
Mobile provider	Every three months	30%	45

Table 2: List of service industries with longest wait compared on waiting time and recurrence (Source: Press Ganey, author)

When we lay the information on a chart (Figure 37), we see that there is a correlation between recurrence and waiting time: longer waits happen where people go seldom. The conditions for quick adaptation would be at the top right corner (where people wait often) where, unfortunatelly, we could not place any services that are known to us. We cannot conclude that the remote queuing as a technology will not be used in the future, the graph just shows that there is no existing market that would easily implement the innovation we have been working on.

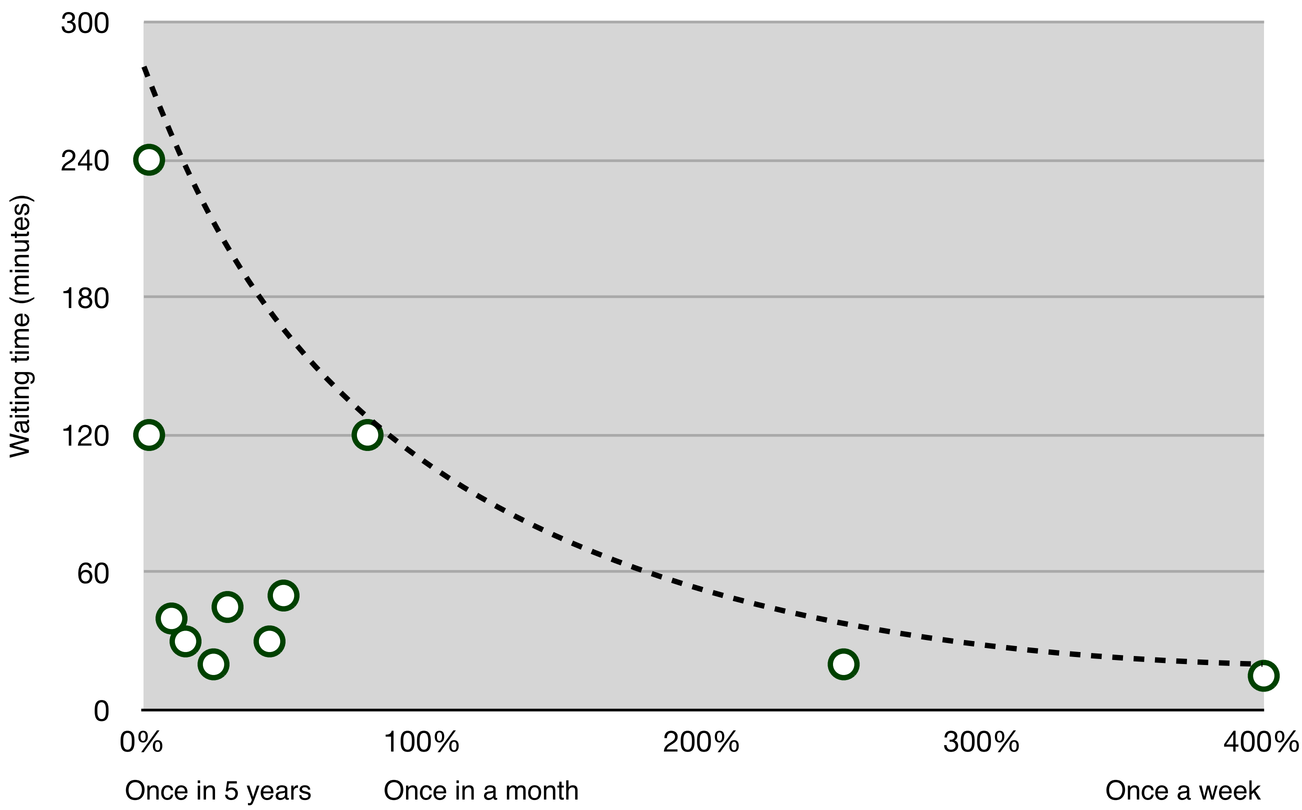


Figure 37: List of service industries with longest wait compared on waiting time and recurrence (Source: author)

29. Conclusion

This work described the complexity of business issues any technology startup faces on their attempts to bring innovative products on the market. Theoretical knowledge about the existing market and product development will accelerate the learning companies made, but it all makes sense only after companies have proven their products advantage over competitors by creating a sustainable business.

The aim of this work was to discuss the findings of the process of introducing new technology of remote queuing to the market on the specific of waiting lines and the conditions where this technology would be most adaptable. The conclusion on my findings is that although people show a lot of interest in the product, it has not yet found its market. The minimum viable product in most test cases has been a fully functional product which does not follow the lean startup principles, the conditions for remote queuing are waiting for higher smartphone penetration and conditions, where waiting happens often and for longer.

DISCUSSION

As stated by Eric Ries, the founder of IMVU, “Certainly our stories of failure were entertaining, and we had fascinating theories about what we had done wrong and what we needed to do to create a more successful product. However, the proof did not come until we put those theories into practice and built subsequent versions of the product that showed superior results with actual customers.” (Ries, 2009, p. 57)

Our biggest lesson from the process was that the conditions where our innovation is appreciated by service companies exists only in theory. As we have learned, businesses that operate with long waiting lines and where customers keep coming back are mostly public services. Those companies can be described as technological late majority and they are willing to invest only into proven technology that has become a commodity. The technology would benefit them if in use, but the sales process and packaging from our side has to be more like what they are used to.

Location based services are experiencing difficulties finding a business model that keeps people using the applications and keep money pouring in as well. World’s most popular check in app Foursquare that has 300 million users is still looking for the best product/market fit as they are struggling to find a sustainable business model for the application (Bilton, 2013). Virtual products are difficult to bring into real life situations without providing infrastructure first: signs in environment, service staff at hand, advertising. The savings that you create with using internet will not help you to compete with physical services. Although there are several devices that help you to navigate in foreign places, people still find comfort in up-to-date local paper guide.

The culture of technology startups has created a belief that products and services can easily change existing paradigms through easy and well designed substitutes. What those companies mostly overlook is the actual complexity of existing products and services, honed with years of experience. Those existing services can be replaced by better substitutes, this is how technology works, but there are only few rare instances, where a bystanders insight quickly trasforms the marketplace as it would have been waiting for it.

LITERATURE OVERVIEW

Beal, G. M., & Bohlen, J. M. (1957). *The diffusion process.* Ames, IO: Iowa State University of Science and Technology.

Bilton, R. 2013. *After a $41M loan, Foursquare still needs to prove it's an actual business.* VentureBeat, April 11, 2013 http://venturebeat.com/2013/04/11/foursquares-quest-for-legitimacy (1.05.2013)

Brabham, D. (2008). Crowdsourcing as a Model for Problem Solving: An Introduction and Cases. *Convergence: The International Journal of Research into New Media Technologies, 14*(1), pp. 75 – 90.

Davis, M. M., & Heineke, J. (1998). How disconfirmation, perception and actual waiting times impact customer satisfaction. *International Journal of Service Industry Management, 9*(1), pp. 64 – 73.

Eisenmann, T., Parker, G., & Van Alstyne, M. W. (2006). Strategies for Two-Sided Markets. *Harvard Business Review, 84*(10), pp. 92 – 101.

EMOR. (2012). *Kodanike rahulolu riigi poolt pakutavate avalike e-teenustega*. Retrieved on April 30th, 2013, from http://www.mkm.ee/public/Kodanike_rahulolu_riigi_poolt_pakutavate_avalike_e-teenustega_2012_EMOR.pdf

ESII. (2012). *Customer reception management*. Retrieved on April 30th, 2013, from (http://81.255.198.178/pdf/EN/ESII-WhitePaper_EN.pdf)

Fitzsimmons, J. A., & Fitzsimmons, M. J. (2006). *Service management: operations, strategy, and information technology.* McGraw-Hill/Irwin

Hall, R. W. (1991). *Queueing Methods for Services and Manufacturing.* Englewood Cliffs, NJ: Prentice-Hall.

Houston, M. B., Bettencourt, L. A., & Wenger, S. (1998). The relationship between waiting in a service queue and evaluations of service quality: A field theory perspective. *Psychology and Marketing, 15*(8), p. 735 – 753.

IBM Corporation. (1999). *Remote queues*. Retrieved on April 30th, 2013, from http://publib.boulder.ibm.com/infocenter/wmqv7/v7r0/topic/com.ibm.mq.csqzal.doc/fg10980_.htm

Ibrahim, R., & Whitt, W. (2011). Wait-Time Predictors for Customer Service Systems with Time-Varying Demand and Capacity. *Operations Research, 59*(5), pp. 1106 – 1118.

ITU statistics. (2012). *Global ICT development.* Retrieved on April 30th, 2013, from, http://www.itu.int/ict/statistics

Jeffries, A. 2012. *Why Apple Maps needs Foursquare's 50 million venues*. The Verge, December 18, 2012
http://www.theverge.com/2012/12/18/3781336/foursquare-and-apple-maps-problem-joke-venues

Lewitz, J. (2011). Postal Service Eyes Closing Thousands of Post Offices. *Wall Street Journal, January 24*, 2011.
http://online.wsj.com/article/SB10001424052748704881304576094000352599050.html
(01.05.2013)

Maister, D. (1985). The psychology of waiting lines. In J. Czepiel, M. Solomon, & C. Surprenant (Eds.), *The Service Encounter* (pp. 113–123). Lexington, MA: Lexington Books.

Moore, G. (1999). *Crossing the Chasm: Marketing and Selling High-Tech Products to Mainstream Customers.* New York, NY: HarperBusiness.

NCR. (2010). *Does queue busting make sense for your business?: Considerations for a Successful Queue Management Program.* Retrieved on April 30th, 2013, from http://c3185012.r12.cf0.rackcdn.com/v3-docs/8e0c38f3bb9613e72137192dc9bfe93a/queue_management_wp.pdf

Ries, E. (2011). *The Lean Startup.* New York: Crown Business.

Seawright, K., Sampson S. E., & Wanamaker, B. (2008). *A Cross-Cultural Examination of Consumer Wait Time Perception: Russia and the U.S.A.* Atlanta, GE: Decision Sciences Institute.

Stone, A. (2012). Why waiting in line is torture. *New York Times, August 18*, 2012. Retrieved on May 1st, 2013, from http://www.nytimes.com/2012/08/19/opinion/sunday/why-waiting-in-line-is-torture.html

Sundarapandian, V. (2009). *Probability, Statistics and Queueing Theory*. PHI Learning.

Van Agten, T. (2012). *The Impact of App Translations*. Distimo Publication.

Q-MATIC AB. (2008). *An introduction to Customer Flow Management*.

Q-MATIC. (2012). *Success with Customer flow in six steps*. Retrieved on April 30th, 2013, from http://qmatic.com/en/WhyQmatic/Customer-flow-in-six-steps/

Q-MATIC AB. (2013). *Queuing and Waiting in the NHS*. Retrieved on April 30th, 2013, from http://i.qmaticmail.com/CmpDoc/2012/52517/xidplaceholderx_qmatic_waiting_and_queuing_nhs_white_paper.pdf

Technology adoption lifecycle. (2013, definition). Retrieved on April 30th, 2013, from http://en.wikipedia.org/wiki/Technology_adoption_lifecycle

The surprising psychology of waiting in queues. (2013, article).
Retrieved on May 1st, 2013, from
http://behaviouraldesign.wordpress.com/2013/03/11/the-surprising-psychology-of-waiting-in-queues/

How many claimed venues are on foursquare? Have they ever released the data? 2013, Quora
http://www.quora.com/Foursquare/How-many-claimed-venues-are-on-foursquare-Have-they-ever-released-the-data (1.05.2013)