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Implementing Appointment Scheduling and Virtual Meeting Systems

Metropolia University of Applied Sciences

Master of Engineering

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PREFACE

I started thinking about a topic for my master's thesis in the fall of 2020 as soon as I started my studies. A development project to implement online IT systems was soon selected as a suitable topic. During the fall I collected material for the thesis and at the turn of the year I started writing.

During the spring, the project progressed and so did my writing. At times, I did not have enough time for the work or only managed to write very little for a couple of weeks, but luckily these episodes were not too frequent. Now, after almost eight months of work, the work is finally done!

What did I learn while writing my master's thesis? At least that the actual work takes place in front of the keyboard and you should start writing the thesis as early as possible. It takes a lot of time.

Finally, I would like to thank my instructors for their helpful guidance and tips. I want to extend special thanks to my family members for encouraging me and giving me the opportunity to focus on my studies.

Espoo, Finland, 8.5.2021

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| <p>Appointment scheduling and virtual meeting systems are widely used in the digital communications with the customers in many different business areas. Customers often do not want to go to the bank branch in the middle of the working day but handle banking matters in the evening from their own couch using a laptop and a network connection. The COVID-19 pandemic has further increased the popularity of this remote approach.</p> <p>The purpose of this study was to implement an appointment scheduling and virtual meeting systems for S-Bank. The study describes the current state of these systems in the case company and clarifies the reasons why the old systems needs to be replaced. The theoretical background elucidates digitalization in banking, the impact of the COVID-19 pandemic on online banking in Finland, MIFID2 legislation and the history behind appointment scheduling and virtual meeting systems. The study also defines the project framework used including different phases, timetable and the non-functional requirements for the new systems.</p> <p>The study delineates the different steps that are needed to implement new appointment scheduling and virtual meeting systems with agent and customer flows, access and channel roles, user interfaces, core functionalities and architectures. It also covers pilot version deployment to production with deployment plan and usage in production.</p> <p>As a result of the thesis, working appointment scheduling and virtual meeting systems for the case company were implemented. Both are in production use. Based on the first month of user experience, the systems met the need which motivated their initial implementation. The development of the systems continues, and some subsequent improvements have already been agreed on.</p> | |
| Keywords | Appointment scheduling, Virtual meeting, Digitalization, Non-functional requirements, MIFID2, Deployment to production |

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| <p>Verkkoajanvarauksen ja verkkotapaamisen järjestelmiä käytetään laajasti digitaalisessa asiakasviestinnässä monilla eri liiketoiminta-alueilla. Asiakkaat eivät useinkaan halua mennä kesken työpäivän pankkikonttoriin, vaan hoitavat mieluummin pankkiasiat illalla omalta sohvalta kannettavan tietokoneen ja verkkoyhteyden avulla. COVID-19 pandemia on vahvistanut tämän toimintamallin suosiota entisestään.</p> <p>Opinnäytetyön tarkoitus oli toteuttaa ajanvarauksen ja verkkotapaamisjärjestelmien uusiminen S-Pankille. Se kuvaa järjestelmien nykytilan ja avaa syitä vanhojen järjestelmien vaihtamiselle. Teoreettinen tausta selvittää pankkitoiminnan digitalisaatiota, COVID-19-pandemian vaikutusta verkkopankkitoimintaan Suomessa, MIFID2-lainsäädäntöä sekä ajanvarauksen ja verkkotapaamisen historiaa. Tutkimuksessa määritellään myös käytetty projekti-kehys, mukaan lukien eri toteutusvaiheet, aikataulu ja uusien järjestelmien ei-toiminnalliset vaatimukset.</p> <p>Opinnäytetyössä kuvataan eri vaiheet, joita tarvitaan ajanvaraus- ja verkkotapaamisjärjestelmien toteuttamiseen agentti- ja asiakastyönkuluilla, pääsy- ja kanavarooleilla, käyttöliittymillä, ydintoiminnoilla ja arkkitehtuureilla. Se kattaa myös pilottiversion käyttöönoton tuotantoon, käyttöönottosuunnitelman ja käyttökokemuksia tuotannossa.</p> <p>Opinnäytetyön tuloksena syntyi ajanvarauksen ja verkkotapaamisen järjestelmät, jotka ovat tuotantokäytössä. Ensimmäisen kuukauden käyttökokemusten perusteella järjestelmät täyttivät tarpeen, miksi niitä alun perin lähdettiin rakentamaan. Järjestelmien kehittäminen jatkuu, ja seuraavista parannuksista on jo sovittu.</p> | |
| Avainsanat | Ajanvaraus, verkkotapaaminen, digitalisaatio, ei-toiminnalliset määrittelyt, MIFID2, käyttöönotto tuotantoon |

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List of Abbreviations

| | |
|--------|--|
| AD | Active Directory |
| CRM | Customer Relationship Management |
| DNS | Domain Name System |
| DTLS | Datagram Transport Layer Security |
| ESB | Enterprise Service Bus |
| IETF | The Internet Engineering Task Force |
| FFI | Finance Finland |
| HTTPS | Hypertext Transfer Protocol Secure |
| MIFID2 | The revised Markets in Financial Instruments Directive and associated regulation |
| MFA | Multi-Factor Authentication |
| MVP | Minimum Viable Product |
| O365 | Microsoft Office 365 |
| SAFe | Scaled Agile Framework |
| SCA | Strong Customer Authentication |
| SMS | Short Message Service |
| SRTP | Secure Real-time Transport Protocol |
| SSO | Single Sign-On |
| TLS | Transport Layer Security |
| WebRTC | Web Real-Time Communication |

1 Introduction

The purpose of this study is to investigate the successful implementation of appointment scheduling and virtual meeting systems for S-Bank. A well-designed and prepared change reduces barriers and resistance to change and improves the quality of the final implementation. The timing of this study is also significant for the bank, as the need for companies to meet customers virtually online has increased significantly due to the Covid-19 situation. Serving and interacting with customers in the traditional way is not possible due to the pandemic. This requires a major reform in the systems, but also guidance and user training for employees.

1.1 Case Company

S-Bank Plc is a Finnish deposit bank established in 2007 based on strong co-operative values, which means that social responsibility is inherently at the core of its operations.

S-Bank is owned by

- SOK Corporation (37,5 %)
- Cooperatives belonging to S Group (37,5 %)
- LocalTapiola (23,5 %)
- Elo Mutual Pension Insurance (1,5 %). [1]

S-Bank offers products and services to household customers and some targeted services to companies. The services are daily banking, saving and investment, and financing of purchases. Under the FIM brand, S-Bank offers private banking services and services to institutional investors.

S-Bank serves its customers at customer service points located in the S Group's business locations and through its telephone service, its online bank, the S-mobiili app and various social media channels.

The bank's earnings model is mainly based on customer deposits, lending, and investment activities. Operating expenses consist of personnel expenses, IT expenses and other administrative expenditures. If the customer's insolvency risks increase, the bank will have to record credit loss funds and, in the event of insolvency, credit losses. [2, p.25]

KEY FIGURES

- 3.1 million customers
- 2.4 million international payment cards
- 2.1 million online banking IDs
- EUR 6.9 billion in deposits
- EUR 5.4 billion in granted loans
- EUR 10.8 billion in assets under management
- 15.7 % capital adequacy ratio
- EUR 21.0 million operating profit [2 p.10-11]

1.2 Business Challenge and Objectives

The challenge behind this thesis are the defects of the current appointment scheduling system. It is not reliable; some appointments are occasionally lost or overlap with already booked ones. This causes a large amount of extra work and complications for the bank employees. The other challenge is within the virtual meeting system – it lacks a trustworthy storage solution. This is a mandatory requirement for all banks in the EU due to data storage legislation in the European Union (MIFID2).

These systems are vital for the S-Bank because of the growing need for online interaction with customers as well as the Covid-19 situation. Customers are unwilling or unable to come physically to the branch to discuss banking matters. Of course, banking on the phone is possible, but it is not conducive for more extensive interaction. At the same time, S-Bank is aiming to increase the number of customers using the appointment scheduling system.

The objective of this study is therefore to implement new appointment scheduling and virtual meeting systems for S-Bank.

This study aims to achieve the following research goals:

- evaluate the current state of the appointment scheduling and virtual meeting system in S-Bank,
- examine the background of virtual meetings in banking,
- define non-functional requirements for the project,

- implement new systems for appointment scheduling and virtual meeting.

1.3 Structure

This thesis has been divided into 7 sections.

- The first section introduces the case company, the business challenge and the objectives of the study.
- Section 2, Current State Analysis, explains the implementation of appointment scheduling and virtual meeting systems status in the case context.
- The third section contains the theoretical background of the research. It contains information concerning digitalization in banking, the impact of the COVID-19 pandemic on online banking in Finland and MIFID2 regulation. The section also describes appointment scheduling with appropriate software and a short history of virtual meetings.
- Section 4 outlines the planning of the project. Scope for the work, project framework, project model and timeline, non-functional requirements, appointment scheduling system and virtual meeting system are covered.
- Section 5 consists of the implementation of the appointment scheduling and virtual meeting systems. The focus is on the main functionalities of appointment scheduling, such as access and channel roles, customer and employee interfaces, work calendar synchronization, automated confirmation and reminder messages, security, reporting and architecture. Section also outlines the virtual meeting systems core functionalities such as meeting flow, meeting lobby, virtual meeting controls, recording module and architecture.
- Section 6 focuses on pilot version usage in production. It consists of deployment plan with verifications made. Section also outlines release and production usage of the pilot version.
- Section 7 discusses and concludes the research by evaluating the initial implementation plan and highlighting the practical implications of the study that can assist in ensuring efficient implementation of the appointment scheduling and virtual meeting systems.

2 Current State Analysis

This section first introduces the present state of appointment scheduling system in S-Bank and focuses then into the current virtual meeting system. The last part of this section summarizes the outcome of the analysis of the current state of systems in the case company.

2.1 Appointment Scheduling System

S-Bank has used an appointment scheduling system for several years to manage appointments for customers. The system has been used in Daily Banking and the Financing of Purchases units. Saving and Investment unit has used a different system to schedule appointments for customers.

The technology behind the appointment scheduling system has gotten old. Exchange 2010-integrations and Exchange Web Service -interface are almost a decade old. Modern cloud-based solutions are not suitable for smooth use with these ones. S-Bank uses an Enterprise Service Bus (ESB) to communicate between software applications, e.g. frontend and backend systems are isolated in the architecture of web-based services. Current appointment scheduling system has straight integration between frontend and backend without ESB which is not a preferred solution as summarized in Figure 1.

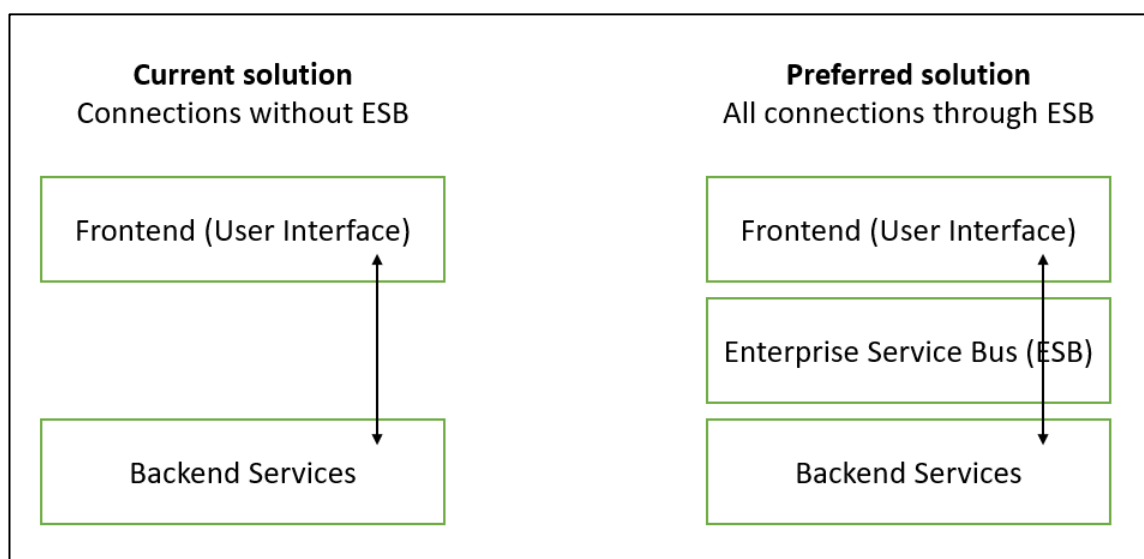


Figure 1. Connections between frontend and backend should be established through Enterprise Service Bus.

One challenging problem has been with synchronizations between the appointment scheduling system and Outlook calendars. Some appointments have occasionally been lost or overlap with already booked ones. This problem has caused a huge amount of extra work and problems for the bank employees. The supplier has tried to solve the problem without success.

2.2 Virtual Meeting System

S-Bank has tested a virtual meeting system, tried it in pilot use, but it has never been in a proper production use. The system contains a great deal of challenges. The biggest one seems to be a recording functionality that does not meet the requirements. The recording should always be created, the recording should stay immutable and the audit trail should remain the log data of the people who has been watching the recordings. All these requirements have not been met with the current virtual meeting system. The supplier also faces major challenges in meeting S-Bank's updated information security requirements to the required level. Information security is an extremely important part of the bank's technical package and the security of the systems is regularly reviewed and assessed.

The challenges with the recordings of the virtual meeting system were tried to remediate without success. The most challenging problem seems to have been the issue of liability - who would be responsible for delivering the files to the desired location for archiving. Access rights to view recordings from the archive must also be manageable and adjustable at different levels for smooth operation of the system. The required functionalities appear to have been too difficult for the supplier to be solved.

2.3 Summary

Current appointment scheduling and virtual meeting systems do not fulfill all the required functionalities S-Bank has. Several negotiations have taken place with suppliers, but the work required to rectify the problems seems very large. At the same time S-Bank needs well-functioning appointment and virtual meeting systems to meet the competitive situation and customer expectations in a constantly evolving operating environment. Without these systems, it is difficult to offer a meeting with customers regardless of location.

As a result of these issues, S-Bank has ended up moving forward with the acquisition of new systems.

3 Theoretical Background

This section first introduces digitalization in banking, then focuses on the impact of the COVID-19 pandemic on online banking in Finland. The third part concerns legislation of data storage in European Union (MIFID2). Last two parts contain information about scheduling an appointment with a software and a short history of virtual meetings.

3.1 Digitalization in Banking

Traditional banking has been digitized on various Internet channels in recent decades. All banks in the EU region have their online banks on the Internet accessible via browser or mobile. People are used to having their banking services via digital platforms. The growth of users in online banking has been exponential and banks have been developing the services to fulfill the growing needs. At the same time, a great number of bank branches are reduced due to increase in online banking usage.

Elisa Di Febo and Eliana Angelini have studied the digitalization in European banks in their publication *Digitalization and Business Model: The Case of European Banks*. One conclusion they have found in their study is that *“the most probable way that internet banking can influence community banking is by influencing the nature of the relationship between banks and their customers.”* [3, p.7].

In the Nordics the transformation to use online banks has been even bigger than in most countries in Europe. As shown in Figure 2, the percentage of persons who use online banking was about 90% in 2016.

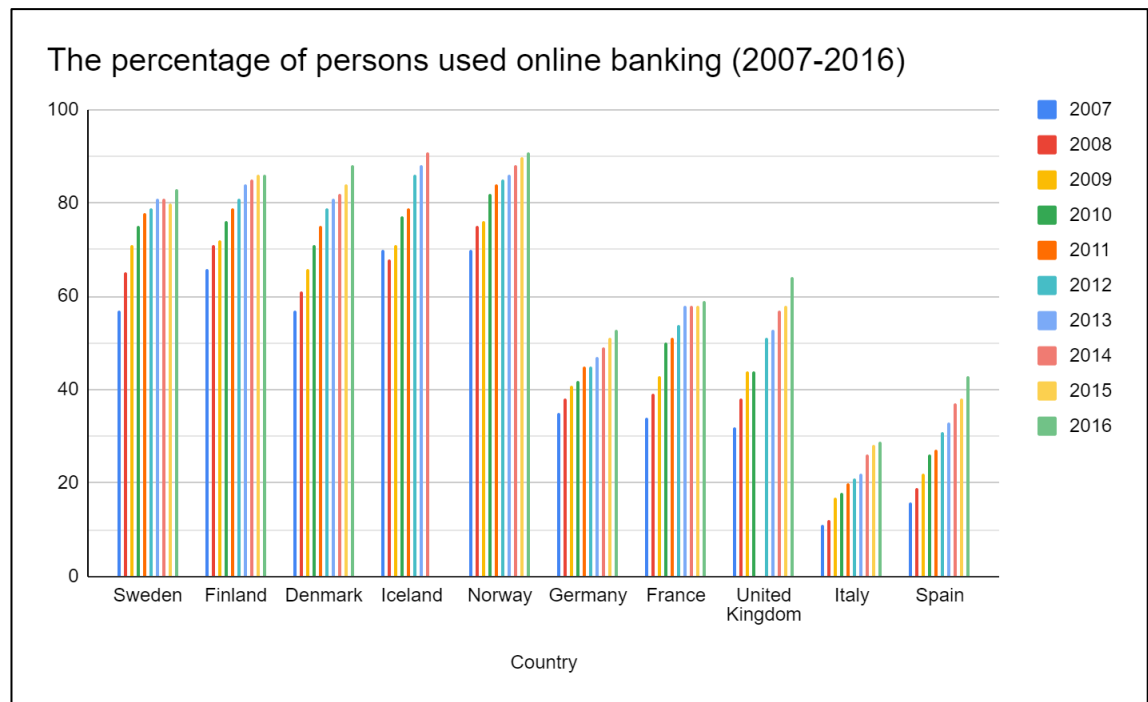


Figure 2. The percentage of persons who use online banking in EU 2007-2016. [3, p.13]

At the same time in Germany, France and United Kingdom 50-60 % of persons were using online banking. In Italy and Spain percentages were only 30-40%.

3.2 Impact of the COVID-19 Pandemic on Online Banking in Finland

Finance Finland (FFI) has published a report that shows COVID-19 pandemic has increased the usage of digital banking channels in Finland. At the same time, most banks serve customers at bank offices only by appointment.

In September 2020 private customers' mobile bank logins have increased more than 35% compared to September 2019 in OP Financial Group. Private customer's online appointments have risen over 30% in Danske Bank and by 70% in Nordea compared to February 2020.

FFI reports on Nordea's survey, which shows customers' attitudes towards digital banking have become increasingly popular. In the report, 62% of customers could manage all their banking with digital banking channels. In 2019, 54% thought the same way. Virtual meetings are soon the new normal - about 40% of customers thought they could

manage appointments with virtual meetings. In 2019, only 28% thought it was possible. [4]

3.3 Legislation of Data Storage in European Union (MIFID2)

The revised Markets in Financial Instruments Directive and associated regulation (MIFID2) entered into force on 3 January 2018. The purpose of this legislation according to KB Associates [5] is to *“harmonize regulation across EU financial markets, increased competition between EU financial markets, ensuring appropriate levels of investor protection, and strengthening of supervisory powers”*.

Here are the main areas of MIFID2 regarding KB Associates:

- Market Infrastructure/Transparency
 - Changes to market infrastructure, a new concept of an Organised Trading Facility (“OTF”) and new requirements for high frequency and algorithmic trading.
- Product Governance
 - Manufacturers must identify the target market and take steps for the product's distribution. They must also ensure that distributors have adequate knowledge of the manufacturers' products and their approval processes.
- Transaction Reporting
 - Extended range of products to be reported.
 - Increased number of data fields required for MiFID transaction reporting.
- Rules on Inducements and Unbundling of Research
 - Investment companies should review how their assets are distributed.
 - Companies should unbundle the research purchases from execution services.
- Investor Protection/Best Execution
 - Investment companies are required to take "all reasonable steps" to provide the best possible results for their clients.
 - Investment companies must publish information related to the quality of execution (e.g. costs, speed) at least annually free of charge. [5]

One demand of MIFID2 to EU-based financial companies is record-keeping. Best practices should be used when archiving records to ensure they remain unchanged and their location is always known. Depending on the content type, records are demanded to store safely with certain retention time. E.g. Telephone & electronic communications content requires to be archived for 5 to 7 years due MIFID2. [6, p.3, p.5]

3.4 Scheduling Appointment with Software

What is an appointment scheduling software? By Adam Goldberg it could be a tool that allows businesses in different fields to handle the schedules for all appointments and reservations. This kind of system has a great number of synonyms and quite similar features can be found under products with phrases online booking, time reservation, meeting organizer, appointment planner or consultation arranger.

Here are some benefits an appointment scheduling software provides:

- Helps to attract and retain customers: Scheduling an appointment is always much easier and faster than calling to a customer service. Web-based applications are reachable anywhere and do not follow the normal business hours. Surveys show that a large proportion of customers prefer to book appointments online than in other ways.
- Increases productivity: The software simplifies keeping schedules up to date and helps employees focus on the essentials by serving more customers daily. When using an automated flow, this also reduces the number of customer calls
- Boosts employee's efficiency: Customer service representatives are typically busy with several daily customer meetings. Appointment scheduling software boosts their daily work by reducing duplicate bookings. The software helps scheduling work for employees. Most appointment scheduling is handled by the customers themselves - the employees have more time for other important things.
- Minimizes no-shows: The software facilitates scheduling and reminds the customer of an upcoming appointment via SMS or email messages ensuring the customer comes to the scheduled appointment. This helps to minimize no-shows and allows companies to better utilize their employee time. [7]

3.5 Short History of Virtual Meetings

Virtual meetings have several synonyms, such as video conferencing, web conferencing, online meeting, engaging online event, interactive online conference, live online conference. In the publishing of EzTalks frequently used term seems to be video conferencing.

Here is a short history of virtual meetings or video conferencing:

- 1964 AT&T introduced the first video call Picturephone at the World's Fair, New York.
 - AT&T started their research in 1956 and the prototype of Picturephone could transmit images over analog telephone lines.
 - In World's Fair, New York 1964 AT&T introduced Picturephone. A caller could see his/her picture and hear the voice.
- 1970 Debut of Picturephone by AT&T
 - Picturephone service was too expensive for most people and the system also had some problems with quality.
- 1982 Compressions Labs released the first video conferencing system.
 - System was huge and expensive, but it was the only available system until 1986 when a company called PictureTel came to market.
- 1991 PictureTel partnered with IBM.
 - PictureTel provided the first PC-based video conferencing system with a reasonable price.
- 1992 Macintosh released the first video conference software CU SeeMe v0.1 for PC.
 - Software didn't include audio, but 1994 audio transmission was included.
 - The software was limited to Mac users until a version was released in 1995 that also worked on Windows computers.
- 2000 video conferencing free of charge in the Internet
 - Skype and iChat were introduced in the beginning of 2000.
 - Samsung's first MPEG-4 streaming 3G (CDMA2000) video cell phone
 - 2005 Lifesize published the first HD video conferencing system.
- 2010 Video conferencing is put to the Cloud, possible to use mobile devices.
 - In 2020 there are tens of video conferencing software's from the Cloud.

- Here are some examples: Microsoft Teams, Google Meet, Zoom Meetings, Cisco Webex, Vonage, Pexip, ClickMeeting, U Meeting, GoToMeeting, RingCentral VideoBigBlueButton, Bluejeans Meetings, Lifesize, EzTalks Meetings, StarLeaf. [8]

4 Planning

This section first introduces the beginning of the work. This is followed by a presentation of the project framework and model, timetable, and non-functional requirements. Finally, the definition phase describes the procedures by which the project was initiated. The section will cover the planning phase in the appointment scheduling and virtual meeting systems.

4.1 Beginning of Work

The work started in May 2020 with a preliminary study about possible vendors to implement an appointment scheduling and virtual meeting system for S-Bank's needs. Both systems were put out to tender at the same time to obtain synergies from a technical and economic point of view. At the same time, a simpler support process with the software vendor would be possible, as the systems will be used together. The project group of S-Bank made the following delimitations based on which ICT vendors were asked to participate in the tender:

- The company has already been found to be a reliable vendor for S-Bank.
- The company is the right size for S-Bank.
- The company can meet S-Bank's security requirements.

In the first round of tenders, one to two companies were selected to continue. More detailed definitions were made based on S-Bank's needs, considering issues such as cost estimate, implementation schedule, technical requirements & reliability, integrations, and suitability for business, end user and the architecture used in S-Bank.

After reviews and internal investigations, the ICT vendor was selected. The decision placed special emphasis on the most finished products possible, as well as its domestic references. Prior to signing the contract, the terms were carefully reviewed in conjunction with the lawyers. Many changes and clarifications were made so that the rights, responsibilities, limitations, and obligations of both parties were properly recognized and considered. The final contract included a total of 16 different documents and a total of more than a hundred pages of text. The project started in early October 2020.

4.2 Project Framework, Model, and Timetable

Project was planned to be executed with agile methodologies, within four increments. Every increment consists of four two-week sprints. The project was divided into successive phases, for each of which the acceptance criteria for the phase were defined. Phases of the project were Definition, Implementation, Testing and Releasing.

In the definition phase the aim was to understand the needs of user interface, integrations, and technical details. The implementation phase consisted of the work need to build systems. In the testing and releasing phase the focus was on finding possible defects and finally launch the systems to S-Bank's customers.

Project model

Project model covers risk management, change management and exception management processes. The risk mapping considers typical risk-causing areas such as project management, technology, third parties as well as other possible areas that affect the implementation or outcome of the project. The aim of risk analysis is to assess the probability of each risk and its possible consequences, as well as the impact of its realization. The resulting list of risks is attached to the actual project plan.

Risks are identified, assessed and monitored during the project. Risks are discussed at each steering group meeting, where, if necessary, it is agreed e.g. risk mitigation and / or mitigation measures. The steering group monitors the impact of the measures.

Changes, exceptions and development proposals are reported in the steering group meetings. Project managers can agree on changes that do not affect the project schedule or total workload. Requests for changes to tasks must include the estimated impact on the project schedule, resources, and costs. The implementation of the changes requires a joint decision of the parties. The steering group approves the changes.

Timetable

The timetable for the project was mentioned to be very fast - only a few months from start to production. The first version of the timetable was trying to obtain an implemented system to the production right after January 2021. Quite soon it was realized this schedule is too strict. Finally, it was agreed the timetable should be more than a half-year period. At the top level, the schedule contains 3 increments, the first of which includes

basic functionalities for both appointment scheduling and virtual meeting systems, the second changes for the credit and institutional customers and the third basic banking services as Figure 3 illustrates.

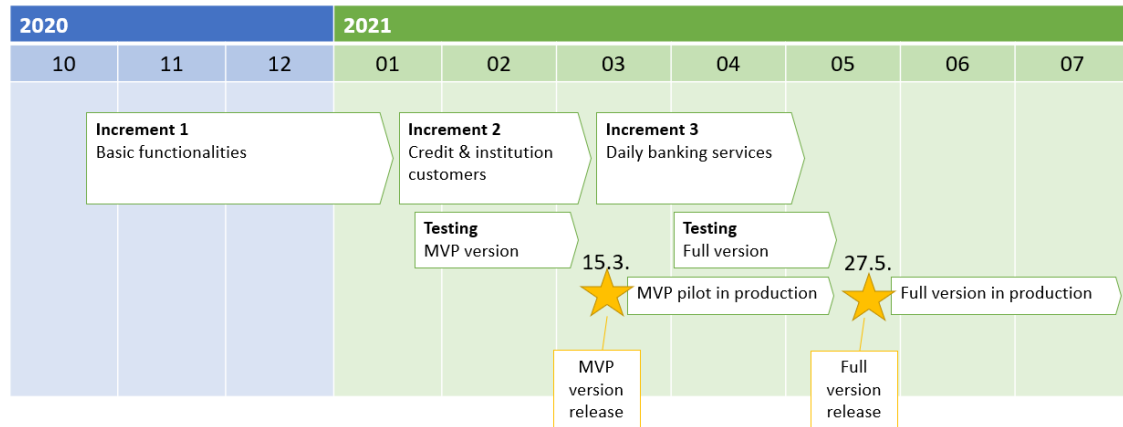


Figure 3. Timetable in the high level of the implementation project and releases.

Testing of the systems will be performed before releases. The supplier performs its own system tests in test environment and S-Bank acceptance tests. After successful acceptance testing, the systems can be released to production environment.

The MVP (Minimum Viable Product) version will be released in mid-March and the full version in the end of May 2021. MVP version includes mainly the results of Increment 1 – basic functionalities for appointment scheduling and virtual meeting systems.

Employees in Savings and Investment, Private Banking and Customer Service are involved in the pilot use of MVP in production, a total of about 30 people. The aim is to gather experience and feedback on the pilot from customers before the full version is released in the end of May. During the pilot, the old appointment scheduling system will still be used by other channels and employees in S-Bank. The old system will be abandoned on May 27 at the same time as the full release takes place. It is not intended to transfer data from the old appointment scheduling system in to the new one in the full version release. Booked appointments are completed through the old system and when there will not come any new bookings after 27.5., the old system can be run down smoothly.

4.3 Non-functional Requirements

In this project ISO/IEC 25010 model was used for the non-functional requirements to ensure a high-quality system. This model was created by International Organization for Standardization (ISO). ISO/IEC 25010 model is used for the purpose of the product quality within the eight quality characteristics - Functional Suitability, Performance Efficiency, Compatibility, Usability, Reliability, Security, Maintainability and Portability. Each of them has been divided into sub-characteristics as shown in Figure 4.

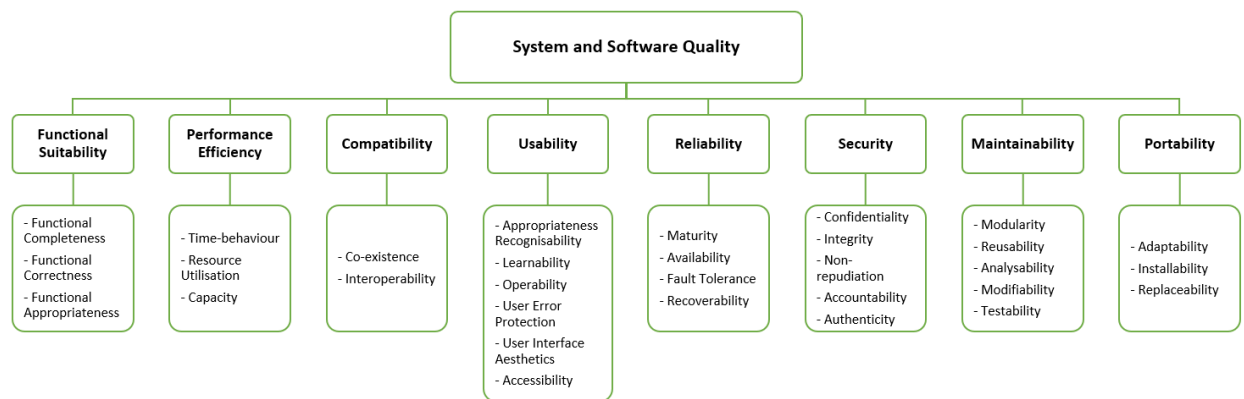


Figure 4. ISO/IEC 25010 model ensures software product quality. [9]

Non-functional requirements for the appointment scheduler system were grouped according to the ISO/IEC 25010 model as shown in Table 1. Values for the requirements were based on current usage levels and an estimate of future developments. Model's sub-characteristics were not applicable in all aspects but at the upper level it provides a general model to quality assurance.

Table 1. Non-functional requirements for the appointment scheduling system.

| ISO/IEC 25010 Quality characteristic | Non-functional requirements for the appointment scheduling system |
|--------------------------------------|--|
| Functional Suitability | <ul style="list-style-type: none"> • O365 integration to 150-200 calendars. • User access should be handled by AD integration and MFA with O365 is needed. |
| Performance Efficiency | <ul style="list-style-type: none"> • The system shall not slow down other systems in the shared environment. • Response time is maximum 2 seconds for up to 100 users. |

| | |
|-----------------|--|
| Compatibility | <ul style="list-style-type: none"> • Able to handle 300 simultaneous users and 10 000 daily events. |
| Usability | <ul style="list-style-type: none"> • Available 24/7/365. • The system is easily restored from back-ups. |
| Reliability | <ul style="list-style-type: none"> • Able to disallow end users to insert erroneous input, excluding external system input. • Must be possible to prove both events and activities so that their operation cannot be disputed afterwards. The resource or object must be able to prove it as claimed. • The system and all contained data is backed up regularly. |
| Security | <ul style="list-style-type: none"> • The modified solution functionality shall be available for confirmation via testing. • Test automation shall be taken in consideration in building the system. • Access to confidential information must be restricted from outsiders. Solution supports role-based access control. |
| Maintainability | <ul style="list-style-type: none"> • The system keeps log of logins, data changes, and browsing of ID detail. • System should be easy to modify and further develop. |
| Portability | <ul style="list-style-type: none"> • The solution can be moved to another environment. |

Non-functional requirements for the virtual meeting system in high-level were also grouped according to the ISO/IEC 25010 model as summarized in Table 2. Values for the requirements were based on current usage levels of appointments by phone and an estimate of future usage of virtual meetings.

Table 2. Non-functional requirements for the virtual meeting system.

| ISO/IEC 25010 Quality characteristic | Non-functional requirements for the virtual meeting system |
|--------------------------------------|---|
| Functional Suitability | <ul style="list-style-type: none"> • Able to disallow end users to insert erroneous input, excluding external system input. |
| Performance Efficiency | <ul style="list-style-type: none"> • Response time max 2 seconds for up to 60 simultaneous users. • The system shall not slow down other systems in the shared environment. |
| Compatibility | <ul style="list-style-type: none"> • Able to handle 100 simultaneous meetings. |
| Usability | <ul style="list-style-type: none"> • Available 8-20 EET every day. |

| | |
|-----------------|---|
| Reliability | <ul style="list-style-type: none"> • Must be possible to prove both events and activities so that their operation cannot be disputed afterwards. The resource or object must be able to prove it as claimed. • Ensures all recordings stay intact and unmodified. Virtual meeting recordings shall not be editable by any user. |
| Security | <ul style="list-style-type: none"> • The modified solution functionality shall be available for confirmation via testing. • Test automation shall be taken in consideration in building the system. • Access to confidential information must be restricted from outsiders. Solution supports role-based access control. |
| Maintainability | <ul style="list-style-type: none"> • The system keeps log of logins, data changes, and browsing of ID detail. • System should be easy to modify and further develop. |
| Portability | <ul style="list-style-type: none"> • The solution can be moved to another environment. |

In the Planning phase of the project, the non-functional requirements were reviewed in more detail point by point and formed a more detailed listing for the implementation phase.

4.4 Definition Phase

The definition phase started in October 2020. The phase included in Increment 1. It was estimated that 4 meetings were needed, and a deadline of 3 hours had been set for each meeting. S-Bank's business representatives, project manager and IT representative participated in the meetings. Correspondingly, the project manager, architects and application experts were involved on the vendor's side. The aim was to get the specifications for appointment scheduling system, virtual meeting system and other open issues. The meetings were held remotely due to the situation at Covid-19, which naturally posed challenges in going through requirements and other issues.

After the first definition meetings, it became clear the planned number of meetings will not be enough. There were so many issues to go through the more meetings were held to ensure all the most important issues were considered before the actual start of the implementation work. One of the factors in this error assessment was the already productized appointment scheduling and virtual meeting systems used in production by other companies. The number of necessary changes could not be estimated in advance with sufficient accuracy.

The definition phase also revealed several technical solutions that had to be made for the whole system due to information security and enterprise architecture. These were also not considered with sufficient accuracy in the tender phase.

5 Implementation

This section first introduces the appointment scheduling system with different features, user interfaces and architecture concluded in it. The second part of this section focus on virtual meeting system, it's features and architecture.

5.1 Appointment Scheduling System

Appointment scheduling system is a solution for managing and booking appointments. Appointments can be booked in different topic areas and meetings can be organized through different channels. The channels include office, phone or virtual meetings.

The appointment scheduling flow for customers is extremely simple and consists of four steps as illustrated in Figure 5. In the first step the suitable appointment channel, agent, language, and appointment time are selected by the customer. In the second step the details of the selected appointment are displayed, and the customer enters their contact information. Customer confirms the reservation in the third step. On the confirmation page, details of the booked appointment will be displayed. Finally, the confirmation will be sent to the customer via email or SMS.



Figure 5. The appointment scheduling flow for customers.

A reservation can be made by the customer on a self-service basis or by a S-Bank's agent. For the S-Bank's agent the flow consists of five steps as shown in Figure 6. In the First step the agent logs in to the appointment scheduling system with Single Sign-On (SSO). In the second step the agent selects topic, time, and contact channel for the appointment. After that, the agent fills the needed customer contact information. After confirming the customer information, the customer receives the booking confirmation and the agent gets the calendar entry into O365.

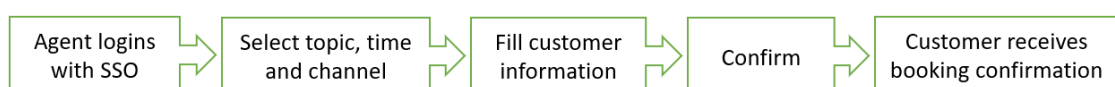


Figure 6. The appointment scheduling flow for the S-Bank's agents.

Appointment scheduling system functionalities are divided into the following main use cases.

- Appointment made by a customer without being identified.
- Appointment scheduled on behalf of a customer by an agent.
- Agent to manage available meeting slots and cancel scheduled appointments.
- Administrator to manage the system through the admin interface.

Access and Channel Roles

Appointment scheduling system roles are based on Active Directory groups. Access control is simple and straightforward in this way, giving flexibility to grant appropriate user privileges to service and match the organization hierarchy to right resources for right people. This way users will see the most relevant information for them. Different roles are listed and described in Table 3.

Table 3. Access and channel roles used in the appointment scheduling system for S-Bank employees.

| Access Role | Description |
|-----------------------|--|
| Administrator | Company Administrator. Visibility is not limited. |
| Company Administrator | Channel-specific administrator. In addition to the access role, needs a channel-specific role to see only the issues related to the channel management interface (Admin UI). |
| Supervisor | Supervisor role, which also has a channel-specific role. The appointment management system interface defines the subordinates of the supervisor. Access to Agent UI only. |
| Agent | An expert role that all basic appointment users have, e.g. S-Bankers, Investment Experts, Cooperative Workers and Customer Service. |

| Channel Role | Description |
|-----------------------|---|
| Banker | A role for S-Bankers Channel |
| Private Banking | A role for Private Banking Channel |
| Investment Specialist | A role for Investment Specialists Channel |
| Institutional | A role for Institutional Channel |

| | |
|-------------------|---------------------------------------|
| Customer Service | A role for Customer Service personnel |
| Cooperative Agent | A role for Cooperative Agents Channel |

Access roles are used together with channel roles. The employee needs both roles to use the system. The access role limits the scope and strength of the rights, while the channel role allocates the rights to the correct area, the channel, of the system.

S-Bank uses a process of granting access rights, in which the user can apply for the desired right to a specific system. Approval for the requested right comes from the supervisor or system administrator. Appointment scheduling system rights management will be integrated into this process.

5.1.1 Customer and Employee Interfaces

Appointment scheduling system consists of three different UI frameworks to support different roles to use. All the UI's are responsive and usable via computer or mobile device. Customers, agents and administrators have different views of the system and all are role based.

S-Bank employees use the system with a web UI to book and manage customer appointments. Administrators can manage and configure variables that are needed for pooling resources, adding new topics and building company hierarchies.

Customer UI

The Customer UI for booking appointments consist of the best practice booking flow that can be configured by administrators. Users can search suitable meeting times by desired criteria in MVP version as shown in Figure 7: channel, agent, language, and date. In the full release version, the customer UI will be implemented to www.s-pankki.fi sites and there will be also added many other search criteria.

Säästämisen ja sijoittamisen ajanvaraus

Tapaamismuoto
KaikkiAsiantuntija
Testaaja TaavettiKieli
KaikkiPäivä
10.3.2021

Hae vapaat ajat

Tyhjennä

| Päivä | Aika | Tapaamismuoto | Asiantuntija | Toimipaikka | Kieli | Valinta |
|-----------|-------------------|---------------|---|-------------|-------|---------|
| 10.3.2021 | 8.00 — 8.45 | Puhelin_fi |  Taavetti Testaaja Test Agent | S-Pankki | Suomi | Varaa |
| 10.3.2021 | 8.00 — 8.30 | Puhelin_fi |  Taavetti Testaaja Test Agent | S-Pankki | Suomi | Varaa |
| 10.3.2021 | 8.15 — 9.00 | Puhelin_fi |  Taavetti Testaaja Test Agent | S-Pankki | Suomi | Varaa |
| 10.3.2021 | 8.15 — 8.45 | Puhelin_fi |  Taavetti Testaaja Test Agent | S-Pankki | Suomi | Varaa |
| 10.3.2021 | 8.30 — 9.15 | Puhelin_fi |  Taavetti Testaaja Test Agent | S-Pankki | Suomi | Varaa |

Figure 7. Customer UI in MVP version.

The details of the selected appointment are displayed, contact information needs to be added and reservations to be confirmed as Figure 8 illustrates. The confirmation page includes the details of the booked appointment.

S-Pankki

Säästämisen ja sijoittamisen ajanvaraus

Syötä yhteystiedot vahvistaaksesi varauksesi

The screenshot shows a customer interface for filling contact details. On the left, there is a circular profile picture placeholder. Below it, the event details are listed: "KESKIVIIKKONA 10. MAALISKUUTA 2021", "8.00 — 8.45 Säästäminen ja sijoittaminen", and "PUHELIN_FI". The agent information is "Taavetti Testaaja", "Test Agent", and "S-Pankki Mikonkatu 9, 6. krs 00100 Helsinki". A phone icon and number "+358 100 000000" are also present. On the right, there are several form fields: "Etunimi *" with the value "Testi" (5 / 45 characters), "Sukunimi *" with the value "Testinen" (8 / 45 characters), "Henkilötunnus *" with the value "010101-0101", "Maatunnus" with a dropdown set to "Suomi" and "Puhelinnumero" with the value "+358" and "010000000", and "Sähköposti *" with the value "testi.testi@s-pankki.fi" (23 / 150 characters). At the bottom right, there are two buttons: "Keskeytä" (Cancel) and "Vahvista" (Confirm).

Figure 8. Customer UI for filling the contact details in MVP version.

Booking confirmation will be sent to the customer via email and/or SMS. Also, the reminders and follow up messages will be automatically sent to the customer.

The customer's reservation can be limited to a specific time window: how many days in the future the meeting can be booked and what's the earliest time that the system offers for the customer. Bookable at earliest setting prevents unexpected appointments and allows enough time to prepare for the appointment. These parameters for pre and post meeting buffers can be adjusted per meeting subject and channel in the Admin UI.

Agent UI



The Agent UI consists of the basic scheduling functionalities to book and manage appointments with customers. Agent UI is intended to be used with desktop browsers. Login uses SSO to obtain the information from Active Directory, so the agent does not have to enter their username and password separately to make reservations. The user can schedule meetings for the customers in the same way as in the Customer UI. The agents can see the reservations made to them and have the possibility to cancel or edit existing

reservations as shown in Figure 9. When the agent is also a supervisor, he or she can manage agent groups and their bookings based on access rights.

Asiantuntijan tiedot *
Testaaja Taavetti

Aikaväli
22.2.2021 – 24.2.2021

Hae tapaamiset

| Päivä | Aika | Aihe | Tapaamismuoto | Asiakas | Toimipaikka | |
|------------|------------------|------------------------------|------------------|-----------------|---|---|
| 22.02.2021 | 15.45 — 16.30 | Säästäminen ja sijoittaminen | Verkkotapaaminen | testi 010101 | S-Pankki Mikonkatu 9, 6. krs Helsinki |  |
| 22.02.2021 | 12.15 — 12.45 | Jatkoneuvottelu | Puhelin_fi | testi 010101 | S-Pankki Mikonkatu 9, 6. krs Helsinki |  |

Näkyvillä per sivu: 20 1 - 2 / 2 < >

Figure 9. Agents can search the reservations and cancel them.

While scheduling a meeting, agents' availability is always automatically confirmed from his or her O365 (Microsoft Office 365) calendar and all the booked meetings will be visible in the calendar. The agent can change the availability hours the customers can book as illustrated in Figure 10. These are weekly recurring periods of time.

Asiantuntija *
Testaaja Taavetti

Paiva *
22. helmikuuta 2021

Hae ajat Hae edelliset ajat Kopioi Liitä Tyhjennä

| ma 22.02 | ti 23.02 | ke 24.02 | to 25.02 | pe 26.02 | la 27.02 | su 28.02 |
|--|--|---|---|---|----------|----------|
| S-Pankki 8.00 — 16.00 Kaikki tapaamismuodot | S-Pankki 8.00 — 16.00 Kaikki tapaamismuodot | S-Pankki 8.00 — 16.00 Kaikki tapaamismuodot | S-Pankki 8.00 — 16.00 Kaikki tapaamismuodot | S-Pankki 8.00 — 16.00 Kaikki tapaamismuodot | | |
| S-Pankki 16.00 — 20.00 Kaikki tapaamismuodot | S-Pankki 16.00 — 19.00 Kaikki tapaamismuodot | | | | | |

Tallenna

Figure 10. Agents can maintain the availability hours through the UI.

It is possible to add several availability periods for a day, and if there are reservations in the calendar, those periods will be banned to the customers.

Admin UI

Admin UI is a tool for administrators to manage and configure variables that are needed for pooling resources to competences. This UI manages all activities in companies and can be set to match company hierarchy so that each organization and company can have their own administrators. One example of Admin UI controls is language. Administrators can add, modify or delete languages used in all UI's as shown in Figure 11. Admin UI is intended to be used with desktop browsers.

S-Pankki Perttu Soini Europe/Helsinki

Kieli

Kanava
Sijoitusasiantuntijat

Kanava

Kieli

Aihe

Tapaamismuoto

Alue

Tunniste

Toimipaikka

Asiantuntija

Tapaaminen

Palveluajat

Raportit

Suodatin Hae kielet Lisää kieli

Kirjoita suodattaaksesi näkymää

| Nimi | Koodi | Käännökset | | |
|---------|-------|-----------------------------|--|--|
| Suomi | fi | fi - Suomi sv - Finska | | |
| Ruotsi | sv | fi - Ruotsi sv - Svenska | | |
| English | EN | en - English | | |

Näkyvillä per sivu: 20 1 - 3 / 3 < >

Figure 11. Administrators can manage e.g. languages in the system with Admin UI.

The access rights are defined as roles based for the user groups. The required user groups are created in Active Directory and the desired users are added to these groups.

The Admin features are divided into the two main modules for managing the company structure and the agent roles.

- Administrating company information includes adding and modifying the corporate structure, location/addresses, regions, meeting channels, topics and duration including the pre and post meeting preparation time.
- Administrating agent roles includes the basic information of the agent including competences (topics that agent knows), service times and offices/channels for the appointments. In case of agent's sick leave, the service times can be disabled by Admin user or by Supervisor so that new bookings cannot be made for that agent.

5.1.2 Core Functionalities

Appointment scheduling system's many flows and features are described in this section.

Work Calendar synchronization

The status and activity of O365 calendars are synchronized between the appointment scheduling system at the point when new meetings are to be reserved. This ensures that double booking will never occur. MS Graph implementation has been used to connect customer calendar systems with predefined prerequisites.

Automated Confirmation and Reminder messages

Automated confirmation and reminder messages effectively reduce no show and customers arrive to appointments saving time and money. Customers can easily cancel the scheduled meeting and pick new more convenient time for them.

Confirmation message templates can be modified with HTML. The language of the used template is selected based on the language of the user interface so that confirmation and reminder messages are delivered in the language used by the customer. The templates are filled with the meeting details including the following:

- Appointment date and time, topic, name of the agent to whom the appointment is reserved and the message the client has written at the time of booking
- Meeting channel, including the office contact information
- A link to cancel the reservation

The customer can cancel the appointment as a self-service using the link provided in the booking confirmation.

Security

Appointment scheduling system meets high security standards. Security starts with sound processes and the system is designed in the way that controls how confidentiality, integrity and availability of information is handled. The sensitive information that is transmitted through the service is protected in many ways:

- User authentication/login
- Segregated management

- Signaling encryption
- Database encryption
- Encrypted tokens for session security

Reporting

Basic reporting for administrators provides an overview with search criteria of different metrics about the use of service. Reports can be executed for several meetings per selected time slot. The reporting parameters are agent, channel, and topic.

The data of booked appointments are retrieved from the Appointment Scheduling system for business reporting needs. For this purpose, a separate interface was created, which the bank's Business Intelligence (BI) systems can utilize. S-Bank retrieves the data regularly and processes the reports required for business operations with BI tools.

5.1.3 Architecture

Appointment scheduling system has been implemented with tightly integrated modules using industry recognized standard cloud services to ensure scalability, security and performance.

Appointment scheduling system has been divided into frontend, backend and service layers as shown in Figure 12. Frontend consists of frontend apps, customer validation and employee authentication modules. Backend consists of database, engines and messaging modules. Service layer offers API's to the main integration systems.

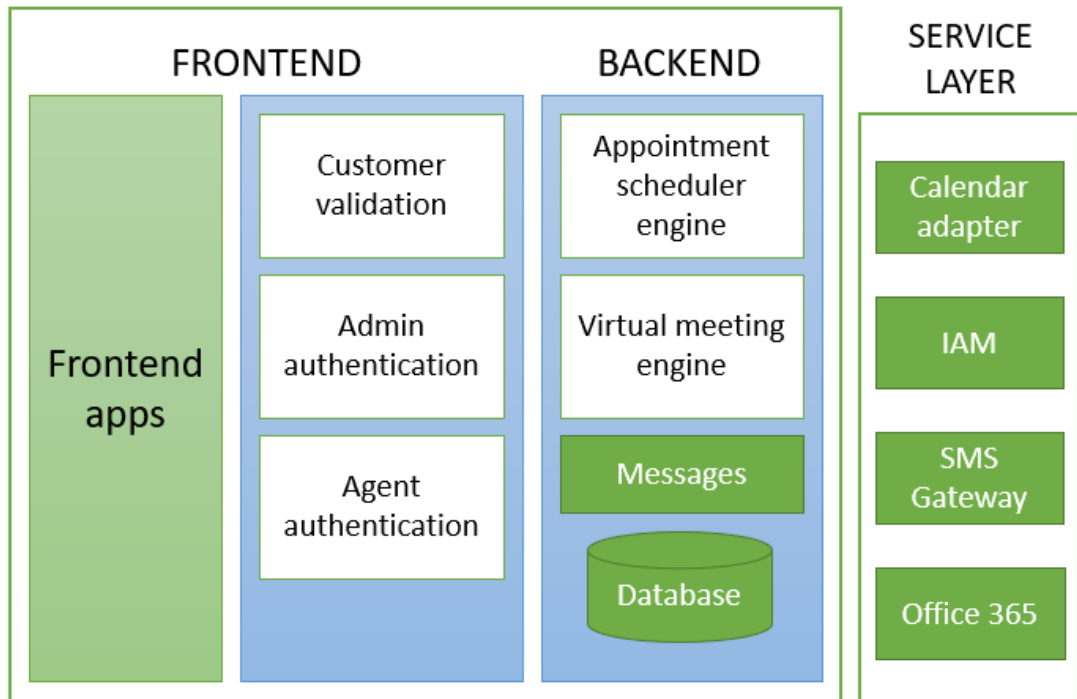


Figure 12. Architecture of appointment scheduling system.

The appointment scheduling is hosted on AWS and has similar test and production environments. The environment is configured against the O365 system. Access to the environment is limited from specified network address ranges. Appointment scheduler backend services include the business logic for the system functionality and through the service layer it is connected to the all necessary source systems including O365 to enable the comprehensive and automated process.

Technology stack of the appointment scheduling system represents the used technologies behind the system. As illustrated in Figure 13, Technology stack consists of Presentation layer, Session management, Business services and processes and Infra.

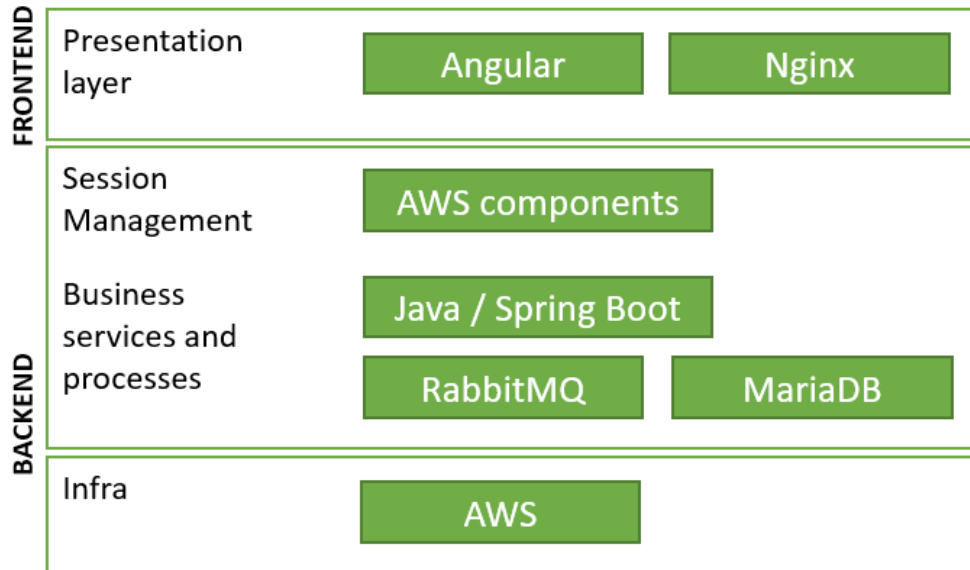


Figure 13. Technology stack of appointment scheduling system.

All the technologies used in the appointment scheduling system are common and widely used in cloud solutions. Angular is an open source Typescript based software framework and Nginx used for a web server. Solutions for an identity and access management are handled with the AWS components. Spring Boot is used for building RESTful Web Services, RabbitMQ for a messaging broker and MariaDB for a database. AWS is Amazon Webservices cloud provider.

5.2 Virtual Meeting System

Virtual meeting system enable effective meetings as there is a possibility to get personal customer service regardless of location. With a high-resolution video service together with screen sharing enables needed quality for advisory meetings and negotiations processes.

The services hours can be extended to weekends and evening hours. Customers are reached remotely, and to the meetings can be joined from everywhere with any device. This allows S-Bank to give better service promises.

The system supports voice, video, screen share and can be used in any devices with plug and play WebRTC technology from the Cloud.

5.2.1 Meeting Flow

Virtual meeting flow varies depending on the participant role customer and agent as summarized in Figure 14.

Virtual meeting flow for the customer consists of 6 steps. In the first step the customer enters the meeting id to the www.s-pankki.fi site. The customer receives the meeting id from the meeting confirmation via email or SMS. In the next step Strong Customer Authentication (SCA) is performed. After selecting the camera and audio options the system performs an automatic compatibility test before starting the meeting. In the fourth step the customer waits for the meeting to start in a lobby and finally the virtual meeting and recording starts when the agent joins the meeting in step five. In the sixth step recording is transferred to the archive - this will be performed automatically.

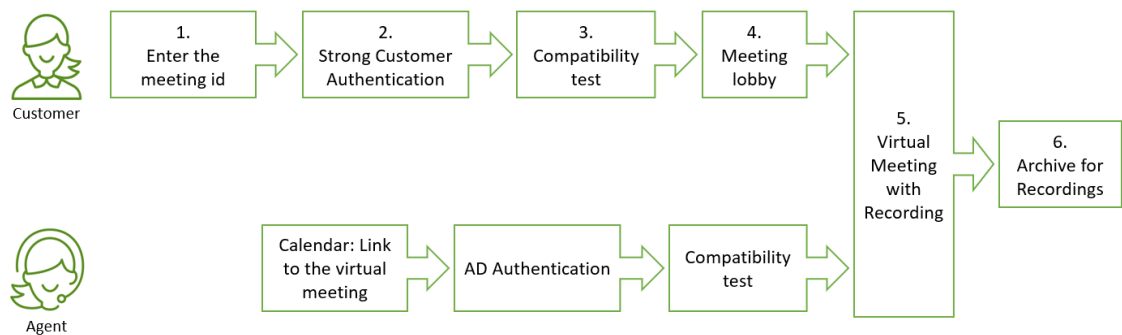


Figure 14. Meeting flow for customer and agent.

Virtual meeting flow for the Agent consists of 5 steps. In the first step, the agent will click the virtual meeting link in the calendar reservation. Next, authentication will be performed through Single Sign On (SSO). After selecting the camera and audio options the system performs an automatic compatibility test before starting the meeting. The virtual meeting and recording start in the fourth step and recording is transferred to the long-term archive in the fifth step.

5.2.2 Core Functionalities

Virtual meeting system's main features are described in this section.

Meeting Lobby

Before the agent has joined the meeting, the customer will be waiting in a meeting lobby for the meeting to start. Customers are instructed to select from a few controls such as language selection (Finnish, Swedish), device selection for camera and microphone & audio output. An automated pre-call check notifies if something is blocking the access or there is an issue with devices. UI has been developed using Angular material libraries with an extensive set of modules.

Virtual meeting controls

The participants have all the needed controls for a virtual meeting. While the meeting is in progress the participants can control their own input and output with intuitive control buttons as shown in Figure 15. In the order from left to right controls are camera on/off, microphone on/off, speaker on/off, chat functionality and end the meeting.



Figure 15. Virtual meeting controls for the customer.

The agent UI for the virtual meeting has a few more functionalities and are illustrated in Figure 16. In addition to controls for the customer, agent can verify customer information (name and social security number) and mute the customer or hide the customer's camera with the first button from left. Agent also have the possibility to share the screen or preferred document or page from their computer with the fifth control button.

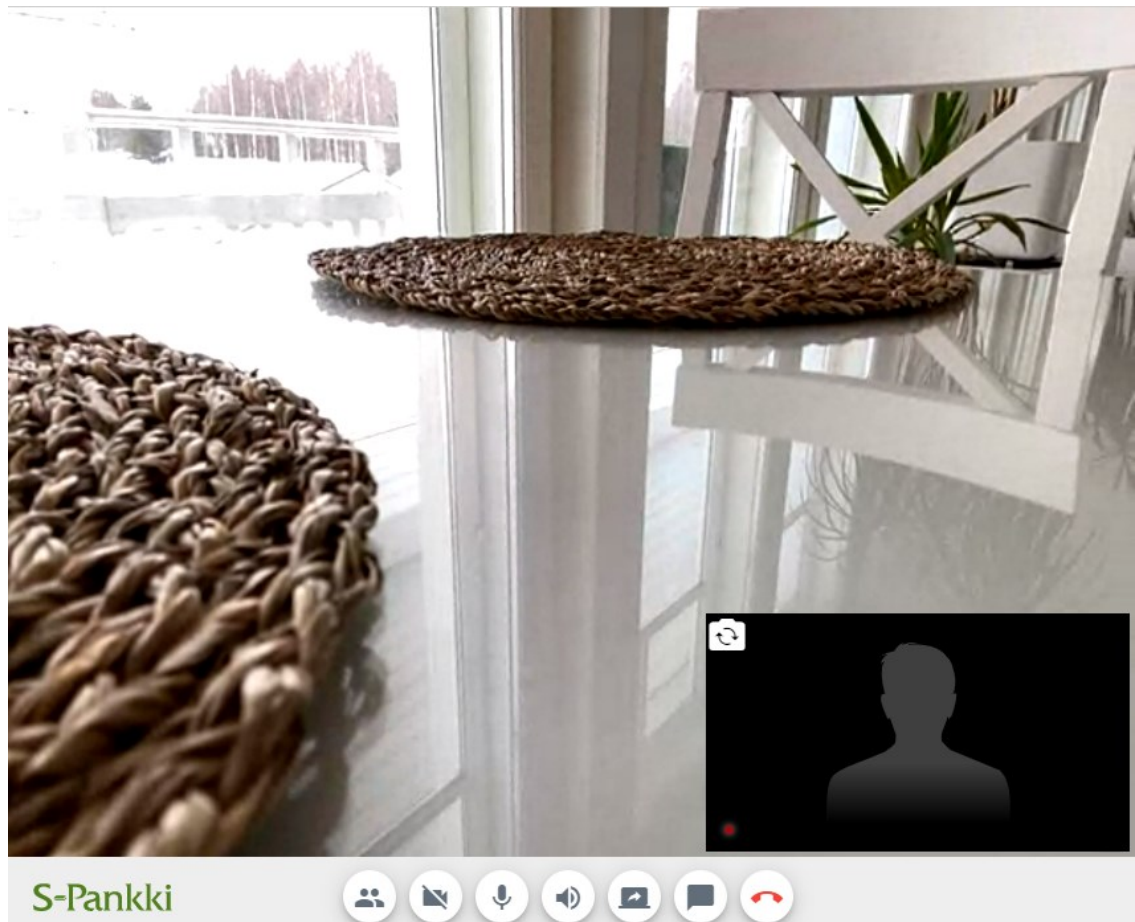


Figure 16. Agent view and controls in virtual meeting.

Customers and agents can also expand to full screen and switch cameras (for example front/back in mobile devices).

Recording module

As mentioned in section 3, Theoretical Background, the virtual meetings are required to be recorded for compliance purposes. The recording starts automatically in the background and participants can not join the meeting if the recording does not start. During the meeting, it is ensured that the recording is in progress. If not, the meeting will be ended. The recording is created inside the media component and the finished recording is automatically transferred to long-term archive in mp4 format including relevant metadata. The recordings can be searched with multiple criteria from the long-term archive and from where a single recording can be subsequently returned to be viewed by the authorized person.

The recording retention period is determined by the Channel role group, described in section 5, Access and Channel Roles. For the roles Banker and Cooperative Agent, the

retention period is 2 years and for the Private Banking, Investment Specialist, and Institutional roles 5 years. If for some reason an agent does not belong to the Channel role group located in Active Directory, the default retention time will be 5 years. Recording includes audio and shared material. The solution fulfils legal compliance and audit trail requirements along with possible training purposes.

Recordings can be searched from the long-term archive with different criteria such as social security number, customer name, meeting id and the time when the virtual meeting has been held.

5.2.3 Architecture

Virtual meeting uses tightly integrated modules using industry recognized standard cloud services to ensure scalability, security, and performance. Functions and roles of components are shown in Architectural diagram, Figure17.

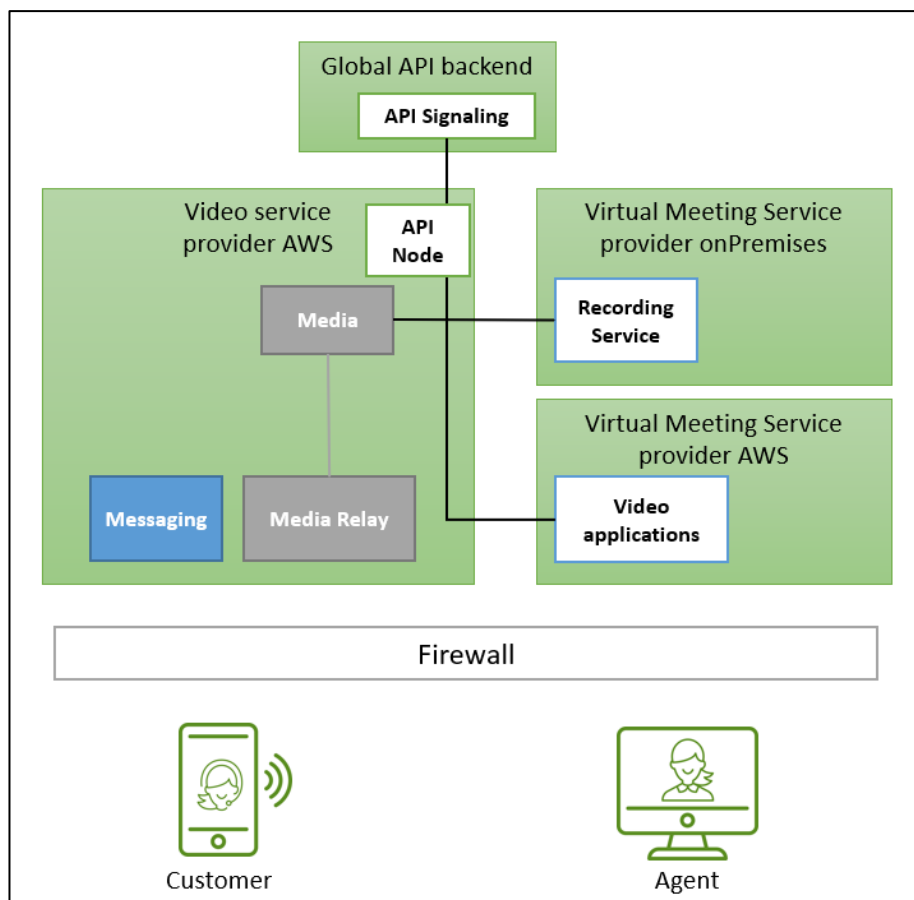


Figure 17: Architectural Diagram of Virtual Meeting

The solution leverages components from Video service provider AWS cloud. The first and only API signal that goes through Virtual Meeting service provider API node to AWS has a function of initiating call details to the user. This means that the user knows what tenant they belong to and what media zones they should be using.

All media traffic between users in a virtual meeting is encrypted using the Secure Real-time Transport Protocol (SRTP) using the Web Real-Time Communication (WebRTC) standard. The SRTP encryption key is negotiated using the Datagram Transport Layer Security (DTLS) and SRTP according to the Internet Engineering Task Force (IETF) standard. WebRTC endpoints generated by user devices use Advanced Encryption Standard encryption key to encrypt audio and video. [10]

User applications are downloaded to the user's WebRTC compatible browser from the application server using the Hypertext Transfer Protocol Secure (HTTPS). The HTTPS encryption protocol uses Transport Layer Security (TLS) 1.2.

6 MVP Pilot Version in Production

This section first introduces the deployment plan of the MVP pilot version and then focuses on the releasing and using the version in production.

6.1 Deployment Plan

A deployment plan was prepared for the release of the MVP pilot. When the systems came to production for the first time, there was no need to worry about downtime or night-time deployment. Deployment could be scheduled to take place in the middle of the day. Deployment tasks were divided into two categories - non-urgent tasks that could be done in advance of production and tasks to be performed just before deployment. Table 4 describes the non-urgent tasks and responsibilities.

Table 4. Non-urgent task for the deployment.

| Task | Responsible |
|---|----------------|
| Environment for appointment scheduling system | Vendor |
| Customer, Admin and Agent UI's | Vendor |
| Virtual Meeting environment | Vendor |
| Recording and archiving environments | Vendor |
| VPN tunnel for AWS | Vendor, S-Bank |
| Strong Customer Authentication | S-Bank, Vendor |
| AD-integration | S-Bank, Vendor |
| AD-roles to production | S-Bank |
| Calendar-integration | Vendor, S-Bank |
| Firewall openings | S-Bank, Vendor |
| Domain names | S-Bank |
| SSL-certificates | S-Bank, Vendor |
| Starting the maintenance of the systems | S-Bank, Vendor |

Non-urgent tasks were primarily the responsibility of the vendor. The table of non-urgent tasks consists of building the environments, VPN and Strong Customer Authentication (SCA), integrations to AD and calendars, firewall, domain, and SSL certificate openings. In the end of the list is mentioned the maintenance of the systems. It was decided to start normal maintenance and production support service already in the MVP pilot stage to ensure the processes are working as intended. E.g. in the event of production defects, it was agreed to use a ticket process.

Tasks to be performed just before deployment with responsible information are shown in Table 5.

Table 5. Tasks to be performed just before deployment.

| Task | Responsible |
|--|----------------|
| Admin UI test | Vendor |
| Agent UI test | Vendor |
| Customer UI test | Vendor |
| Migration of agents to appointment scheduler verification | S-Bank |
| Verification of all agent details in scheduler | S-Bank |
| Strong Customer Authentication test | S-Bank, Vendor |
| Virtual meeting test | S-Bank, Vendor |
| Archive UI and storage test | S-Bank |
| www.s-pankki.fi starting point test | S-Bank |
| S-Bank Intranet link test | S-Bank |
| Email to S-Bank employee – production verifications can be started | S-Bank |

The table of tasks to be performed just before deployment consists of testing in production the environments and UI's, Strong Customer Authentication (SCA) for virtual meeting and archive solution. Migration of agent details from test environment to production was included to facilitate and expedite deployment, as agent data was entered into the test system during the testing phase. Www.s-pankki.fi starting point test means the link in www.s-pankki.fi where customers navigate to the appointment scheduling system's

Customer UI. S-Bank Intranet link test means the link agents use inside S-Bank's network to navigate to the Agent UI. The last row in the list was very important reminder - a message must be sent to S-Bank employees when it is possible to start production testing.

Rollback plan was not designed because the systems had never been deployed into production before. It was noted that if there are problems with deployment, the start of the actual pilot use with customers will only move forward. There was no need to recover the systems to the previous version. Therefore, rollback plan was not considered necessary in this context.

6.2 Release and Production Usage

The original goal was to release the MVP pilot version to production on March 15, 2021. As the time of publication approached, this goal proved insurmountably difficult to achieve. All the training had been held and the agents were ready to take the services on pilot, but technical challenges prevented it. The problems were due to the occasional misalignment of internal and external network addresses for the appointment scheduling and virtual meeting systems. This was reflected in the testing as random 503 error messages to the agents.

The solution to this technical challenge was eventually found when creating separate names for the intranet and Internet on the S-Banks Domain Name System (DNS) server. This means that S-Bank's intranet uses its own separate domain addresses to access the Admin and Agent UI, and the Customer UI has its own domain address for the Internet use.

The MVP pilot version released to production on March 24, 2021. Customers were able to make reservations for investment experts through the www.s-pankki.fi website, and private banking experts began booking online meetings for customers. At the same time, the old appointment system remained in use for other channels in S-Bank.

The process of the pilot version for appointment scheduling followed the same model as described in section 5. However, in terms of virtual meeting, the process was different, and the steps are illustrated in Figure 18.

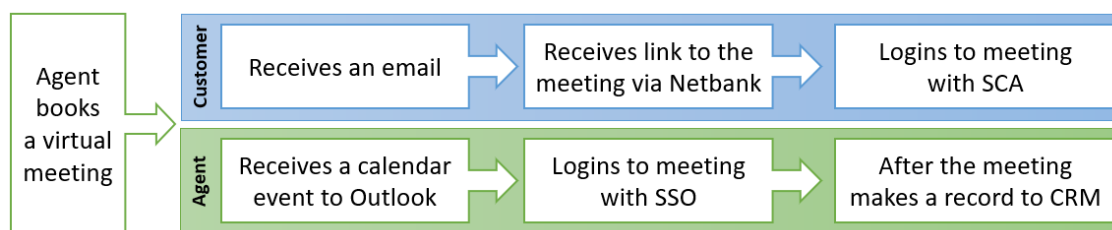


Figure 18: Process in the MVP pilot of Virtual Meeting

When an agent books a virtual meeting, an email is sent to the customer and a calendar event is created in agent's Outlook. The email customer receives explains in more detail how he or she joins the virtual meeting via a separate link, which is delivered via online bank (Netbank). When the time of the virtual meeting comes, the customer logs in using Strong Customer Authentication via the link they received. The agent logs in with SSO via a link from the Outlook calendar entry. Before the meeting starts both agent and customer select whether the camera and microphone are on or off. These settings can be changed during the meeting. When the meeting starts, its recording will also start. When the meeting ends, the recording is transferred to the archive. After the meeting, the agent saves the meeting information in S-Bank's Customer Relationship Management (CRM) system.

First Month of Production Usage

Production use started on March 24, 2021 with eight agents from private banking and seven from investment experts. As shown in Figure 19, the amount of appointments per week gradually increased from week 12 to 16.

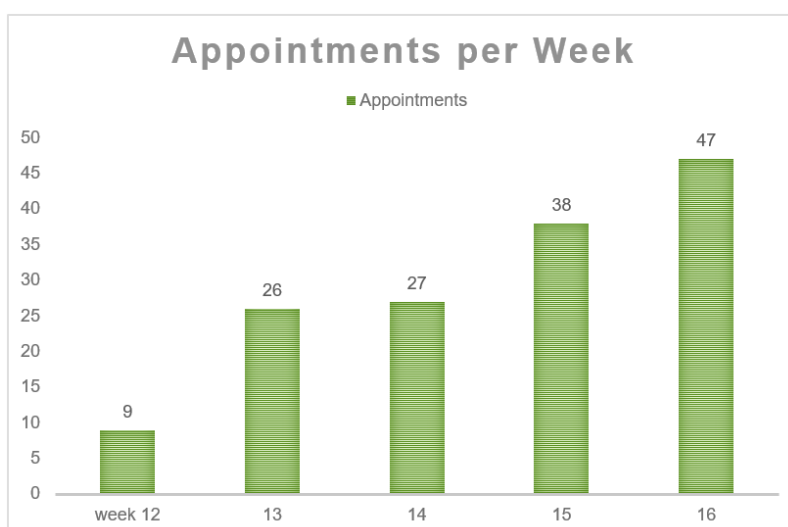


Figure 19: Appointments per Week in Pilot Usage

During the pilot period, only phone meetings and virtual meetings were booked for the different types of meetings. Clearly most of these were telephone meetings as Figure 20 illustrates.

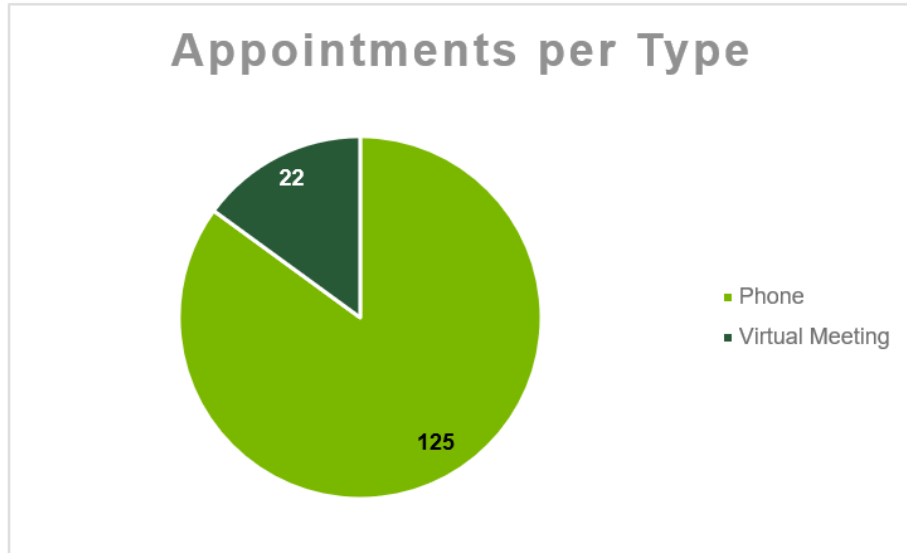


Figure 20: Appointments per Type in Pilot Usage

Almost 85 % of appointments were booked as phone meetings and 15 % as virtual meetings.

The experiences of the agents during the pilot period were promising and the feedback received suggested that there is a need for virtual meetings. The problems observed in the old system were also not encountered during the pilot period. During the pilot phase, no major problems or errors occurred that would affect the start of the full relay in any way.

7 Conclusions

The objective of this master thesis was to implement new appointment scheduling and virtual meeting systems for S-Bank. The objective was divided into four research goals, which were

- evaluate the current state of the appointment scheduling and virtual meeting system in S-Bank,
- examine the background of virtual meetings in banking,
- define non-functional requirements for the project,
- implement new systems for appointment scheduling and virtual meeting.

7.1 Summary

Thesis focused on the current state analysis in section 2. The old appointment scheduling and virtual meeting systems did not fulfill all the required functionalities. As a result of the analysis, S-Bank decided to continue ahead with the acquisition of new systems.

The section 3 focused on the theoretical background of digitalization in banking, MIFID2 related regulation, and a short history of virtual meetings. Section 4 outlined the planning of the project and defined non-functional requirements with ISO/IEC 25010 model for appointment scheduling and virtual meeting systems.

Section 5 consisted of the implementation of the appointment scheduling and virtual meeting systems. Non-functional requirements were met in the implementation phase - Functional Suitability, Performance Efficiency, Compatibility, Usability, Reliability, and Security were validated in the end of implementation phase. Maintainability will be tested in production use and Portability will be required if the systems are to be transferred to another vendor.

Section 6 focused on deployment plan, release, and production usage of the pilot version. Despite all the challenges, the systems were released into production and, based on the first month of user experience, the systems met the need, why they were initially implemented.

7.2 Challenges

The project that this thesis describes faced many challenges, especially during the first increment. Most of the problems concerned technical implementation and architectural solutions, but there were also challenges with vendor, regulation, and information security. However, the first challenges were related to the contract negotiations with the vendor that took place until the end of December 2020. Fortunately, the contracts were signed before the Christmas holidays.

The following challenges pertained to the definition meetings. After the first meetings, it became clear that the vendor's views on the project differed greatly from those of the bank. The vendor had a very product-centric mindset and focused on delineating the functionalities of the product without taking S-Bank's perspectives into proper consideration. After lengthy discussions and steering group investigations, the matter was resolved, and S-Bank's requirements were duly considered.

Technical and architectural challenges were faced in the integration of the bank's network and AWS. After lengthy studies, a VPN pipeline was chosen as the solution to protect this integration. At a later stage, a second VPN pipeline had to be built for virtual meeting recordings, as the first pipeline would be overloaded with large amounts of data. Due to these solutions, the firewall openings had to be refined and adjusted several times. A total of almost 25 openings / closures had to be ordered before the systems were running in production use. This is partly due to the bank's tight architecture, with all firewall ports closed by default.

There were also long discussions and inquests about joining the virtual meeting. The default functionality of the system sends the customer an email link. When the customer clicks the link, it takes the customer to a virtual meeting. The main problem with this concerns phishing scams where an attacker pretends to be a bank and sends a scam link to the customer. When the customer clicks the link the scam site prompts to enter their bank ID. Therefore, banks will not send email with links to the login page, as this method involves considerable security threats. The solution was extensively explored, and five different alternatives were devised. The result was a solution with a strong level of security.

One set of problems related to the different needs of MIFID2 to identify the retention period of the meetings. Depending on the content of the virtual meeting, it should be archived for either 2 or 5 years. As a solution to this, 2 different AD group families were eventually created. The archiving time of the recording is determined by the group to which the employee belongs.

7.3 Future

The systems pilot was launched in March 2021. The next release will take place at the end of May, introducing the following functionalities:

Appointment Scheduling system

- Implementation of Customer UI to www.s-pankki.fi website
- Automatic activity entry for an appointment to CRM
- Sending a confirmation and reminder message via SMS
- Booking appointments for more than one person
- Booking appointments for a company
- Reporting appointments to Power BI
- Capability for the customer to cancel the appointment on S-Bank's website
- Quick link for the employee to the appointment scheduling system in CRM with the customer's pre-filled information.

Virtual Meeting system

- Chat functionality
- Participation of 1-3 customers in the virtual meetings
- Virtual meeting for companies
- Virtual meeting attendance information is automatically sent to the customer when the booking is made.
- The customer can make an appointment for a virtual meeting with an investment expert.
- A confirmation message can also be sent via SMS.

- The CRM automatically makes an entry in the customer data at the booked time.
- The customer can cancel the appointment themselves.

Other new development ideas are being documented, and more than 20 requests have been raised. Systems will continue to be developed by prioritizing these ideas and agreeing on more detailed implementation schedules.

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