



# Improving the Viewing Experience at Nokia Arena — A Case Study of Nokia Corporation

Eemil Hämäläinen, Jani Kerttula, Kalevi Lindman, Emma Pirttimäki

2022 Laurea



Laurea University of Applied Sciences

**Improving the viewing experience  
at Nokia Arena  
– A Case Study of Nokia Corporation**

Eemil Hämäläinen

Jani Kerttula

Kalevi Lindman

Emma Pirttimäki

Business Information Technology,

Tietojenkäsittely

Bachelor of Business Administration,

Tradenomi

Thesis

October, 2022

**Laurea University of Applied Sciences**

**Abstract**

Degree Programme in Business Information Technology

Bachelor of Business Administration

Eemil Hämäläinen, Jani Kerttula, Kalevi Lindman, Emma Pirttimäki

**Improving the Viewing Experience at Nokia Arena – A Case Study of Nokia Corporation**

Year	2022	Number of pages	45
------	------	-----------------	----

---

The purpose of this thesis was to develop Nokia Corporation's future services. The development work was to develop innovative new ideas for Nokia Arena. Two different options were considered: Next Generation Stadium and Network-as-Code. Next Generation Stadium was chosen by our team as the development theme. The goal was to improve the customer's viewing experience at sporting events at Nokia Arena.

The project was implemented using the Design Sprint method in a team. The purpose of the five-day Design Sprint workshop was to put together a pitch for the partner company and after that, the report writing began. The project was supposed to be written in three weeks.

Three different research methods were used during the project: brainstorming, benchmarking, and a survey. These were used to select the final research and development target. The result was a proposal for an application of the digital business service concept. The results and the prototype will be useful in the product development of Nokia Corporation.

Keywords: Design Sprint, Nokia Corporation, Prototype, Customer experience, Survey

## Contents

1	Introduction .....	5
2	Introduction of the Client Company and Operating Environment .....	5
2.1	Client Company.....	5
2.2	Project Environment.....	6
2.3	Thesis Sprint and Design Sprint .....	8
2.4	Design Sprint Schedule .....	9
2.5	Cooperation .....	10
3	Research Questions and Project Goal .....	10
4	Knowledge Base for Broadcasting at Nokia Arena .....	12
4.1	5G Network .....	12
4.2	Network-as-Code .....	12
4.3	Broadcasting Rights .....	13
5	Research .....	14
5.1	Brainstorming .....	15
5.2	Benchmarking.....	16
5.3	Survey.....	21
6	Results .....	29
6.1	Solution Prototype .....	29
6.1.1	Feature Selection.....	31
6.1.2	Feature Use .....	33
6.2	Summary of Results.....	35
6.3	Relevance and Benefits for the Client and the End User .....	36
7	Conclusions and Future Development .....	37
	Figures .....	41
	Appendices .....	42

## 1 Introduction

The purpose of this thesis was to improve the services offered by Nokia Corporation at various arena events. Improving the customer viewing experience in sporting events at Nokia Arena was the main goal. The end result was a solution that took into account all visitors at the arena.

The theoretical part of the project delves into the challenges and opportunities that were encountered in the development. The main challenges revolved around the differences between 4G and 5G networks. In this section, we go over their benefits, challenges, and opportunities in relation to our development work. Considering different broadcasting rights also presented its own challenges. Based on these, we were able to form a functioning entity. The section also talks about the operations of Nokia Corporation and describes the operating environment. The importance of Network-as-Code in the development project is opened and its possibilities are explained.

In the functional part, the content of the five-day Design Sprint method will be opened. The teams working days of the five-day Design Sprint workshop and its content will also be reviewed. We will compare the differences, benefits, and challenges of the usual Design Sprint. The section also reviews the purpose of the prototype and its operation at Nokia Arena.

The database was built using a survey, brainstorming, and benchmarking. The content of the survey will be reviewed in detail. Our own thoughts, views, and opinions on the topic of development will be opened. The results of the benchmarking and the conclusions drawn from them are reported.

## 2 Introduction of the Client Company and Operating Environment

### 2.1 Client Company

The client of the Thesis Sprint was the public limited company, Nokia Corporation. The company is a Finnish telecommunications company that operates worldwide in seven continents and around 130 different countries (Nokia 2022a). Nokia was founded in 1865 (Nokia 2022b). The company has nine Nobel prizes and is one of the largest companies in Finland (Nokia 2022c). Nokia has been the largest company in Finland in terms of turnover in 2017 and since then the company has remained in the top fight among the largest companies in Finland.

Nokia Corporation provides technology and devices to its consumers (Nokia 2022c). Nokia's largest businesses are in mobile networks, network infrastructure, technology development and licensing. The largest of the business groups is mobile telephone networks, more specifically wireless transmission networks.

Network infrastructure is the second largest of the business groups, with a particular focus on fixed transmission networks. In addition, cloud and network services are responsible for core networks, network software and cloud services. Licensing of patented inventions and brands is the responsibility of Nokia's technology unit. (Sajari 2022.)

## 2.2 Project Environment

Design Sprint is a powerful, five-step development tool designed to reduce the risk of introducing new products, services or features to the market (Heinolainen 2020). The "Design Sprint" approach was originally created and developed by Jake Knapp in collaboration with Google Ventures (Kanava 2022). In Design Sprint, the idea is planned, risks and opportunities are mapped, a prototype is created, the idea is put into practice and its functionality is tested using various means. The achieved results are examined, and conclusions are drawn from that.

Working with the Design Sprint method takes place in groups. Nowadays it is possible to work entirely physically on site, remotely or in a hybrid form of working. Each day of the five-day Design Sprint is intended to focus on a different part of the development process.

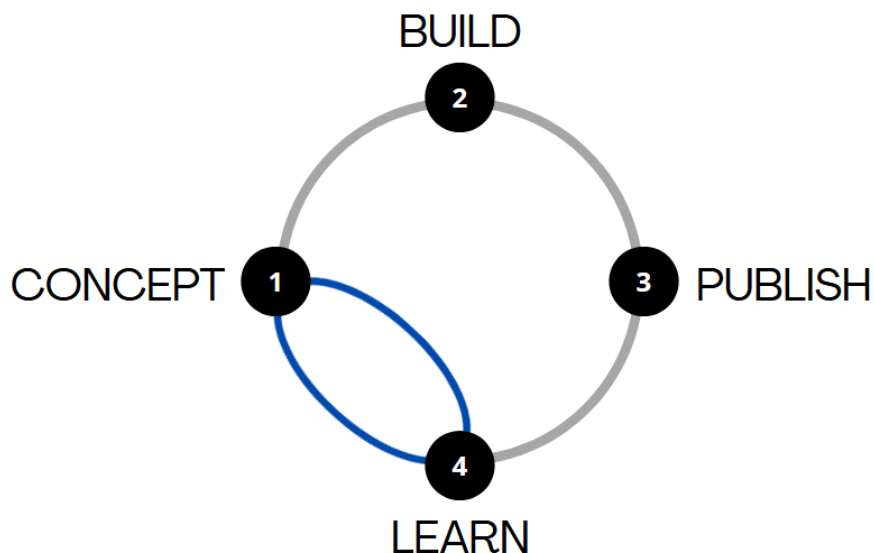


Figure 1: Design Sprint in a Nutshell

When starting a new development project, many different questions and challenges come to mind that need quick answers to get the project started. For this problem, Design Sprint is the best solution. Design Sprint gives you quick and tested answers, as well as concrete results in a short time frame. This is one of the biggest benefits of the Design Sprint method, when several months of work is compressed into just five days. (Heinola 2020.)

Other benefits of Design Sprint:

- Turning an idea into a solution
  - The Design Sprint provides concrete information and insight into an idea through clear features and operational logic.
- Basing design work on real needs and understanding
  - Ensure the right problem is solved in the right way through research.
- Facilitate take-up and possible training needs
  - Create a good enough prototype to avoid major revisions at a later stage.
- Improving the efficiency of system implementation
  - Implementation is more efficient when the authors already have a ready-to-use, high-quality basis to guide them.

(Röyhy 2022.)

Development work carried out using the Design Sprint method can also present various challenges. The work during a sprint is so intense that conflicts can easily arise within a familiar team and environment. Challenges can take the form of physical or psychological challenges. The form of the challenges is influenced by the team members and their personal lives.

One of the most common challenges is certainly the timeframe. The Design Sprint is designed to take place five days, so the days can easily become too long. It is therefore important to stick to the working hours and work as effectively as possible during these times. Eight hours a day is generally a good working time, and no more than that should be done to prevent possible burnouts.

There can also be challenges with different personalities and familiar ways of working and reconciling them can be challenging. In this case, a single facilitator may be needed and is usually recommended to be sourced from outside the team to avoid conflicts. (Surakka 2021.) The role of the facilitator is therefore to encourage the team to work together and to support their way of thinking. The facilitator aims to create an atmosphere in which the conditions

for good thinking play the most important role. (Turku 2021.) It is also a good idea for the team to agree on rules at the beginning of the sprint, which everyone will stick to. This way conflicts will less likely arise when everyone has an idea of how to act.

During the Design Sprint a lot of ideas are generated. The aim is to plan the development idea based on where you want to be in several years' time. Many different ideas are left swirling in the mind. This can make it challenging to focus only on the essentials, i.e., the core issue. (Surakka 2021.)

When a sprint is conducted in a telecommuting mode, time can easily be spent searching for software, files or some other tool related to the sprint. (Surakka 2021.) The solution to this is quality preparation and shared work folders where everything essential can be found. It is worth creating and going through these with the team well in advance of the sprint week, so that when the sprint starts everyone knows where to find the materials and time is not wasted looking for them when the schedule is already tight. It is also easier to lose concentration when working remotely, so you should be prepared in advance for the fact that it may take a little longer to do almost everything than if you were physically in the same place.

### 2.3 Thesis Sprint and Design Sprint

The Thesis Sprint is an option for writing a thesis that has recently been introduced at Laurea University of Applied Sciences. The content of the five-day sprint week is very similar to the usual Design Sprint method. The content of the week is the same, the product development is carried out in the same way, and the goals and objectives are the same. The main difference happens after the sprint week.

While a normal Design Sprint usually ends after a five-day workshop, the Thesis Sprint starts the actual work phase, writing the thesis report. The teams start a three-week publication phase. In the publication phase, the entire thesis will be written. The main advantage of this sprint format is that the thesis can be completed in a very short time.

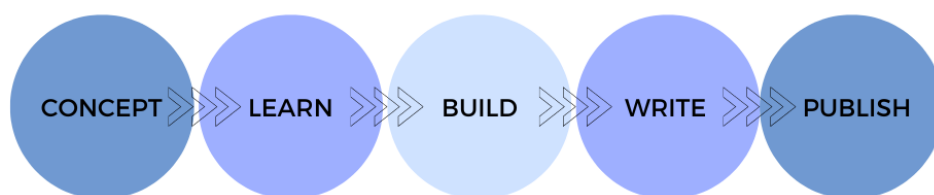


Figure 2: Thesis Sprint Steps



It is also possible to write the thesis in a group of up to five people. This reduces the individual workload. Due to shorter timespan for writing the thesis, efficient teamwork is a necessity.

#### 2.4 Design Sprint Schedule

The thesis was conducted using the Design Sprint method. We were meeting in person at the school for most of the sprint week in the same workspace. This chapter summarizes what we did at the five working days of the Design Sprint workshop.

We started the first day of the Design Sprint workshop with a concept design. As a team, we shared different development ideas and thoughts on things that need to be developed in different events. From these ideas and thoughts, we came up with a set of different ideas, which we then used to narrow down and select the final development topic. Help and guidance in choosing the topic was also provided by the partner company, Nokia Corporation. At the end of the day, the final development theme was the Next Generation Stadium and improving the viewer experience in the VIP boxes, as well as in the general seating. However, the final features were still a little unclear.

The second day of the workshop started with the distribution of tasks. Part of our team started designing the final development package. At the same time, another part started to collect the knowledge base for the product development. Benchmarking was used to collect the knowledge base. The aim was to gather as much information as possible about the features offered by different streaming services and VIP boxes.

At noon, we put all the information together and formed an idea of our final product and its features. We also asked a partner company for their thoughts on the subject, who gave us some good tips on the features of VIPs in our product, as well as on the use of live chat. There seemed to be a lot of good ideas at this stage, so we conducted a survey on the topic with users. The aim of the survey was to gather other sports fans' thoughts on important and desirable features for sporting events in the Arena. The survey was distributed via email and WhatsApp. We also started developing a prototype.

The third day, the so-called "field day", was spent analyzing the results of the survey, building the prototype, and planning the content of the pitch. We received survey responses throughout the day, so we could begin altering our prototype based on perceived trends. The responses provided us with valuable information to support the development of the final prototype. By the afternoon, the final version of the prototype was completed. At the end of the day, we considered the pitching concept and started to create the pitch.

The tasks for the fourth day of the workshop were finishing the pitch and creating a customer story. The pitch summarized the prototype's functionality and its benefits for the user, and the customer path to the App. In the afternoon, we participated in a pitch general exercise with the other teams of the course and practiced it with our own team.

On the last day of the Design Sprint, the topic and solution were presented to the other participants of the course and Nokia representatives. After the presentation, we received positive feedback on our topic. Later, we re-recorded our entire presentation to send to Nokia due to a mistake with an earlier recording.

## 2.5 Cooperation

During the Design Sprint week, sparring sessions were organized together with representatives of the partner company. The sparring sessions took place on the first three days of the week. During these times, our team received good ideas and insights on our development theme from the representatives of the partner company. Each sparring session lasted 15 minutes. From all the sparring sessions, we ourselves gained new perspectives on how to approach our development topic.

In the first sparring session, our team was directed to focus on the Nokia Arena instead of our original idea of home stands and to see if our development idea could be implemented in the arena. The second sparring session led to recommendations that we narrow down our broad topic a bit, so that we focus on just a few issues. This would also allow us to go a little deeper into certain issues and develop them further. In this sparring session we were also asked to think about the features of live chat. In the third and final sparring session, we were directed to be more ambitious with the features of the live chat. To do this, we were suggested to bring different competitions and offers to the chat, which would potentially make it more engaging for the consumer to use.

Each sparring session was very useful and helped shape the final features of our final product. Sometimes it also felt like there were so many ideas and new perspectives coming from the partner company's representatives that we didn't know what they were really asking from us anymore. It was still great to see that in each sparring session, the incorporation of previous ideas into the development process was praised.

## 3 Research Questions and Project Goal

Possible development themes to choose development targets from were given by Nokia. These Design Sprint Challenges included options of developing the Next Generation Stadium

and Network-as-Code. These themes are quite broad and have a lot of overlap, which gave lots of options to choose a development target.

After discussion with the project members, we decided on the service design focused option to improve the customer viewing experience in sporting events at Nokia Arena. The research questions we came up with were “how can we improve the viewing experience in sporting events at Nokia Arena” and as a continuation “how can we create value to both the client and the end user through an application”. To answer those questions, we set out to create an application around improving the viewing experience.

The outcome of our project was decided to be a proposal for an application, which when used at an arena, improves customers’ viewing experience in sporting events. We decided to focus the service to a mobile app or software. Its features are focused on video footage from cameras at the arena and how to manipulate them, as well as interactions between visitors and arena services and sponsors.

Our development target was concretely selected halfway into our design sprint week. This was due to feedback from Nokia contacts and new ideas created from brainstorming. At first, we thought about creating a service to use from home but ended up focusing on a similar service to be used locally at an arena. Finding the right limits for our project was one of the biggest challenges during our design sprint week.

We generally chose to focus on developing the experience of viewing a stadium event, specifically a sports event. This was mostly because it was easier to come up with improvements to experiences that we had personally experienced ourselves. It also seemed feasible to turn into a real product in the near future instead of decades from now, which made the service easier to refine. Due to time constraints of creating a service in one week, we limited our focus to mostly service design aspects. Technological and legal requirements simply take too much time to dissect and working around them limits the creative process.

Network-as-Code was mostly left out from refinement due to being more difficult to create use cases for as well as limited competence in the topic between project group members. 5G and Network-as-Code are however necessary for the implementation of our service. This is why they couldn’t be entirely ignored.

Broadcasting rights are also an additional complication for our development target. Which parties hold which rights for which events and in what limits depends on the location and the event. It would have made the scope of our project too wide to include potential solutions to these issues. If our service prototype is put into further development, these aspects should be taken more into consideration.

## 4 Knowledge Base for Broadcasting at Nokia Arena

There are a number of technological and legal requirements to take into account with our solution. In order to provide the service, adequate infrastructure is needed: cameras are a requirement to offer viewing angles and efficient wireless network is needed to deliver those viewing angles to the customer. This chapter explains some of the key concepts required for the implementation of our app.

### 4.1 5G Network

In order to stream high fidelity camera footage to multiple devices simultaneously, the network must have adequate download and upload speeds as well as enough capacity to handle thousands of devices' demand at once. To do this wirelessly, 5G-technology is extremely useful. 5G-networks have higher speeds than older technologies, have higher capacities, and make optimizations such as network slicing possible (Seppälä 2020).

We designed our prototype with Nokia Arena in mind. Nokia Arena can accommodate up to 15 000 visitors at once (Nokia Arena 2022). Providing both live and recorded footage of possibly multiple cameras for every visitor at once may be needed. This makes 5G-technology a necessity.

5G also enables position tracking with accuracy of 10 centimeters or less with latencies on the order of 10 milliseconds (Ghosh & Keating 2021). Tracking this accurate could be used in tandem with Network-as-Code to grant access to services optimize routers used based on location alone. It could also enable other features that require precise tracking.

### 4.2 Network-as-Code

According to Watts (2022), "Network as Code is the practice of writing code to perform tasks related to network configuration." This is a method that optimizes networks and enables some automated operations in the network. When used in combination with 5G-technology, it makes things such as automated network slicing possible.

There are multiple use cases for our service with different network requirements. For example, users watching live footage on their device in split screen, users watching recorded replays in split screen and users using chat with video footage minimized in the background. Network-as-Code could be used to prioritize certain users or specific elements of the service by adjusting network download speeds based on current use of the service (Watts 2022). A user watching live footage in full screen needs higher resolution for the image and cannot load upcoming footage in advance. Whereas a user watching replays can for example download a 30 second video clip in less time, freeing that network use downtime as capacity for other users or services. A user only focused on chat and occasionally watching footage in a

smaller portion of the screen needs less bandwidth from the network for the text-based service element and lower resolution video footage.

The service concept prototype also requires usage rights to access its features. For example, a customer with a VIP-ticket could have access to more camera feeds than a standard user. Validating the user's mobile device and granting access for these devices requires functionalities of Network-as-Code. The device communicates with the network and gains access and speeds to certain features automatically. With 5G, validation could also be based on location. For example, if a user is detected in a VIP-booth, they automatically get VIP-access for their device.

The biggest challenge for the application of Network-as-Code is the lack of standardization between different operators, cloud services and devices (Adler 2018). We are, however, designing the app to be used in a local network at Nokia Arena. This should circumvent the issue of standardization.

#### 4.3 Broadcasting Rights

“Broadcasting rights (also known as media rights) are legal rights which a broadcasting organisation owns and negotiates for the purpose of with a commercial exploitation” (Olisa Agbakoba Legal 2021). For most sports organizations broadcasting and media licenses are the largest source of revenue. There are also variables to consider, such as image rights, which consist of the rights that individual players hold over their image and brand. (Olisa Agbakoba Legal 2021.)

For broadcasting rights, all parts of the broadcasting process should be taken into account. This includes filming and camera positions at the location, streaming that video footage at the location, streaming the footage outside the location, and how viewers can access that footage. There are also differences in broadcasting live and recorded footage.

Exclusive broadcasting rights are over time becoming more uncommon due to online broadcasting. Different broadcasting contracts can also vary heavily based on the complexity of the situation at hand. (WePlay Esports 2021.) This means that planning ahead for how to implement our application is very difficult. We don't know the terms of current broadcasting contracts. Due to the flexibility in negotiating future contracts, however, our application is definitely possible to implement.

## 5 Research

The phases of exploratory, research-based, development work can be structured as a process. This process can be summarized into three phases which are planning, implementation and evaluation. (Ojasalo, Moilanen & Ritalahti 2015, 22.)

The research-based development process is divided typically into six phases (figure 3):

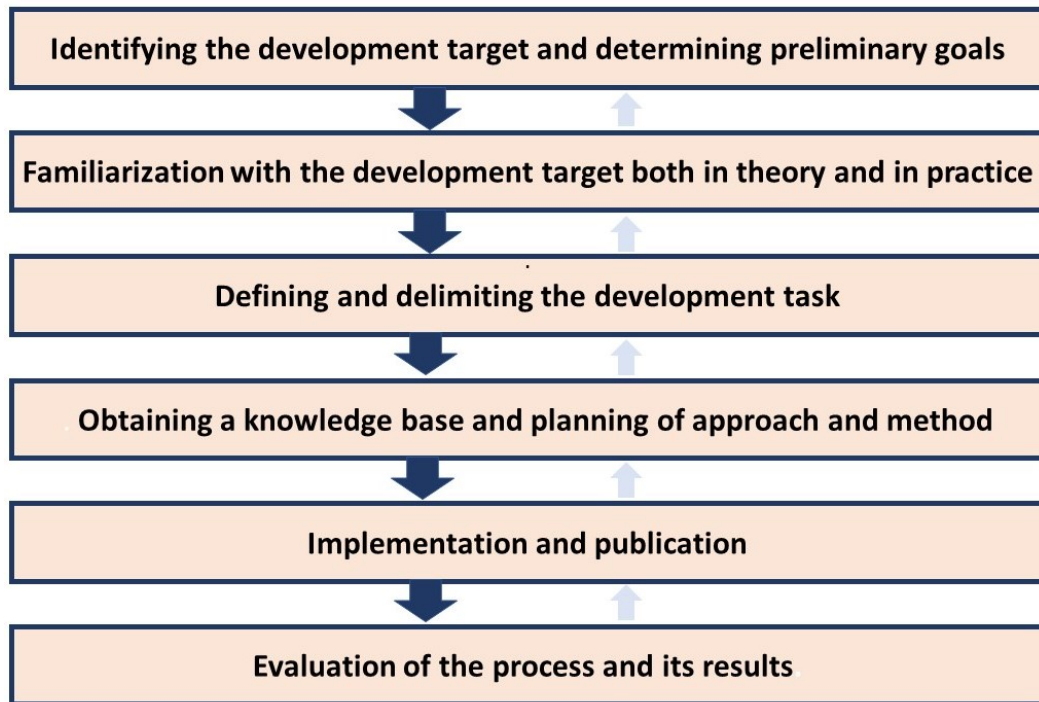


Figure 3: Phases of Research-based Development

(Ojasalo et al. 2015, 24).

It should be noted that the process does not always progress in a straight line and sometimes it is necessary to return to the previous step. Five-day-long sprint requires that several phases

must be done at the same time. The phases of our development process is shown in figure 4:

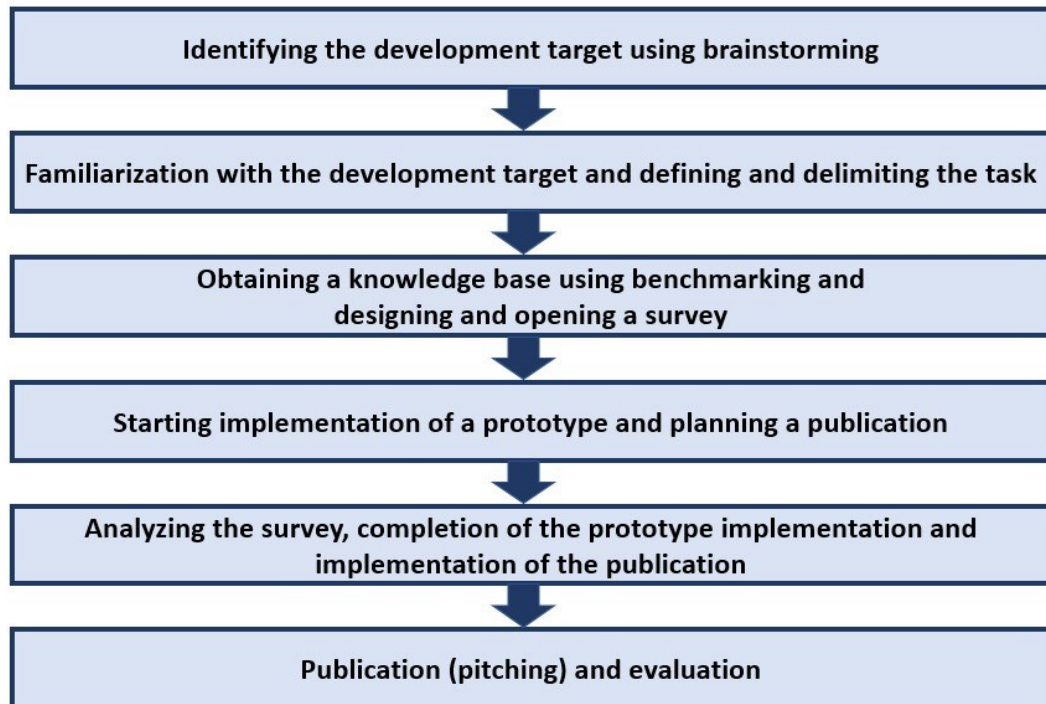


Figure 4: Phases of Our Development Process

In the following subchapters is described each of research methods used and the way we implemented them.

### 5.1 Brainstorming

Brainstorming is the foremost group creativity technique whose purpose is to generate new ideas. Objectives of the brainstorming are to find new approaches or a solution to some clearly defined problem (Ojasalo et al. 2015, 160). There are several implementation models for brainstorming, but the main idea in all models is that a group of people generate as many ideas as possible to solve a problem. It is very important that participants can express their thoughts and ideas spontaneously without criticism. (Ojasalo et al. 2015, 44.) The generated ideas are evaluated and the best of them are selected. Burgus (2014, 130-131) emphasizes that ideas must be not only new but also useful to be truly creative and meaningful in order to develop them further.

We started our sprint week with brainstorming. Our development target was Next generation Arena Experience. We already had some ideas when we started the brainstorming session. We developed the ideas which seemed to be good enough and evaluated them. In our opinion the best idea was improving the viewing experience at Arena.

As a result of brainstorming, we had now the research question which was how to improve the viewing experience in sporting events at Nokia Arena and also possible solution which was an application. The main feature of the application was the possibility to choose cameras which to watch. Other possible features of the application were timeline for which the operator or user can add timestamps, opportunity to view replays and slow motions using the timeline and live chat with other users.

## 5.2 Benchmarking

Benchmarking is a method based on comparing one's own activity with the activity of others. Comparison is often made to the best practice or practices. Its purpose is to identify own weaknesses and to create from their basis new developing ideas and targets. The main idea is to learn from others and questioning one's own activities. (Ojasalo et al. 2015, 43.) There are many models of benchmarking. Steps and their number vary depending on the model. Niva and Tuominen (2021, 34) present a model with 10 steps:



Figure 5: Steps of Benchmarking

Finding and comparing existing services, products or solutions is important because this allows development by which one can separate from competitors (Tuulaniemi 2016, 139). Ideas can be also adapted from another industry. Strategy choices can be made easier when other players in the competitive field are known. (Tuulaniemi 2016, 187.)

The main feature of application, possibility to choose camera angles, was invented in brainstorming and we knew that no other service provider offers this. We used benchmarking



to investigate the other important features which the application could have: timeline, timestamps of timeline, possibility to watch replays and slow motions and showing statistics. We selected for review some commonly used streaming services and also some betting sites. The chosen services were Allente, YLE Arena, Netflix, YouTube, Veikkaus and Nordicbet. The review showed that the most important feature is timeline. Timeline allows you to select a viewing point. Following are examples of implementations of timeline.

Figure 6 on the left shows the timeline of Netflix. Pointing the timeline shows a picture in picture from the point indicated and there is a possibility to choose rewind or forward 10 seconds. Netflix has also a possibility to choose playback speed as shown in figure 6 on the right.

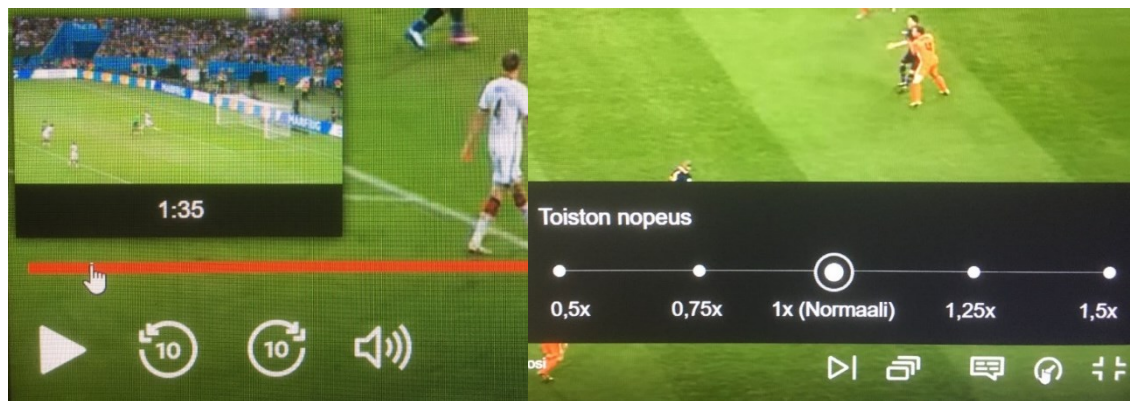


Figure 6: Benchmarking Netflix

(Netflix 2022).

Figure 7 shows the timeline of YouTube. You get views from different points of recording by dragging the picture, but without start times and possibility to choose starting points. By pointing the timeline, you get a picture (in picture) from the point indicated.

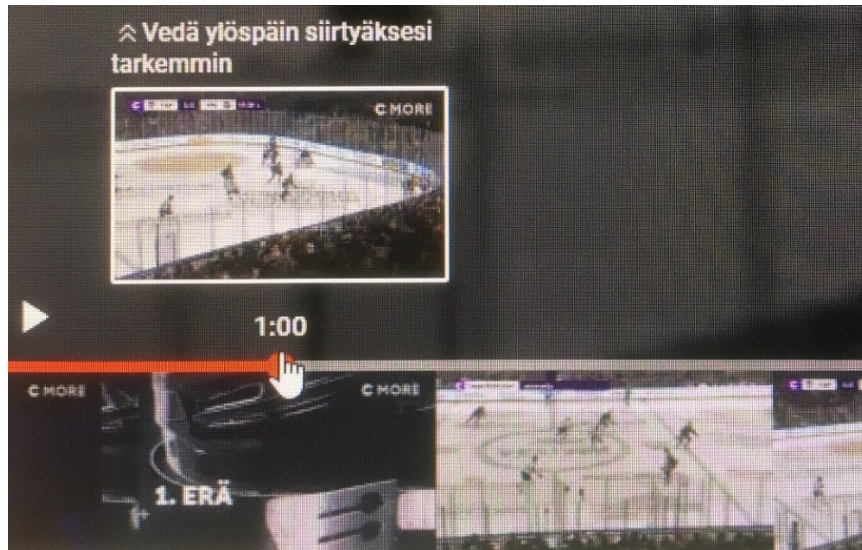


Figure 7: Benchmarking Youtube

(YouTube 2022).

Figure 8 shows the timeline of Veikkaus. There is no possibility to move in timeline. Timeline is visual and it has statistics and symbols of events.

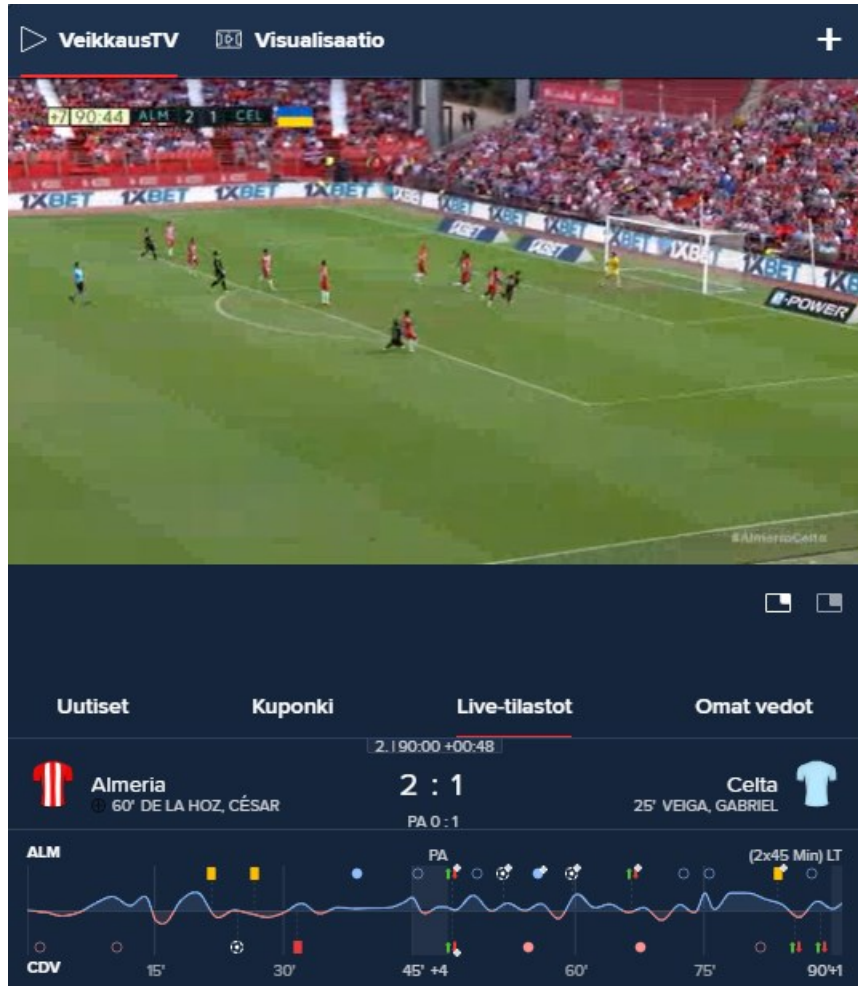


Figure 8: Benchmarking Veikkaus 1

(Veikkaus 2022).

Figure 9 shows other features of Veikkaus. Veikkaus has a visualization in addition to live stream. Statistics, line-ups, timeline as a text format and a league table are also available.



Figure 9: Benchmarking Veikkaus 2

(Veikkaus 2022).

The Benchmarking gave a good picture of implementations of timeline. The implementation of Veikkaus was clearly the most versatile and its timeline was the most interesting from our point of view. The use of symbols in the timeline to mark events was highly illustrative. Netflix and YouTube had implemented livestream management best: you were able to see the desired moment as a picture in picture by pointing the timeline. Netflix had also an option to choose playback speed and this is a good feature.

The best solution would be to combine the solutions of Veikkaus, Netflix and YouTube. The timeline should be visual, and it should show the most important events with symbols. Marking your own timestamps to timeline was not possible in any of services. Showing the time of event and the possibility to see the desired moment as a picture in picture and to choose the playback speed are important features. Statistics can be displayed in very many ways and the implementation of Veikkaus was very good.

### 5.3 Survey

Survey is a method of empirical, quantitative research (Heikkilä 2014, 13). Quantitative research answers questions such as "what", "where", "how many" and "how often". Sample is numerically large and representative. Data is typically collected using questionnaire and it can be treated by statistical methods. (Heikkilä 2014, 15.) Self-administered query is a survey which is done without a subsidy of interviewer (Andres 2012, 47).

The advantages of self-administered surveys are that they allow to collect a large amount of data and a large number of people can be asked many things. The self-administered query is a fast, efficient, and often affordable method. (Ojasalo et al. 2015, 121.) Respondents answer usually at their convenience and therefore the responses may be thoughtful and reflective (Andres 2012, 47). One of the advantages of self-administered surveys is also that the answers can be classified unambiguously if the questionnaire is done properly. The main disadvantages of self-administered query are that responses can be inaccurate, misunderstandings are possible and there is not always chance of knowing who has responded (Heikkilä 2014, 18).

It is important in developing a questionnaire that the research problem is clearly defined. Developing and evaluating questions are the central tasks in questionnaire design. Questions must be evaluated to determine that they meet demands of the study. (Hair, Wolfinbarger Celsi, Money, Samouel & Page 2011, 252.)

Ethics must be taken into account when constructing the questionnaire. The order of questions shall not be manipulated and there shall be no leading questions. The samples must be chosen in such a way that they do not aim at the desired result. (Nardi 2006, 101.)

Andres (2012, 66-68) lists four principles for questionnaire design: questions should be designed so that it is possible to answer them and the results are meaningful, each question should concern only one thing, words should be chosen carefully and answer instructions should be provided. Likert scale is one of the most commonly used measurement scale in business research. It is used to measure attitudes or opinions and it has typically five to seven points which indicate respondents' strength of opinion to the statement or question asked. (Hair et al. 2011, 221-222.)

We chose query as a research method because it was the only method by which we can collect a large amount of data in a short period of time from the possible users and features of the application. The query was conducted with Google Forms as a questionnaire (Appendix 1) and the distribution channels were WhatsApp, SMS, and email. The query was opened sprint week Tuesday at 6pm and it was closed Thursday at 12am. Because the survey was open only a short period it had to be as short as possible in duration.

We indicated in the inlet the survey authors, purpose, duration of the survey and that the survey does not collect personal data. We estimate the response time of approximately two minutes. The query had a total of 12 questions. First asked the respondent's age, gender, and number of visits to sporting events in arenas. It was then asked using the five-tier Likert scale how an interested respondent would be to use feature presented in each question. The extremes of the scale were *I don't like the idea* and *the idea is excellent*. Finally, respondents were asked the preferred ways of controlling TV of VIP-box and an open question where the respondent was allowed to show their own suggestions or ideas on the subject. 68 people responded to the survey.

#### Question 1: Age.

The respondents were aged between 18 and 64. The age distribution was extensive, but of note is the under-representation of 25 - 40-year-olds which can indicate the fact that the target population is not correctly selected.

Ikä

68 vastausta

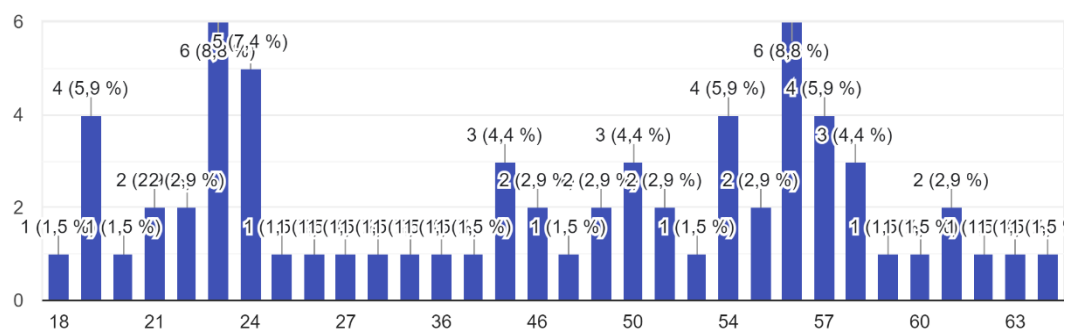


Figure 10: Query Question 1

### Question 2: Gender.

61.8 % of respondents were male and 38.2 % of respondents were female.

#### Sukupuoli

68 vastausta

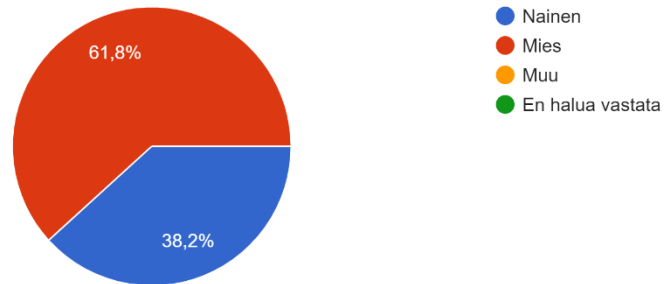


Figure 11: Query Question 2

### Question 3: How often do you go to sporting events in arenas?

22.1 % of respondents visit arenas once a month or more often and 22.1 % of respondents visit arenas every few months. 25 % of respondents visit arenas once a year or less often and 27.9 % of respondents rarely or not attend sporting events.

Kuinka usein käyt urheilutapahtumissa areenoilla (esimerkiksi jäähalleissa)?

68 vastausta

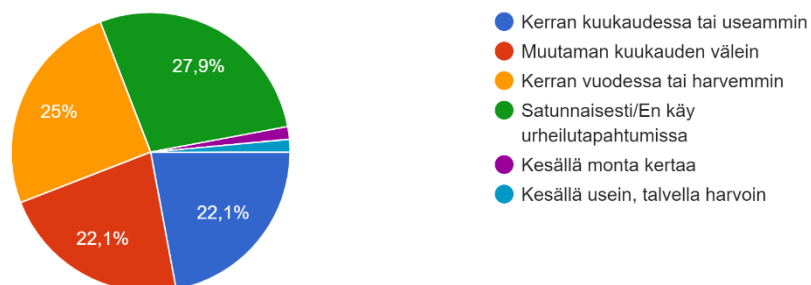


Figure 12: Query Question 3

The following questions were answered using the Likert scale where the response options 1 and 2 were *I don't like the idea*, option 4 was *The idea is good* and option 5 was *The idea is excellent*:

	1	2	3	4	5	
En pidä ideasta	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Idea on erinomainen

Figure 13: Query Likert Scale

Question 4: You can see the desired angle of view on your device.  
75 % of respondents considered this as a good or excellent idea.  
This was the third most liked idea.

Näet laitteeltasi haluamasi kuvakulman.

68 vastausta

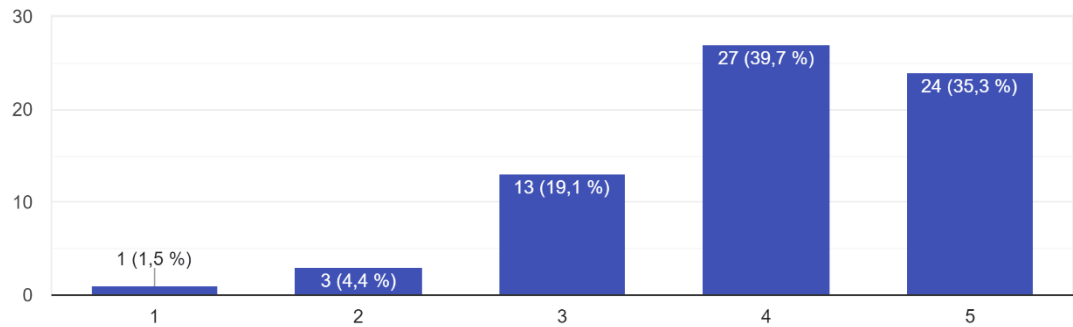


Figure 14: Query Question 4

Question 5: You can see multiple angles of view on your device at the same time.  
44.1 % of respondents considered this as a good or excellent idea.  
There is, however, a large dispersion of answers.

Näet laitteeltasi samanaikaisesti useita kuvakulmia.

68 vastausta

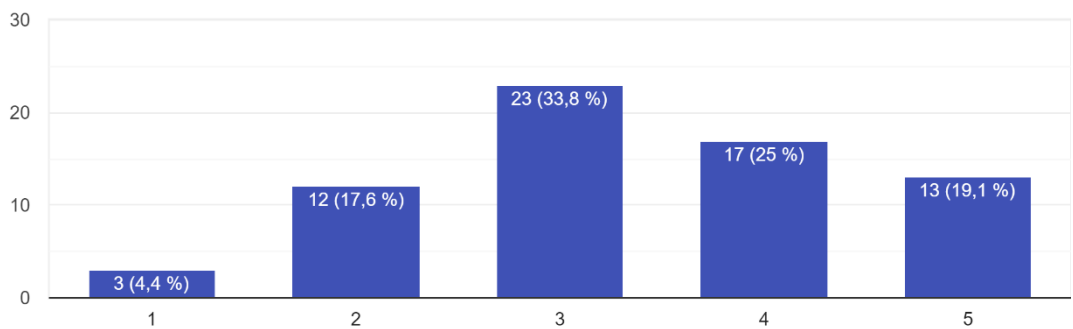


Figure 15: Query Question 5



Question 6: You can rewind the event timeline and watch replays and slow motions.  
88.2 % of respondents considered this as a good or excellent idea.  
This was the most liked idea.

Voit kelata tapahtuman aikajanaa taaksepäin ja katsoa uudelleen kohokohtia/hidastuksia (esimerkiksi maalintekopaikat).

68 vastausta

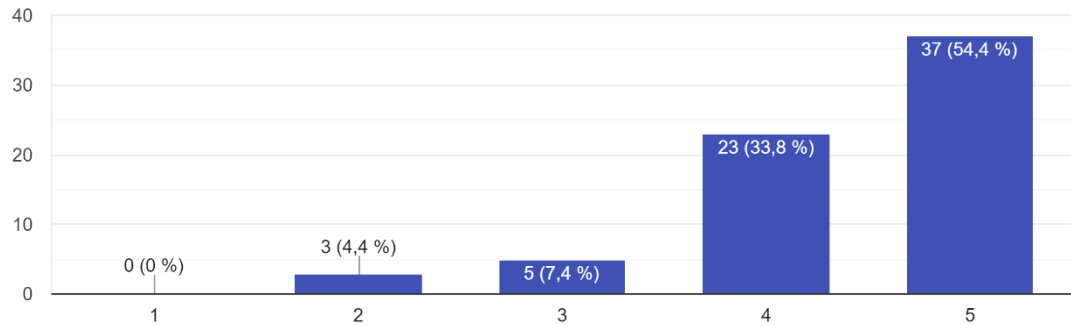


Figure 16: Query Question 6

Question 7: Highlights are marked in the timeline, and you can add your own timestamps.  
69.1 % of respondents considered this as a good or excellent idea.  
Timestamps of timeline was only the fourth most liked idea, but a clear majority of respondents liked it.

Kohokohdat merkitty aikajanaan ja/tai voit lisätä aikajanaan omia aikaleimojasi.

68 vastausta

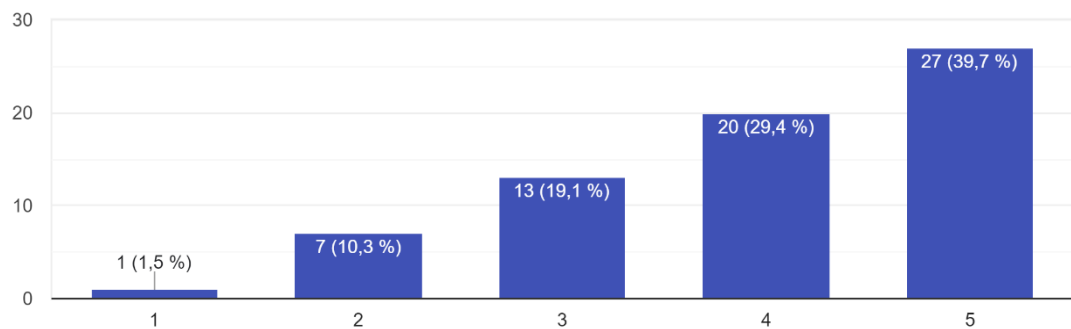


Figure 17: Query Question 7

Question 8: You can take part in the chat and share pictures/videos with other viewers.

39.7 % of respondents did not like the idea.

32.3 % of respondents considered this as a good or excellent idea.

Participating chat and sharing of pictures was the least liked idea, but the dispersion of answers was large.

Voit keskustella chatissa ja jakaa kuvia/videoita muiden katsojien kanssa.

68 vastausta

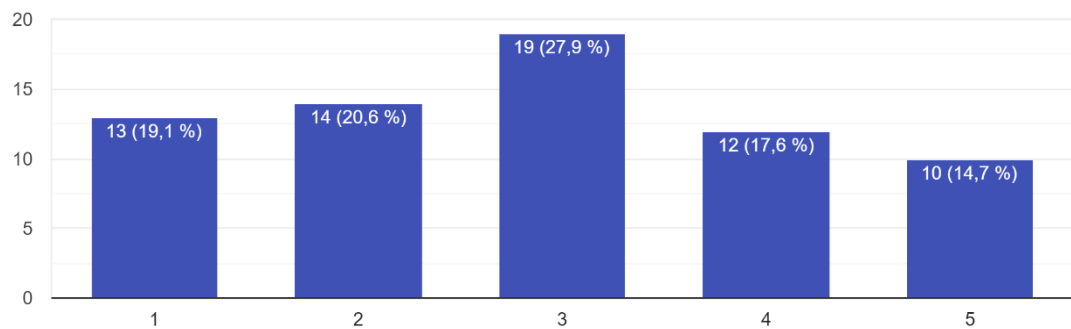


Figure 18: Query Question 8

Question 9: You will receive a compilation of match highlights after the event.

76.5 % of respondents considered this as a good or excellent idea.

Compilation of match highlights was the second most liked idea.

Saat tapahtuman jälkeen koosteen ottelun kohokohdista.

68 vastausta

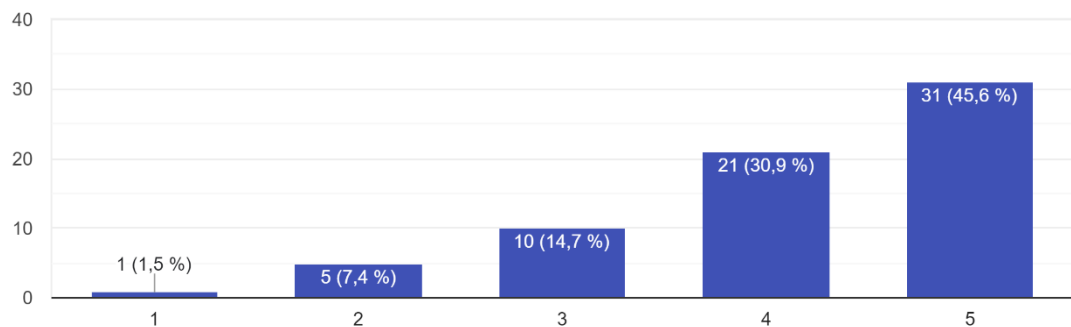


Figure 19: Query Question 9

Question 10: After the event, you will receive a compilation of the pictures and footage shared by viewers. 35.3 % of respondents considered this as a good or excellent idea. 29.4 % of respondents did not like the idea. Compilation of the pictures and footage shared by viewers shared opinions, like question 8, chat participation, and the dispersion of answers was large.

Saat tapahtuman jälkeen koosteen yleisön jakamasta kuva-/videomateriaalista.  
68 vastausta

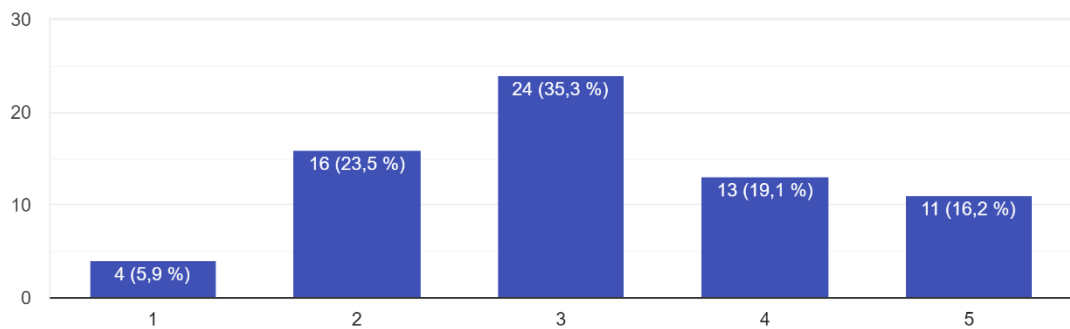


Figure 20: Query Question 10

From the point of view of research, the most important group are the respondents who frequently visit arenas (question 3). These 44.2 % of respondents are the most potential users of the application. The most liked ideas were the possibility to rewind the event timeline and watch replays and slow motions (question 5, 88.2 % of respondents), compilation of match highlights after the event (question 10, 76.5 % of respondents) and the possibility to choose the desired angle of view (question 4, 75 % of respondents).

Question 4, multiple angles of view, shared opinions. Frequent visitors' responses to the question were: 45 % (options 4 and 5) thought multiple angles of view was a good or excellent idea and 21 % of frequent visitors (options 1 and 2) did not like the idea as shown in figure 21.

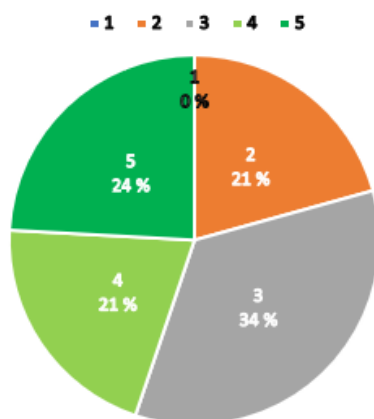


Figure 21: Frequent Visitors and Multiple Angles of View

Question 8, chat participation, shared opinions most clearly. Frequent visitors' responses to the question were: 41 % of frequent visitors (options 1 and 2) did not like the idea of chat and 28 % (options 4 and 5) thought it was a good or excellent idea as shown in figure 22.

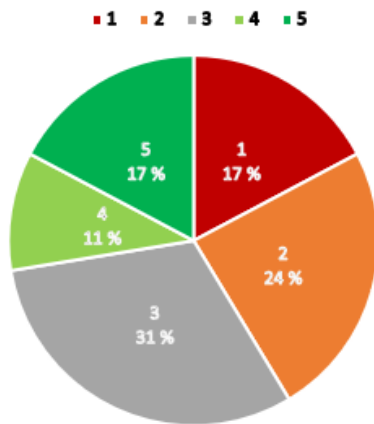


Figure 22: Frequent Visitors and Chat

Question 10, receiving a compilation of the pictures and footage shared by viewers, shared opinions too. Frequent visitors' responses to the question were: 45 % (options 4 and 5) thought this was a good or excellent idea and 24 % of frequent visitors (options 1 and 2) did not like the idea as shown in figure 23.

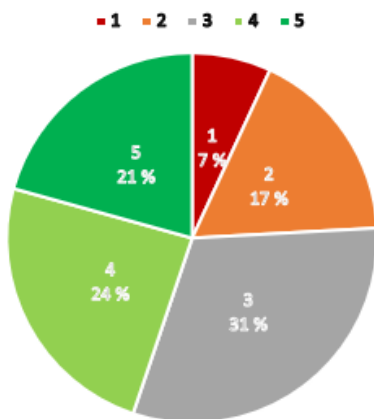


Figure 23: Frequent Visitors and a Compilation of Pictures and Footage

Based on the survey, the application should have a timeline with timestamps and the possibility to rewind the event timeline and watch replays and slow motions, to have compilation of match highlights after the event and to choose the desired angle of view. A significant part of frequent visitors considered multiple camera angles, chat and a compilation of the pictures and footage shared by viewers to be good features, so including them as part of the application would be justified, but a more detailed study of these features would be necessary.

The Design Sprint method allows only a very short time to implement survey. The survey respondents liked most of the ideas we presented, but due to the lack of time the survey could not be targeted at the right population and therefore the results can only be considered indicative. For possible further development a new survey needs to be done for a correctly selected target population and the sample size must be sufficiently large.

## 6 Results

This chapter analyzes the results and discusses the proposed solutions. The prototype is presented in detail. The chapter also discusses the benefits for the client and the end user.

The goal of the development project was to develop and improve the customer viewing experience from the current to the future Nokia Arena. The planning and brainstorming of the development project started on the first day of the five-day Design Sprint workshop week. The task was to design and select a topic based on predefined topics and write a thesis for the partner company Nokia Corporation.

There were two different options: the Next Generation Stadium and Network-as-Code. We chose Next Generation Stadium as our topic. The choice of this topic led us to start developing the issue from the perspective of sporting events in particular.

### 6.1 Solution Prototype

The service we developed to improve arena visitors' experience is an application. The functionality we decided to build a prototype for could be part of an application offering other features and services related to Nokia Arena. It could also be made into a standalone application.

The focus of our solution and prototype was on options to customize and select video footage from different camera angles at the arena. This includes both live video feed and the ability to rewind footage to watch replays prior moments. Another service element we included in the prototype was live chat. Based on our own discussion as well as feedback from Nokia, this is a feature with great potential. Our survey, however, showed mixed feelings about the feature. Therefore, we focused on the universally liked video manipulation elements.

The number of features available to the user is tied to their ticket or season pass used to access the event. The user gives their phone number upon purchase of the ticket, and upon entering the arena, the network validates the user's device based on it. VIP-customers would gain access to all features of the service. They could also have devices in VIP-boxes with the service installed and ready to use. Having an exclusive chat based on the tier of the user's

ticket is also possible. Users with basic tickets could have limited access to the features, for example limited ability to view multiple camera angles at once. The service access could also be sold separately if, for example, a visitor with a basic ticket changes their mind at the event and wants access to a certain feature. Figure 24 shows possible differences in features for full and limited access users.

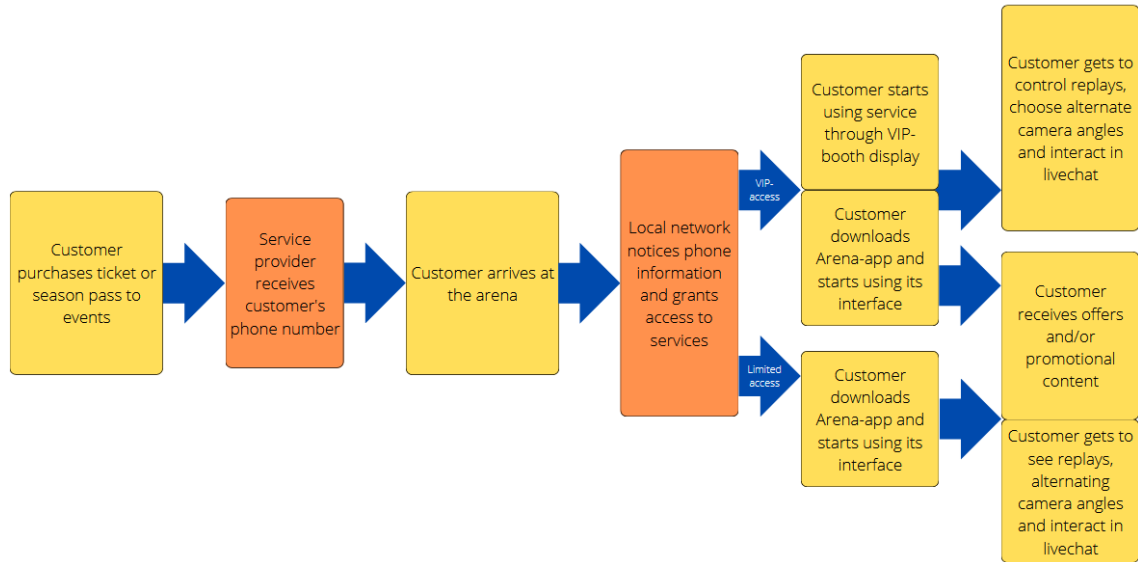


Figure 24: Service Activity Diagram

### 6.1.1 Feature Selection

Here are examples of how the user could choose different camera angles. The simplest solution would be a grid pattern selection screen shown in figure 25, where the user sees several available camera angles at once. Depending on the number of options available, they could be shown either on a single screen or divided to multiple pages. The different camera angles are identified by the name of the camera, such as CAM 1 or GOAL 1, and a preview of the footage available from that angle. Similar grid pattern screens could be used to select other features, such as live chat or statistics as well.

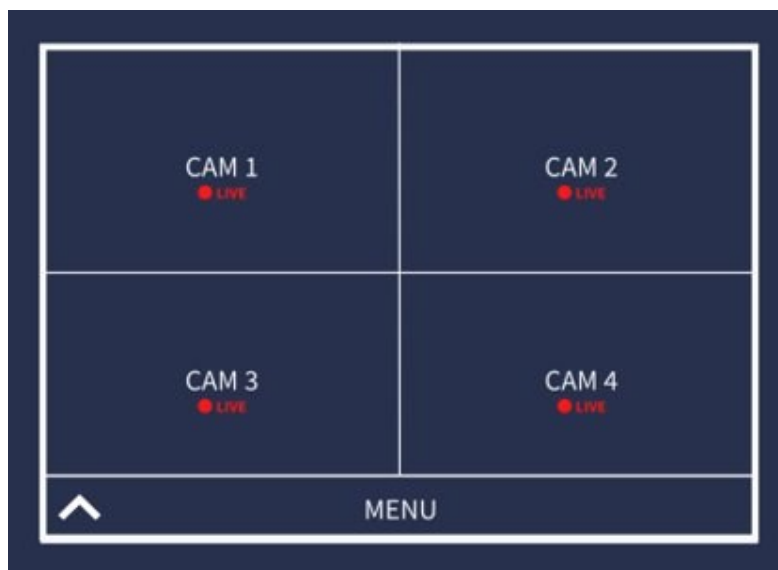


Figure 25: Grid Pattern Camera Selection

However, this solution has its own challenges. Displaying live feed from multiple, or even all available camera angles at once, requires a rather heavy use of the local network. Network-as-Code could be utilized here, to limit data transfer amounts by optimizing the resolution of each video feed. Showing multiple camera angles at once in a grid pattern can become quite confusing to the user as well.

An alternative selection screen we created to solve the issues of complicated selection screens and heavy network requirements is a map version. In figure 26 available camera angles are displayed as points on a map of the arena. This solves the issue of having to stream multiple live video feeds at once as well as being more clear about where each camera is recording from. With 5G-technology the user can also be located accurately in the arena, to show their location in relation to the cameras, to help the user choose camera angles not already available to them from their seat.

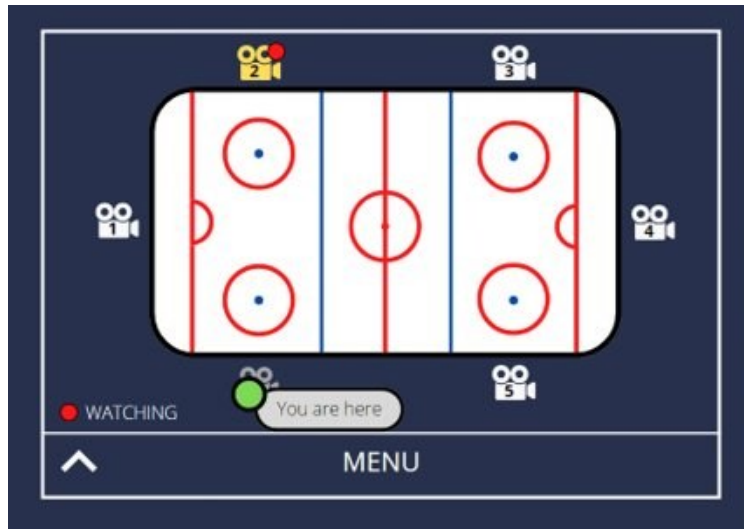


Figure 26: Map Camera Selection

Figure 27 is an example of the contents of the menu bar apparent in other prototype images. When pulled up, it reveals buttons to navigate between feature selection screens and other important elements, such as settings. It can also display the users level of access to features.



Figure 27: Expanded Menu Screen

In the example, the user has VIP-access. We used a pull-up menu in our prototype to make it user friendly for mobile users, as that is a key audience for our service.



### 6.1.2 Feature Use

After a desired camera angle has been selected, the user moves to a proper viewing screen. Here the user sees their preferred camera angle in full screen with other alternate camera angles and elements they've chosen in smaller boxes. The following images are examples of what these proper viewing screens could look like in use.

In figure 28 the user is watching live footage of the event from camera 2. They have also chosen to view and possibly participate in the event's live chat. This is a fairly simple way to use the service; the user requires access to a single camera feed and live chat. This doesn't create too heavy network loads, nor does it require much oversight or work from the users end.

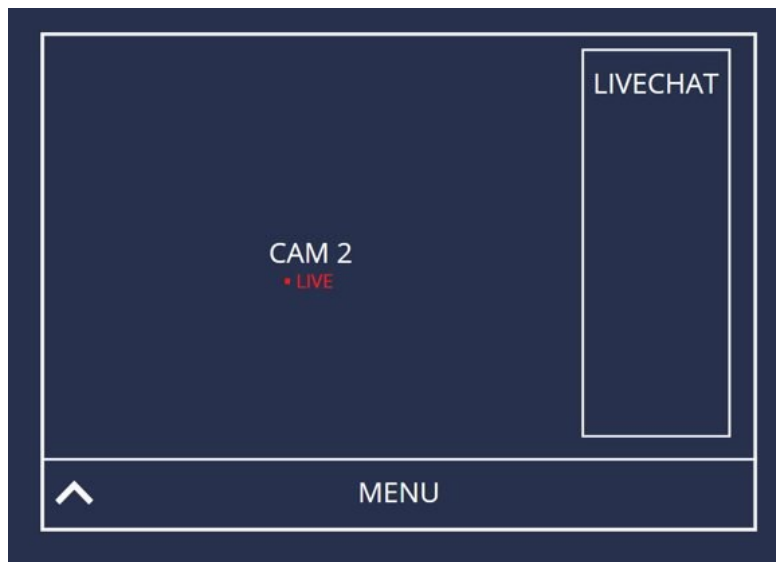


Figure 28: Simple Viewing Screen

Figure 29 is another use case for our service. This user is watching past footage from camera 1. They have also selected another camera angle, statistics screen and livechat to watch or swap to the full screen.

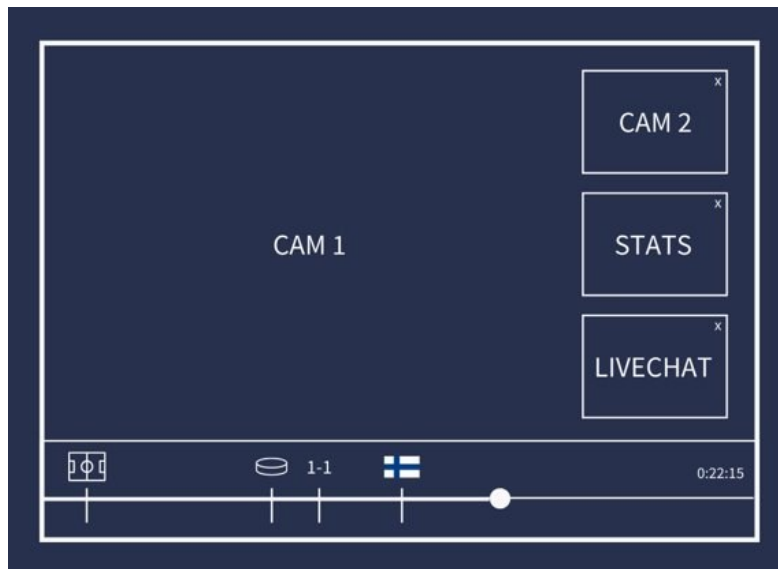


Figure 29: Viewing Screen with Timeline

This use case is more complicated and demanding than the previous one. The user could require multiple streamed video feeds at once as well as access to multiple other elements. The event also needs to be recorded and the recording should be available for streaming straight away. With multiple cameras recording at once, this can be an intensive task for on-site servers.

Figure 29 also highlights the timeline functions. The user select a point in any past moment of the event to watch again. This is made easier by having time stamps of important moments being shown. In this example of an ice hockey match, the starting point and scored goals are examples of such time stamps. Clear and easy to use timeline is a valuable part of the service, as it was seen as a great feature in our survey.

The live chat element could be used to increase user engagement. Users can chat with each other and share pictures and video they've taken at the event. They can choose their own usernames, making anonymity also an option. This helps reduce the barrier to entry for users, who don't want to share personal details with strangers. Chat could also be used to share timestamps to share certain highlights or replays with others.



Figure 30: Live Chat Element

Another option to make use of the chat is to use it for interactions between customers and arena services. Sponsored content can be offered through the chat. For example, arena restaurants can offer coupons or raffles could be organized.

## 6.2 Summary of Results

In the survey, we wanted to find out the interest of viewers at sporting events to control video footage and information about the event, and to discuss and share media with other spectators. We received 68 responses to the survey in one day from people of different age groups. The age range of responses was 18-64 years old. The majority of respondents to the survey were men.

The first thing we wanted to find out from our respondents was how often they attend sporting events in arenas in general. The dispersion was large between the four different response options. Some respondents go to arenas once a month or more, others occasionally or not at all. The remainder fell somewhere between the two, i.e. every few months or once a year.

Next, we asked about interest in managing devices and socializing via live chat with other event viewers. Most people want to decide the angle from which they want to watch the event. In addition, the ability to view multiple angles simultaneously was also popular and

supported. However, the most popular question was about re-watching certain moments or slow-motion sequences afterwards, such as goal-scoring sequences. This was one of the most popular questions in our survey. To control different camera angles and slow motion are clearly much needed.

Live chat was a divisive feature. From our limited data, we cannot make any conclusions about its popularity in a wider sample. Investing in it as a major feature could be risky but could also great value to the end user.

Due to the small sample size of survey results, it is not possible to draw conclusions from the data. The results suggest that with minor modifications, this app for event arenas would be in demand and would see use. However, more data is required to make this a definite statement

At this point, it is good to think again about which features are important to have in the app and what could still be improved. Based on the results, there is a desire to be able to adjust the camera control, but live chat could be reconsidered. It would be good to introduce live chat, considering the benefits for the client, but it should be further developed to ensure that there is more demand for it from customers, i.e. users of the app.

### 6.3 Relevance and Benefits for the Client and the End User

The results are very important for the client, as the survey allows them to see what users like and dislike. Our product was developed with all factors involved in mind. The parties involved in our development were the client and the end user. Our product is of great importance to both parties.

Through implementation of our service or parts of it, Nokia Arena will become even more modern than before. To our knowledge, through results from benchmarking, nothing like our product has been developed or implemented elsewhere. This would put Nokia Arena at the forefront of development regarding stadium experiences.

The app-service could be used to offer deals and services to customers, enabling additional revenue from marketing. Interactions with customers can also be made memorable. This would increase customer retention and offer additional advertisement by word of mouth.

A visitor to Nokia Arena would gain access to a viewing experience unlike anywhere else. As our survey highlighted interest in various features of our app, their viewing experience will be greatly improved by the app's implementation. Not only does it give the user the ability to see perspectives they couldn't see before, but they can also watch those later in slow motion.

Live chat making interactions between sports fans possible is a memorable feature not regularly found at events. A sense of community or rivalry is a value that many sports fans hold in high regard. Competitions, predictions, and raffles arranged through chat can be exciting, bringing additional enjoyment and potentially, prizes. It can also serve as a way for the customer to save money.

## 7 Conclusions and Future Development

The purpose of this thesis was to create or improve a service in collaboration with Nokia. For our development goal, we chose to improve the customer viewing experience in sporting events at Nokia Arena. We achieved this goal by developing a prototype for an application, which has features designed to improve that experience.

We made several key observations during research and development. During benchmarking, we discovered that similar applications for sporting events that we had in mind didn't exist yet. We also received very positive feedback for the features we were designing from our survey, suggesting the application would have demand. In particular, the timeline feature and the ability to pick and choose replays to watch were received well. Live chat feature received mixed feedback, from being undesirable to extremely desirable. Which target groups this feature is or isn't desirable for should be further researched.

Due to time constraints and our limited expertise in certain topics, we were unable to develop and research our app fully. When designing our app and creating the prototypes, we focused on usability from the users end and not too much from the service provider's end. We brushed over some technical requirements and broadcasting rights, but those need more thought if one wishes to actualize the service.

Also, our survey was limited in its scope. As we only had a day or two to collect data, we couldn't get enough participants to fully validate our concept. We did get enough answers to get a feeling for if we were on the right track for development at all, but more data is required.

During our design sprint we came up with possible features for our app which we delimited due to lack of time. They also weren't key features required for our app to function. Notable one would be 360-degree slow-motion cameras to watch replays from. This would further increase the technological difficulty of implementing our ideas. Another idea would be to provide a compilation or recap of the event to the viewers afterwards. We did see some interest in this idea from our survey, but we ultimately decided to focus on improving viewing experience during the event.

Since our service idea is mostly built with it being an app in mind, it could be feasibly extended to be used from home. It could in some instances have even more value when used outside the arena, as the selection of camera angles and especially interactions with other viewers can be lacking. However, this would introduce additional complications regarding network solutions and broadcasting rights.

Overall, our survey respondents were very receptive of our ideas. There is great potential in our application to improve viewing experience and provide value to all parties involved in its implementation. We believe this case study showed great opportunities for further development of these ideas.

## References

### Printed

Andres, L. 2012. Designing & Doing Survey Research. SAGE Publications.

Hair, J., Wolfinbarger Celsi, M., Money, A., Samouel, P. & Page, M. 2011. Essentials of Business Research Methods. 2nd edition. New York: M.E. Sharpe.

Nardi, P. 2006. Doing Survey Research. A Guide to Quantative Methods. 2nd edition. Pearson Education.

### Electronic

Adler, I. 2018. Networking As Code. Cloudify. Accessed 29 October 2022.

<https://cloudify.co/blog/networking-as-code/>

Burgus, D. 2014. The Myths of Creativity. E-book. San Francisco: Jossey-Bass.

Ghosh, A. & Keating, R. 2021. 5G will open new possibilities in positioning. Nokia Bell Labs.

Accessed 29 October 2022. <https://www.bell-labs.com/institute/blog/5g-will-open-new-possibilities-positioning/>

Heikkilä, T. 2014. Tilastollinen tutkimus. E-book. Helsinki: Edita Publishing.

Heinolainen, M. 2020. Mikä on Design Sprint? Lamia. Accessed 22 October 2022.

<https://lamia.fi/blogi/mika-on-design-sprint>

Kanava 2022. Mikä ihmeen Design Sprint? Accessed 22 October 2022. <https://kanava.to/mika-ihmeen-design-sprint/>

Netflix 2022. Accessed 29 October 2022.

Niva, M. & Tuominen, K. 2021. Benchmarking käytännössä. Itsearviointin työkirja. E-book. Benchmarking.

Nokia 2022a. Worldwide presence. Accessed 22 October 2022.

<https://www.nokia.com/about-us/company/worldwide-presence/>

Nokia 2022b. Historiamme. Accessed 7 November 2022. [https://www.nokia.com/fi\\_fi/about-us/company/historiamme/](https://www.nokia.com/fi_fi/about-us/company/historiamme/)

Nokia 2022c. Yritys. Accessed 22 October 2022. [https://www.nokia.com/fi\\_fi/tietoa-nokiasta/yritys/](https://www.nokia.com/fi_fi/tietoa-nokiasta/yritys/)

Nokia Arena 2022. Tietoa areenasta. Accessed 29 October 2022.

<https://nokiaarena.fi/info/tietoa-areenasta/>

Ojasalo, K., Moilanen, T. & Ritalahti, J. 2015. Kehittämistyön menetelmät. Uudenlaista osaamista liike-elämään. 3rd-4th edition. E-book. Helsinki: Sanoma Pro.

Olisa Agbakoba Legal 2021. Understanding Commercial and Media Broadcasting Rights in Sports. Lexology. Accessed 3.11.2022.

<https://www.lexology.com/library/detail.aspx?g=7c333e57-e419-472a-a6f9-98136a3578af>

Röyhy, J. 2022. Maksimoi sovelluskehityksen hyödyt design sprintin avulla. Fellowmind.

Accessed 22 October 2022. <https://www.fellowmindcompany.com/fi->

[ajankohtaista/maksimoi-sovelluskehityksen-hyodyt-design-sprintin-avulla/](https://www.fellowmindcompany.com/fi-ajankohtaista/maksimoi-sovelluskehityksen-hyodyt-design-sprintin-avulla/)

Sajari, P. 2022. Nokian liikevoitto liki 100 miljoonaa euroa arvioitua suurempi - osake kohosi yhdeksän prosenttia viiteen euroon. Helsingin Sanomat. Accessed 22 October 2022.

<https://www.hs.fi/talous/art-2000008957934.html>

Seppälä, A. 2020. 5G vs. 4G - mikä muuttuu? Telia. Accessed 29 October 2022.

<https://www.telia.fi/yrityksille/artikkelit/artikkeli/5g-vs-4g>

Surakka, S. 2021. Design Sprint, osa 3: Prosessi tukee fasilitoijaa Design Sprintin haasteissa.

Insta. Accessed 22 October 2022. [https://www.insta.fi/asiantuntijablogi/design-sprint-osa-3-](https://www.insta.fi/asiantuntijablogi/design-sprint-osa-3-prosessi-tukee-fasilitoijaa-design-sprintin-haasteissa)

[prosessi-tukee-fasilitoijaa-design-sprintin-haasteissa](https://www.insta.fi/asiantuntijablogi/design-sprint-osa-3-prosessi-tukee-fasilitoijaa-design-sprintin-haasteissa)

Turku, J. 2021. Mitä fasilitointi on? Ideapakka. Accessed 22 October 2022.

<https://ideapakka.fi/blogi/mita-fasilitointi-on/>

Tuulaniemi, J. 2011. Palvelumuotoilu. 4th edition. E-book. Talentum Media.

Veikkaus 2022. Accessed 29 October 2022.

Watts, S. 2022. Network as Code Explained: How Ansible & Automation Support Agile Infrastructure. Splunk. Accessed 29 October 2022.

[https://www.splunk.com/en\\_us/blog/learn/network-as-code.html](https://www.splunk.com/en_us/blog/learn/network-as-code.html)

WePlay Esports 2021. Broadcasting Rights: what are them and how do they work. Accessed

3.11.2022. [https://weplayholding.com/blog/broadcasting-rights-what-are-them-and-how-do-](https://weplayholding.com/blog/broadcasting-rights-what-are-them-and-how-do-they-work/)

[they-work/](https://weplayholding.com/blog/broadcasting-rights-what-are-them-and-how-do-they-work/)

YouTube 2022. Accessed 29 October 2022.



## Figures

Figure 1: Design Sprint in a Nutshell .....	6
Figure 2: Thesis Sprint Steps .....	8
Figure 3: Phases of Research-based Development .....	14
Figure 4: Phases of Our Development Process.....	15
Figure 5: Steps of Benchmarking .....	16
Figure 6: Benchmarking Netflix.....	17
Figure 7: Benchmarking Youtube .....	18
Figure 8: Benchmarking Veikkaus 1 .....	19
Figure 9: Benchmarking Veikkaus 2 .....	20
Figure 10: Query Question 1 .....	22
Figure 11: Query Question 2 .....	23
Figure 12: Query Question 3 .....	23
Figure 13: Query Likert Scale .....	23
Figure 14: Query Question 4 .....	24
Figure 15: Query Question 5 .....	24
Figure 16: Query Question 6 .....	25
Figure 17: Query Question 7 .....	25
Figure 18: Query Question 8 .....	26
Figure 19: Query Question 9 .....	26
Figure 20: Query Question 10 .....	27
Figure 21: Frequent Visitors and Multiple Angles of View .....	27
Figure 22: Frequent Visitors and Chat .....	28
Figure 23: Frequent Visitors and a Compilation of Pictures and Footage .....	28
Figure 24: Service Activity Diagram.....	30
Figure 25: Grid Pattern Camera Selection .....	31
Figure 26: Map Camera Selection .....	32
Figure 27: Expanded Menu Screen .....	32
Figure 28: Simple Viewing Screen .....	33
Figure 29: Viewing Screen with Timeline .....	34
Figure 30: Live Chat Element .....	35

Appendices

Appendix 1: Survey Questionnaire ..... 43





Jos aitiossa on televisioruutu, josta voi käyttää edellä mainittuja ominaisuuksia, mitä tapaa \*  
haluaisit käyttää sen ohjaamiseen? Voit valita useamman vaihtoehdon.

- Kaukosäädintä
- Aition omaa tablettitietokonetta
- Televisioruudun kosketusnäyttöä
- Omaa mobiililaitetta
- En käyttäisi aition ruutua
- Muu...

Onko teillä muita ehdotuksia/ajatuksia aiheesta?

Pitkä vastausteksti

---