

Aalto University - Department of Communications and Networking

ELEC-E7830 Value Network Design for Internet Services

Telia Smart Home

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Abstract

This report examines the smart home business in Finland in the next 4 years (2017-2021). The analysis is presented with different methods: the scenario analysis, value network configuration(VNC) and the STOF-model. We identify the key trends of data analytics, cloud computing and IoT and the key uncertainties of competition and smart home hub ownership. We showcase four different possible VNCs of the smart home market. Lastly, we use the STOF-model to describe the smart home case from a service, technological, organisational and financial aspects and identify the CDIs and CSFs of the case. As a conclusion of our analysis, we recommend Telia to be extremely careful while entering the smart home market as no “silver bullet” exists and the demand of smart homes has to go up naturally.

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1. Introduction

According to the leading futurists and visionists, the homes of the 2020 will be highly automatized and computerized. The temperature is automatically chosen to be perfect by the smart thermostat, the water and electricity consumptions are logged and analyzed and a watchful cameras and proximity sensors make the house extra secure.

The current megatrend is that every aspect of our lives are going digital and mobile, but the place where we spend most of our time, our homes, have not yet caught on with the progress. Why is that and when is the modern smart home ready for the ordinary consumer? The technology is already there, but where is the market?

Most of the consumers are excited intellectually by the smart home concept, but the current smart home solutions don't seem to provide enough value to get over the adoption gap between the early innovators and the early majority. What are the key concepts and ideas that would allow the early majority to get interested and make way for the new smart home business?

This report tries to answer that question by analysing the smart home concept from the viewpoint of a telecommunications operator, Telia. We explore the concept using three different methods and summarize the key findings in the conclusion. First we describe each of the methods, characterize the Telia Smart Home case and finally end with the analysis and its summary with conclusions. The scope of the analysis is Finland with the time frame of next 4 years(2017-2021).

2. Methods

In this section of the report we are going to present a synopsis of the methods implemented in analysing the case company Telia. We used three different methods: Scenario analysis, Value Network Configuration analysis and the STOF Method. Scenario analysis (Schoemaker, 1995) helps to determine range of possible challenges and their recommended assumptions in great detail. Value Network Configuration analysis (Casey et al., 2010) helps to understand the value creation and value chain in an inter-organizational domain level. STOF Model (Bouwman et al., 2008) helps to assess the activity of a business plan using different business model domains. In the following sub-chapters each methods are described in detail. As a side note, we had a meeting and discussed with a company representative from Telia Sonera to get additional information about the company and the business market of the Smart Home Solutions .

2.1. Scenario planning analysis

Scenario planning is a disciplined method for imagining possible future that companies have implemented to various issues as part of a process for generating and evaluating strategic business forecasts. It also simplifies an array of data into a limited number of possible scenario states, in which each state can be formalized to maintain internal consistency and plausibility. It helps to capture a wide range of possibilities, making open for decision makers to consider changes knowing the correlation between possible trends and key uncertainties. (Schoemaker, 1995)

The process of developing scenarios method (Shoemaker, 1995) consists of ten steps of which the first five are the one implemented in this project. The first step is to set up time frame and scope analysis using PEST (Political, Economic, Social and Technological) factor analysis method. Time frame can depend on the political, geographic location, technological advancement and social awareness. Once appropriate time frame is defined the next step is to identify major stakeholders, the major stakeholders could be customers, suppliers, competitors, employers,

governments etc. The next two steps are identifying basic trends and key uncertainties. Trends are events which is likely going to happen with certainty. key uncertainties are events which are not certain and could probably affect the company case market. The main purpose of the key uncertainties are finding the two most uncertainties among the possible events and move to the next step of the constructing scenario planning. In the final stage of the constructing scenario planning, taking the two most key uncertainties that are found from previous step are used to form the scenario matrix.(Schoemaker, 1995). The scenario matrix quadrant is formed from the two most uncertainties and mapp them in the vertical and horizontal axis a total of 4 quadrants of the axis. The two most uncertainties are total independent to each other. Fig. 1 below illustrates the scenario matrix of Smura and Sorri (2009) shows access technologies and their providers when viewed in scenario matrix.

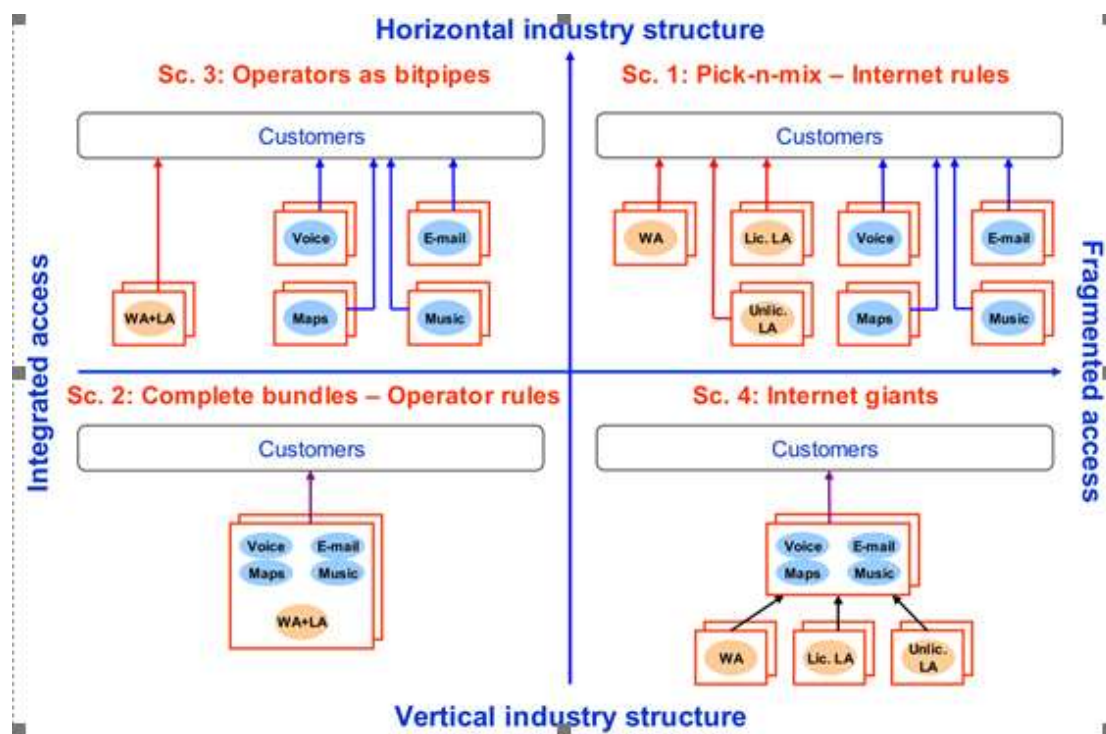


Figure 1. The scenario matrix (Smura and Sorri, 2009)

The scenario planning method is a crucial input to the next stages for Value Network Configuration(VNC) and STOF model.

2.2. Value Network Configurations

Value Network Configuration(VNC) is a concise way to present the relationships between the technological and business components and all the stakeholders of a business ecosystem. VNC can be seen as an expanded version of the value chain, in which all steps of value creation are mapped in a sequence. The main difference is that the VNC incorporates all stakeholders of the business ecosystem and such provides a vast look over the system as a whole. This value network has its technical components and roles which are static in the presentation and only the ownership of different components change by the actors(companies, users, non-profits etc.). Every actor of the network has to receive monetary/non-monetary value for the system to be sustainable and profitable in the long run. (Casey et al, 2010)

2.3. STOF Method

The idea of STOF model, according Bouwman et al, 2008 is to create business models using four basic domains: Service, Technology, Organization and Finance as shown in figure 2. The model evaluates and analyses whether the new business model is feasible and workable.

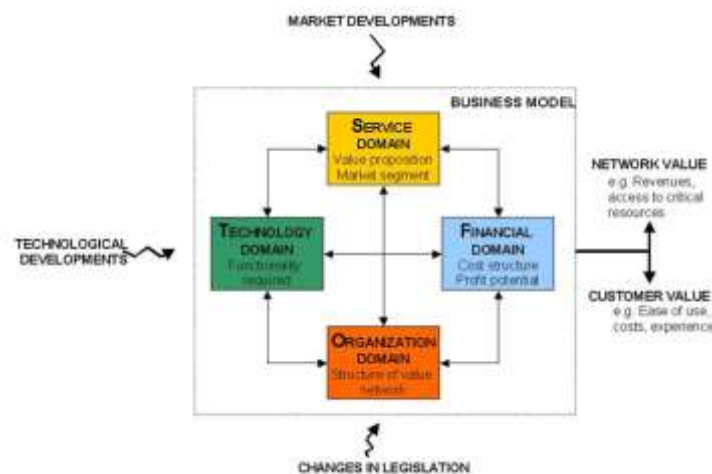


Figure 2: STOF business model (Bouwman et al, 2008)

Service domain mainly focuses on customer value of the product. It tries to answer

questions such as what kind of products or services are provided to the customer. It also identifies the target groups of the new business along with branding and enhancing end users' trust on the service.

Technology domain concentrates mainly on the type of technology used to implement the business model. This may include to security issues, quality of the service which has to be according the service level agreement (SLA) and accessibility issues.

Organizational domain analyses mainly on accessing critical resources and capabilities in order to offer the service. Network governance and complexity are the main issues of this domain.

Finance domain deals with the division and valuation of costs and revenues between network actors. It also focuses on investments and pricing issues.

STOF model helps to identify the weakness and strength of the new business model which would Cause the business to succeed or fail. It is very important to single out these issues at the early stages of the business so that it would be easier to respond to different challenges faced and react to the market at the right time. Evaluating the model using the STOF method includes four different steps as shown in figure 3 below:

- ❑ The Quick scan: provides the general overview of the STOF domains i.e., Service, Technology, Organization and finance domains of the case.
- ❑ Evaluation based on Critical Success Factor (CSF): forecasts whether the business model is feasible from the perspective of customer value and network value.
- ❑ Specification of Critical Design Issues (CDI): refines the initial business model based on critical design issues. These design issues are variables which are important to evaluate the feasibility and sustainability of the business model.

- ❑ Robustness check: deals with the ability to withstand changes in the business model and resist outside influences.

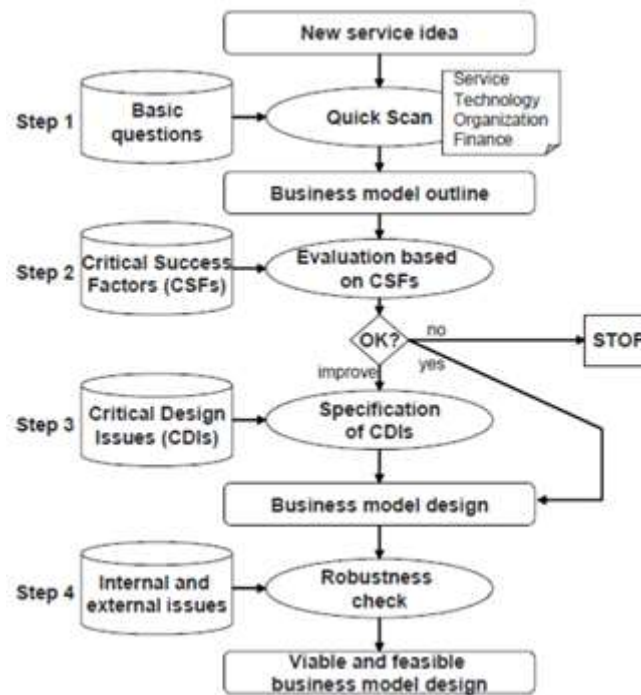


Figure 3: STOF method

3. Telia Smart Home Case

Telia (formerly Telia Sonera) is a telecommunications operator company with almost 30 000 employees worldwide with 10 000 people working in Sweden and 4500 in Finland. Telia's largest shareholder is the Swedish state with 37.3 % of the shares. Telia is offering modern operator services such as broadband internet, mobile subscriptions and TV entertainment for both the common and the business customers.

Current competitors in Finland include operator companies Elisa and DNA. The competitors have not yet launched smart home products. Globally, all of the biggest electronics manufacturers like Apple(Home), Google(Nest) and Samsung(Smart Things) are working on their own smart home products and have already released them. A previous failed smart home concept developed by Telia(then Sonera) was the Sonera Vahti. Sonera Vahti allowed the user to remotely monitor their home with a camera and to monitor their electricity consumption online. Vahti wasn't popular and it was shut down (old users can still use the service).

According to a study(GFK, 2015), where of 7000 consumers were interviewed in 2015, cost is the key barrier to smart home adoption followed by privacy concerns. Also, outlook of the smart home market(Statista, 2017) shows the current smart home penetration in Finland to be 2.6 % and is projected to be 33.8 % in 2021. United States is the current leader in smart home adoption followed by Germany in Europe.

Possible hurdle for the smart home concept could be the technical standards or more precisely the lack of established and agreed standards. The current smart home appliances and sensors use either Wifi, Zigbee, Bluetooth Low Energy or Z-Wave for their data transmission. The smart home devices from different manufacturers can't communicate with each other and as such lock the end user to one manufacturer's platform or to learn and manage multiple accounts and systems. One way to centralize the smart home concept is to provide a smart home hub, in which other devices could connect and transmit their data. This hub could be given for the end-user for free as part of the smart home subscription.

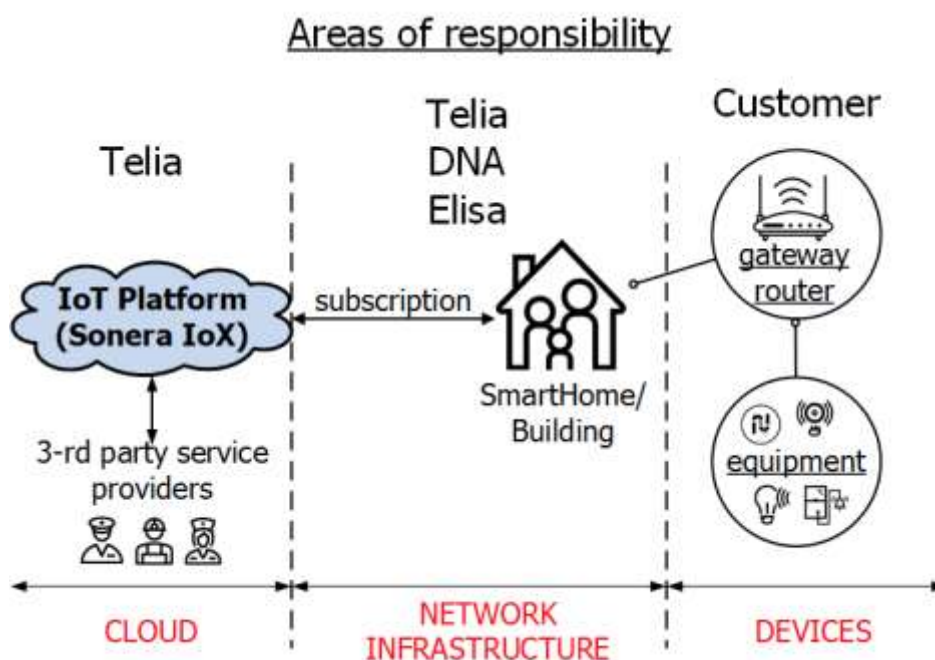


Figure 4. Smart home hub concept visualized, showing the the areas of responsibility for different actors.

The smart home hub concept would centralize the data collection and make it easily manageable and allow it to be analyzed properly. The hub could be the same device as the gateway router in the future. If the end-user would allow their personal data to be collected, the smart home service provider could sell it for a third party or the end-

user could gain lower prices from the third parties. The third parties could be for instance insurance companies or health care providers. For example, the end user could allow for their data to be used by an insurance company (data collected and stored in a Telia cloud), which in return would give a discount on house insurance for the end user.

4. Telia Smart Home Analysis

4.1 Scenario Analysis

In this section of the scenario analysis, we will look in more details to the company case scenario planning tools implemented. Nowadays as technology is advanced and change in lifestyle for example growth in digitalization, high access demand in internet(mobile) this changes daily activities of users. Smart sensors,actuators and cameras are connected to the internet. The time frame and scope analysis for Telia smart home solution is 4 years (2017 - 2021) which is bounded to geographic location to Nordic Countries, especially to Finland.The current political(government perspective) view towards IoT in Finland is encouraging, this brings favorable environment to implement smart home solutions.

Who will have an interest in the smart home solutions? Who will be affected by them? Who could influence them? the major stakeholders are competitors, sensor suppliers, data analyzers, customers and shareholders.

In the market point of view, the focus market area for smart home solutions is towards B2B and B2C side of the business model.The revenue is coming from subscribed customer and B2B side of the third party(data analyzers).

From technology point of view, smart home solutions uses internet technologies.

4.1.1. Key Trends

Customers want to have easy lifestyle and become more integrated to technology products. The key trends for the company case are as follows:-

- Industrial internet and IoT are a growing part of new businesses
- growing interest and market for Smart Homes
- Households want green energy and to lower overall energy consumption
- Mobile services and user data analysis create and expand business opportunities
- Growing interest in smart homes in USA and also in Europe

4.1.2. Key Uncertainties

Telia doesn't want to be only a connectivity provider, so its expanding business sectors since most of the company's revenue (smart home) depend on the subscription and selling data to third party (insurance companies), and loan or sell hubs. Early majority and early adopters should be taken care of by providing good offer, for example loaning the hub for 6 month free or other benefits. Smart home competition and hub ownership are the two most uncertainties.

What about introducing other competitors to finland (Google, Amazon or apple)?

Some of the key uncertainties are listed below:-

- U1 Large companies such as Google, Apple etc. could enter the market make the market more challenging
- U2 who owns the HUB
- U3 Economic situation of target customers may change(recession)
- U4 Political intervention for or against smart home services
- U5 People's perception could change unexpectedly e.g data privacy issues and acceptance of new service

What are customer concerns while using smart home solutions? Obviously cost or value provided , privacy and ease of use.

4.1.3. Construct Initial Scenarios

After refining the events from basic trends and key uncertainties, we have selected the two most important scenarios which are hub ownership and competition of smart home service providers. Fig. 4 below illustrates the scenario matrix of smart home solutions shows both the competition of smart home service providers and the hub ownership on their respective axis.

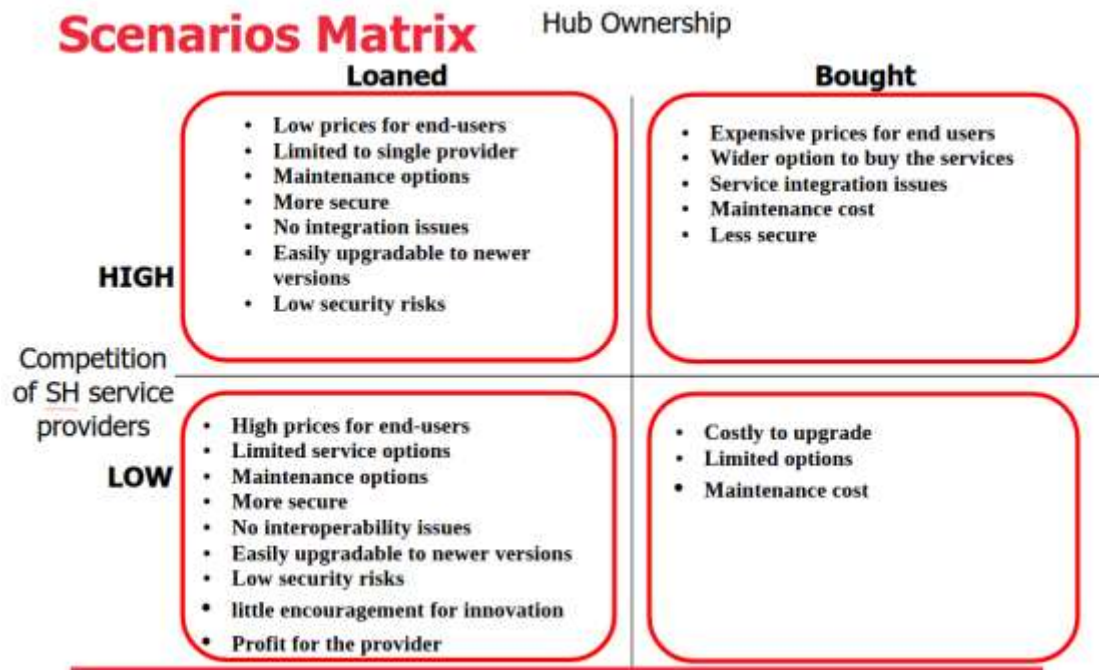


Figure 4. The Smart Home scenario matrix

4.2 Value Network Configuration

Taking into account the previously compiled matrix, the wishes of the company and our point of view, various combinations of VNCs were built. The process of creating VNC starts from outlining technical components, that build a core of business. We figured out next important components:

- Provider cloud equipment, where Smart Home service is running
- Network infrastructure
- House/building cable system
- Venue sensors and equipment
- “Smart Home Hub”
- End user equipment
- Computing machines of 3rd parties

By connecting them due technical interfaces we create a complete version of technical layout.

On the next step it's necessary to determine which of the stakeholders is responsible for which technical component. On business level different roles are connected by business interfaces (contracts, agreements and etc.).

Thus, having a set of VNC, we can quickly analyze market share, who drive this VNC, the involvement of roles and the approximate value proposition.

We found, that core technical component in therm of our case is “Smart Home” Hub. All VNC will differ only in that the hub will be owned by different actors. Thus, the name of each VNC shows who owns the hub and who drive the VNC.

So let’s have a look at found VNC:

4.2.1 X-company driven VNC

In order to show the comprehensiveness of the VNC received, as well as to take into account competitors in the field of providing a smart home service, we called this actor the X-company.

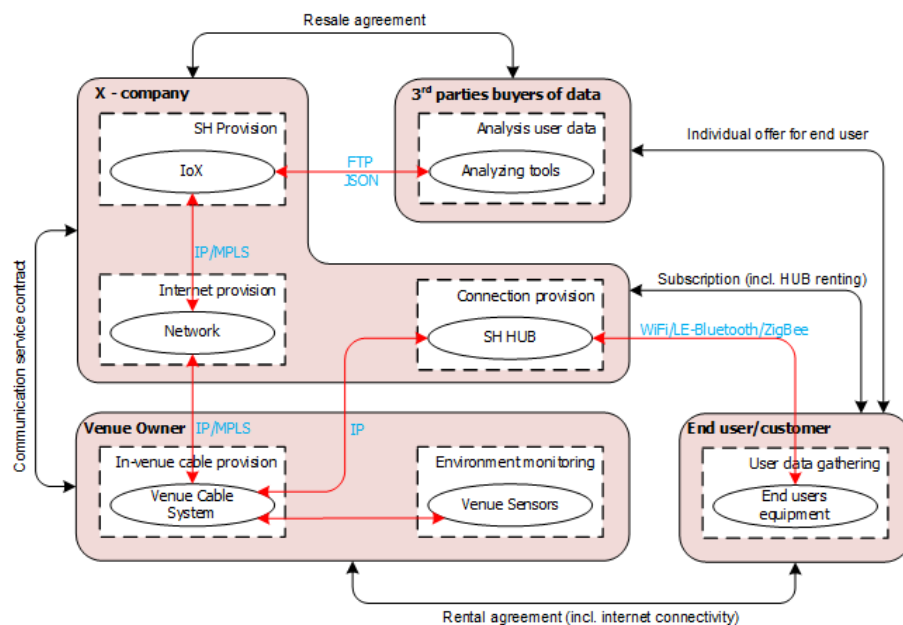


Figure 5. X-company driven VNC

First of all, let’s explain technical layout. What is the way of data from end-user

equipment to cloud of smart home provider?

First point that data faced is “Smart Home Hub”. It’s a home gateway. All end-user’s equipment mostly connected to hub through wireless interfaces. Technology like LE-Bluetooth, ZigBee and other are using here. Next step after hub is home/building owner cable system. By the law of Finland, venue owner, not a service provider, owns all cabling system inside of the venue. After data reach equipment of service provider through network infrastructure of internet connectivity provider. Finally, third-parties could get access to end-user data for further analyzing.

One of the early found uncertainty is hub ownership. In VNC presented here, we used the model of loaning a hub. X-company own network infrastructure, service cloud and hub. The end user just buys the subscription which includes hub loaning fee. In this case, end-user saves money by not buying expensive hub at a time.

Third parties get the access to available from users data and by analyzing them could present special offers for a different type of users. In other words, they don’t just explore who is their possible client, they also could provide individual service. By the way, X-company earns money by providing access to this data. On of the example for third-party is Air Conditioners sales company. By analyzing data from temperature sensors they could figure out who might be interesting in purchasing an air conditioner. This VNC covered only B2C market.

4.2.2 End user driven VNC

Other possible future is that price for hub would be reduced manly. And each customer, who wish to have “Smart Home” could buy hub as from X-company, as from other supplier. In this case X-company becomes just service provider for B2C. It’s not such a good perspective as shown on previous VNC. End user driven VNC is shown on figure 4. Different with VNC from figure 3 is that now hub fully owned by end user and this fact reduce the price of subscription for smart home service. It’s a bit difficult to figure out for whom this VNC is better than previous. And again this VNC cover only B2C market.

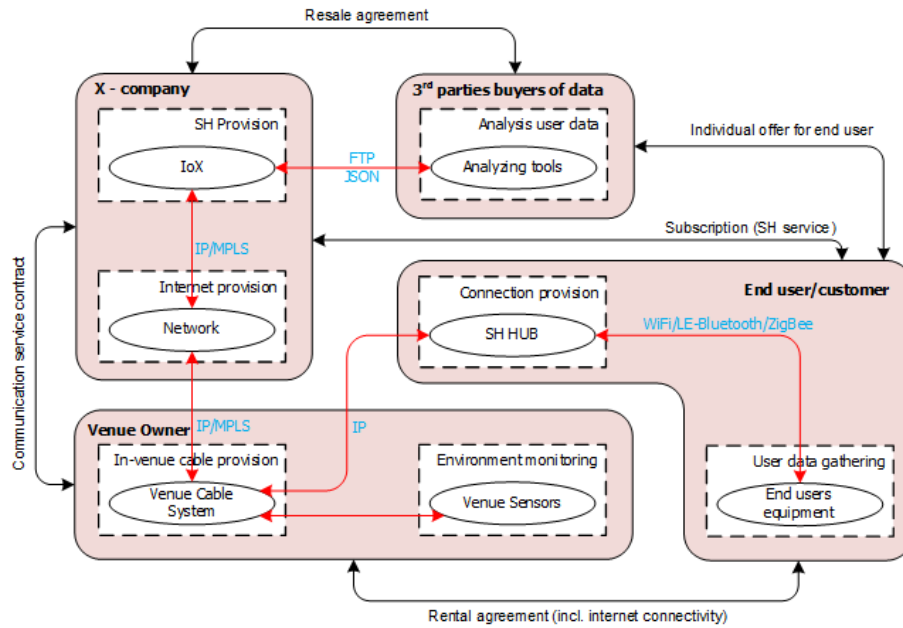


Figure 6. End user driven VNC

4.2.3 Venue owner driven VNC

One of the wishes from our contact person - try to cover both B2B and B2C markets. On VNC from figures 3,4 only B2C is involved. We started thinking how to get B2B. Only one B2B option is to provide an opportunity for venue owners to also use the services of a smart home. Lots of sensors are pre-installed in houses/buildings (like fire alarms, moving sensors and other). And they are under control of venue owner. All this equipment currently connected to a central server by wires. It might be interesting for venue owners reduce wires and make all this equipment “smart”. But it’s too expensive for them to buy hub for each floor. By keeping in mind possibility to loan hub, we create last and most valuable VNC, that cover both markets. Idea that lying behind is that venue owner install hub into each flat, house and end-users from that flats got an ability to use this hub at the same time this hub is used to connect venue sensors to smart service.

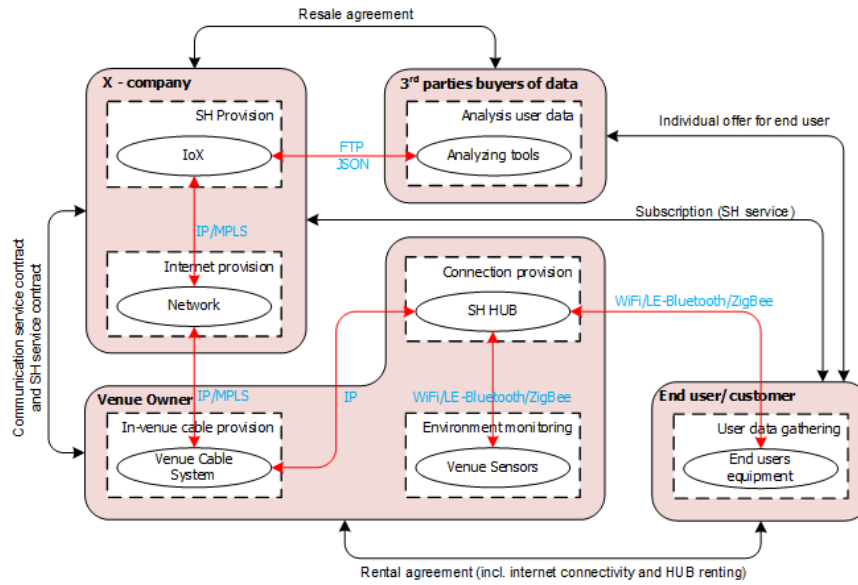


Figure 7. Venue owner driven VNC

In this case X-company will have much more subscriptions for smart home service. Venue owner got flexible service to control his property. It become much easier to interconnect with third-party services, like firefighters. Final VNC is shown on figure 8. Technical components to connect smartcloud are added.

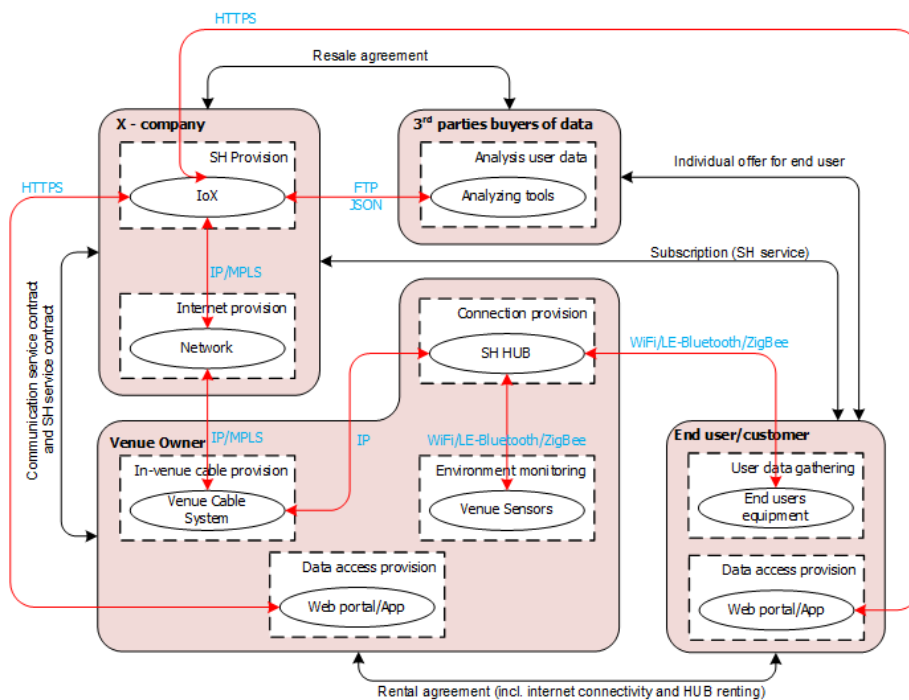


Figure 8. Final VNC

4.3 STOF model

The STOF method consists of four steps based on STOF model which was explained before, in which an initial value proposition is refined to check the robustness of the model (Bouwman et al, 2008). In this section three of the four domains are discussed in detail along with the critical success factors and finally refined with the critical design issues (CDI). The Financial domain will not be discussed here in detail because there is not enough information concerning the costs of the services and products of the business.

Service Domain:

Telia smart home service provides customers to easily access, browse and buy smart home services (Lars de Jonge et al, 2009). Currently almost all Finnish population is using digital television and at least 10MB internet access is the right of every citizen. Significant number of these users are customers of Telia telecom operator, this indicates that digital services are gaining popularity among the Finnish society even though the usage pattern is different among households. For example the usage of digital services of a young family is different than that of an older resident who might use it for healthcare services.

The idea of the smart home service is to provide customers a platform called smarthome HUB to choose the service. The billing process could be done through Telia for the use of the service then Telia can take some portions of the fee and the rest to the service provider (energy company for instance). The other service which Telia can offer is that selling collected user data to third party (insurance companies, medical research centers etc) which they could get some intangible benefits advertising their products to target customers based on the consent of the user. In return the user can get offers from these parties some kind of discounts.

The critical design issues of the service domain along with their detail description are listed in the table 1 below:

Table 1: Description of critical design issues of service domain

Critical Design Issue	Description	Smart Home Service
Targeting	What is the demographic?	-B2C early adopters and early majority - Targeting group of third parties based on collected user data
Creating Value	What value is the customer getting for his money?	Simplifying household chores, making house appliances smart and mobile, increase security and analyzing data.
Branding	How to promote the brand?	If the user already has internet subscription, it's easy to promote. On the other hand, no “killed-app” exists.
Trust	How to enhance end users' trust in the service?	Making the Smart Home contract transparent and clear. Promoting security as a key factor of the service.
Customer Retention	How to stimulate recurrent usage of the service?	Providing special offers for long time users

Technology Domain

Once the user signs into the service , smart home appliances such as sensors, fire alarms etc, are connected to the HUB using technology such as bluetooth, Zigbee and other low energy wireless technologies. All the information collected from each smart devices are stored in Telia cloud service infrastructure through appropriate protocols listed in the VNC and the company make sure that every device is working correctly according to the set of service level agreement. Thus, all third party data analysers retrieve data from the cloud using JSON/REST API(Application Programming Interface) and manipulate it for further use according to the users consent of his/her data. In return the user can be offered different products and services for discounts.

The table below shows the technology domain of the critical design issues such as security, Quality of service, system integration and accessibility are listed in detail .

Table 2: Description of critical design issues of Technology domain

Critical Design Issue	Description	Smart Home Service
Security	How to arrange secure access and communication?	Encrypting data and authentication with official documents
Quality of Service	How to provide for the desired level of quality?	Making sure all parts of the service are according to the SLA(Service Level Agreement)
System Integration	How to integrate new services with existing systems?	Buying/loaning the smart home hub

Accessibility	How to realize technical accessibility to the service for the group?	Making the service and the devices as easy to install and use as possible
Management of user profiles	How to manage and maintain user profiles?	User profiles are held in the database in the cloud

Organizational Domain

In this section Telia needs to identify itself what role can it play with in the network of its partners to achieve its goal of providing smarthome service. Once this is identified main partners can be selected and the services they provide in the value network would be defined according to the interest of the target customer. partners could be sensor providers, insurance companies, building owners etc. The idea here is that it is Telia who can control and govern the business infrastructure and can add extra services to the network such as reselling userdata to third parties and creating new business opportunities by allowing their cloud infrastructure to access through API as discussed in the service domain. However, there could be some companies who can provide their services over the internet such as the fire brigade who are directly connected the sensors of the building to the internet. those companies take care of their services independently.

Every actor in the value network has to get its fair share of the market in order for the business to survive. Some of the critical design issues related to organizational domain are listed in detail in the following table below.

Table 3: Description of critical design issues of Organizational domain

Critical Design Issue	Description	Smart Home Service
Partner selection	Who is offering access to critical resources and capabilities in order to offer service?	Third parties who analyse end user data through API.
Network openness	Degree to which new partners can join the network, and are allowed to offer services	The network provider, device manufacturer, cloud service and user data analysis are all interchangeable.
Network governance	Dominant partners set and monitor rules over partnership, support partners. Customer ownership and control is key asset	Making sure that every actor is getting its market share.
Network complexity	Degree of complexity of network, both organizational and technical	Low network complexity

Financial Domain

It is very difficult to give detail information on the financial domain of the business, as there is no adequate information regarding costs and risks of the business. Currently there are around 6% of Finnish population are users of smart home services

how ever there is no any detail cost analysis and benefits made so far. In this report we tried to explain the general financial relation of the value chain.

Telia is planning to collect revenues from subscription fees in two ways:

- ❑ charging the customer for the service(smart home) it provide, provided that customer can buy the HUB by himself
- ❑ Charging the customer as a package including service and HUB device.

There is also additional source of revenues from user data analysers(third parties) by reselling user data collected at Telias cloud service for further use. However, this depend on how much those parties are willing to pay for the data which would bring them intangible benefits. Financial and business relationships among different actors in value chain are clearly demonstrated in in the VNC figures above.

HUB ownership and Competition remains the top most uncertainties in the business. Providing both the HUB and the service seems more profitable for the time being, however, focusing on loaning or providing only the service looks profitable in the feature as the price of the HUB is expected to lower the price and end users would prefer to buy it from other stores or can get it for free from the provider to attract customers. Thus it would not have a significant impact on the revenues. Regarding competition huge companies such as Google, Apple who have big data centers and cloud service infrastructure would enter to the business which would make the competition tough for the company.

some of the critical design issues such as pricing, investments and division valuation of costs and revenues are listed in the table below.

Table 4: Description of critical design issues of Finance domain

Critical Design issue	Description	Smart Home Service
Pricing	Price level	Increasing market share as the priority for pricing strategy

Investments	Capital investment and risk assessment	Risk is high because of intangible benefits.
Division and valuation of costs and revenues between network actors	Assessment of valuation is based on access to resources, direct revenue and strategic benefits.	Smart home Subscription Smart Home Hub retail

Evaluation of Critical success factor(CSF)

Critical success factor is used to predict whether the business model is feasible from the perspective of customer value and network value.

CSFs for Network Value:

- ❖ Acceptable profitability: Increasing market share as a priority for pricing strategy
- ❖ Acceptable risks: Risk is high because of intangible benefits that means no killer-app has yet been found
- ❖ Sustainable Network strategy: In order for the business to sustain every actor in the business has to get fair share of the market. In addition there should be good relationship with the third parties.
- ❖ Acceptable division of roles: Each actor has sufficient motivation and resource to keep the network profitable.

CSFs for Customer Value:

- ❖ Compelling value proposition: Simplifying household chores, making house appliances smart and mobile, increasing security and analysing user data
- ❖ clearly defined target group: -B2C early adopters and early majority
 - Targeting group of third parties based on user data
- ❖ Unobtrusive Customer Retention: providing special offers for long time users or offering HUB for free for certain time.

Acceptable quality of service: Making sure that all parts of the service are according to SLA(Service Level Agreement)



5. Conclusions

In this report, we have given an overall look at the smart home business and what Telia's role in it could be. We analyzed the future scenarios and presented the scenario matrix with four distinct but possible futures. The key trends of industrial internet(IoT), data analytics and cloud computing were identified as well as the key uncertainties of hub ownership and the level of competition. Four value network configurations were created to show the relationships between different actors in the smart home market and how different business models could work, determining the best option for Telia to be the x-company driven VNC. Finally, we applied the STOF-model to the case and described the CDIs and CSFs in the service, technology, operations and finance domains.

We recommend Telia to take extra care when entering the smart home business. It would be ideal to be one of the first players who “gets it right” with correct timing, well designed service and products that fill a real user demand. According to our analysis, there is no “silver bullet” to be found and only as the market and products and even the societal attitudes towards smart homes develop and mature, can the smart home business be viable. One possible direction for Telia could be working together with construction companies to provide complete smart home solutions directly to new homes and offices and so accelerate the adoption of smart homes.

The only major technological difficulty at this moment is the lack of agreed upon standards for data transmission but this is not necessarily a leading problem. The dominant problem is the adoption gap between the early adopters and the early majority which still is an unsolved obstacle as no “killer-app” exists. The fight for the smart home market will be vicious with the big players like Google and Apple wanting to take their share. Four years into the future in 2020, there will be quite a lot more smart home devices and services available but with the current knowledge it's impossible to say if the smart home business will start booming next year or in 2025.

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Feedback for the course

Workload for this course was in line with 5 credits. We met 1-2 times a week with our group in addition to the lectures. The methods taught in the course fit our case quite well.

We got the Telia spokesperson to come to the university to give a lecture, which was nice. It would have been great to have people from the other case companies as well.

The sessions sometimes went a bit long, but every team got detailed personalized feedback.

The final report deadline could be before the final presentation to motivate or the separate parts of the final report could be mandatory to submit before each presentation.