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A critical techno-anthropological view on the IoT in Danish media

Master thesis

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Summary

Internet of Things (IoT) er i de seneste år blevet et prominent term. IoT teknologier kan med fordel give store mængder af information til brug som analyser i real tid. Selvom dette lyder lovende, møder IoT teknologier stadigvæk udfordringer. DDOS-angreb har foregået i forlængelse af IoT enheder og disse kan visse sig at være farlige, hvis de ikke bliver kontrolleret. I dette master thesis, fokusere vi på brugen af en blanding af *netnography* og *digitale metoder* der fungerer som vores metodiske rammesætning, med det formål at indsamle narrativer fra den Danske IoT scene, i en seksårig periode (2014-2019), til brug i vores analytiske arbejde. Til denne rammesætning, tilføjer vi også tankerne fra Andrew Feenberg og hans *Critical Theory of Technology* (CTT) for at beskrive potentielle undertrykkende designs af IoT teknologier. Gennem vores undersøgelser, er vi blevet i stand til at identificere forskellige mønstre af forandring, både af IoT adoptionen i Danmark, men også i forhold til Danske virksomheder og deres skift i position relateret til sikkerhedsforanstaltninger. Med brugen af Feenberg's *instrumentalization theory*, er vi blevet i stand til at identificere hvilken påvirkning IoT har på teknologier, og hvor nemt det kan *dekontekstualisere* disse, for at få dem til at virke undertrykkende i deres design imod potentielle brugere.

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Introduction

We live in an age where technology is ever-changing, and new exciting technologies are developed faster than before. To keep up with the constant development of technology, organizations and we as individuals have to adapt to the fast pace of this technological change (Handly, 2018). When the advancement of various technologies goes too fast for society to adapt, we cannot help to have concerns about this matter. The only people skilled enough to understand these fast-paced changes are the creators of technology and if only a select group of people can adapt to the change, our society has little to no chance, in keeping up with technological development and become more susceptible to oppression the further we advance. This phenomenon is present in many variations of technological development. In a report from the UN (United Nations) called *"The impact of rapid technological change on sustainable development"*, they are addressing this exact phenomenon of struggling to follow the increasing pace of the technological development: *"Some experts note that recent developments in synthetic biology and the increasing pace of development create knowledge gaps and pose challenges for some countries to carry out risk assessments and understand the possible impacts on biodiversity and human health."* (United Nations, 2019). This of course raises concerns in terms of how the governments and societies plan to adapt to technological development in the future and could potentially create a skewing in the balance of developing new technology and still uphold ethical values connected to certain societies (United Nations, 2019).

Even though this subject is troublesome, the quick evolving of technology is not only a bad thing. Our societies can benefit from technological advancements that help to create new medicine, the development of new products and perhaps break new barriers in the constant societal progression. Breakthrough in the development of technological solutions, have earlier helped humankind to travel the space and more down to earth, literally, leading to the invention of ground breaking technologies such as the internet, which alone has had a huge impact on societies all over the world (Handly, 2018).

Today, the invention of the internet has progressed into setting the stage for a new way of connecting technologies, this is called the Internet of Things (IoT). IoT is a newly developed global network consisting of various machines and devices that all can interact with each other. IoT has been envisioned as one of the most important areas of future technology, for many different industries have become aware of the possibilities the network of IoT is providing to their various technologies. The potential is huge and for some industries IoT technologies can make an impact right away (Lee & Lee, 2015). In order to provide an understanding of how quick the development and implementation of IoT devices has been through the last five years, we show Gartner's forecast from 2014 predicting that 25 billion devices are installed in 2020, compared to the 4,8 billion in 2015 (Gartner, 2014). That is a fivefold increase in just five years and shows that this development has no further plans of slowing down. To further show if these predictions were true, or close to it, we provide the statistics for how many IoT devices present from 2018 (see figure 1). We here see that 22 billion connected devices are present (Statista, 2020) and that number is close to the 25 billion estimated for the year of 2020. This is therefore establishing that this rapid increase in devices, as we mentioned earlier, is not slowing down. Another way of seeing this enormous increase in devices is also to be looking at the number of publicly known IoT platforms worldwide from 2015 to 2019 (see figure 2). An IoT platform is functioning as a sort of operating system for a given IoT technology such as a sensor. It is within this platform you handle hardware and software communications protocols and provide the security and authentication needed for the

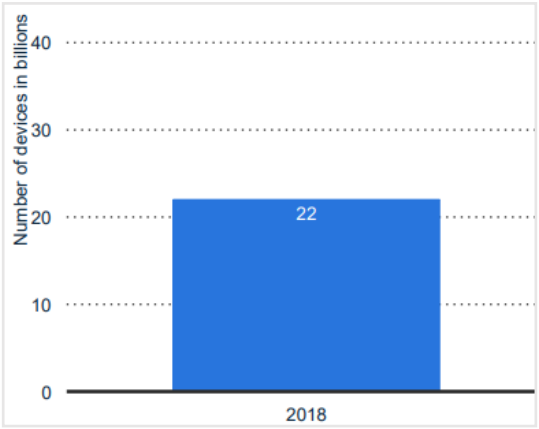


Figure 1 - Number of devices in billions for 2018 (Statista, 2020).

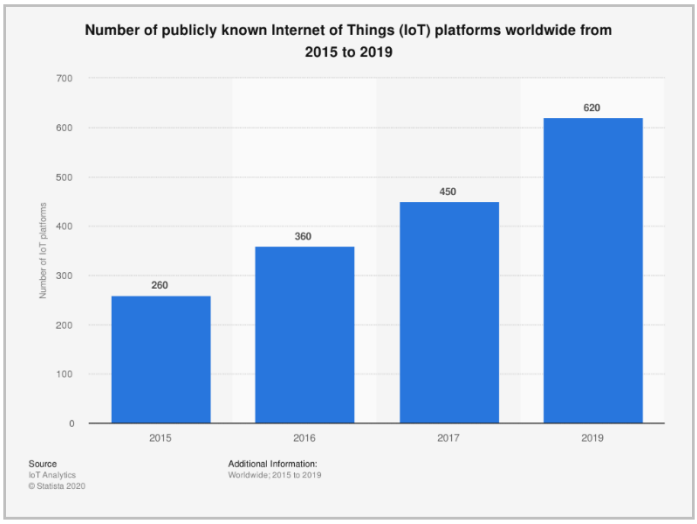


Figure 2 - Number of platforms publicly known for various years (Statista, 2020).

users of the technology. It is also within these platforms you can visualize your data to receive the needed information about a product. By seeing an increase in the development of these platforms, we see the connection to the increase in IoT devices as well (Lee & Lee, 2015). Looking at these statistics we see that many specific platforms are sought after, in order to get your IoT device to show what you exactly need information about. All these devices and related platforms will impact various industries and provide these with important information in order to do optimization and generally increase rates of success (Lee & Lee, 2015).

In this thesis, we focus on showing how IoT is discussed in the Danish media, by looking into various newspaper articles, both regional and local, magazines, web media and Ph.D. dissertations combined with the use of Critical Theory of Technology to illuminate how certain power dynamics of IoT, are unfolding in Denmark. We are interested in showing a mixture of how IoT is contextualized in Denmark as well as in various industries. By investigating the difference in how certain actors both address and implement IoT technologies, we provide the reader with a certain awareness of which strategies and plans there was for the development of IoT in Denmark.

So, to sum up, we aim to provide the reader with an understandable picture of different narratives that has surrounded the Internet of Things in Denmark. We are furthermore inspired by taking a more critical position, in order to not be blinded by narratives that glorify the vast potential of new technological solutions such as those of an IoT network. To further elaborate, a lot of concerns about losing societal relevance are still present in developing technologies and we want to investigate why these concerns are present by looking into the more near and local narratives present in extension of the Danish media. As techno-anthropologists, we want to focus our work on investigating a technological heavy subject that, whether we have a choice or not, is likely to influence society in more ways than one. Therefore, we head out into the world of IoT, in order to illuminate how these technology-driven networks, potentially could be an industrial game changer or just another tool for the tech-giants to become even more powerful.

Background

This section will provide the reader with information that is relevant for understanding the history of IoT and how it has become this popular technology we know today. We will here be setting the

stage with different information and contexts about IoT in order to enlighten the reader about the birth and early development of this technology. Lastly in this historical section we will provide a graphic of the most notable major events of the development of IoT up until the year of 2017. We will also provide the reader with important background information for how IoT is adopted in Denmark both by businesses but also how the government has plans for an increase in the use of these technologies.

A brief history about IoT

The concept of IoT is often thought of as a new and emerging type of technology. However, the concept was coined in the late 1990s and many of the essential components relating to an IoT network have existed for many years. The concept of IoT is made up of hardware and software technologies, which mostly is connected to sensors, smartphones and wearable devices and the networks that are tasked with linking these devices, such as; 4G, Long-Term Evolution (LTE), Wi-Fi and Bluetooth (*"The Internet Of Things: Making The Most Of The Second Digital Revolution"*, 2014, p. 13).

The beneficial thing about the IoT software components, is that it gives IoT using industries a platform for storing data and in some cases also analytical programs that can provide valuable information about your field of expertise. Even though the help from these types of standalone software components are highly sought after from actors in various industries, the real value with IoT technologies is created, when components are combined and are working seamlessly among each other (*"The Internet Of Things: Making The Most Of The Second Digital Revolution"*, 2014, p. 13). In 2010 the concept of IoT started to gain some popularity in society, with for example the Chinese government opting for prioritizing an IoT strategy in a future five-year plan.

The year after, 2011, Gartner invented the *"hype-cycle for emerging technologies"* and included the concept of IoT on this famous list among technology-driven companies (Lueth, 2014). This sparked interest from various consumers, industries and governments in the world, to investigate what potential this concept really was bringing to the table. IoT was now being perceived as a prominent field to work with and in 2012, Europe's biggest internet conference, LeWeb, had the Internet of Things as their main theme. This was also the year that popular tech-minded magazines

like Forbes, Wired and Fast Company were starting to implement IoT into their vocabularies and in general describing what this phenomenal concept was about. In 2013 the International Data Corporation (IDC) published a report stating that the market of IoT would be worth 8.9 trillion dollars in 2020, that is from 1.9 trillion in 2013. This means that on the big market scale there is a huge potential for increasing your technological growth and funds for various actors that buy into the concept of IoT (Lueth, 2014). In order to view the most notable major events in the development of IoT technologies, see appendix 1. This appendix is multiple pages long and is best seen in a printed version (The History of IoT: A Comprehensive Timeline of Major Events, Infographic - Hqsoftware, 2018).

IoT in a Danish context

In 2015, the company Ericsson Denmark in collaboration with Monitor Deloitte and DI Digital (Danish ICT and Electronics Federation) performed a large study, which led to a report about Danish companies and their adoption of IoT technologies. Even though IoT was an established and prominent phenomenon, Danish companies still hesitated to implement these IoT technologies for use in their various expertise areas (*"Every. Thing. Connected.",* 2015, p. 4). This report was first of its kind, and it provided the readers with insight into a topic that had not been addressed before. In order to gather the empirical foundation for making this report, they used a questionnaire survey and qualitative follow-up interviews with IT and business leaders from the 35 highest-ranked Danish companies. These leaders were expected to have extensive knowledge about their companies IoT strategies and were found to be the right persons for answering questions about the subjects (*"Every. Thing. Connected.",* 2015, p. 4). To give the reader an understanding for how large the companies were and which industries the respondents, from the qualitative work in the report were working in, we here provide visual graphs from the report (figure 3):

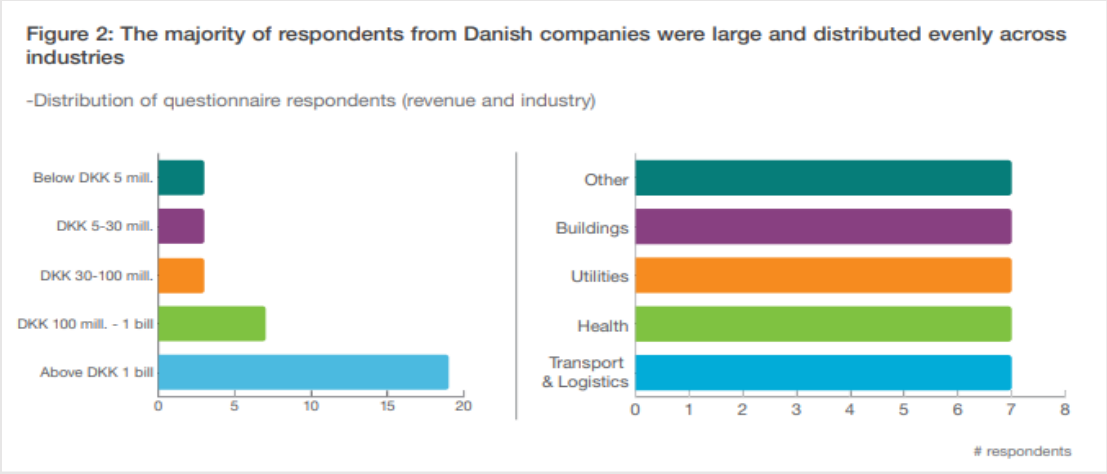


Figure 3 - Overview over respondents from Danish companies ("Every. Thing. Connected.", 2015, p. 6) (Ignore that it is called figure 2 in the graphic)

It is clear, that most of the Danish companies involved in this study are well established businesses with a good foundation for investing into new initiatives. It is also clear that the study, were missing information about IoT adoption in the various industries, so they also choose to reach out evenly amongst the industries being investigated. Other than the missing information, this was also done in order to locate potential patterns that could lead to future statistical investigations (*"Every. Thing. Connected.",* 2015, p. 6).

By showing the revenue of the companies, the report argued that these companies had the resources to adopt the idea of using IoT technologies in their area of expertise. The idea of adopting IoT strategies into the companies, were also supported by the companies themselves. Compared to the rest of the world, the Danish companies were showing that they had more faith in the idea of using IoT for their own expertise areas, see figure 4 (*"Every. Thing. Connected.",* 2015, p. 12).

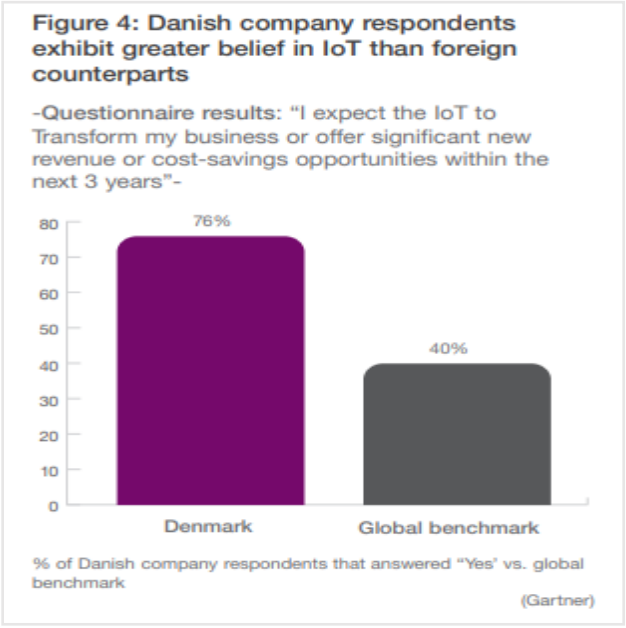


Figure 4 - Danish companies' beliefs in IoT compared to the world ("Every. Thing. Connected.", 2015, p. 12)

Even though the revenue was there to back an investment in IoT related technologies for most of the companies and a general positive vibe was present among these Danish companies, regarding the use and implementation of IoT technologies, the report showed that these types of companies had not acted on the opportunity to venture into this market of huge potential (*"Every. Thing. Connected.",* 2015, p. 4).

The report identified five key roadblocks for an IoT adoption in the Danish companies. These roadblocks are listed here:

1.	**2.**	**3.**	**4.**	**5.**
A perceived high cost of IoT that holds the companies back.	A challenge of identifying the value capture in a company-specific context - despite an almost unanimous belief in the potential of IoT.	A clash between IoT and companies' traditional governance structures, as IoT still presents both uncertainties and a lack of historical precedence.	Paralyzation that occurs when IoT requires a company to undergo change to a degree that it stifles action.	Knowledge gap on IoT, especially among top management.

Table 1 - Five key roadblocks for IoT adoption in Danish companies ("Every. Thing. Connected.", 2015, p. 4).

These roadblocks give us a potential idea of why IoT technologies and strategies are not adopted more into the various companies and their areas of expertise. The companies are not sure that their own organizational capabilities are ready for capturing the true potential of the adoption of IoT. (*"Every. Thing. Connected.",* 2015, p. 4). In order to make the companies ready for an implementation of IoT strategies and technologies in their expertise areas, the report is suggesting four critical points to get the companies started with an IoT adoption:

1.	2.	3.	4.
Appoint dedicated leadership to drive IoT momentum	Evaluate value captures using both experiences from four industries and a maturity continuum	Create IoT adoption plans, categorizing projects into Simmer, Pilot and Scale	Explore partnerships to fast track adoption

Table 2 - Points for making companies ready for an IoT adoption ("Every. Thing. Connected.", 2015, p. 4).

To address the knowledge gap and to handle the big feat of doing an IoT-transformation in the company, it is required to appoint the right personnel to sit in the management in order to find the right IoT focus needed for the specific company. This can be a guiding team or person that will have to act as the driver for change in a company setting. ("Every. Thing. Connected.", 2015, p. 27).

The second point is revolving around being able to identify the value of an IoT adoption in the companies and the appointed personnel from the first point, will also be helpful with this. To make a fair assumption on how an IoT adoption creates a value for the companies, the managements must ask themselves some questions that revolve around different scenarios. One of these questions could for example be: *"Would IoT-generated data bring value to your customers and could you capitalize on it as an add-on service?*" ("Every. Thing. Connected.", 2015, p. 27).

The third point is based around creating a plan for this IoT adoption. In the report they present a "simmer" stage and a "pilot" stage, in order to map which IoT opportunities that would benefit the given company the most. The simmer stage seeks to map specific IoT possibilities that would create value but are not yet being pursued because of other prioritization choices. The pilot stage is a common phase in companies, where they carry out pilot projects, that can provide them with valuable knowledge about a new implementation of a technology for instance. Even though the companies plan for the future, the report is stating that they are not taking scaling of the pilot projects into account and this can lead to an abrupt stop in the implementation of the IoT technologies on a bigger level ("Every. Thing. Connected.", 2015, p. 27).

The last point the report is suggesting that can help clearing free of the roadblocks is the exploration of partnerships. With only a third of the report' respondents stating that they are actively searching for new IoT partnerships, two thirds of all the companies are not allowing themselves to solve problematic subjects, such as increasing the capabilities of a given technology or collaborating in fast tracking possibilities in an area of expertise, which might be unexplored territory for the company. This has to improve in order to achieve a deeper level of commitment from the companies in order to adopt IoT technologies in their given expertise areas ("Every. Thing. Connected.", 2015, p. 27).

Since this report has been the first of its kind, when looking at Danish companies' IoT adoption, it is safe to say that it is providing us with a lot of valuable information in order to better understand the world of IoT in a Danish context. The report highlights which areas that are lacking in order to implement IoT more into the Danish infrastructure and why some of the bigger companies do not act, even though they can see potential. The information in this report will also help us to understand the next section - the plan for digital growth in Denmark.

Strategy for Denmark's digital growth

In 2018 a new report came from the Danish government, more specifically the Ministry of Industry, Business and Financial Affairs, about Denmark's future strategy regarding digital growth. The government had clear visions for Denmark in the future as we see here:

> *"The Government's vision is for Denmark to be a digital frontrunner, with all Danes gaining from the digitalisation. We must be ambitious, striding confidently into the future to exploit the potential offered by new technology. The Government therefore presents its Strategy for Denmark's Digital Growth, which contains clear goals and initiatives for the digital transformation of Danish commerce – for the benefit of all Danes."* (Brian Mikkelsen, Minister for Industry, Business and Financial Affairs, Strategy for Denmark's Digital Growth, 2018, p. 5).

The government is incentivizing the Danes to take part in this global digital development and are laying the foundation for this themselves by showing their newly found technology-positive

agenda. This strategy could perhaps help to push the IoT adoption in the right direction for the more well-established companies, we mentioned in the section above. There is stated from the government's side a clear goal of providing some smaller companies with help in regards to their digital growth: *"With this strategy, the Government aims to create a strong environment for growth in Denmark, and to support the digital transformation of our many small and medium-sized enterprises."* (Brian Mikkelsen, Minister for Industry, Business and Financial Affairs, Strategy for Denmark's Digital Growth, 2018, p. 5). This is of course good news for the SMEs (Small and Medium-sized Enterprises), because they can get the help, they need to invest into for example IoT technologies and other beneficial initiatives. This could also mean that the collaborative work between companies in an IoT setting, could become a reality. This was also a huge point for concern in the earlier mentioned report about the adoption of IoT in Danish companies. In order to see how the projected governmental plan is visualized, see appendix 2. This gives us a quick overview of what the overall vision, the objectives that the government value as important is and what their focus areas mainly are going to be.

There are a lot of benefits to the government in pushing a strategy that focuses on lifting the general digital growth. For example, we see how countries with a higher perceived investment in IT equipment/technologies have contributed to their overall growth of GDP (Gross Domestic Product) as well. In figure 5, we see how Denmark is listed compared to some other countries, including our neighbors Sweden and Germany:

Figure 5 - GDP growth among different countries around Denmark (Strategy for Denmark's Digital Growth, 2018, p. 14)

In figure 5, we see a growth in GDP and how IT equipment/technologies are playing a substantial part in that. Denmark is relatively well placed in this figure but would have been a bit lower if we did not invest so much in IT technologies and equipment. They describe it relatively straight forward: *"Digitalisation is also a driving force for productivity and growth. It will help make Denmark richer."* ("Strategy for Denmark's Digital Growth", 2018, p. 14). This is one of many reasons that the government made a strategy to support the digitalisation of Denmark even further, and this is also closely connected to technologies such as IoT, that will thrive with governmental acceptance and strategies like these.

Problem area

As mentioned in the introduction, IoT has for the past few years become a very prominent term for a set of technologies in a network, that provides a large amount of information for real-time analysis, machine learning, commodity sensors and remote control/access of said technologies. IoT is not a singular technology but a term that encompasses several different technologies or "things" that are connected to the internet or each other in a network as well as an embedded system. What makes the IoT different, is that it can function without human-to-human or human-

to-computer interaction, as well as utilizing UIDs (Unique identifiers) to share information in a network (Rouse et al., 2016). What is most commonly associated with IoT are smart houses and smart devices. However, many everyday appliances and gadgets, have a high chance of being part of IoT, because a simple connection to the internet is all that it takes for a device or "thing" to be connected. Moreover, IoT is also becoming a major part in manufacturing as a part of what is called the fourth industrial revolution or short Industry 4.0 (Lasi et al., 2014). IoT will also play a part in 5G, but more in the sense that IoT will depend on the capabilities of 5G (Millet, 2018). It is hard to say what IoT specifically is made to solve other than with its advancements in a vast array of fields, it creates a great deal of convenience both in business and society (Nolin and Olson, 2016).

IoT still faces challenges, such as implementation and regulation, so we have still not seen the full potential of the IoT, but it has already proven in some cases to be a dangerous technological framework if left unchecked (Lindqvist and Neumann, 2017). Denial-of-service (DDOS) attacks have earlier happened on some major websites and services such as Amazon, Twitter, Reddit, Tumblr and Netflix. The way this attack was done, was with a malware called Mirai. This malware infected millions of vulnerable devices such as closed circuit tv's, cable boxes and digital video recorders making them part of a botnet that would swarm these sites with seemingly legitimate requests (Lindqvist and Neumann, 2017). What this case shows is not that the "things" themselves are a liability, because you are not able to find a singular weak link in such a vast network of devices as of right now, but even though these networks are of a complex size, it does not necessarily make it more secure. We cannot know for certain that hackers in the future potentially find methods that can target a singular device. This would make every single device, or "thing", be this weak link in a vast network of devices and it would be almost impossible to identify this weak link in order to rectify the damage it could cause. The general idea with the security of IoT is that more extensive measures are needed to protect both businesses and consumers from attacks of this kind.

In our thesis, we initially wanted to work with a Danish telecommunications company called TDC (Tele Denmark Communications) to learn about their IoT strategies and to get insights on how they, as one of the biggest companies in this field, were present on the Danish market for IoT. However, we were not able to get a partnership established, so we redirected our focus to have an

outside view of this market and the ongoing debate regarding IoT in Denmark. To achieve insights about these two subjects, we are inspired by the thoughts from Andrew Feenberg and his Critical Theory of Technology (CTT). With this theory as our framework, we want to extract narratives from our empirical material in order to show the public debate of IoT in Denmark from 2014-2019. We also seek to cover controversies, inequalities in business, politics and the emerging technologies that all in some way are a part of this field. Based on these goals, we seek to enlighten the reader in terms of how the landscape of IoT is developing through these years. We have therefore made a problem statement that is followed by two sub-questions, that each will help find the answers we need in order to successfully answer the overall problem statement:

How is the Internet of Things debated through various Danish media outlets and can we identify certain power dynamics with the use of critical theory?

- *What are the prospects for the future of IoT in Denmark? And can we see a pattern of where it is headed?*
- *What are the different main positions from the news media compared to the scientific literature?*

Our theoretical and methodological sections will create the needed framework for our thesis and our analytical part will provide an in-depth analysis of the stated concerns pointed out in this section. Another foundation for making our analysis will also be the use of Infomedia's media archive. This will provide us with recorded news articles that will become our empirical material and help us in order to create our wanted data corpus. Additionally, we will try to map the Danish IoT scene based on limited parameters on Infomedia. With the aid of this mapping we will try to find narratives that we can use for our analysis. In our analysis we will look into different articles, we believe to echo the most common themes throughout our empirical material. While doing this we will also apply our theoretical beliefs to help us discover possible power struggles and, if any, pushes made against potential user oppression.

Critical Theory of Technology

For our thesis we have chosen to use critical theory, and more specifically Critical Theory of Technology (CTT). Critical Theory has its roots in the Frankfurt School of sociology and was first defined by Max Horkenheimer in his 1937 essay *"Tradition and Critical Theory"* from 1937. Horkenheimer took inspiration from Marxian theory, to seek out and fight ideological mystification, class oppression and hegemony, but wanted to take Critical Theory to a more radical and emancipatory form of theory (Felluga, 2015). The general theme of Critical Theory is to liberate humans of the circumstance that enslaves them (Bronner, 2002). There are a few generations of critical theorists who often draw on the works of those before them, the first generation consists of Max Horkenheimer, Theodore Adorno and Herbert Marcuse. Most notable of the second generation is Jurgen Habermas, whose work with pragmatism influenced his work with Critical Theory. We will primarily use theorists from the 4th generation, namely Andrew Feenberg and his thoughts on Critical Theory of Technology. However, we do acknowledge that there are many different iterations of Critical Theory we could have used in our thesis.

Feminism or feminist theory is also a form of Critical Theory that focuses more heavily on power structures (such as patriarchy) and concerns of gender and gender equality. We have not chosen to use feminism, because it would be better suited in a micro perspective of IoT, whereas we have gone more macro in the way we are looking at Danish media throughout the years. We also run the risk of seeming very nitpicky in an attempt to find a conflict regarding gender in the context of IoT, where there might not be one.

Andrew Feenberg' Critical Theory of Technology

Andrew Feenberg is a philosopher of technology, with a focus on critique of technology. He is inspired by the likes of Herbert Marcuse, Martin Heidegger and Jürgen Habermas. He also draws on marxist theory and incorporates it in his own work, such as "*instrumentalization theory*" (Veak, 2006). His primary argument is for a democratic transformation of technology. This quote from his book published in 2002, *Transforming Technology,* summarizes his idea of how technology can be oppressive:

> *"What human beings are and will become is decided in the shape of our tools no less than in the action of statesmen and political movements. The design of technology is thus an*

> *ontological decision fraught with political consequences. The exclusion of the vast majority from participation in this decision is profoundly undemocratic"* (Feenberg, 2002, p. 3)

Feenberg agrees with Marcuse that technology is socially shaped, but the form technology takes is a political choice (Veak, 2006). Technology in and of itself does not have to be oppressive, but its design and use can lead to oppression, and moreover it is not readily obvious if this oppression is intended or not. The context of the technology's use plays a significant role.

As part of Feenberg's critique of technology, he has developed his own theory called *"instrumentalization theory"*. In *"instrumentalization theory"* you must analyze technology on two levels, at the first level we seek to find affordances in the devices or systems, by *decontextualizing* the objects of experience and reducing them to their useful properties. As a part of this, you *de-world* the objects from their original context and subject them to analysis and manipulation, while the subjects (users) are positioned for distanced control. Instead of *de-worlding* the human, which makes them subject to technical action, which is called management, the technology is *de-worlded* as to reveal its complex technical network (Feenberg 2005, p. 50).

At the second level we look at the design and implementation of a technology. These designs can be integrated with already existing devices and systems that have social constraints, such as ethical and aesthetic principles. Feenberg describes these principles as *"technical codes"*. These *"technical codes"* are derived from the criteria of different social or technical groups. What this means is that certain groups will try to limit the amount of influence there is to any given technical design by selecting the right technical experts, as well as the corporate and political elite they serve. Feenberg further explains the "*technical codes"* application for the second level of his theory in this quote:

> *"I argue that the intervention of interests and ideologies does not necessarily reduce efficiency but biases its achievement according to a broader social program. I have introduced the concept of "technical code" to articulate this relationship between social and technical requirements. A technical code is the realization of an interest or ideology in a technical coherent solution to a problem. Although some technical codes are formulated explicitly by technologists themselves, I am seeking a more general analytic tool that can be applied even in the absence of such formulations."* (Feenberg, 2005, p 52)

"Technical codes" therefore becomes a criterion that must be selected for technical workable designs for social goals. Goals are ranked in the sense of being ethically permitted or not, or aesthetically better or worse. These *"technical codes"* are important for the second level of *instrumentalization theory* because they reflect ethical and aesthetic meditations.

So, to sum up, the first level helps simplify objects, so that they can be incorporated into devices, while the second level simplifies the objects to a natural and social environment. To do this, Feenberg borrowed a term from Heidegger called *"disclosure"* or *"revealing"* of a world. *Disclosure* involves a process of realization, which qualifies the original functionality by orienting it towards a new world involving those same subjects and objects Feenberg were describing (Feenberg 2005, p. 50). Feenberg makes an example of how these two levels can be applied with this quote:

> *"Cutting down a tree to make lumber and building a house with it are not primary and secondary instrumentalizations, respectively. Cutting down a tree "decontextualizes" it, but in line with various technical, legal and aesthetic considerations determining what kinds of trees can become lumber of what size and shape and are salable as such. The act of cutting down the tree is thus not simply "primary" but involves both levels as one would expect of an analytic distinction"* (Feenberg 2005, p. 50)

Feenberg believes that Marx's critique of capitalist economy is still relevant in a technological context. Even though Marx focused on the economy, with production being the principal domain of technology in his time, these thoughts could still be applied to our times technology, because it has a stronger presence in the everyday social life of today. To elaborate on this, when looking at production, we see the focus on ownership is not lying in the produced wealth, but in the control of the conditions of the given labor. The owner not only has an interest in the economy of the factory, but also a technological interest revolved around this place of work. What this means is that the owner seeks to increase production and profit by controlling the process of work. This leads to new ideas and implementation of machinery and mechanization in the industry, which is, in turn, deskilling the workers and instead formulates certain requirements to manage these new machines. This then extends the hierarchy of technical subjects and objects into human relations to gain efficiency. Marx calls this impersonal domination, because it is embodied in the design of

tools and the organization of production. When this type of management and organization is transferred from the private sector into public sectors, such as governmental administration, education and medicine, our life environment of society comes under the rule of technology (Feenberg 2005, p. 53). This type of control Feenberg calls *"operational autonomy"*, where the freedom of the owner to make independent decisions on how to do business in their organization is stripped away, regardless of the views or interests of their subordinate actors and their surrounding communities. What the *"operational autonomy"* does is position the administration and management in a technical relation to the world, which frees them from the consequences of their own actions (Feenberg, 2005, p. 53).

Feenberg paints a picture of how technology is dominating our lives, through technological design we cannot hope to affect. However, technology is not as passive as it would seem. A side effect of our technological advancements is that feedback loops, that join the technical subject and object, become more obtrusive in societies organized around a certain technology. We increasingly try to control nature with technology, resulting in these feedback loops becoming shorter. So how do we ensure our survival? Feenberg proposes that democratization of technology can help. What this means, is to expose the technical actors to these feedback loops. Spreading knowledge is not enough, the interest of actors must be enlarged and the feedback from disempowered groups must be made almost impossible to ignore. A democratically constituted alliance of actors must embrace these groups to expose the consequences of the design some decisions make (Feenberg 2005, p 55.).

We will use Feenberg's *"instrumentalization theory"* to decontextualize affordances of IoT, either as part of a system or a singular device. We will afterwards use this theoretical view to analyze how designs are integrated with already existing devices and systems within the Danish world of IoT. With the use of Feenberg's thoughts, we aim to get a better understanding of the concept of IoT and we furthermore want to be able to locate if any kind of resistance is present, that seeks to protect humans from the potential oppressive design and management of IoT technologies.

Methodology

In this section, we will showcase our methodology and the choices we have made throughout this thesis. We will use this section to establish how our empirical material is beneficial for investigating IoT in the Danish sphere. We will also describe which circumstances we have been working under and how it has affected our thesis.

COVID-19

Throughout the production of this thesis, we have been forced to work from the comfort of our homes, due to the requirements stated from the Danish government in regard to the rules of self-isolation. When the COVID-19 disease first broke out, we were in the early stages of gathering our empirical material and had just entered the process of starting to delve into our physical field. Before the COVID-19 were being a problem in Denmark, we managed to do one expert interview with a Senior Director at TDC/Yousee. After this interview, the Danish government was quick to close down all unnecessary physical contact, and therefore we could not get into contact or make agreements with other actors/fields that we wanted to interview/investigate. This meant that we had to figure out another way of gathering our empirical material for our thesis. In order to still keep the same focus in our thesis, mainly IoT in Denmark, we delved into the vast information accessible on the internet, with hopes that it could provide us with the empirical material needed for producing a thesis, that were both relevant and could address some of the problematic areas that we identified.

Netnography

In our thesis, we have adapted from using physical qualitative methods to do online qualitative research in order to gather the most of our empirical material. This was a necessary means in order to respect the isolating requirements from the Danish government under the time battling the COVID-19 disease. Lucky for us, this is a relatively common method for researching in today's world and with the term "*netnography*", coined by Robert Kozinets in 2010, we have an established scientific method, connected to the internet, that we are able to use in the work of our thesis. Since we are taught of using interviews and observations (qualitative methods) in its physical form, we were drawn to the idea of finding these stories you otherwise would get from an interview on the internet instead. Kozinets is describing the internet as: *"Billions of individuals*

joined into networks partake in a complex world that not only reflects and reveals their lived experiences but is also, itself, a unique social phenomenon." (Kozinets, 2015, p. 2). This is for us a good sign, because we can apply our knowledge about ethnographic work, even though it is mostly done in physical form, to gather narratives that in some way will help us to portray the Danish IoT scene. The internet is for us a gateway to do research about the debate of IoT in Denmark, both from the side of the scientific articles and the more business-oriented ones. To be more specific, the part of the internet we are interested in using is the various news media outlets and scientific outlets and by combining narratives from both of these worlds, we believe that we can gather the needed material in order to analyze the IoT situation in Denmark from 2014 to 2019.

Netnography is rooted in core ethnographic principles such as participant observation, while also seeking to incorporate digital approaches in your research. We want to use these principles in our thesis, in order to achieve access to the digitally born field of IoT adoption in Denmark (Kozinets, 2015). When talking about the internet we also seem to forget that social interactions also are embedded, in writing an article, commenting on a blogpost or in a comment. It is these underlying social interactions we are drawn to when harvesting narratives out of various articles that is revolving around IoT (Kozinets, 2015). This is valuable for us as ethnographers because it is providing us with a sense of a more near relation compared to a broadly ontological view on the matter. We also value this nearness important instead of just using a digital tool to "crawl the web" in order to harvest huge amounts of keywords etc., that we would not be able to achieve the same social or cultural interaction out of (Kozinets, 2015).

So, to sum up, the concept of netnography is not to be understood as simply opening up for a mobile phone or another device to search for various terms in order to get information. Netnography is instead a gateway for understanding the collected material in more ethnographical and analytical ways (Kozinets, 2015). By adding a certain social value to your gathered online material or by assuring that it is given different kinds of informative representations, we establish the importance of our use of the concept of netnography in order to create strong analytical claims with our research (Kozinets, 2015). One of the reasons why we also want to use this methodological toolset, is to avoid concepts like culture and community when having to reference online social phenomena, because they in some way can become unstable to rely on (Kozinets,

2015). Kozinets is arguing that these concepts are of the old school and were used to describe online phenomena in the 1950's. Since then the online world has evolved a great deal, and therefore we also need to follow these evolutionary steps by avoiding those concepts, that, in some way, have a hard time keeping track (Kozinets, 2015). In our thesis, we aim to mostly follow these thoughts that Kozinets is advocating for, about doing research on the internet, but with our own intuitive ways of performing techno-anthropological research. We do this in order to provide the reader with beneficial and possibly new information about the IoT adoption in Denmark. The concept of netnography is then automatically becoming a mediating factor, for our analysis, research representation and in the forming of our analytical questions (Kozinets, 2015).

Digital methods

Digital methods are a designation for a lot of things. When using these methods, it is obvious that they are dependent on some degree of digital processes (Drotner and Mosberg Iversen, 2017). Some digital methods are building on the more traditional analog methods as they are known from either qualitative or quantitative work (Drotner and Mosberg Iversen, 2017). Others are using things like machine learning, in ways that deviate a lot from the more mechanical ways of working back in the time, with the use of for example a calculator (Drotner and Mosberg Iversen, 2017). We are interested in using digital methods as a means to perform our analytical work, because we intend to use visualization tools, specifically a tool called Gephi, to illustrate the digital interaction we have had on the digital archive called Infomedia, this will be addressed later.

In our thesis we are interested in seeing which controversies are present on the Danish IoT scene and use them in our analytical work to answer the questions stated in our problem area. This type of analysis is situated in the use of digital methods according to Noortje Marres. What Marres exactly is saying is; *"controversy analysis as a digital method involves the use of computational techniques to detect, analyze and visualize public contestation over topical affairs."* (Marres, 2015, p. 657). This way of thinking about digital methods, is how we will try to use it, in this thesis. We are with computational techniques, able to detect valuable narratives about the IoT development on the Danish scene and analyze these narratives in order to enlighten this subject that are being researched. In the wake of data being omnipresent, controversy analysis has become a more suitable way to perform digital research, because of the many digital tools available and

the overall better structure of digital sources (Marres, 2015). Our approach to the use of digital methods is by the *discursive* approach (Marres, 2015), this means that we are not interested in determining statuses of statements or topics, but to map the positions in a debate. By using controversy analysis, we seek to explore and detect relations between arguments, socially and politically actors (Marres, 2015). By adopting this approach, we are positioning ourselves to render the relations of the various actors present in these narratives and we therefore provide our own interpretation of the given situation in regard to the IoT scene in Denmark (Marres, 2015).

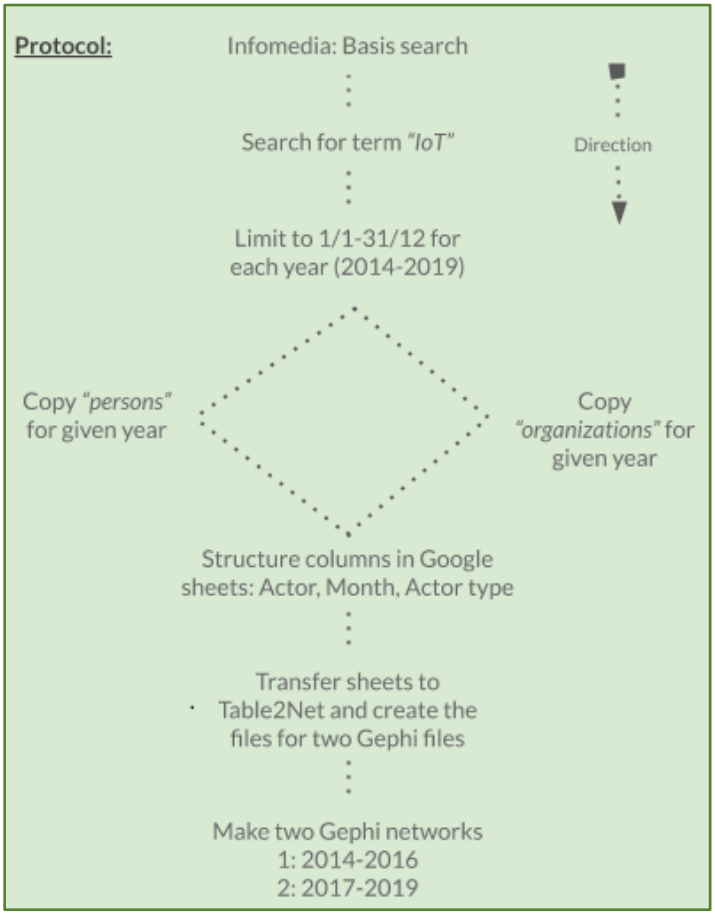
In the above we have stated how we are positioning ourselves before delving into our work of collecting, analyzing and visualizing our data. We believe these choices are best suited to pursue our interest in showing how Internet of Things has developed over the years and furthermore how it is adopted by Danish actors.

Our empirical data

In the early stages of this thesis, we tasked ourselves with finding information about the adoption of IoT in Denmark. We were looking through a lot of news articles from various media, in order to perceive better insight into this subject. We chose to look into news articles, because of the easily accessible overview it gave us in regard to detecting certain events or important breakthroughs in IoT development. We also could use these articles to identify which actors were mentioned a lot. This was useful for us in order to see which actors were present in the debate about IoT. We quickly found that news articles are a mix of both positive and negative articles, so by looking more into these, it also helped us to understand both sides of what the technologies pros and cons were for the various actors. We are aware of the potential biases in the news media writing and portrayal of IoT. News media is quite often writing their articles based on a general agenda, such as economy or computer technology, that suits their readers interest. This could have an influence on our own gathering of empirical material, in terms of providing us with a biased understanding of the benefits of IoT in various settings. Another subject that we have become aware of, is that Infomedia's media archive is a *blackboxed* platform, because we do not know how their algorithm exactly works, even though they state some basic information on their website. We still chose to do research within these types of media, because of the sheer amount of focus on concepts such as IoT, which were a beneficial gateway for us, into a newly established field of

technological solutions. We also felt that with Critical Theory of Technology as our lens, we would be able to be as objective enough, in order to find narratives that showed power dynamics in our empirical data. We could also have researched other digital areas in order to achieve our empirical findings, such as forums, podcasts or social media. The narratives would likely be different from what we have gathered, but there would still be a bias in what we would have found, be it a podcast led by a tech-company or a forum with a general negative view of IoT.

A platform that has been crucial for our gathering of data online, has been the online media archive called Infomedia. Infomedia is Denmark's biggest media archive with over 75 million articles dating back to 1990, this platform also possesses content from over 2500 different sources. It is updated 24/7 and was therefore a relevant source of information for our thesis (Mediearkiv - Infomedia DK, 2020). By using this platform, we quickly gathered material about how IoT in Denmark had developed throughout the years. In order to show our data gathered from Infomedia and how we have curated this, we have made a protocol that will enlighten this process step by step:

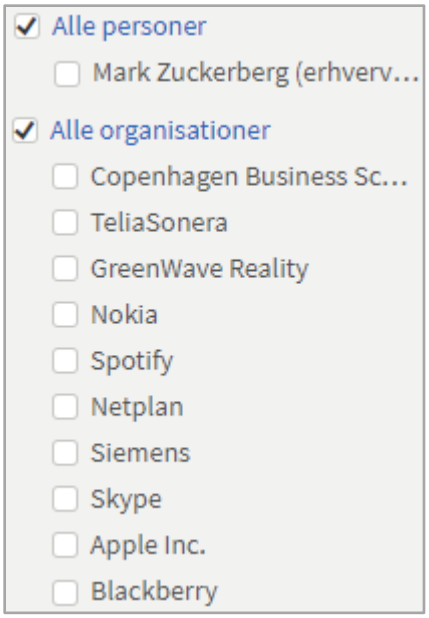


Picture 1 - This is our protocol for how we have gathered and transformed our empirical material

This protocol is showing how we have been actively limiting our searches to various specific time periods. We chose to extract data from a six-year period stretching from 2014-2019. We initially wanted to look at a five-year period, but did not want to include 2020, because we expected a lot of noise in the form of articles about the coronavirus. Then we decided to have the period being 2014 to 2019 but did not want to miss important events that potentially had happened in 2019, so we changed our period for research to be six years, instead of five.

Our protocol also shows how we have gathered data from the platform of Infomedia and escorted it further on to Google Sheets and lastly a visualizations programme called Gephi. This is specifically addressed further on in the section. We ended up splitting all of our data into two networks and the reasons for that were based on choices of trying to make our dataset easily readable and more amicable for ourselves. Furthermore, by actively limiting our data extraction, to focus on persons and organizations, we also were able to cut away some noise in the dataset, that otherwise could have produced doubt and a non-transparent view of the given datasets. This noise could for example be misleading articles, containing the same keywords as we have used in our search (IoT). A lot of these articles were showing when searching for IoT, but we found that a lot of these did not have any relation to the subject at all. It also specified our search for interesting actors in the debate about IoT and could also potentially lead to exciting narratives, from certain individuals.

The focus on extracting data about persons and organizations from our various Infomedia searches, also gave us an easy to use approach for figuring out which events and stories that were connected to different months in each of the years. An example of that could be by looking at a selection of our data from March 2014. On picture 2 we see the search on Infomedia limited to contain material from March of 2014. In the picture we also see which persons and organizations that are present in this search. This information we copy pasted into our ordered Google sheets as seen on picture 3. The sheet is ordered into columns with the categories, from left to right, Actor, Month and Actor type.



Picture 2 - Our search on Infomedia for the months of March 2014

23	Mark Zuckerberg (erhvervslede	March 2014	Person
24	Copenhagen Business School	March 2014	Organization
25	TeliaSonera	March 2014	Organization
26	GreenWave Reality	March 2014	Organization
27	Nokia	March 2014	Organization
28	Spotify	March 2014	Organization
29	Netplan	March 2014	Organization
30	Siemens	March 2014	Organization
31	Skype	March 2014	Organization
32	Apple Inc.	March 2014	Organization
33	Blackberry	March 2014	Organization

Picture 3 - This shows our way structuring our data in Google sheets

By finding persons and organizations for the different months each year, we can quickly pinpoint where certain relevant stories and valuable information about the subject of IoT are happening. We are mainly interested in what is happening on the Danish IoT scene, but it appears that the Danish media also are writing about foreign points of interest such as Facebook founder Mark Zuckerberg in this example. These foreign points of interest we also consider, because it, for instance, could be an article about a breakthrough within the development of a certain IoT technology and such an article also have an influence on the Danish IoT scene in some way.

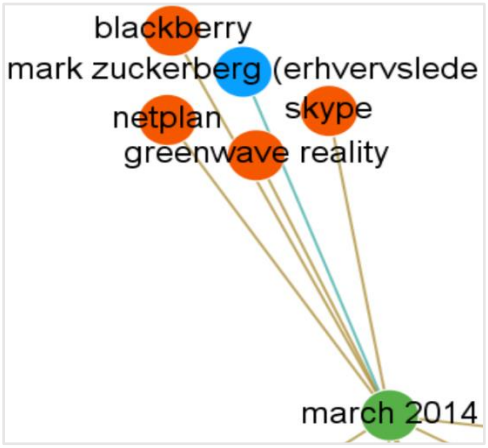
So, the persons and organizations found for each month are indicating that an article has been written about them or an event connected to actions performed by them. Naturally, we are interested in investigating these articles in order to tell the narratives connected to these. We choose to do that even though they are not only revolving around the Danish IoT scene, because some of them also have relevance for our thesis and the story we want to tell, while others do not have the same relevance and therefore are avoided. We can continue our example from our gathered data. Here we saw Mark Zuckerberg as the only person to show up in our search for March 2014. This automatically led to us having interest into why he was the only one present here. There are not a huge number of articles about IoT in 2014, and we get the feeling that it is a theme that slowly is starting to be established that year. If we compare our data from some of the later years, we are able to see more entries of both persons and organizations. This could mean that IoT is getting more and more exposure in the Danish media and therefore is showing more results for our data collection. Now we have addressed why Mark Zuckerberg is the only person showing up for the section of March 2014, but what is the story about him that specific month?

To answer this question, we started to investigate what led to him being mentioned in our data and we found out why. He is present in a Danish article roughly translated to *"A tele-kingdom can quickly turn into a one-bedroom with a lid"*. This article is, in a broader sense, about IoT and Mark Zuckerberg stating that he is aiming to create possibilities for free internet, especially in parts of the world where the internet is not present at the moment. He is also stating that one of his goals is to make the world a more open and connected place. This is of course a disturbing statement for actors in the industry of telecommunications, because, from a standpoint of mere survival and profit, they are marveling about their position in this industry in the future.

In this example, we show our methodological course of action and how we have used our collected data in order to tell the various narratives that exist around this theme of IoT. We aim to use these narratives in our analytical work in combination with our theoretical beliefs, in order to secure a strong analytical framework in our thesis.

Gephi - Visualizing our data

In the section above, we have ventured through our collection of the data we have at our disposal. We have given informative examples of the general use of the data, but we still need to address how we visualize it. This section will cover how we, following our protocol, *"make two Gephi networks"*. Gephi is an open-source network analysis and visualization tool that we have used in order to create networks based on this structured data from our Google sheets and afterwards visualized these as well. Gephi is a programme initially developed by students of the University of Technology of Compiègne (UTC) in France. Gephi has been used globally in various research projects in academia or journalism. An example of the latter is *New York Times* using the programme for visualizing the connectivity of their content (Gephi - The Open Graph Viz Platform).



Picture 4 - A picture of how our Gephi nodes were looking. Here we see March of 2014.

First, to make a network in Gephi, we had to transform our structured data from our Google sheet into a gexf file (Graph Exchange XML Format). This is where we use another open-source tool, called Table2Net, which essentially transforms your csv files (comma-separated values) from your sheets into the necessary files for use in Gephi, also depicted in the protocol as the second to last step. Table2Net is also developed by the French UTC students linked to the development of Gephi. The important part when doing this transformation of our data, is that you must actively choose what your *nodes* shall represent in the Gephi network. In our case, we choose to make a bi-partite network (a network where there are more types of nodes) in order to account for both persons and organizations being visible as separate nodes in the Gephi networks. As shown in picture 4, the nodes with persons is blue, where the nodes with organizations is orange in our network. The green node is each month of the years present. The first network is from 2014 to 2016 and the second is from 2017 to 2019. We transformed our data into these two networks in order to make it easier for ourselves, when having to analyze and visualize the networks and with a hope of the bigger clusters giving us more and exciting narratives to analyze upon. By color coding our networks, we also made it easy to see

how many persons and organizations that were connected to each month. In picture 4 we see four organizations and one person being connected to March 2014. This means that in this picture we still miss some organizations compared to what structured data we have in March 2014 that picture 3 shows. The reason for that is, that the nodes only connected to March 2014 (picture 4) are present only in that month throughout the time period of 2014-2016. The other organizations are more centered in this network because it is mentioned in more months, which in other terms means that the *occurrence count* is higher for the given nodes in the network and therefore they are placed more to the center.

To give the reader a chance to view our two created networks, we have included them as appendixes. Appendix 3 is our network from 2014 to 2016, while appendix 4 is the network from 2017 to 2019. It is with the help of these two networks that our thesis is performing analytical sections further on. These two networks give us a good indication of in which time periods we can research various actor's narratives and use it for our analytical points in this thesis. We have now established how the theoretical and methodological processes looks like in this thesis, and we aspire to perform good analytical research based on these frameworks.

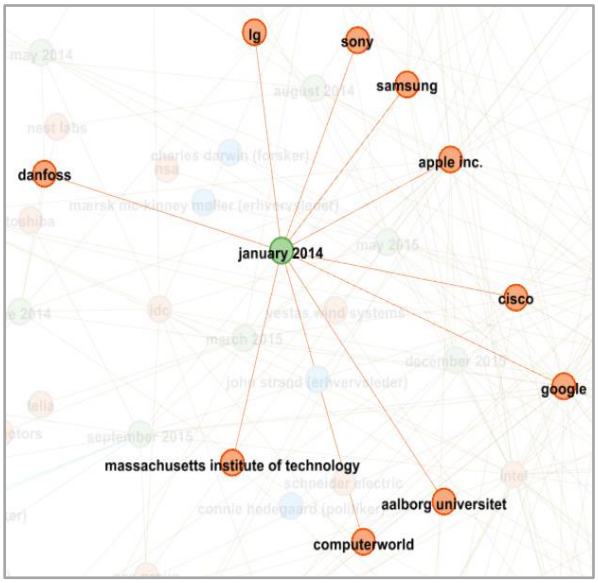
Analysis

In this section, we will provide the reader with our analytical part of this thesis, which is based on the framework of our theoretical and methodological beliefs and choices. The theoretical part is essential to this section, because of Andrew Feenberg's critical view on technology, such as IoT technologies, will help us to break down the narratives in our empirical material and provide an insight into how the evolvement of IoT technologies have been in constant development throughout the researched time period of 2014-2019. By looking into stories and events about the broad spectrum of Internet of Things, we also create a network of actors that can help us analyze which of these that have made an impact or influenced this field. This will increase the analytical value we create in this thesis, because we can identify controversies and unfold narratives in order to answer our problem statement. We will also stay true to our stated problem statement by basing our work solely within our stated framework of researching given articles with the critical lens our theory provides. We aim to highlight controversies that have happened surrounding IoT in Denmark. We will establish, through our mapping of our Infomedia corpus, a IoT network that we

have split into two sections, what the discussion of IoT was like and how it is formed by the actors present in these.

2014 - January

We started our research by looking more into January 2014. This month has, together with nine other months, the lowest connected nodes to them, this is out of 72 months in total. So, we get an overall picture of the general low activity connected to the talk about IoT for this month compared to some of our other months in our dataset. In our search within this month we found only actors present in the form of organizations (see picture 5). Some of the more interesting narratives come from two actors, Aalborg University and ComputerWorld. With actors such as Google, Apple, Samsung etc. it is hard to see anything IoT related in January of 2014, because these are often used as buzz-worded companies connected to another context than what we are interested in. So, we continue to look for other more exciting narratives, which we value Aalborg University and Computerworld to be. They both have articles that describe IoT as flourishing and still in the early stages of development, but also with a need for focusing on security measures while in this early stage. The article (Mahalle et al., 2014) connected to Aalborg University is about Parikshit Mahalle, who has just achieved a Ph.D. degree, and his dissertation is called *"Identity Management Framework towards Internet of Things"* (Mahalle et al., 2014). This dissertation is about addressing identity problems in networks in the wake of mobile and wireless devices being ubiquitous. In order to address this problem, Mahalle is claiming that there are required changes to architecture for naming, addressing and discovery in regard to online protocols. The reason for a change to these subjects is to achieve better ways of finding elements/actors that expose privacy information for users and to get more precise knowledge of the identity of authorized parties. The paper presents what it is calling the Identity



Picture 5 - This picture shows the month of January 2014 in our Gephi network

Management (IdM) Framework for Internet of Things. This framework is built based on existing systems and addressing the key challenges mentioned above (Mahalle et al., 2014).

We here have a narrative that addresses early flaws with the technologies embedded in the world of IoT. We have written in our introduction, that the number of IoT devices is growing fast, and even though these devices have restrictions in the form of ownership and subscription, Mahalle states that security measures are missing. When the users are venturing out in public, they temporarily add things to their public space, by connecting to an IoT device. There is a general struggle to secure these interactions, secure the management and exchange of data and to secure the authentication and access control.

We have described in our theoretical section, that we see concerns around technologies that are not, by design, upholding acceptable ethical standards for the users and this creates potential social constraints. By having little to no focus on security measures in IoT technologies by the government or the various businesses providing these products, the users are then subjected to oppression because of the lack of action by the government and the lack of oversight of companies that go unchecked. It is these power dynamics we aim to address in this analysis, and they become clear with the insight, given to us by the work of Parikshit Mahalle. These social constraints related to a lack of public security in IoT devices, have led to interest in addressing these security concerns with IoT technologies in the early 2014s, such as Mahalles development of the IdM (Mahalle et al., 2014).

The other article from ComputerWorld, called *"The 10 most important it-trends in 2014"* (Stendal, 2014), is more predictive. It is about an analysis, made by IDC (International Data Corporation), that is predicting the ten most important it-trends in 2014. The number one trend was a predicted growth for the Nordic it-market (Stendal, 2014). This ComputerWorld article is also reproduced in Denmark's biggest business media, called FINANS (Finance), and it is here the article is located in our dataset. With a lot of the article revolving around business and growth, it makes sense why a news outlet such as FINANS would reproduce this article, because ComputerWorld is more it-oriented media. As mentioned earlier, the top one it-trend in 2014 is said to be the growth on the nordic-it market, which is good news for businesses in this industry and probably also why this is

valued to be at the top (Stensdal, 2014). Compared to 2013, 2014 is predicted to have an increase in growth of more than two percent on the it-market. This gives us a good indication of how IoT technologies could increase in demand, supply and use for relevant actors in 2014 and further on (Stensdal, 2014). The other top three predicted important trends are mobility - which are an acknowledgement of more smartphones, tablets etc. on the market and therefore businesses need to cater to these users, with new smart solutions. The last trend, in the top three, is the change to "the third platform" - which is an amalgamation of the responsibilities of for example CIO's and CxO's in the companies, connected to cloud technologies, big data analysis and social business (Stensdal, 2014).

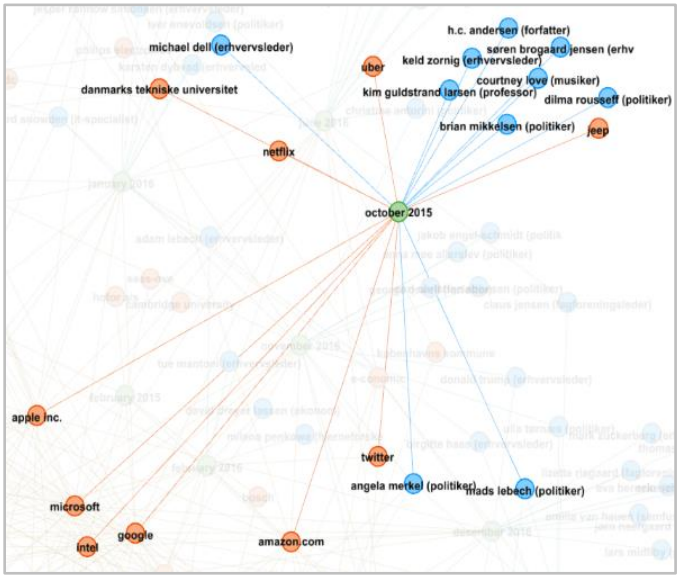
All of the top three trends revolve around either growth, development of smart solutions or internal business responsibilities that are merging. There is no talk about security or improving already existing frameworks for these new technologies that are being developed for the market. Trend number four on the list, is revolving around the Internet of Things and the number of units connected to the internet is predicted to grow tremendously in 2014 (Stensdal, 2014). Compared to the scientific literature, the dissertation made by Parikshit Mahalle, that we presented above, which have things like security and improving already existing frameworks high on their lists, we only find the trend of increasing security measures at spot number nine on the list in the article. This shows a clear distinction in how the scientific literature values things such as security and social constraints, higher than businesses and their affiliated media outlets do.

When we see the above controversy from early 2014 of, on one hand valuing security high in the scientific world and on another see the valuing of security being low from the business world, we can relate this example to the *decontextualizing* thoughts of Feenberg. In the narrative described above, we see how the companies *decontextualize technology*, by breaking it down in order to deploy them with a new IoT framework in them. If we return to the quote from our theoretical section, Feenberg is describing this as such; "*Cutting down a tree "decontextualizes" it, but in line with various technical, legal and aesthetic considerations determining what kinds of trees can become lumber of what size and shape and are salable as such."* (Feenberg 2005, p. 50). By implementing the technologies as IoT technologies, the companies essentially turn an already existing technology into something new. By doing this, they are indirectly performing an

undermining of the users, because the companies give the technologies new meanings in terms of its new technological capabilities. Furthermore, when doing so they also, we assume, unknowingly create legislative requirements in regard to these new capabilities. Mahalle, on the other hand, we identify his actions as being part of the second step in Feenberg's *instrumentalization theory*. He is interested in looking at the design and implementation of the technologies and is suggesting changes to the non-existing legislative limits. So, he looks to remove the social constraints by implementing the IdM framework, that can provide some degree of ethical value to these IoT technologies.

2015 - October

In the section above, we have presented narratives from one of the months with the lowest activity regarding the talk about IoT in the period 2014-2016. We will now analyze narratives, from the other end of the spectrum, in one of the most active months in this period, October 2015. By doing this we will discover if there is any difference in the talking points around IoT for low and high activity months. The reason for how we can evaluate how each month has high or low activity is by looking at the occurrence counts. The first month we analyzed, January 2014, were in the lowest bracket of this part of our dataset. October 2015 is in the top with 20 occurrences compared to the 10 of January 2014. In total for October 2015, we see ten persons and organizations as actors in this month (see picture 6). Out of the 10 persons there are four potential candidates for telling narratives, which are relevant in terms of our research questions. We have determined that the others do not relate to the talk of IoT because their names are addressed in affiliation with IoT as a buzzword, presumably as a way of generating clicks. The four people we find interesting to investigate are Angela Merkel (Chancellor of Germany), Søren Brogaard Jensen (Vice President for Schneider Electric), Kim Guldstrand Larsen (Professor at



Picture 6 - This picture shows the months of October 2015 and all its present actors

Aalborg University) and Keld Zornig (CEO of SAS Denmark). We find them interesting because of their high positions in both business, government and academia.

This month is characterized by a high interest from various actors to invest more in IoT, both in developing reliable networks, building research campuses, increasing security measures and to cater more to the users of their products. October 2015 continues on the subject from the section about January 2014, with further talk about the aspect of security. In October 2015, businesses seemed to have a better understanding of the importance of robust security measures. In an article called *"Security will be crucial to the next wave of digital innovation"* from the newspaper BØRSEN, Keld Zornig discusses this higher focus we need to have on security (Arkir, 2015). When companies are urging the users of their services to be approving of the companies using their data, for example to develop better products, Zornig states that it is the company's duty to do everything in their power to honor this trust and provide a secure experience for these users (Arkir, 2015). This is a change in what the businesses are valuing as important in regard to the development of IoT technologies, compared to January of 2014. We here see a new narrative, which is the realization from the business world to improve on subjects like security. Returning to the thoughts of Feenberg, we here see in this narrative that a change is happening in terms of designing the technologies. The companies are turning more to the second step of *instrumentalization theory*. They are in October 2015, actively thinking about developing better legislative frameworks for the IoT technologies, which are the opposite mindset compared to January 2014 and shows us the internal development of the companies also.

This leads us to the next relevant narrative from the person called Kim Guldstrand Larsen, professor at Institute for Computer Science, at Aalborg University. In an article from Videnskab.dk called *"Internet of Things: When things see, hear, feel and spy on you"* he is addressing the needed processing requirements for these huge connected networks that IoT technologies are embedded in and state that these networks have to be strongly reliable in order for most functions to run smoothly (Salomonsen, 2015). He is also addressing that examples are seen, where some of these networks not always are working as intentionally and this can create concerns in various contexts (Salomonsen, 2015). For example if we someday get self-driving cars or are tracking our own well-being, the networks where these technologies are connected to, have to be completely

reliable, if we want to avoid the dangers of say, a pacemaker possibly not working or a car going rogue in the traffic, because of a unreliable connection to the network. The talk about this subject was not present in January 2014, so naturally we see how the implementation of IoT technologies and the cementation of IoT on various markets, force both the scientific world but also businesses to think more about this onrushing phenomenon in October 2015 (Salomonsen, 2015).

In regard to accommodating the phenomenon of IoT as mentioned above, we also see politicians being more involved and new measures being developed in order to follow the onrushing development of IoT. The Chancellor of Germany, Angela Merkel, is part of an interesting narrative from this period in our empirical data. An article from PackMarkedet.dk called *"Bosch is opening a new research campus in Renningen"*, is addressing the need for businesses and interested researchers to do industrial and scientific research on how to improve IoT in various contexts (Windeløv, 2015). In order to establish Germany as a location affiliated with technological innovation, Bosch opened a new research campus, which had the purpose of exactly doing that, innovate and create new ways of connecting different fields of study. The CEO of Bosch Volkmar Denner also compared this new facility to Germany's Stanford University (Windeløv, 2015). Angela Merkel is mentioned only as being present at the opening day of this research campus, but together with her a lot of other politicians, researchers and business were represented (Windeløv, 2015). This shows how a campus of research working with, among others, IoT technologies, draws the attention of various important figures from the German top. With Germany taking the steps to build such a facility also shows that compared to earlier, that the businesses and scientific world is trying to follow the evolution of IoT. By investing 310 million Euro, Bosch shows us that they are committing to the development of IoT technologies, as part of Industry 4.0 and that it is an important part of the future. They act in order to follow the constant pressure of IoT development in the business and perhaps to produce research that will keep them in a position that ensures that they can have an impact on this continued development.

The last article we find interesting to research is from Danish newspaper BØRSEN and is called *"It was like getting 500 hours of therapy"*. The narrative in this article, is about the former vice president, from the tech-giant Schneider Electric, named Søren Brogaard Jensen and his invitation for his VL group (business management group), to gather relevant actors and brainstorm, how to

get his company started with IoT (Rasmussen, 2015). There was a special theme for this meeting, that being how to develop technologies within the sphere of IoT so it would benefit the consumer in the best possible way. Brogaard Jensen, was anticipating that the development of IoT as well as new actors on the market, were able to disrupt their businesses in the following years (Rasmussen, 2015). Therefore, he called for this VL-meeting in order for Schneider Electric to prepare for the future. A vast array of fields was gathered to talk about these problems Schneider Electric was facing and Brogaard Larsen expressed, in the article, that he was overwhelmed by the groups many suggested strategies and solutions. The group quickly stated that instead of using a business model as for looking through what your products can provide to the customer, they would do it the other way around - Look into what the wishes from the customers were and how could they adapt their products to accommodate this line of thought (Rasmussen, 2015). Here we are addressing the question of how the customers are being considered an important step in the development of IoT. These thoughts were not present in our other section about January 2014, and therefore we see a change in how the businesses' IoT strategies are evolving, to cater to their customers more.

Summing up 2014-2016

Throughout the analysis of our first period 2014-2016, we have started out by showing various narratives from the low activity month of January 2014, the earliest point in our dataset. We have continued to further analyze the talk about IoT in the very active month of October 2015. The two chosen months, in this period, were about different subjects, but still had some similarities in how they addressed the development of IoT and how companies were forced to act upon new revolutionizing ways of doing business and new technologies becoming part of the market. We saw an interest from the scientific world throughout this period, first being concerned about available security measures regarding IoT solutions and second, in the form of suggesting preemptive solutions to new and existing platforms and networks of IoT technologies. The main positions from the business world were at first evolving around how to maximize growth and secure a spot on the market for your business. Later on, this focus switched to care more about the consumers' needs and how the companies have to earn the right to use their personal data. In order to earn this right, the companies had to ensure protection of the consumers personal data and make sure it was not violated, when deploying various IoT technologies. We also saw narratives telling us that big tech companies were focusing more on looking with the outside-in perspective rather

than the opposite. This could help them identify what the needs of the consumers were, instead of just developing their technological solutions with no regards to the consequence and possible benefits of this technology for the consumers. Consumers now have a way of participating and possibly influencing the agenda of future development of IoT technologies.

When analyzing this period with the thoughts of Feenberg, we also see various patterns come to light. In January 2014, we saw the pattern of the consumers/users being oppressed by the design of the companies' technologies, because little effort was put into making these technologies secure to use. With the focus mostly being on improving growth and investing in the IoT market in order to profit, the businesses were indirectly oppressing consumers (Van Den Eede, 2016). Even though this is raising societal concerns, actors from the scientific world were increasingly interested in solving the problem of these security measures being absent by suggesting different changes to the infrastructure of the IoT technologies. The actors from the scientific world, ventured out into the process of *decontextualizing* the present IoT technologies and their platforms, by looking into the core framework built around IoT with the help of other technical and legal considerations (Van Den Eede, 2016). These identified patterns changed in October 2015. The consumers were not being oppressed by the design of the technologies, because the companies were focusing more on improving security in these technologies. The businesses also actively took choices to switch from an inside-out development perspective to an outside-in perspective instead, which again would benefit the consumers in terms of their needs being heard in the development of new technologies. Even though companies seem to act in the best interest for the consumers, the first part of Feenberg's *instrumentalization* theory is still present here (Van Den Eede, 2016). Embedded in the process of developing new IoT technologies to a lush market, are a lot of political and business interests. This is because the IoT technologies still are used, often unnoticed, as a means to preserve the power of the businesses. This is for example the case with the research campus being created in Germany. The reasoning for building this campus is of course to use it to develop new exciting technologies that cater the users/consumers, but the other side of this story is that a company, such as Bosch in our example, also feels the need to establish their own relevance in this fast-paced technological era, by funding projects like these (Van Den Eede, 2016) and that could potentially undermine users of these technologies, because Bosch is then controlling the design processes of these technologies.

2017-2019

As mentioned earlier, we have split the analysis of our network into two sections, this section will be focused on the three-year period from 2017 to 2019. The reason we have done this was to make it more manageable to dive into for ourselves and more transparent for the reader. Similar to the 2014-2016 network, organizations appear to have the highest occurrence count. Microsoft and Google still have the highest counts, but instead of Intel and Apple Inc. being named the third and fourth highest, the EU and Amazon.com take their place (See appendix 5 & 6 for comparison). One reason for EU having a higher occurrence could be because of the election in the European parliament in 2018. This is however not the only reason as there still are many articles regarding EU law and projects surrounding IoT. Amazon.com' high occurrence count is due to Amazon being a global company and investing a lot of money in home appliances, cloud services and smart technologies. There are still a lot of names of both famous people and businesspeople being mentioned but having a very low occurrence count. We have tried to focus on the organizations and people with the highest occurrence counts, because they often occur in several different months making it easier to follow if there is a story to pursue. Another thing that made it worth limiting ourselves to these few keywords, is that they are used in a lot of different articles, so we were able to find different topics that were useful in a continuation of these.

Elon Musk and Donald Trump are names that both have a high occurrence count compared to other names in this dataset, Trump with 14 and Elon with 16 counts. Both of these names however are not directly related to IoT in almost all of the articles we have looked through. Most of the articles where their names occur, is an article that mentions IoT alongside other technologies. Often Elon will appear when AI is mentioned because he has been outspoken about his concerns with AI (Piper, 2018). Elon is not outright used as clickbait, but his name is used in these articles because of his popularity. This is perhaps to make it easier for search engines to find the article, but we cannot say for sure because we do not know how Infomedia's algorithm works.

Trump's name appears much the same as Elon's, but it is usually in articles that are a sort of compilation of many short excerpts gathered in one. For example, one of the excerpts has a short

story about IoT and further down there is a short excerpt of something unrelated Trump has said or done.

There is however one article from June 2019, that is interesting regarding Trump and IoT. It is called *"USA sanctions halt AI and IoT"*[1]. As the title implies the US government added the Chinese company Huawei to a list of 'foreign adversaries', meaning that American companies cannot trade with Huawei. The article states that Trump is doing this to halt Huawei's influence on the development of 5G networks in the US (Bennetzen, 2019). Though the title implies that IoT and AI is significantly affected by these sanctions, the article explains that it might affect American companies even more because it is beneficial for them to do trade with Huawei and it will not affect Huawei as much, rather it will leave Huawei to have more autonomy over what types of components they use. This article paints a sort of negative picture of the actions taken by the US government, without there actually being a good argument for the title of the article. As the article states the actions taken would not really affect the growth of AI or IoT on a global scale, especially when looking at what we have already covered about how the former Danish government has made plenty of moves to promote and support this growth. Another article called "The debate around Huawei has been completely derailed - And there is no solution" (Jørgensen, 2019) even states that the debate regarding Trump and Huawei has been derailed and the focus has been shifted away from concerns about safety in regard to 5G, and the fear that a Chinese company is trying to build a 5G network in western countries. What this debate shows is that there is a power struggle within the technocratic elite, to gain power. If we use Feenberg's first level of *instrumentalization*, we will argue that the next generation, 5G, of broad cellular network is being *decontextualized* and instead of having the same limiting uses as 4G, new technology is taking advantage of the capabilities of 5G, and therefore enable companies to use it more effectively and spread their influence father than before (Gotschalk, 2019). This in turn would give the companies controlling the data flows generated through 5G, more power.

When looking into the Danish scene, the politician Brian Mikkelsen is a name that comes up a lot in this period (2017-2019). It is most likely attributed to him being the Minister of Business and Growth as part of the political party Venstre which is the governing party during this period. In

[1] Danish title: *"USA-sanktioner bremser AI og IoT"*

2017 Brian Mikkelsen led a presentation of a newly opened "Exploratorium" made by the German company SAP in Copenhagen. This place is made to show visitors what IoT is and what it can do (Hovgaard, 2017). This goes to show that companies and governments are finding a common place to discuss the development of IoT. In 2018 a partnership was formed between the government and World Economic Forum (WEF). WEF is an NGO that seeks to join together governments, business leaders, international political leaders, academics, and journalists to discuss and improve the global and regional industry in the world (Tarp, 2018). This is a further example on how private business and government form an interest group to discuss and potentially agree on solutions that could affect the lives of individuals that do not or cannot hope to have an influence on what is decided. This is also a continuing trend from late in the 2014-2016 network, where we also saw interests in collaborating across disciplines.

Prosabladet 2017, January 6. by Anders Kjærluff – journalist and radio host on the program "*aflytte*" where he has been critical of digitalization of society. This is a commentary article by him, which is why the nature of it is critical, but the information is no less troubling if you look at it from the perspective of Feenberg. The government is taking advice from a company that is a major player in designing technology, technology which is already a huge part of our everyday lives. Based on this article they are also making their claim on the industry with the promise of financial gain and more jobs. Google is the designer of technology while the government is using it. The only claim to a democratic process would be that of the elected politicians. They do not have a say in how Google, are to design their technology or how businesses use that technology. Google reap the benefits while the society accepts the choices made on their behalf. Even the ability to choose whether or not you wish to use certain technologies is quickly diminishing as an option (Baldwin, 2019).

Anders Kjærulff wrote an opinion piece called *"Disrupt: The disturbed government"*. He writes about a conference called *"digital frontrunners"* in September 2016, where Google and Singularity University promised Danish politicians a growth of BNP by 200 billion and 150.000 full time jobs if they were willing to embrace industry 4.0. For anyone that did not understand what their plans were, they referred them to a report done by Boston consulting group, which coincidentally is paid for by Google. This article paints a critical picture of the government's

actions following this conference. It cites that disruption is a term used to scare politicians and companies into doing "weird" and costly things, to avoid their country or business to be affected by the "uber-effect". A term described as when a company believes it is exempt from paying taxes in a country, where its app is being used. As a result, Danish politician Sophie Løhde was appointed Minister of Innovation, a newly created position. The Danish industry also made a council called "Disruption rådet" which is to help businesses transition into a new more digitalized era of business and industry (Kjærulff, 2017). This action also fits well with the goals set by the Danish government towards increasing their digital growth as earlier mentioned

Same as we did in the first part of our analysis, we tried to look into a name that had a low occurrence count. At random we chose a few names from different months to see if we could find an interesting story. The name Jørgen Tang-Jensen were one of these names, because it appeared alongside a company with a high occurrence count, Apple. Jørgen Tang-Jensen is the CEO of Velux. In this article called *"Indoor climate: Velux in a digital gamble with Apple"* (Kongskov, 2017). Danish company Velux teams up with French company Netatmo that is creating digital solutions for your smart house. Velux specializes in windows, and with Netatmo they want to digitize your windows so that you can control your windows only using your smartphone. The goal is to be a part of the Apple home kit. Note that Apple, Google and Amazon all are in competition with each other to create a platform for smart homes. This is just an example of how most companies are moving towards a more digitized approach to business in 2017. At this point in time most of what is mentioned about IoT, is how industry is moving towards this digitalization. Big companies like Apple, Amazon and Google are mentioned frequently and across different articles, because they are big movers in the industry. They supply a lot of technology that is beneficial for companies to outpace their competition.

The term Industry 4.0 has a common occurrence in many of the articles revolving around businesses, both foreign and Danish, and how it will usher in a new wave of doing business. Industry 4.0 was a movement headed by the German government back in 2011. A workgroup led by Siegfried Diaz from Bosch and Henning Kagermann, a German physicist and businessman, formed a plan for how best to go forward. What this revolution entails, is a shift to more automation in manufacturing, called Cyber physical systems and automated logistics (Marr, 2018). If we are to believe the claim by Google, that is mentioned further up, that with Industry 4.0 will

generate 150.000 new jobs, then that is a huge feat. But we find it problematic because Feenberg describes a process similar to what happens with the implementation of Industry 4.0, he says.

> *"By reorganizing the work process, he [red, the owner] can increase production and profits. Control of the work process, in turn, leads to new ideas for machinery and the mechanization of industry follows in short order. This leads over time to the invention of a specific type of machinery which deskills workers and requires management. Management acts technically on persons, extending the hierarchy of technical subject and object into human relations in pursuit of efficiency."* (Feenberg, 2005, p. 52).

With Industry 4.0 there is an even greater focus on manufacturing without the need for human interaction. This could mean that even management would not be needed. It is not outside the realm of possibility that manufacturing could be done without humans at all and how this would lead to more jobs, new or old, is hard to picture. However, there are still challenges that Industry 4.0 must overcome before becoming a new standard for how manufacturing is done. A reason we see so many articles about how businesses should prepare for organizational change is because with Industry 4.0 organizational change is needed. Rules and regulation are also needed to accommodate the changes and new uses of technology. Concerns for privacy is also a challenge. We will address this further in the next section.

An interesting name that stood a bit out in this part of our dataset is the name of the author George Orwell. Famous for his social criticism and opposition of totalitarianism, and most notable the book *Nineteen Eighty-Four*. This article is written by a Danish politician, Pernille Weiss, and it was released in several local newspapers and on a few news websites in May 2019. This is the only article where he is mentioned, a reference to his book is made, in the title of the article called "*Big Brother on the backseat*"[2] (Weiss, 2019). The book *Nineteen Eighty-Four* tells the story of a dystopian society where mass-surveillance is everywhere, and the government is exerting totalitarian control with it. The first line of the article states that Orwell's vision of mass surveillance would occur in such a way as it has today. The point being made is that in our current society, almost everything we own is connected to the internet in some way. It is mentioned that

[2] Danish title: "Big Brother på bagsædet"

this is what IoT is and in the coming years it will change the way we live. The politician goes on to make examples of how everything is connected and what the benefits and concerns are regarding this development. A positive is that with smart technology, we will be able to save time, create comfort and save lives. The politician then goes onto use the car to show concerns with smart technology. For example, the EU has made an emergency call system called Ecall, which has become mandatory in new cars since 2018, this system relies on a mobile data connection, which transfers all kinds of data about the cars behavior, e.g. parking, speed and who is driving. The intent is to increase traffic safety, but the politician raises concerns of who owns this data. The fear is that the data can be used against the owner of the car. The politician then states that not only are drivers raising these questions of concern, but so are interest groups, and there is a request for rules and regulations to help ease their concerns.

However, as informative as this article is, it is overshadowed by the timing and presentation because the politician who wrote the article, could have an ulterior motive. The person is a candidate for the coming EU parliament election that was set to happen May 23 to 26 in 2019. While the concerns that are raised in this article have merit, you can easily make a link to how technology eventually affects us based on the design decisions made by either a company or authority. The car becomes *decontextualized* when new technology is integrated into the car that does not necessarily make it better at its intended purpose e.g. transportation. These new technologies also subject the car to further regulations both legal and technical. These technological design changes ultimately serve to make the car better, but the car does not undergo a democratic process in choosing these changes. This is the only article that makes a direct reference to George Orwell himself, a few other articles also use the term “Orwellian state”, as a way of describing how IoT and its uses has some semblance of mass surveillance and oppression. These article often do not truly explore this but rather goes onto either give some insight into what IoT is being used for, its development or some safety concern.

Most of the articles we have encountered in this network are very business focused and with the written language being very technical and sometimes hard to follow if you are not familiar with the technology being discussed. We have come across articles that raise concerns about the size and scope of IoT. These articles have both appeared when selecting either EU, Google,

Amazon.com or Microsoft on Infomedia. One of these articles is an article from 2018 by Vibeke Arildsen called "*IoT developers call for ethical data revolution*"[3]. In this article she has interviewed Irina Shklovski[4], about one of her projects, the VIRT-EU[5] an EU funded project. She has specifically worked with how IoT developers address ethical questions concerning IoT (Arildsen, 2018). Who these developers are, the article is not specifying. Arildsen's work has shown that IoT developers are trying to get more focus on these ethical questions and laws pertaining to privacy. This is interesting because when we look through many of the articles on Infomedia, we very rarely see articles with a similar notion of the need for ethical considerations. We have seen articles with the notions of need for laws to regulate IoT, but never some about these ethical considerations. Furthermore, the research Irina Shklovski has done within this project calls for ethical questioning being applied as early as possible in the design process of IoT technologies. What this means, is that one of the goals of this project is to create tools and guidelines for the developers to include ethics more in the design process. This has some resemblance to what Feenberg says about resisting technocratic elitism. He states.

> "*... shattering the illusion of transcendence by revealing the feedback loops to the technical actors. The spread of knowledge is not enough by itself is not enough to accomplish this. For knowledge to be taken seriously, the range of interests represented by the actor must be enlarged so as to make it more difficult to offload feedback from the object onto disempowered groups."* (Feenberg, 2005, p. 55).

The gist of what Feenberg says here, is that information is led back to the developer, in this case that could be via tools or guidelines. If you say that the users of IoT technologies are the disempowered i.e. you have no say in the design process of these technologies, a project like VIRT-EU has a lot of backing and we can assume that the feedback, tools and guidelines, does influence developers and ultimately help address the concerns regarding laws and privacy.

Another notable example of a call for more inclusion of the users of IoT technologies, comes from

[3] Danish title: *"IoT-udviklere kalder til dataetisk revolution"*
[4] Irina Shklovski is a researcher at ITU Copenhagen
[5] Values and Ethics in Innovation for Responsible Technology in Europe

Anja Bechmann and Anne Henriksen, both researchers at AU (Aarhus University) data lab, working with personal data use, algorithms in technology and society as well as research- and business-networks. They have an article in Jyllands-Posten, where they address some positives and negatives regarding the development of IoT in our society (Bechmann and Henriksen, 2018). They note that there are high expectations in Denmark for IoT to make everything smarter and more convenient, and that European and Danish companies need to be the first to develop and deploy IoT in Denmark, otherwise Google, Apple, Microsoft or Facebook will do it. Bechmann and Henriksen then note that as technology has become smarter, it has already become part of our everyday life. But how is this technology smart, when the end users have not been included in the process of making them? Bechmann and Henriksen state that smart technology has long been a functioning playground for engineers and computer scientists. So, what may be smart for the engineers and computer scientists may not translate to real life scenarios. Bechmann and Henriksen see this as an opportunity for namely Danish companies to utilize the Danish welfare-model as an example of how to include people and different living circumstances, as a way of shaping the future of IoT development. Because humanity is a key component when designing IoT and implanting it successfully. This is in line with Feenberg's second level of *instrumentalization* because Bechmann and Henriksen demonstrate that there is a need for a different process in the design of IoT. Instead of all the decision-making power staying in the hands of the engineers, there is a need for understanding the context in which these technologies are used, and the power is therefore divided.

Implications

In this section, we will highlight some implications we value most important to address. These reflections about the different subjects will portray thoughts about our own satisfaction of the thesis and tell about which processes or subjects we found to be problematic or having a disappointing result. We also want to pinpoint what our methodological and theoretical decisions have had certain meaning to our thesis.

The first point we want to address is the decision to only have our thesis to contain material mostly from the Danish IoT debates and events. We felt that taking this decision to only focus on

Denmark would narrow our area down to be more manageable, but by doing this we also wrote off possibilities to achieve beneficial knowledge from other parts of the world. We had one example of looking to one of our neighboring countries, Germany, in order to show the huge progress, they made with IoT technologies. This was a valuable informative source we could have used more in terms of seeing this development of surrounding countries' influence on the Danish IoT scene. By narrowing down to only focus on looking at Danish news articles and their narratives, we potentially could have missed if a breakthrough happened in the development of these IoT technologies in other parts of the world. The Danish media could of course have written about these breakthroughs, but the direct understanding and insight in these could be missed because it was being portrayed through filtered articles.

To stay in these same tracks, we also wanted to pinpoint the same scenario for only looking at Danish scientific articles. By using another database such as LexisNexis, we have potentially missed valuable information about the future development of IoT in the world, and this might have been beneficial for portraying the IoT scene in Denmark. By this we mean that in terms of knowing about the origins of certain imported technological solutions, we could have gotten insight into which political and business decisions that were a part of both the development but also the import of these technologies from Danish actors.

In terms of our dataset, we choose to split it up into two sections. The first one being from 2014 to 2016 and the second one from 2017 to 2019. We did this to focus on smaller periods of time in order to better create the overview of valuable narratives we wanted to address. A reflection connected to this choice, was why we did not go further down into specific periods of time, also to make potentially better and transparent visualizations from our dataset. We realized, too late, that this probably was the way to get the best out of the found narratives in our data and therefore used this way of diving into single months in some parts of our analysis, for making the best interpretation of the field of IoT in these months. We are aware that a potential increase in our results would have happened, if we had done a thorough examination of each month in our six years period, but the work needed for doing that needed a lot of time, that we simply did not have.

Another implication we want to address connected to our dataset, is about the interface of Infomedia's archive of articles. It was hard for us to sometimes figure out the sheer number of articles connected to each actor. A lot of the articles that we could see in this archive was a reproduction of an original article from another news media outlet, which made it hard for us to make clear how many different entries of a given actor there actually was in the dataset. If we take Microsoft for example, it is a company which is often related to technologies also being from the IoT sphere. If we sought articles about Microsoft in a specific period, for example the year of 2018, to get an overview of how many times this actor had been mentioned in the media compared to others in order to see the various actors' impact in the media, it was very hard to get a precise estimate. If we would get 25 articles for a month, a lot of these would be the same articles, but posted from different sources. Another example of this is the person Rasmus Theede, who has an occurrence count of one, but when looking into what is written about him, there are 30 hits to his name. But all these hits are inflated because it is only one article duplicated dozens of times (see appendix 7) This, again, made the workload immense for us, to go through each name and organization to single out articles of interest and for such a project we needed more time. With the knowledge we have now from this thesis, we could see this type of project being interesting in investigating which impact the various actors had on the media, just by being a buzz worded company or present in the hype cycle of the subject, compared to other more unknown companies with a potentially equally important technological claim.

We have mentioned earlier that we could have made our thesis in cooperation with TDC. The prospect of this was very exciting for us because it could have given us insights into how the TDC were working and how they had formulated their IoT strategies. Instead of having an outside-looking-in perspective of IoT and its development, we would have had an inside look at it instead, however from the perspective of TDC and their actions. An issue we would run into, would be how we handled biased information provided by TDC. We would also have to worry about not becoming consultants to TDC, and our thesis becoming more of a helpful guide to TDC and how they should handle IoT related issues. Our theoretical framework could possibly also have changed influenced by interest from their side. With these insights gained, Feenberg's CTT might not have been the best fit and we could have found Actor Network Theory (ANT) more beneficial to work with. ANT might have changed our focus onto focusing more on

specific actors within or connected to TDC and how these individuals potentially would influence the agenda of TDC.

Conclusion

In this thesis we wanted to show the debate and narratives connected to the topic of IoT in Danish media. We did this by utilizing the media archive of Infomedia, and sought out news articles, newspaper articles both local and regional, magazines, commentary and Ph.D. dissertations. Through these we have tried to gauge which actors that have been present in the discussions and narratives of the debate surrounding IoT. Because Infomedia's algorithm is *blackboxed* we had to make two visual networks, spanning six years from 2014 to 2019. These networks would help guide us in the direction of organizations or persons with high occurrence counts, that we believed could be of interest to us. For the most part this was true and a lot of cases they would help to point us in the direction of narratives that were meaningful to analyze. The highest occurrence counts in our networks, where that of the biggest organizations in the world. These were often affiliated in two scenarios, either as buzzwords in articles or with a presence in the narratives that were relevant to the discussion because of their global influence and status in the industry. The narratives we often saw represented the corporate world and how IoT affected business strategies, business dealings, business organization or in business development. These narratives came from news sources often focused on the business world, but we encountered a few articles that were represented in smaller regional newspapers. We very rarely saw any representations of the consumers of certain IoT technologies. The few articles we found, presented by academia and academics had an interest in supporting the rights of the consumers in terms of suggesting improvements to the security measures connected to IoT technologies.

With the help of Andrew Feenberg's Critical Theory of Technology and specifically *instrumentalization theory*, were we able to identify the impact IoT has on technology and how easily it can *decontextualize* technology and create the need for new legislative solutions in order to secure an acceptable standard both ethically and legally.. Additionally, this puts the corporations producing and deploying IoT in a position of power, because they dictate its use. We were able to identify movements that sought to highlight disparities in laws and the need for change. These

changes should come as early as during the design process of IoT technologies and laws should be in place to help guide developers of IoT. These changes would help the consumer gain back autonomy over the data created while using IoT technology.

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