NTNU
Kunnskap for en bedre verden

Department of Computer Science

DCSG2900 - Bachelor Thesis Bachelor of Science in Digital Infrastructure and Cyber Security

Project Plan

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1 Introduction

The bachelor thesis is the final evaluation we have as students in the 3 year bachelor's degree program Digital Infrastructure and Cyber Security at NTNU. We as students spend almost our entire final semester working on an assignment relevant to the program from an actual company and write a thesis about it. It is a good way to help us prepare for the actual work we will do after graduation. This document is the project plan for our bachelor thesis.

1.1 Background

The client for this thesis is Telenor, a company that among other things, maintain and expand the mobile network infrastructure in Norway. Telenor sees that it is critical to uncover quality challenges in the mobile network for industrial use-cases. One of there industrial use-cases where quality of the coverage of the mobile network is important is in self-driving tip-trucks working in quarries. The tip-trucks uses a combination of GPS from satellites and correction data received over the mobile network to get an accurate location of themselves. If they lose connection with the mobile network they can't get a accurate location and they stop and enter a safe mode. To improve this use-case, Telenor wants to find a good way to monitor the quality of the mobile network in these tip-trucks as the quarry gets deeper so they can get an early warning if the quality gets worse. This way they can improve the coverage before the tip-trucks lose connection, enters safe mode and stops.

1.2 Assignment

Ref. Task description in Appendix

Our assignment is to discuss and find a "super parameter" that can be used to give a good indication of "downtime" for an industrial use-case. This parameter should be based on the different parameters that affect the coverage and quality of the mobile network. The parameter should be able to be used to rapport on the quality of the network for a given vehicle in a given geographical area.
The second part of the assignment is to go out and take measurements and test the mobile network in a specific geographical area and develop a system that can take the results of these tests and put them into a map that show the quality of the area based on this "super parameter" that we found.

2 Project Goals

Here we will describe what goals we want to achieve with our bachelor project. We have divided the goals into effect goals and result goals. Result goal is specifically what we want to deliver at the end of project. Effect goals is what we want our project to achieve in the long-term, after the delivering the project.

2.1 Result Goals

Here are the result goals we as team has agreed upon:

- Produce a complete and well-written bachelor thesis.
- Produce a parameter which will indicate downtime and quality of network connectivity in specific industrial use-cases.

- Showcase all our mobile network coverage test results in a map-application, which will give a clear overview of the parameter readings we get from the meraki API.
- Creating a well-documented playbook that can be displayed in Telenor Expo.

2.2 Effect Goals

Here are the effect goals we as team has agreed upon:

- Uncover problems for quality interference in network connectivity with mobile network.
- Telenor will be able to use the super parameter found through the project to gather data on network quality for remote controlled or self-driving vehicles in industrial use-cases.
- Contribute to partner development between Cisco and Telenor.
- Gain experience in conducting scientific assessment and being able to improve their reflective capabilities on all the findings.

3 Scope

To be able to do the assignment we need to establish a clear scope so that we don't stray from the objective.

3.1 Time

The time limit for when the entire project is to be finished is Monday May 22 2023. Beyond that we have as a group decided on some other deadlines for when parts of the project are to be finished, which can be seen in the Gant-chart.

3.2 Testing and Equipment

We will only test within the designated geographical area and only with the network equipment that we have been provided by the client, plus our own laptops. We will do the tests from a car driving through the area. The equipment will stay inside the car during the tests. We have decided to focus our testing on a section of Skonhovdvegen see Figure 1. We have have chosen this section due to Telenor having data from previous tests that indicates varying signal quality on this road. For the tests themselves we will perform three tests on the same day, at different times. This is to see if the signal quality differs due to varying amount of data traffic. Weather conditions can also affect the signal quality, so if possible we will try to do some tests in bad weather. See section 6.2 for more on our testing procedures.

3.3 Product

The product we are going to deliver to the client will consist of a system that will showcase the test result visualized in a heatmap of the designated area and a written report.

There will also be the playbook containing the demo-setup which includes our detailed approach of how to replicate one of our testscenarios, including how to configure the hardware and setting up the heatmap in Elasticsearch using the results from the test.

3.4 Report

The report will include how and when we did the tests and why, and the following results and how we use those results to possibly tweak the next test to give some useful results that can help us get closer to figure out the super-parameter with analysis and discussion. It will also include a theoretical part.

3.5 Theory

The theoretical part will cover some basic theory around frequencies, signal, 4G LTE, measurement of 4G quality, radio propagation and other relevant theory related to the project so the reader of the report can get a better understanding of the main concepts talked about later in the report. The theory will be limited to what is required to cover the tests, the test results and the theory surrounding 4G that is required to better understand 4G.

4 Project organization

Ref. Group Contract in Appendix

4.1 Roles

We have decided to assign some permanent roles and responsibilities within the group. The roles are:

- Project manager - Espen-Andreas Oseth
  Responsible for making sure that problems that arise within the group are being addressed and also that all group members have something useful to do.
- Referent - Lars Martin Nygaard
  Responsible for writing a short summary of every meeting with the client and with the supervisor.
- Document manager - Vebjørn Albinson
  Responible for delivering the right document at the right time and having a local backup of the project.

In addition is Wisam Khalid Razi backup for every role, should the one having any of the roles become temporarily unavailable.

4.2 Rules

Some of the most essential rules that the group has agreed upon:

1. Decisions concerning the project are to be taken with a vote.
2. All expenses concerning the project that the client does not cover are to be split evenly between all group members.
3. Our primary work environment is to be the Git-lab page we made and documents are to we written using LaTeX.
4. Every group member are obliged to work at least 30 hours a week as of week 3, unless the group have decided something else for that specific week (though it is the average number of hours worked that is important, and that should average out to about 30 hours a week).

5. It is expected that each work hour logged consists of at least 50 minutes of work. This is mostly to make logging easier and make it easier to round off hours worked.
6. Every group member is obliged to attend every meeting that the group have agreed upon, though exceptions can be made if there is good reason and the group has been alerted early (though there are a common understanding that in some cases early notice is not possible)
7. There are to be written a short summary from each meeting with either client or supervisor.

4.3 Breach of contract

If any group member violates the rules agreed upon and signed by all members the routine is in escalating order:

1. Talks within the group to try to figure out a solution that the other group members can agree upon. If an agreement is reached, every group member is responsible for following up that the agreement is carried out.
2. Talks with the supervisor
3. Talks with the study manager and possible exclusion from the group. The client will be notified.

5 Planning, follow-up, reporting

To make steady progress in the project we need a plan for how we are going to do our tasks and what meetings we are going to have to ensure the continuous quality of the work and to react quickly if we stray from the assignment.

5.1 Process framework

We have concluded that the scientific method is the method that suits the task best. We will form a hypothesis on what we will observe, then we will do the experiment and analyze the resulting data to form new hypotheses that we can test by changing different parameters in the experiment and try it again to see if the results would be different. We can then make conclusions on how the different parameters affect the experiment. This way we will hopefully manage to find the super-parameter that the client is looking for to determine when a device is in danger of not getting good enough coverage.

We are also using a Kanban board on git to make the project workflow go as smoothly as possible. Kanban is an agile framework that aims to make the workflow more flexible and able to respond to change. A Kanban bord works by having tasks move between categories as we work on them and makes it easier to manage the project (Kissflow, n.d.).

5.2 Plan for regular meetings

We have a regular status meeting every Monday at 09.00 to get an overview of what each group member has done and what status for the entire project is. It is also for quality control so that we can review the work that has been done to determine if the group agrees that it is good enough. Then we can determine what we are going to do the following week and divide the upcoming tasks between us.

We plan to have regular meetings with our advisor Thursday 10.00-10.30 every week. Meetings with the client will also be fairly regular, about every other week, but the weekday and time of day will vary depending on when the client has time.

6 Organizing of quality assurance

This section will describe the standards we have for documentation and which standards we will be using through the project. Risk analysis is also performed to identify the risks we may encounter in this project and identify the measures we can implement.

6.1 Documentation, standards, communication channels and tools

Here are the Documentation, standards, communication channels and tools we as a team will be using throughout this project.

6.1.1 Documentation

The document we produce throughout the project will be written in the Overleaf[1] platform, which allow the group to collaborate on the writing process. Overleaf requires writing all documents in LaTeX[2], which suits our needs to write long reports that contain figures and tables. Citations style we will be using is APA 7th[3].
All the documents are kept on the overleaf platform, we will be using Gitlab-repository[4] on NTNUs Git-lab to store a copy of the documents as well. Any source code and any other resources will also be stored in that Git-repository, where every team member has access. To secure further that we don't have any loss of data, we will have local backups of important documents and source code.

6.1.2 Standards

We will be using the issue board functionality in our GitLab-repository to create and hand out different task to team members. This will keep track of which tasks need to be done and gives an overview over tasks that has been completed. Every task needs to be reviewed by the team member to be marked as completed. These tasks can for example be writing a chapter in the rapport or setting up a test environment. This is very useful to keep track of what the team members are contributing and if the workload in the project is distributed equally.

Source code used should be of high quality, which means the code should be easy to read and understand, with clear and consistent variables and function names. The code should be robust and handle error, so it doesn't produce any faulty or unexpected result as well.

6.1.3 Communication channel

The main communication platform that will be used within the team, is the teams own Discord-server[5]. To communicate with our Telenor's contact people, we will be using a Microsoft Teams-channel[6]. Here every team member be able to see and communicate with the contacts. Document and other data will also be shared via the Teams-channel.

6.1.4 Tools

Here is a list over tools we will be using related to the project:

[1] https://www.overleaf.com/about#who-we-are
[2] https://www.latex-project.org/
[3] https://i.ntnu.no/oppgaveskriving/apa-7
[4] https://about.gitlab.com/
[5] https://discord.com/safety/360044149331-what-is-discord#title-1
[6] https://support.microsoft.com/en-us/office/first-things-to-know-about-channels-8e7b8f6f-0f0d-41c2-9883-3dc0bd5d4cda

- Meraki Gateway MG21[7]: Cellular gateway used to connect to the mobile network and gather signal data
- Meraki Dashboard API[8]: RESTful API that we will be using to get data from the Meraki gateway.
- Nordic Thingy:91[9]: Multi-sensor cellular IoT prototyping platform we use to get GPS data and som signal data
- Elasticsearch[10] with Kibana[11]: Application where we will insert the data gather from the Meraki gateway and the Nordic Thingy:91 into a heatmap
- Docker[12]: Used to host containers with Elasticsearch and Kibana
- SkyHigh[13]: NTNUs implementation of OpenStack[14] where we run a Linux instance to run Docker.
- LaTeX: Typesetting system we use to write the documentation for the project
- OverLeaf: Online LaTeX editor that allows collaboration
- GitLab[15]: GitLab is an implementation of Git used by NTNU and we use it to store files for the project and as a version control system
- Microsoft Teams: Communication platform that we will use for communication with the client and our advisor.
- Discord: Communication platform that we use as our main channel for communcation between team members.
- Microsoft Visio[16]: Software we use to create diagrams and figures for the project
- Python[17]: Programming language we use to create our tools for testing
- Clockify[18]: Online Time tracking software.

6.2 Plan for testing

The objective of the testing is to measure the quality of the mobile network in a geographical area. We will then analyze the data and find a "super parameter" that can give us a good indication on the quality of the signals in the area. This data will then be put into Elasticsearch to be displayed in a map.

6.2.1 Testing Area

The tests will be performed in a specified geographical area found by Telenor. The area is a road where the quality of the mobile network is known to be a bit spotty in some places based on some tests from Telenor. Figure 1 shows a map of the testing area. During our first test we will analyze the data and determine the exact part of the area we will perform the tests based on the results.

[7] https://meraki.cisco.com/product/cellular/integrated-antenna/mg21/
[8] https://developer.cisco.com/meraki/api-latest/#!introduction/meraki-dashboard-api
[9] https://www.nordicsemi.com/Products/Development-hardware/Nordic-Thingy-91
[10] https://www.elastic.co/what-is/elasticsearch
[11] https://www.elastic.co/kibana/
[12] https://www.docker.com/resources/what-container/
[13] https://www.ntnu.no/wiki/display/skyhigh
[14] https://www.openstack.org/software/
[15] https://about.gitlab.com/
[16] https://www.microsoft.com/en-us/microsoft-365/visio/flowchart-software
[17] https://www.python.org/about/
[18] https://clockify.me/

We might have to use a larger area to get test results we can use or we might be able to do a smaller area.

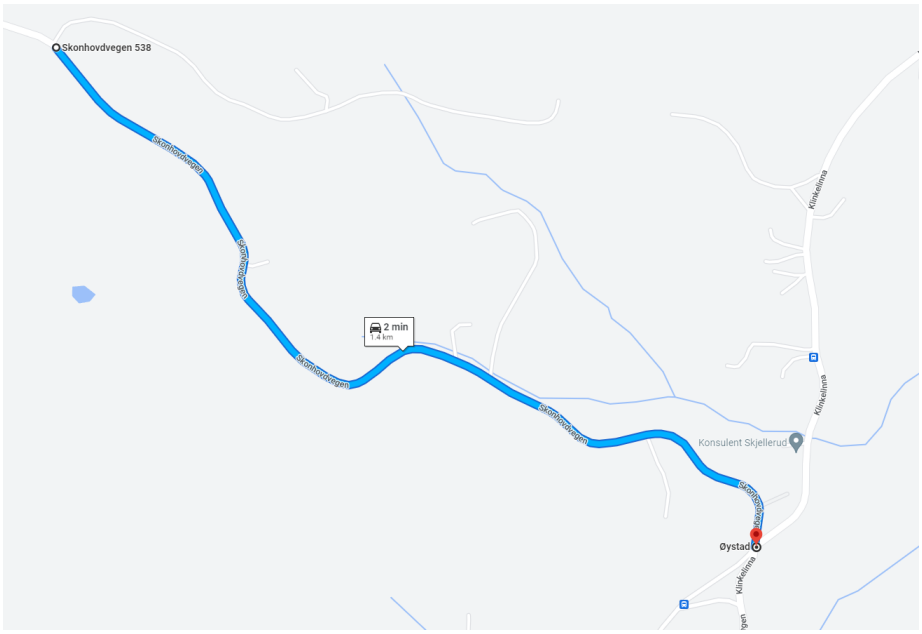

Figure 1: Map of the road used for testing

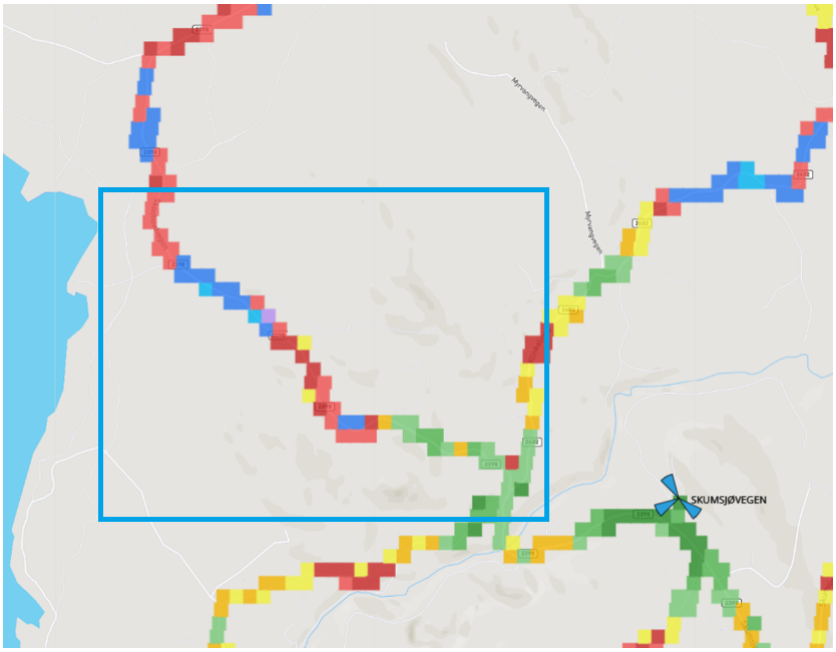

Figure 2: Map of the testing area with messurments from Telenor

6.2.2 Equipment

The equipment we will use for the test will be a Meraki Gateway MG21 and a Nordic Thingy:91. The Meraki Gateway MG21 is a device made by Meraki that connect to the mobile network and can provide connectivity to other device. The MG21 will send data about its connection and the quality of the signal it receives to the Meraki cloud service and show up in the Meraki Dashboard. We will then pull this data using the Meraki API with python. This will give us several different parameters, but the most important parameter for our testing is the connection type, RSRP and

RSRQ.
The Nordic Thingy:91 is a small device made by Nordic Semiconductors. This device will mainly be used for GPS and some signal parameters. We will pull data directly from this device so we will get the data in real time. This will be done by a simple C program.
We will also bring a laptop that the Meraki Gateway MG21 and the Nordic Thingy:91 connects to. This laptop will run the software for the test and collect the data from the devices as well as a Microsoft Teams videocall to another group member that is not in the car to get constant traffic. This will generate more data in the Meraki Dashboard we can use and give use a visual indication when the quality of the signal gets worse based on the video quality of the call.

6.2.3 Software

The software used for the testing will mainly be software we write ourselves. This will be a C program used to pull data from the Nordic Thingy:91 and a Python programmed used to get data from the Meraki API and then combine the data received from the Nordic Thingy:91 and the Meraki Gateway.
We will also use Microsoft Teams to generate data and give a visual indication of the quality of the connection and Elasticsearch with Kibana to organize and display the test data in a map.

6.2.4 Test Scenario

The tests will be done driving a car with the test equipment in the testing area. The Testing equipment will be mounted inside the car in the front of the vehicle. The equipment will be mounted in a way that they will be positioned the same way for every test and drive slowly at the same speed every time to get the most consistent results. During the drive the Meraki Gateway and the Nordic Thingy:91 will gather data and a Teams call will be running to generate traffic. We will pull data from the devices every 5 seconds during testing. This interval might be adjusted based on the results from the first tests, but should be consistent during all tests after we have adjusted it.
When performing the tests, we will take 3 tests on the same day. One test in the morning, one in the middle of the day or the afternoon and one test in the afternoon or during the night. This is to see if the quality of the mobile network will change during the day with different loads. We will also perform some tests during times where we believe we might get some different conditions like the start of the winter vacation and during bad weather if possible.

6.2.5 Test data

The data collected by the Meraki Gateway and the Nordic Thingy:91 will be collected on the laptop used during the testing before it gets combined, analyzed and displayed in a map. The biggest challenge with out setup is the Meraki Gateway uploads its data to a cloud service that we have to ask for the data. This means that there will be a delay between when the data gets recorded by the Meraki Gateway and when it is available in the Meraki Dashboard. The API will also just return the time when we asked for the data, not the time the data was recorded. We will have to do some testing to find a solution to this problem. The possible solutions we have is to either try to compare the data from the Meraki Gateway to the signal data we get in real time from the Nordic Thingy:91 and use this to try to line them up, or if the delay in the Meraki Dashboard is consistent, we might be able to just put a offset on the timestamp and get the data to line up this way.
After we have combined and lined up the data, it will be uploaded to Elasticsearch where we will store and analyze the data. Using Kibana with Elasticsearch we will also be able to put the test data into a map to visualize the mobile network quality in the testing area and compare it for different times.

6.3 Risk analysis

Risk analysis is a very useful to have when conducting any kind of project work. This is because there are many different obstacles that can jeopardize the success of the project or contribute to things not going as smoothly as they are supposed to. The risk analysis will give us a clear overview over the different risks we may face in the project period and how serious they might be.

6.3.1 Risk identification

Table 2 will showcase the possible risks we may encounter. Each risk will get probability score between 1-5, and also get a consequences score between 1-5. Table 1 will give detailed explanation of each level of probability and consequences.

Levels	**Consequences**	**Probability**
1	Minimal and won't affect the project progress	Highly improbable that the risk will occur
2	Impact the project progress to a small degree.	Improbable that the risk will occur
3	Severely impact the project and make it difficult to complete the project with the desired quality.	Probable risk we may encounter.
4	The impact is more severe and can lead to big problems in the project progress	Very probable that the risk will occur
5	Critical consequence which will make it very difficult to get the project approved	Highly improbable that the risk will occur

Table 1: Description of Consequences & Probability

Risk number	**Description**	**Probability**	**Consequences**
R1	Member(s) of the team gets affected by illness or have personal issues.	3	3
R2	Member(s) leave the team	1	4
R3	Test equipment breaks during tests	2	4
R4	Can't perform test scenarios in the designated test area due to roadwork or closed roads	2	3
R5	No access to car or driver to perform test scenarios	2	4
R6	The bachelor thesis is not delivered by deadline	1	5
R7	Losing access to data or online tool(s) used in the project. These tool(s) can be Git repository, Overleaf editor, Meraki API, skyhigh resources	2	4
R8	drift away from the project scope	3	3
R9	Bad communication between the team and the Telenor's contact person	2	4
R10	Breach of group contract	2	3

Table 2: Risk identification

6.3.2 Risk evaluation

We have also inserted each risk identified in table 2 in a risk matrix illustrated in Table 4. Each risk is placed in the risk matrix based on the value of the total risk and the R-number is corresponding with the number in table 2. Total risk is calculated by multiplying the probability value and consequence value of a risk and then placed based on total risk. Table 3 explains what the different colors in the risk matrix represent.

Green	Acceptable risk	Risk reducing measures can be assessed.
Yellow	Tolerable risk	Risk reducing measures must be assessed.
Red	Unacceptable risk	Risk reducing measures must be implemented

Table 3: Risk matrix levels explanation taken from (NTNU, 2013)

		Probability				
Consequences		**Highly improbable (1)**	**Improbable (2)**	**Probable (3)**	**Very probable (4)**	**Highly probable (5)**
	Critical (5)	R6				
	Severe (4)	R2	R3, R7, R9			
	Moderate (3)		R4, R5,R10	R1, R8		
	Minor (2)					
	Minimal (1)					

Table 4: Risk matrix inspired by NTNUs regulation for risk analysis (NTNU, 2013)

6.3.3 Measures

As we can see in Table 4 we can see that all the risks we have identified falls under tolerable risk in the risk matrix. Reference to Table 3, we must assess some risk reducing measures to reduce the probability or/and consequence of a risk, which will result in reducing the total risk for the risks

we may encounter. Table 5 will describe some of the measures we might implement if we find it necessary, as well as which of the risks are affected by these measures.

Measures	**Risks affected**
Divide the workload between the remaining team members, in case a team member(s) are unable to do their assigned work or a member(s) leaves the team	R1, R2
Locate another designated area where test scenarios can be performed in a similar environment as the original given test area	R4
Find a backup driver on standby to help perform the test scenarios, in case Espen-andreas oseth (only driver in the team) is not available due to illness or other reasons	R5
Locate a place where we can borrow a car in case of the car breaks down	R5
Meet all the deadlines found in the Gantt-chart	R6
Have local backups for documents, source code and important data related to the project	R7
Make the project scope as specific as possible and set clear boundaries on what to exclude and include in the project. This should be clarified early in the project plan.	R8
Organize frequent meetings between the team and Telenor's contact person. This is to contribute to better and more clear communication between the different parties	R9

Table 5: Measures

7 Plan for implementation

This section takes a look at our plan for implementation for the thesis. Included is a list of notable milestones and a snippet from our Gantt-chart. The plan is to follow the Gantt as closely as possible, however we are aware that there might be changes and additions made to the project underway.

7.1 Milestones

The following list contains our most notable milestones during the work on the thesis. The same milestones can be found in our Gantt-chart as well.

1. Project Plan Deadline **01.02.2023**
2. Finish first test **17.02.2023**

3. Delivery to advisor **05.04.2023**
4. Finish Playbook **21.04.2023**
5. Finish Testing **21.04.2023**
6. Report Deadline **22.05.2023**
7. Presentation **06-08.06.2023**

7.2 Gantt-chart

Ref. Gantt-chart in the appendix

This subsection contains a snippet of our gantt-chart, where you can see all the tasks, some time windows and a couple of milestones.

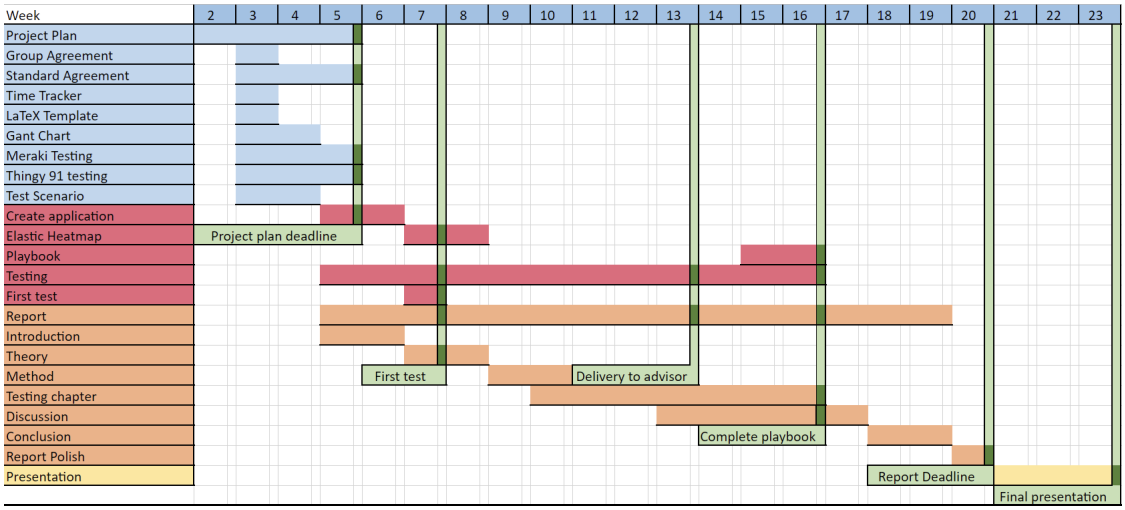

Figure 3: Snippet from the gantt-chart.

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Kissflow. (n.d.). *7 best project management methodologies and frameworks explained.* Retrieved 23rd January 2023, from https://kissflow.com/project/project-management-methodologies-and-frameworks/

NTNU. (2013, October 31). *Gjennomføre risikovurdering.* Retrieved 19th January 2023, from https://i.ntnu.no/wiki/-/wiki/Norsk/Gjennomf%C3%B8re+risikovurdering

Appendix

A Task description

Driver i markedet

Telenor ser at industrien trenger nye mobile løsninger og at det vil være av kritisk karakter å avdekke kvalitets utfordringer i mobilnettet som påvirker de industrielle use-casene

https://www.telenor.no/bedrift/aktuelt/5g/industri/

Entreprenøren Romarheim og teknologileverandøren Steer hadde behov for spesialtilpassing av nettløsningen sin i et steinbrudd på Eikefet. I rutene TipTruckene kjørte, måtte Telenor sørge for en kontinuerlig god mobildekning. Dersom TipTruckene mister 4G nettet, går den i «safe mode» og stopper opp sammen med produksjonen i steinbruddet.

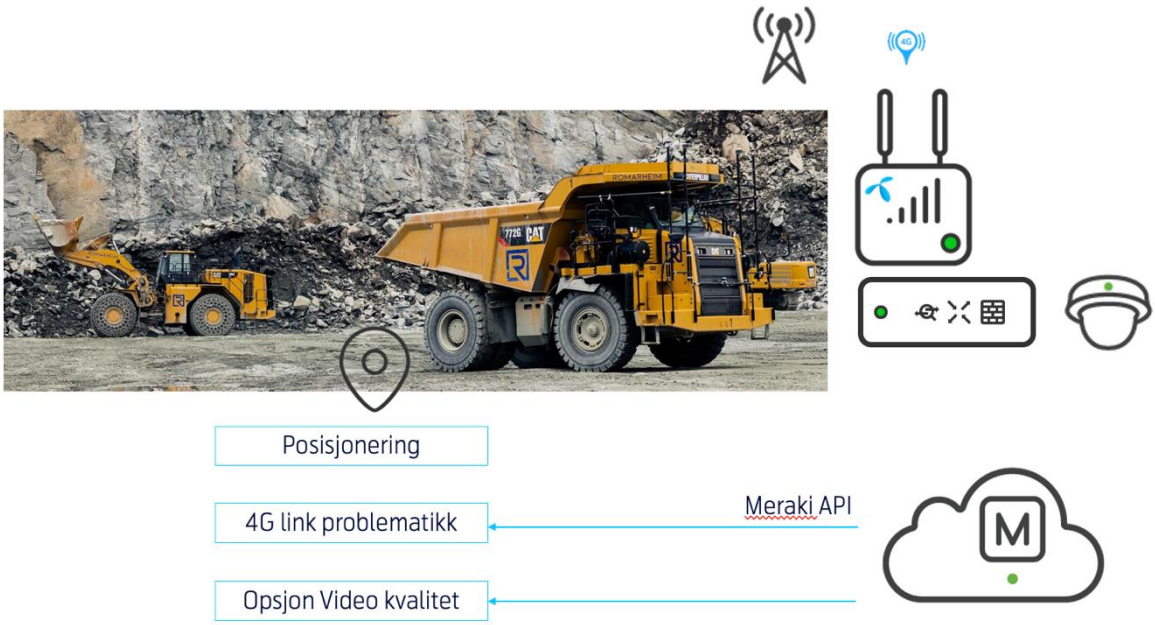
Problemstilling

I tiden fremover vil det være problemstillinger rundt hvordan sikre og avdekke «stans» i industrielle use-caser, som er sterkt knyttet til kvaliteten på den underliggende nettverksinfrastrukturen. Dette innebærer at kravet til robust og sikker nettverkskonnektivet blir kritisk for industrien. For å levere en god nettverkstjeneste, er det avgjørende å sikre kvalitet gjennom monitorering og automatisering. På denne måten kan feilretting og tiltak iverksettes tidligere, for å sikre høy oppetid og god kvalitet på tjenesten.

Oppgave

Teste og lage en visuell kart oversikt over mobildekningen for et gitt geografisk område

- Benytte API fra Meraki, der man tar ut kvalitetsdata mtp. 4G mobildekning.
- Plotte dette inn i ett kart ala Google Maps eller lignende med riktig GPS koordinat.
- Visualisere på kartet hvor god dekningen er i området kjøretøyet/mobilradioen beveger seg.



Teknologi og Testsenario - 4G

Oppgaven skal se på viktige parameter for å understøtte industrielle use-case

1) Et mobilnett kan ha kapasitetsforskjeller ift. posisjon for et gitt kjøretøy

Virkemidler er tilgang til "dekningsband" som gir god arealdekning. I dag benyttes en miks av 800MHz, 1800MHz og 2100MHz for 4G i Norge. Her vil Telenor sammen med student kartlegge dette i et avgrenset testområdet på Gjøvik.

2) Kartlegge hvilke 4G datalink parametere om kan hentes ut vi API spørringer

SNR (signal-to-noise ratio) sier noe om hvor godt brukerutstyr «hører» radiosignalet fra nærmeste basestasjon. Begrepet SINR (signal-to-interference-plus-noise ratio) benyttes i stedet for SNR for å ivareta interferens, dvs «radiohygiene» mellom radiocellene.

SINR er ett styreparameter i mobilnettet for å sette riktig modulasjonsform. De ulike modulasjonsformene gir ulike datarate. Høy SINR gir høy datarate(bit/s). Det oppnås alltid høyest datarate når brukerutstyret er nær basestasjonen. Dataraten vil falle når brukerutstyret beveger seg bort fra basestasjonen.

3)Drøfte en «Kritisk NEDETID-parameter» for en industriell use-case

Det er flere forhold som gir utfordringer for en industriell use-case. Med Telenor briller på, skal studenten drøfte en superparameter som gir en god indikasjon på «nedetid» for en gitt industriell use-case. Denne kan Telenor også bruke som trigger i en SLA tilstandsklokke som rapportere kvalitet for et gitt kjøretøy i et definert geografisk område som en gruve, industripark, skogteig etc.

Validering av verktøy - sikre og avdekke kvalitetsutfordringer presentert i en kartappliasjon

- Sette seg inn i Meraki sin nettverksplattform
- Drøfte mekanismer for å lese av posisjon for målingene, manuelt eller automatisert
- Sette seg inn Meraki API og validere omfang av 4G link parameter som er tilgjengelig på Meraki sin plattform
- Plotte resultatene i en kartapplikasjon mtp. posisjon og 4G kvalitetsparametre.

Forslag til tidsramme

Januar

- Forprosjekt & Studentene setter seg inn i tematikken.
- Kick-off med Telenor og eksterne ressurser.
- Lesing rundt teknologier.
- Utkast til introduksjon for selve rapporten
- Utstyr ankommer studiestedene. Start leking/testing med utstyret

Februar

- Strukturere testing/ scenarioer
- Start testing
- Statusmøter/oppfølging med Telenor

Mars

- Fortsatt testing
- Rapportskriving
- Statusmøter/oppfølging med Telenor

April

- Testing & skriving fortsetter
- Statusmøter/oppfølging med Telenor

Mai

- Finpuss av rapport

Hva kan Telenor tilby?

Veiledning fra fagmiljøet og dagers workshop

Fra Telenor sin side så har vi et ønske om å ha god dialog med studenten i hele prosessen. I januar organiserer Telenor et oppstartsmøte og diskuterer hvordan studenten ønsker å legge opp dette, og hva studenten ser for seg av behov for bistand og struktur. Det blir gjennomført en kick-off der man får en innføring i problematikken fra fagmiljøene Telenor og Cisco/Meraki. Det er etablert god kontakt med leverandørene her, og vil studentene vil ha kort vei til ekspertisen når oppgaven skrider frem.
Telenor og NTNU, gjennom Cisco Academy, arbeider målrettet med opplæring som treffer

behovet i markedet. Dette vil også lede til relevante sertifiseringer når studenten kommer ut i arbeidslivet.

Telenor sin anvendelse

Telenor vil benytte oppgaven til partnerutvikling mot Cisco.
Oppgaven skal føre til en presentasjon rundt temaet.
Det er ønskelig at det lages en playbook for ett demo oppsett, som kan benyttes for kunder på Telenor Expo. Telenor Expo er utstillingsvinduet til Telenor på Fornebu.

Campusnettverk- og internettarkitekturfordyping fra høstsemestret er en forutsetning for å ta denne oppgaven.

Telenor Team

Team

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B Group Contract

Gruppeavtale Bachelor110

Lars Martin Nygaard Espen-Andreas Oseth
Vebjørn Albinson Wisam Khalid Razi

Januar 2023

1 Roller

1.1 Rollefordeling

1. Prosjektleder er hovedansvarlig for å ta tak i problemer som oppstår innad i gruppen (selv om alle gruppemedlemmer har ansvar for å ta tak i slike problemer). Prosjektleder har hovedansvar for å delegere oppgaver (selv om igjen har hvert enkelt gruppemedlem selv har ansvar for å ha noe fornuftig å gjøre). Espen-Andreas Oseth er prosjektleder.

2. Projektleder har god kommunikasjon med oppdragsgiveren via e-post. Hovedsaklig brukes en teamskanal til å kommunisere med den eksterne virksomheten, slik at alle har mulighet til å kommunisere med den eksterne virksomheten og se samtalen mellom begge parter

3. Referent har hovedansvar for å skrive møtereferater fra møter med veileder og oppdragsgiver. Lars Martin Nygaard er referent.

4. Lars Martin Nygaard har hovedansvaret for å kommunisere med NTNU-veilederen

5. Dokumentansvarlig har hovedansvar for riktige dokumenter blir levert i tide. Også ansvarlig for å ha en oppdatert backup lokalt. Vebjørn Albinson er dokumentansvarlig.

6. Wisam Khalid Razi er reserve på alle rollene og overtar ansvaret for rollene til gruppemedlemmer er borte midlertidig. også ansvarlig for å booke rom til fysiske møter.

2 Grupperegler

2.1 Generelle regler

1. Avgjørelser angående prosjektet skal i utgangspunktet tas ved avstemning på møter der alle om mulig skal få mulighet til å avgi stemme. Hvis noen er fraværende skal de bli oppringt for å få avgi stemmen sin. Hvis de ikke svarer får de 10 minutter til å ringe tilbake, ellers stemmer de blankt.

2. Felles kostnader relatert til prosjektet som ikke dekkes av oppdragsgiver skal fordeles likt blant gruppemedlemmene løpende.

3. Timelisten skal ses over ved første statusmøte hver uke og hvert gruppemedlem skal forklare kort hva de har gjort foregående uke.

4. Digital kommunikasjon mellom gruppemedlemmer skal primært gå over discord og digital kommunikasjon med oppdragsgiver skal primært gå over teamsgruppen som er opprettet.

5. Alle gruppemedlemmer kan innkalle til møte på discord og det skal helst varsles minst 24 timer før møtet starter og møtet skal så langt det er mulig starte 9-15 på hverdager.

6. Arbeidsplatformen som primært skal benyttes er Git-siden som er opprettet hvor alle dokumenter skal lagres. Dokumenter skal skrives i LaTeX. Overleaf benyttes for skrive sammen i LaTeX.

2.2 Arbeidsregler

1. Timelisten skal oppdateres daglig med antall timer jobbet og hva man har jobbet med.
2. Hvert gruppemedlem forplikter seg til å jobbe i utgangspunktet minst 30 timer per uke fra og med uke 3 2023 til prosjektet er ferdig (men det kan gjøres unntak hvis gruppemedlemmet har jobbet gjennomsnittlig mer enn 30 timer per uke så langt i prosjektet eller gruppen har blitt enige om at det jobbes mindre uken det gjelder).
3. Det forventes at hver time som legges inn i timelisten består av minst 50 minutter relevant jobbing. Det betyr at man kan ta seg opptill 10 minutter pause per time i gjennomsnitt.
4. Det er møteplikt til alle møter som gruppen blir enige om eller som blir satt opp av veileder eller oppdragsgiver.
5. Til gruppemøter som ikke inkluderer veileder eller oppdragsgiver godtas det at man er opptil 5 minutter forsinket uten å måtte si ifra. Ved møter som inkluderer veileder eller oppdragsgiver forventes det at alle gruppemedlemmer møter presist.
6. Det kan gis dispensasjon fra møteplikten ved god grunn og varsel i god tid, helst 24+ timer før møtet.
7. Det skal skrives et kort referat fra alle møter med veileder eller oppdragsgiver fra og med uke 3.
8. Fast statusmøte i gruppen på mandager kl. 09.00 og i utgangspunktet er det fysisk på NTNU med mulighet for digital deltakelse om nødvendig.

2.3 Rutine ved regelbrudd

1. Samtale(r) i gruppen for å se om problemet kan løses oss imellom.
2. Ved enighet om løsning har alle gruppemedlemmer ansvar for å følge opp at løsningen blir gjennomført.
3. Samtale med hele gruppen og veileder
4. Samtale med hele gruppen og Emneansvarlig. Oppdragsgiver blir informert hvis resultatet kan ha en påvirkning på prosjektets fremgang.

Vebjørn Albinson — Dato: 16. Januar, 2023
Vebjørn Albinson
NTNU Gjøvik

Lars M Nygaard — Dato: 16. Januar, 2023
Lars Martin Nygaard
NTNU Gjøvik

Espen-Andreas Oseth — Dato: 16. Januar, 2023
Espen-Andreas Oseth
NTNU Gjøvik

Wisam Razi — Dato: 16. Januar, 2023
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NTNU Gjøvik

C Gantt-Chart