

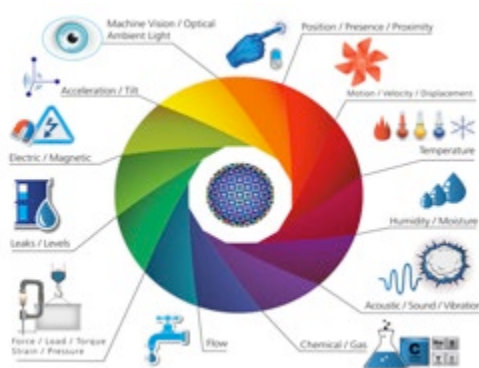
Telenor Research



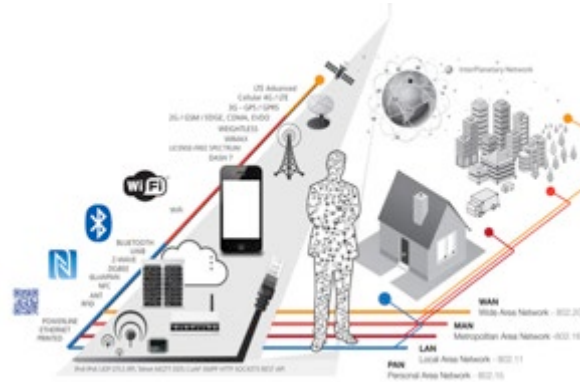
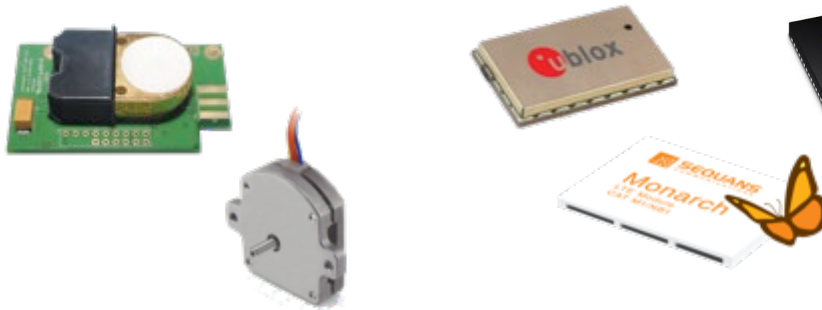
IoT, tingenes Internett, hva er det?

Dr. Arne Munch-Ellingsen, Senior Research Scientist

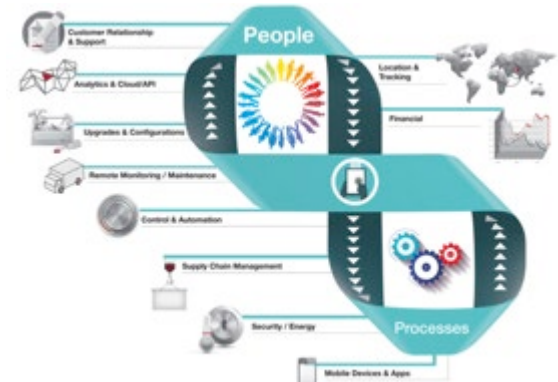
Hva er tingenes Internett (IoT)?



1 SENSORS & ACTUATORS



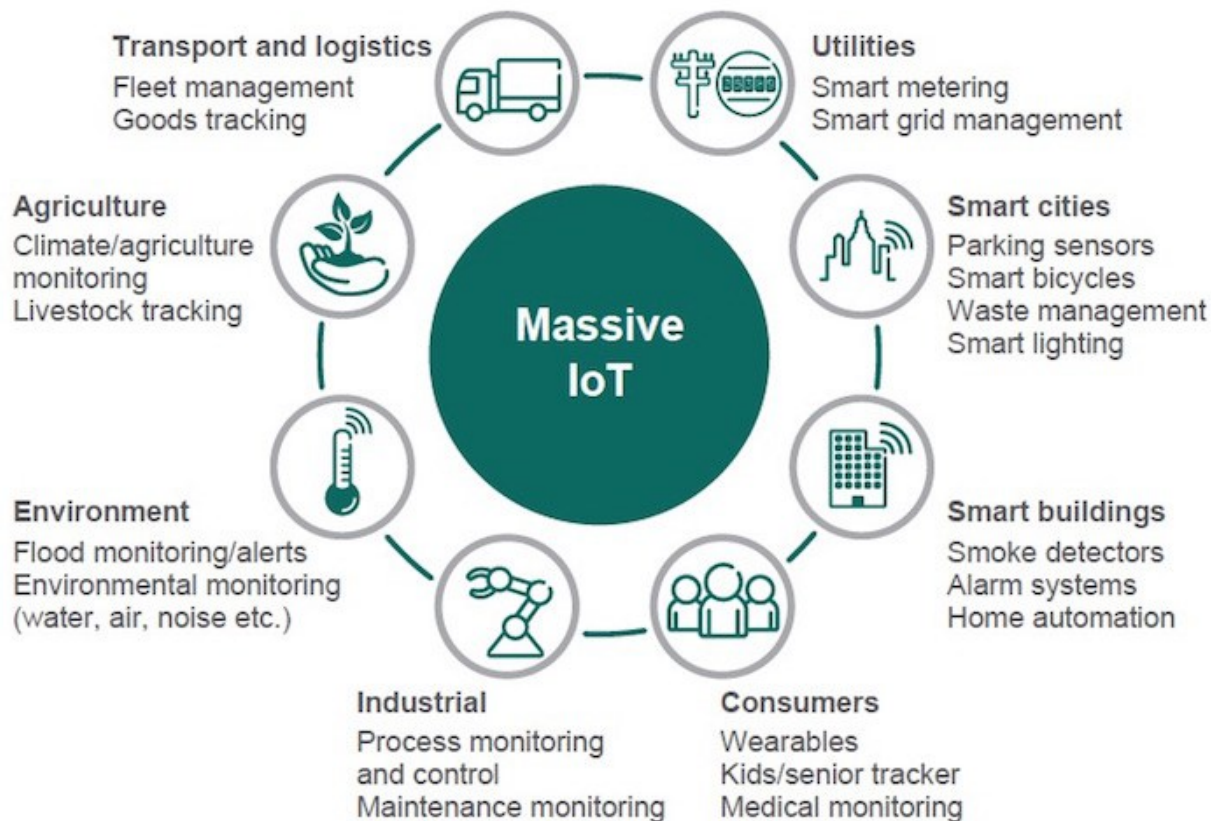
2 CONNECTIVITY



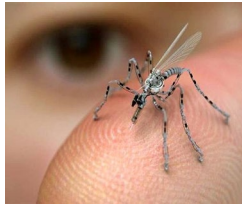
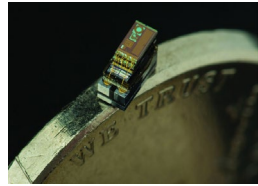
3 PEOPLE & PROCESSES



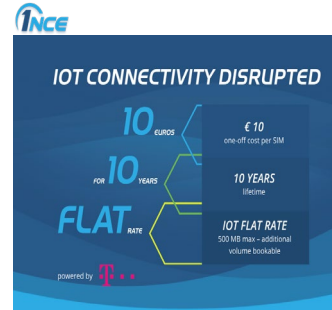
Hva kan det brukes til?



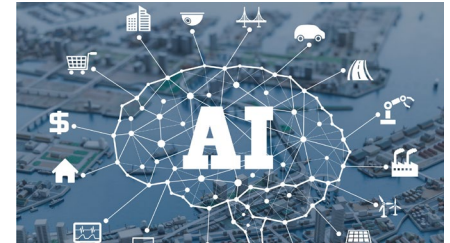
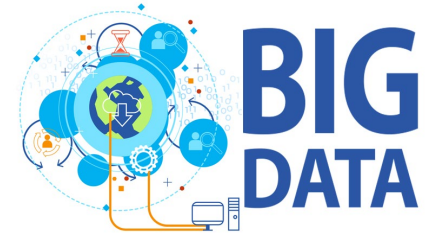
Hvorfor er IoT "hot" nå?



Sensorer og mikrokontrollere blir mindre og mindre samtidig som pris og strømforbruk går ned

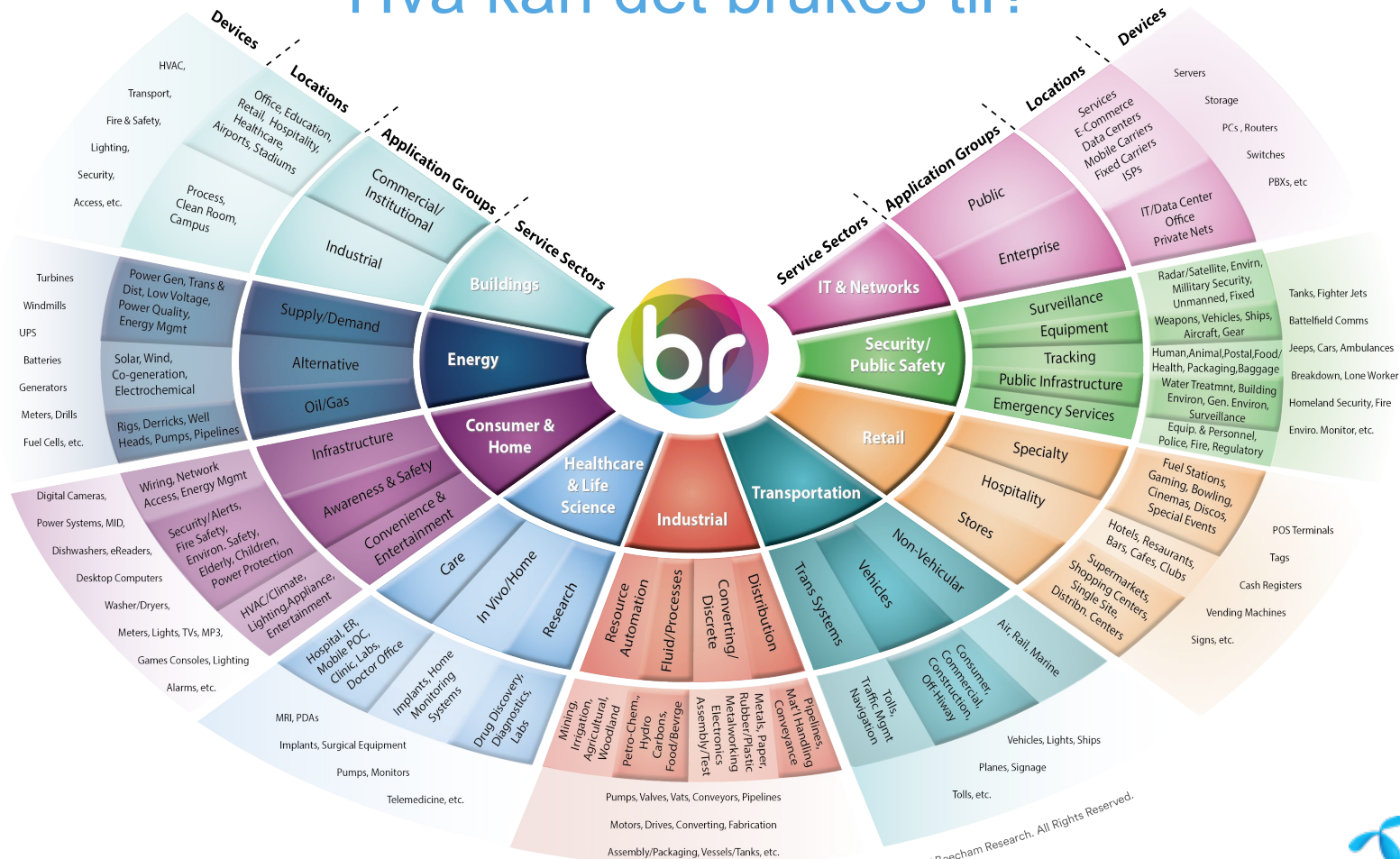


Nye dedikerte IoT protokoller i 4G nettet. Datatrafikk kostnad pr Mbyte har gått kraftig ned



Vi er i stand til å lagre og analysere gigantiske datasett til en overkommelig pris

Hva kan det brukes til?



IoT arkitektur



iot architecture

Alle

Bilder

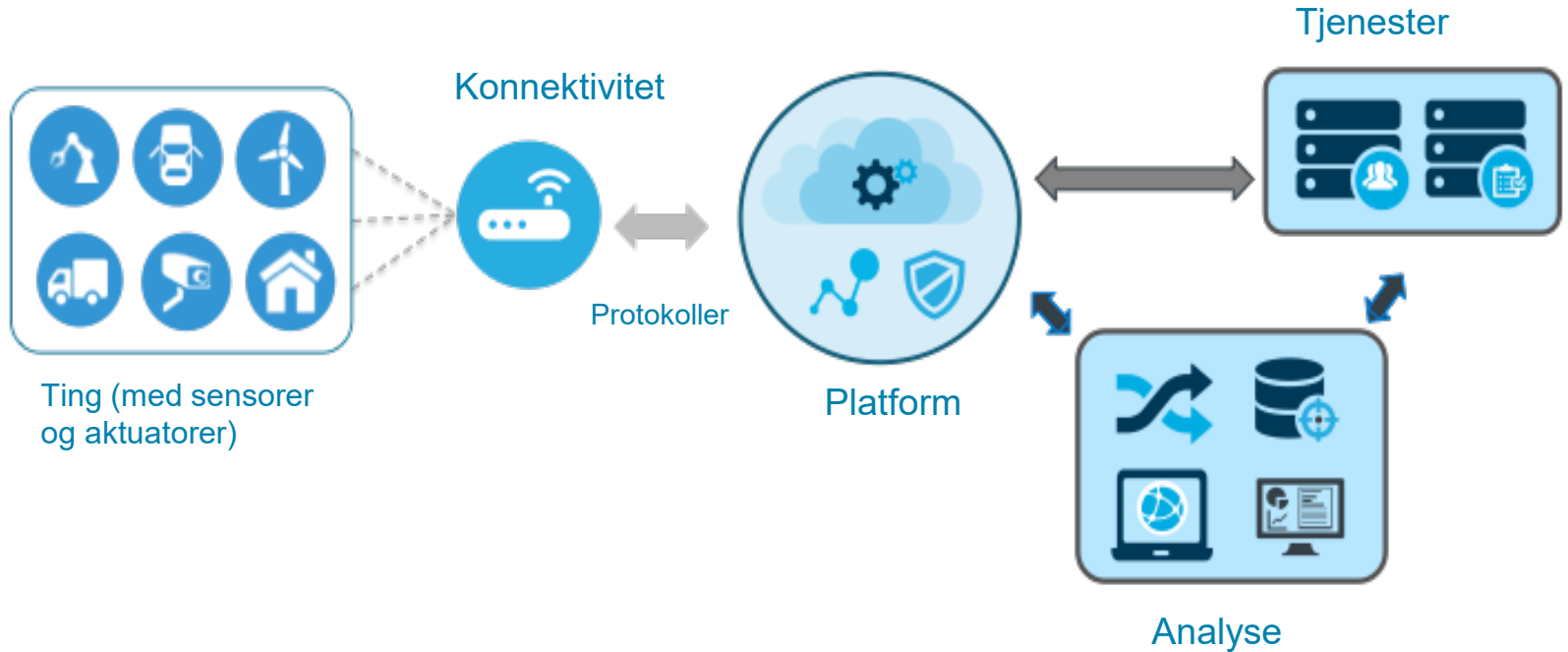
Videoer

Nyheter

Google Maps

Omtrent 109 000 000 resultater (0,36 sekunder)

Overordnet IoT arkitektur



Source: Cloudera open source IoT architecture

Arkitektur: Clod, edge, fog, mist, ...

CLOUD LAYER

Big Data Processing
Business Logic
Data Warehousing

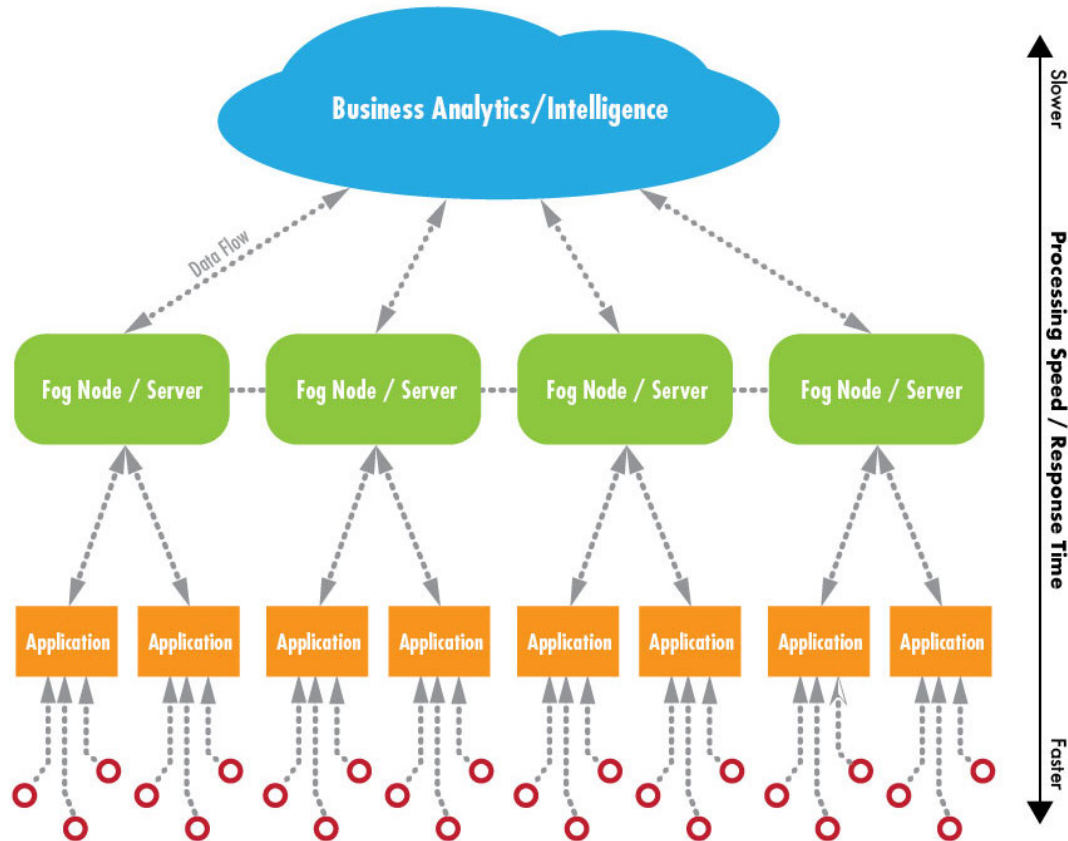
FOG LAYER

Local Network
Data Analysis & Reduction
Control Response
Virtualization/Standardization

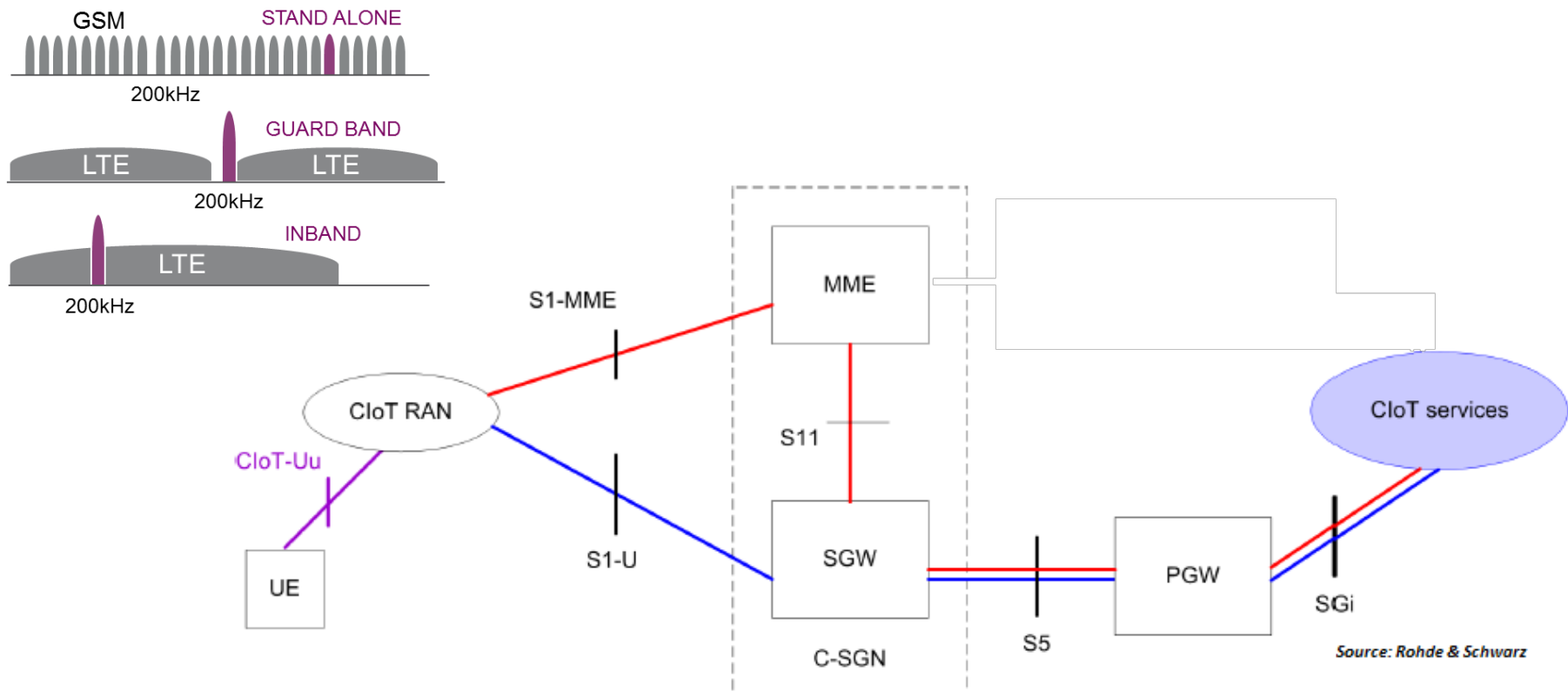
EDGE LAYER

Large Volume Real-time Data Processing
At Source/On Premises Data Visualization
Industrial PCs
Embedded Systems
Gateways
Micro Data Storage

Sensors & Controllers (data origination)

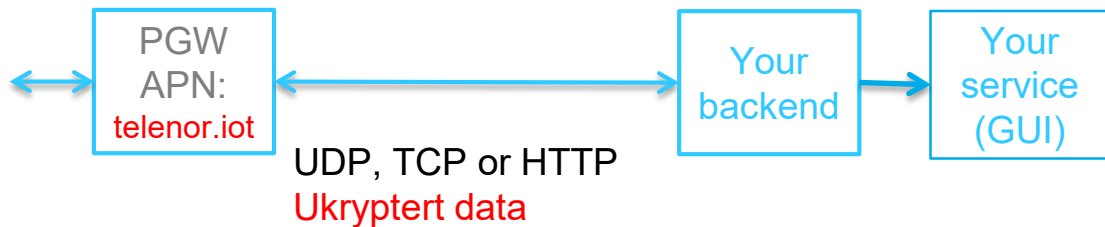


NB-IoT og LTE Cat M1 nettverksarkitektur



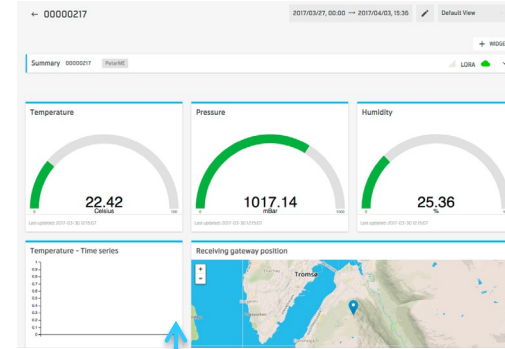
Enkel arkitektur (men kanskje ikke den beste?)

Note: Ditt bak-ende system må håndtere alle aspekter, for eksempel, sikkerhet, provisjonering, management, lagring av data ++



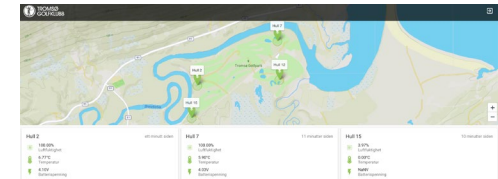
Note: Det vil ikke være mulig med Nettinitiert trafikk til dine enheter (men kan svare når trafikk kommer fra enheten)

Telenor NB-IoT for utviklere



MIC GUI

HTTPS
API bruk



App boards

Managed
IoT
Cloud

Din
tjeneste

HTTPS
API bruk

HTTPS
API bruk

Horde
Radius

MDA Go
(VPN)
Data og kontrolltrafikk

PGW
APN:
mda.ee

Hvor kan jeg kjøpe det?



Internet of Things Landscape 2018

APPLICATIONS (VERTICALS)

PERSONAL		HOME		VEHICLES		ENTERPRISE		INDUSTRIAL/INTERNET	
WEARABLES Apple Watch, Fitbit, Garmin, LG, Motorola, Ringly, Token, Cadenet, Moto, Jeevabots, Jeevabots, Ringly, Token		ENTERTAINMENT Netflix, Amazon Prime, HBO, Disney+, Hulu, etc.		SMART HOME Amazon Echo, Google Home, Apple HomeKit, etc.		VEHICLE CONNECTIVITY Tesla, Uber, Lyft, etc.		ENTERPRISE SOFTWARE Salesforce, Microsoft, Oracle, etc.	
WEARABLES Apple Watch, Fitbit, Garmin, LG, Motorola, Ringly, Token, Cadenet, Moto, Jeevabots, Jeevabots, Ringly, Token		ENTERTAINMENT Netflix, Amazon Prime, HBO, Disney+, Hulu, etc.		SMART HOME Amazon Echo, Google Home, Apple HomeKit, etc.		VEHICLE CONNECTIVITY Tesla, Uber, Lyft, etc.		ENTERPRISE SOFTWARE Salesforce, Microsoft, Oracle, etc.	
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PLATFORMS (HORIZONTALS)

[illegible]

BUILDING BLOCKS

HARDWARE										INFRASTRUCTURE										CONNECTIVITY										PARTNERS																																							
PROCESSORS / CHIPS 										CLOUD 										PROTOCOLS 										TELECOM 										CONTAINERS / SERVICES 										RETAIL 										INCUBATORS 									
OPERATING SYSTEMS 										EDGE COMPUTING 										2G 3G 4G 5G LTE 										WIRELESS 										ALLIANCES 										MANUFACTURING 										FUNDING 									

Hvordan oppstår innovasjon?

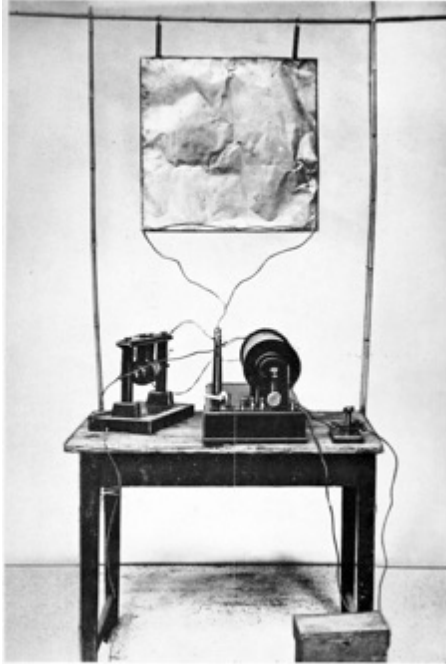
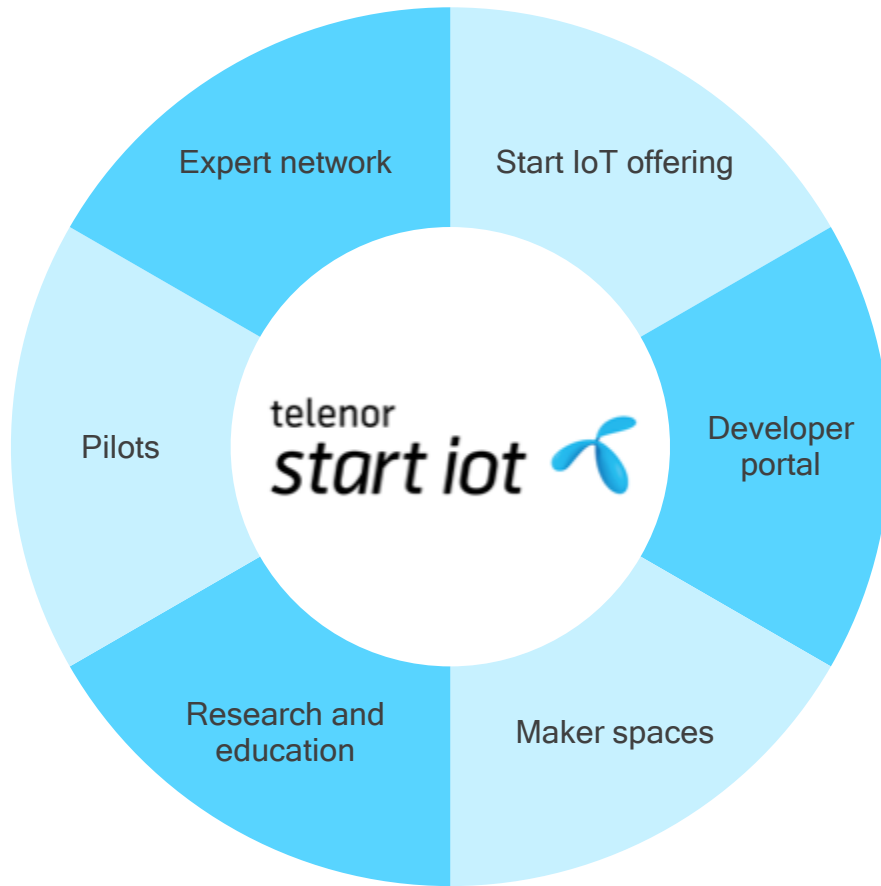
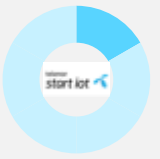


Image source: Wikipedia



**Enabling to explore
is giving access to
various “resources”**

Telenor START IoT tilbudet



Supported Network Technologies

We support different types of network technologies.

Telenor Start IoT is also aiming at being network connectivity agnostic. We currently support LoRaWAN but we are aiming at supporting at least NB-IoT and LTE Cat M1 in the future.

Network Technologies

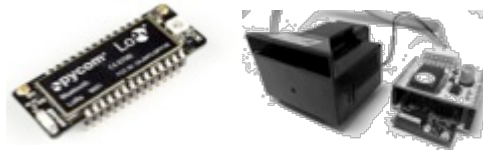


Supported Devices

Read more about what devices we support.

Telenor Start IoT is in principle device type agnostic meaning that potentially any type of device can be supported. We are however focusing on IoT devices that use Low Power Wide Area networks and this potentially limits the type of devices it makes sense to use.

Supported devices



Enablement Platform

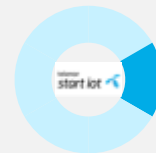
Learn more on how to utilize our enablement platform to it's fullest.

Telenor Start IoT offers Cloud Connect as an enablement platform that will make it easy for you to get started creating your own IoT services using its built in Dashboard editor with click and drag widget functionality.

Get started



DEVELOPER PORTAL



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[Home](#)

**SHAPE
THE
FUTURE**



IoT PROTOLAB



RESEARCH AND EDUCATION



NORUT/Telenor Exploratory Engineering Air Quality pilot



<https://www.dropbox.com/s/eoewlo4owk19274/Nordnytt.mov?dl=0>

Hvordan skaper IoT verdi?

Information within the Internet of Things creates value in a never-ending **value loop** consisting of 5 stages:

ANALYZE

The discernment of patterns or relationships that leads to descriptions, predictions, or prescriptions for action

ACT

Initiating, maintaining, or changing a physical event or state

CREATE

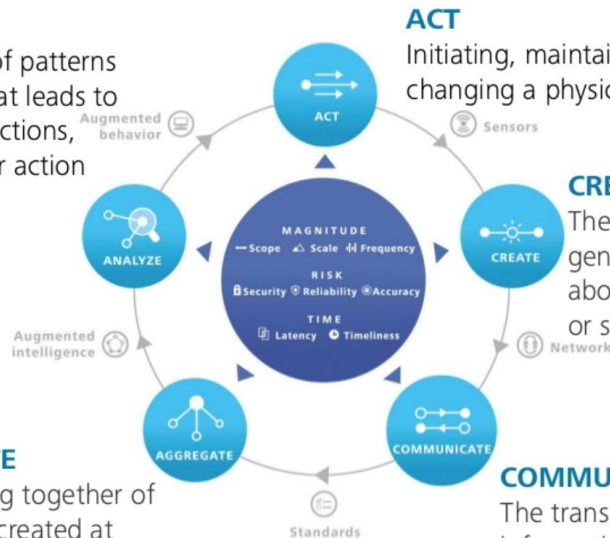
The use of sensors to generate information about a physical event or state

COMMUNICATE

The transmission of information across networks, from one place to another

AGGREGATE

The gathering together of information created at different times or from different sources





How Start IoT helps

- Faster time to market
- Ready made solution to solve non-core problems
- Support from Telenor resources to help in implementation work
- Brand – provides credibility & trust behind our solution