Exploring Connectivity Technologies: Bridging the Electrical Grid to the Internet

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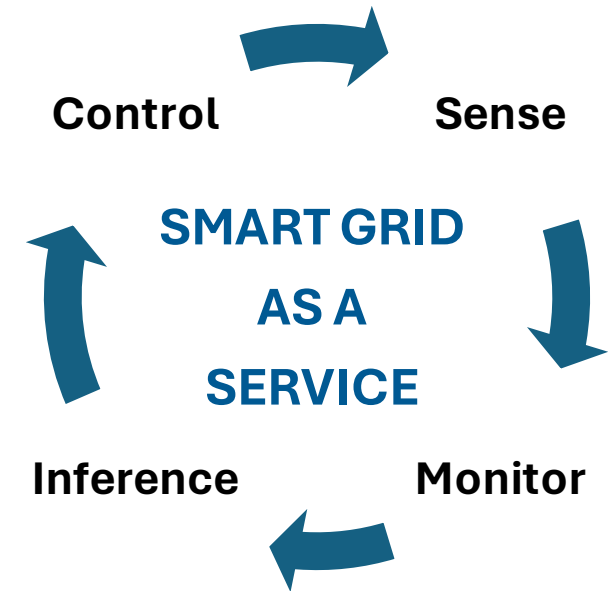https://www.sarodeoverwireless.com

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About me

- Bachelors in Electrical and Electronics Engineering- Amrita Vishwa Vidyapeetham (2008).

- Masters in Electrical Engineering from Eindhoven University of Technology (2011).

- Independent Networks and Wireless Communications Professional.

- Over 14 years of research and industry experience – Microsoft, Liberty Global, Qorvo, Philips and IMEC.

- IEEE member since 2019, Vancouver Section.

- COMSOC member.

- Dedicated to leveraging digital technology for **green energy** initiatives.
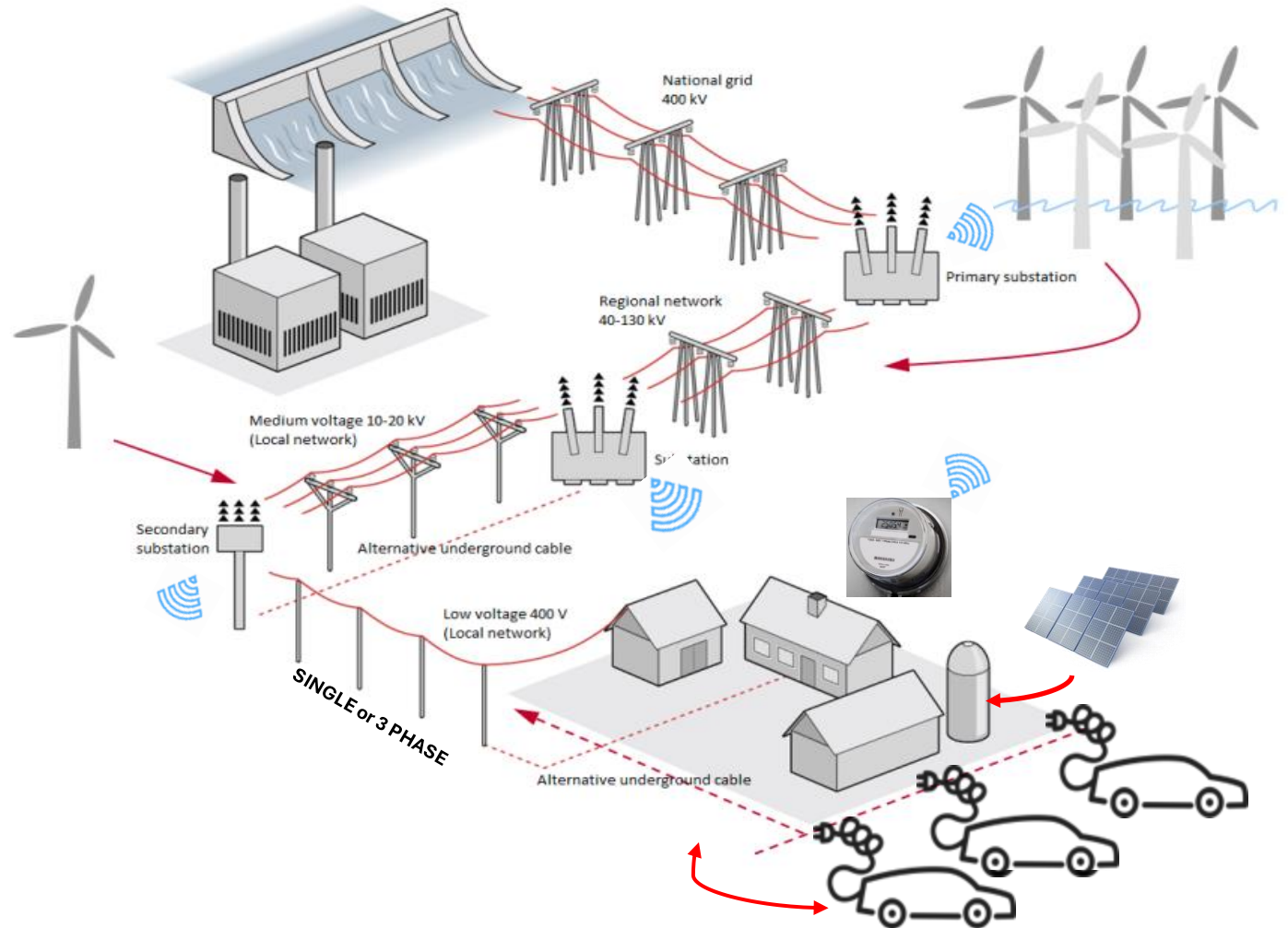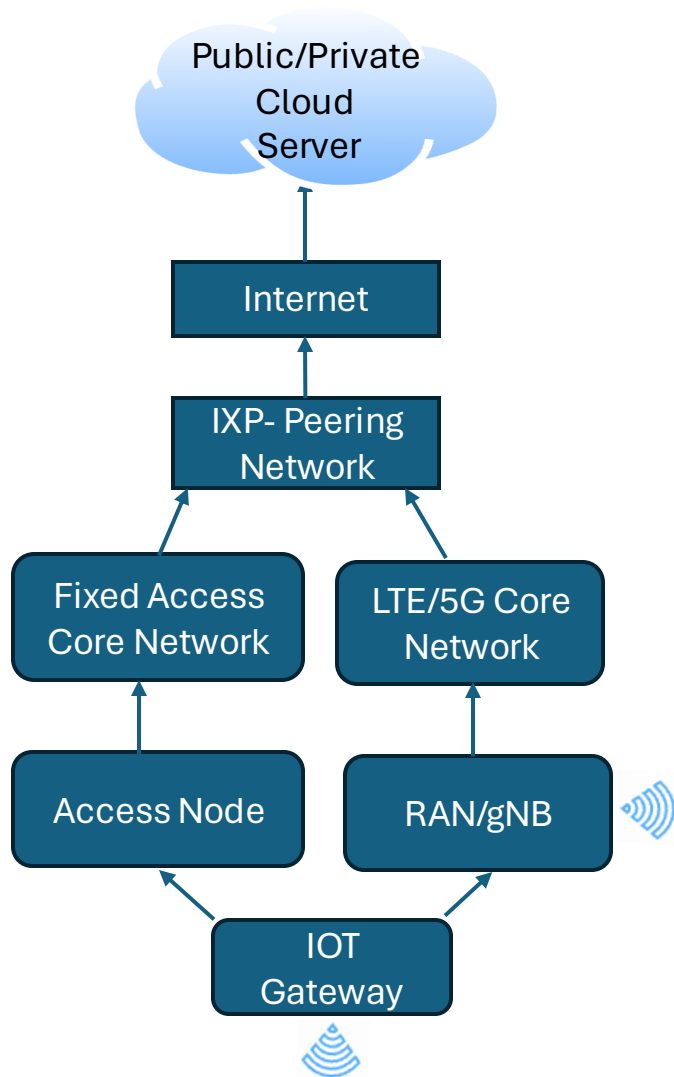
Electrical Grid as a Digital Platform

o **Grid Reliability**
- Monitoring vital stats voltage, current, frequency, phase

o **Grid planning, maintenance and Efficiency**
- Data helps in load profiling,demand forecasting and developing load management straregies

o **Decarbonization**
- Demand side management

o **Enable microgrids and peer to peer energy trading**
- Integration of energy storage

o **Security and resilience**
- Respond to events like short circuits and faults in the grid.

o **Electricity Dierective- 2019/944**
- EU mandates real time monitoring and distribution of data to consumers and producers

Control   Sense

SMART GRID AS A SERVICE

Inference   Monitor

The Connected Grid Architecture

Electrical Grid Reference: Modelling and Forecasting Electricity Load in Secondary Substations – Emma Sjoborg

Communication technologies for Smart Grids

Fixed Access
- DSOs piggyback on a MSO's broadband infrastrcuture
    - Cable – Based on DOCSIS 3.0/3.1/4.0 standard.
   - Fiber optics – ITU's PON standard enabling FTTM.

Wireless
- DSO build their own IOT network or use a MNO's existing infrastructre
    - LoRaWAN - Based on proprietarary LoRa silicon
    - Wi-Fi Halow - Based on IEEE's802.11ah standard
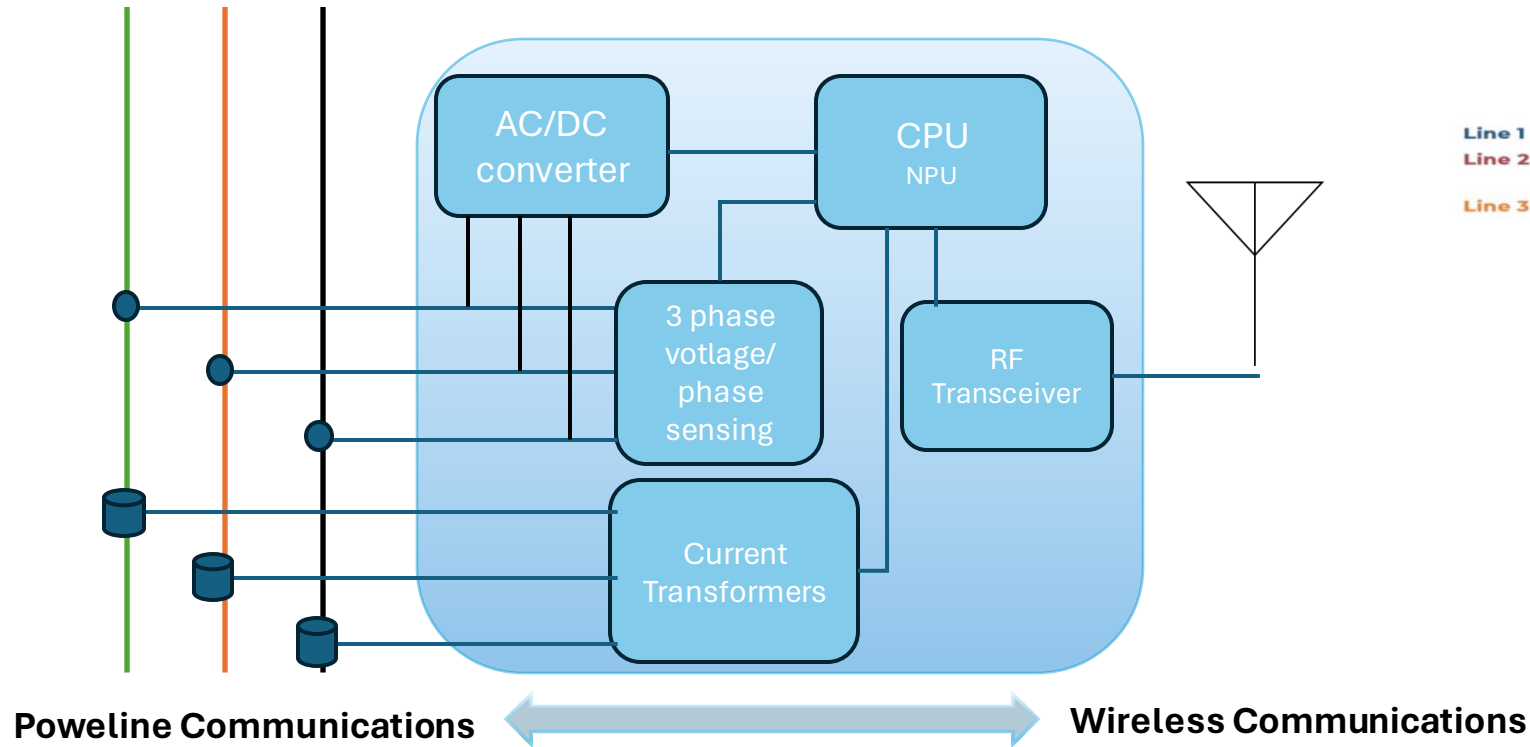   - NB-IOT – Based on LTE standard

Wired
- Data is sent on existing power lines
    - ITU's G.Hn based Power line communication(PLC)

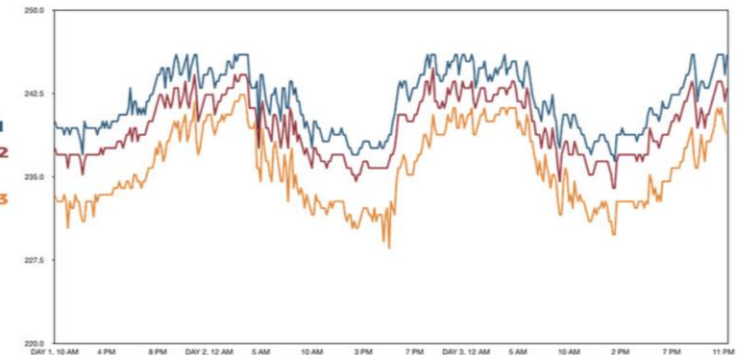| Range	Goodput
Security	Reliability
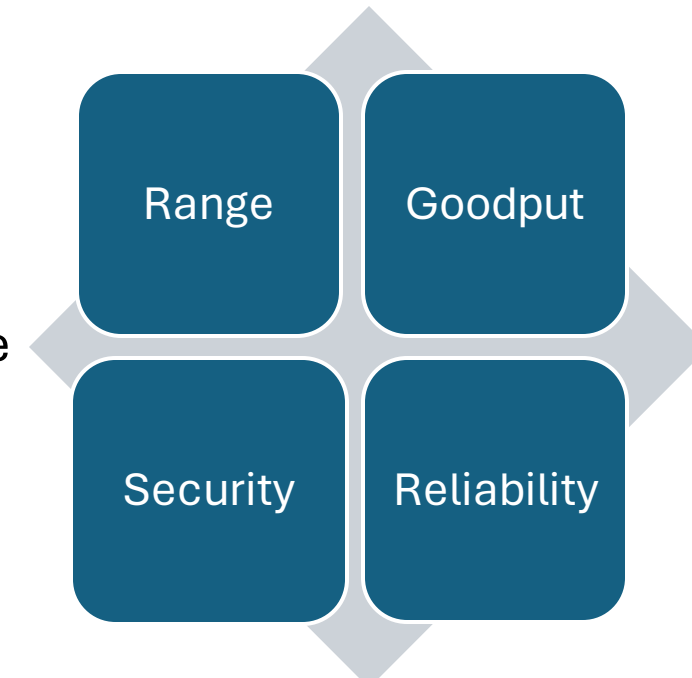
DSO:Distribution System Operator
MSO: Multi System Operator
MNO: Mobie Network Operator

Low Voltage Sensor Architecture

3 phase voltage fluctuation over time[1]

Active Vs Reactive Power[2]

Poweline Communications

Wireless Communications
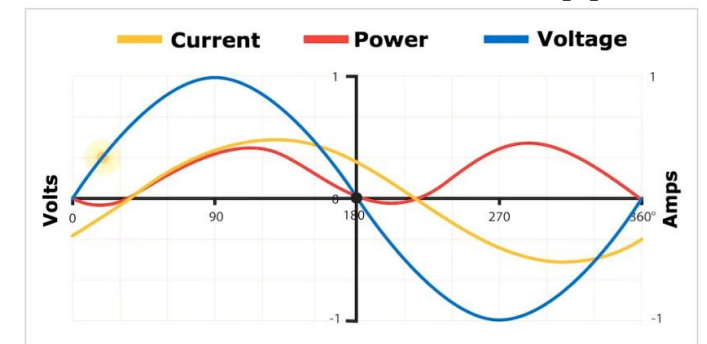
- Power factor is calculated by measuring the phase difference between the voltage(V) and current(I) meausrement.

- The Neural Processing Unit (NPU) can identify load patterns or signatures and make realtime decisions to reduce outages.

Reference:
[1] https://www.ashleyedison.com/2021/11/22/eliminate-voltage-fluctuation/
[2] https://eepower.com/power-electronics-textbook/vol-i-electrical-power-systems-design/chapter-3-power-ac-systems/triangle-of-power-and-power-factor/#

Deployment Considerations

Network and Cloud Secuirty

On premesis vs public cloud

PKI infrastructure,

Authentication, Authorization and Accounting (AAA)

Networking

IPV6 IOT networks over IPV4 backbone

Network maintenance

Firmware upgrades

Remote access

Network ownership and availability

SLA with MSO and MNO

Partner with OEM/ODMs

Integration and Deployment

Integrating sensors in the grid.

Manging the cloud database.

Machine learning and AI

At the edge vs Cloud

Lets us build a secure, connected Gird.

Any Quesitons?

or

Send in your comments/Q's to

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Thank you for the opportunity and listening to my presentation!