



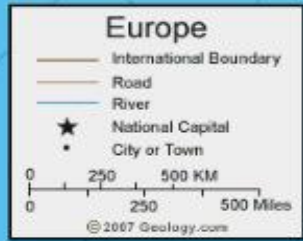
Edge. What is the big deal?

Head of Lab
Tor Björn Minde
RISE ICE datacenter research



RISE ICE
Datacenter
research

RISE ICE datacenter



- 30 projects, from the ground to the cloud
- 28 employees
- 4 MEUR turnover
- Established 2016

2000 physical servers
 250 kW
 200 TB RAM
 10 petabyte storage
 50 000 cores
 240 GPUs
 1,1 M cuda cores
 12,5 petaflops
 HDFS clusters
 OpenStack ECC
 Kubernetes cluster
 OCP servers



Stakeholders: Ericsson, ABB, Vattenfall, Facebook, LTU, Region North, Space agency

A full-scale research datacenter and test environment with the objective to increase knowledge, strengthen the AI & DC ecosystems and attract researchers.



RISE ICE Datacenter current test environment

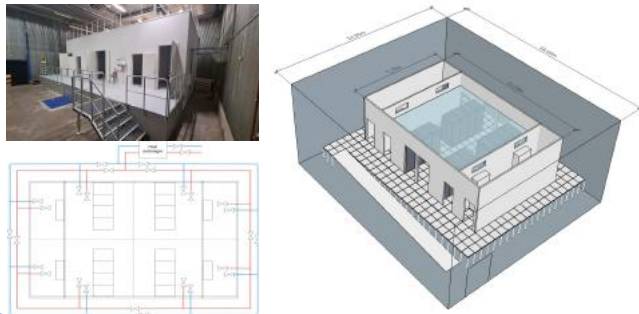
Module 1 & 2 Compute clusters



Module 3 OCP Lab + Climate box + Heat box



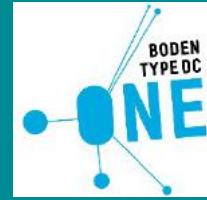
Module 4 Facility hardware test lab



Edge + wind tunnels + liquid cooling test bed

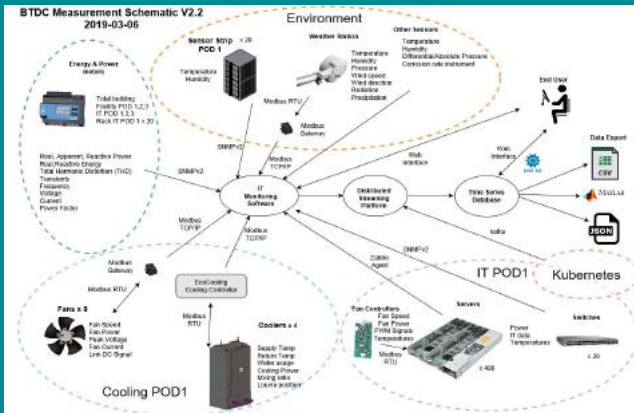


BTDC – a H2020 project



An EU H2020 project
3 MEuro with partners
H1 Systems, Ecocooling,
Fraunhofer, RISE and BBA.
RISE budget 0,9 MEuro

Goal was the Most Energy
and Cost efficient
datacenter in the world



GA 768875

It is a Greenfield datacenter
project with fresh air
cooling, wooden structure,
open-source data collection
and holistic control with a
PUE < 1,1

(Result PUE=1,015)



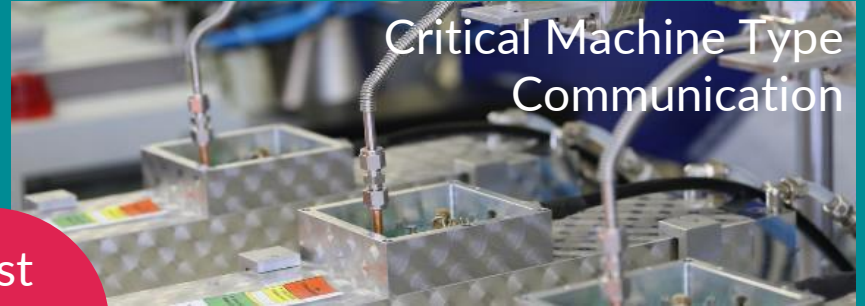
5G and 6G Impact

5G starting with enhanced MBB and then enabling new evolved industry use cases

Massive Machine Type Communication



Critical Machine Type Communication



First use cases

Enhanced Mobile Broadband

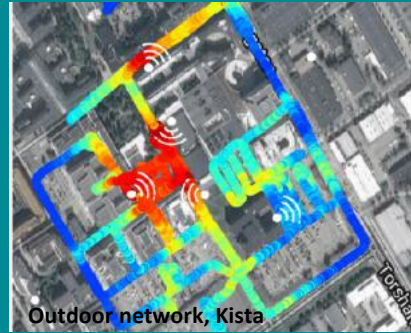


Fixed Wireless Access

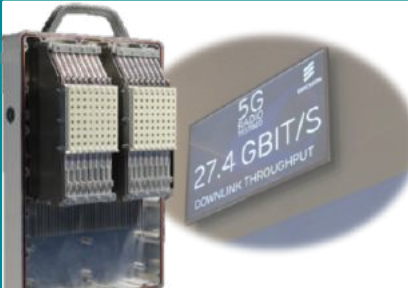
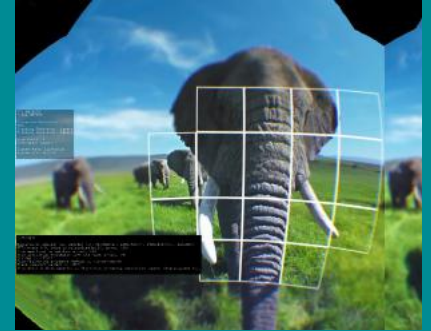


5G – a real game changer

Full-length HD movie
in seconds



10 year battery life for
remote sensors



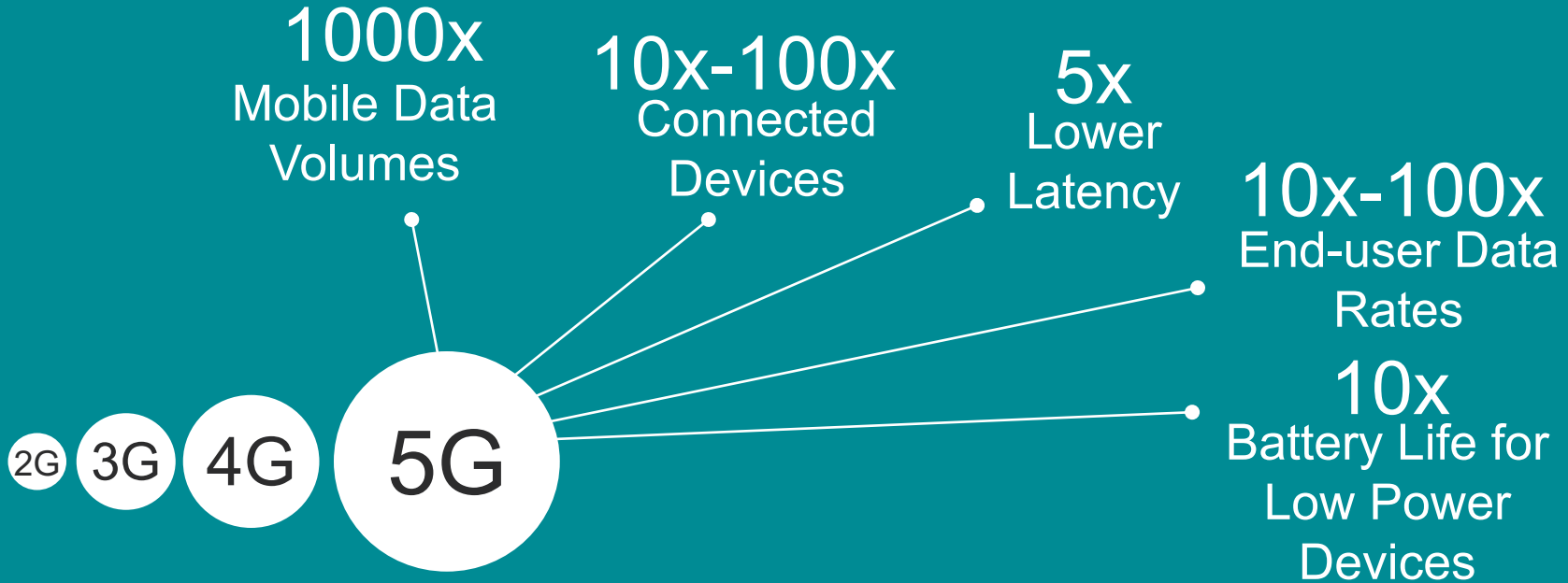
MU-MIMO 15 GHz, 800 MHz IBW

Remotely operated
robots and machinery

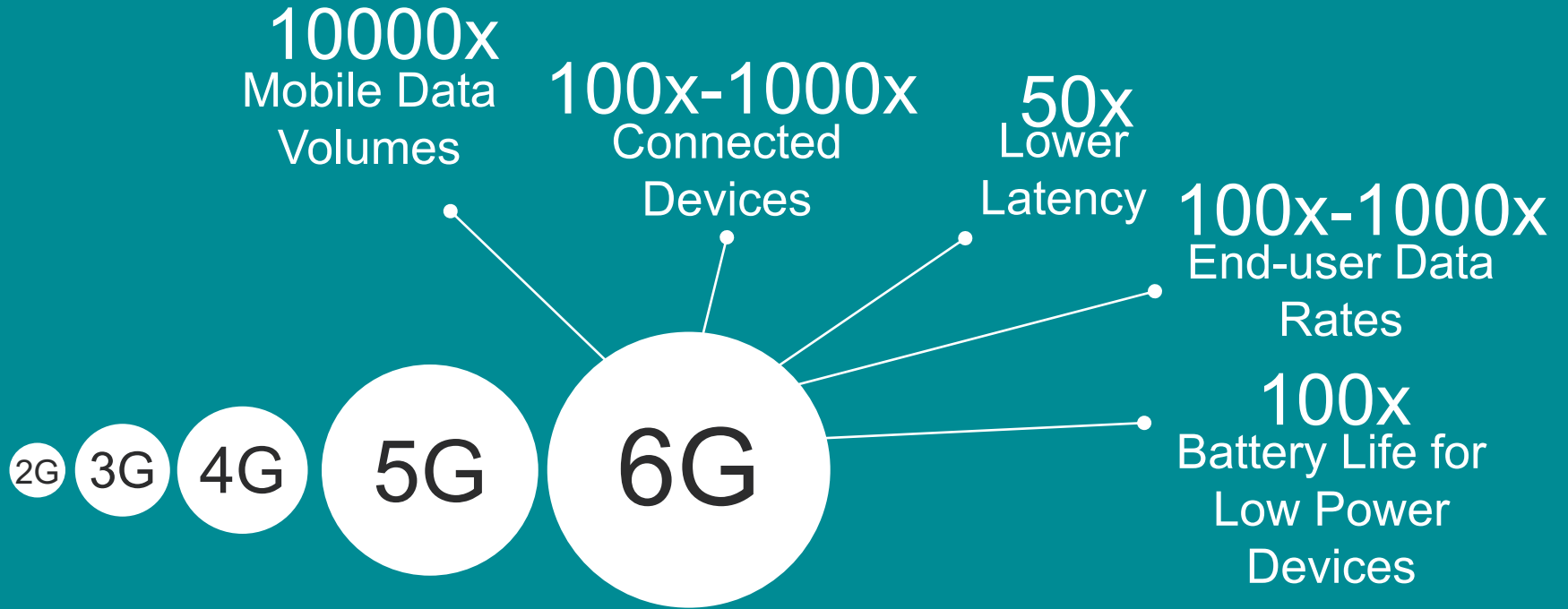


Virtual and Mixed
Reality

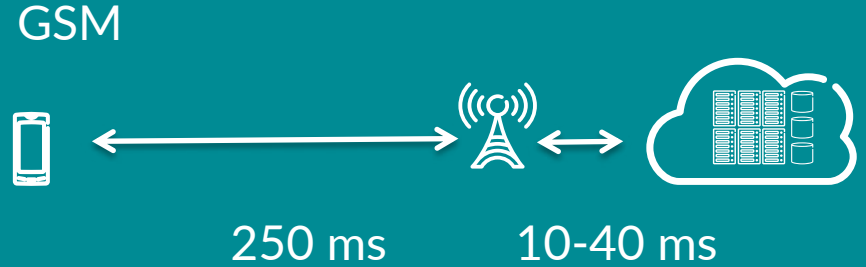
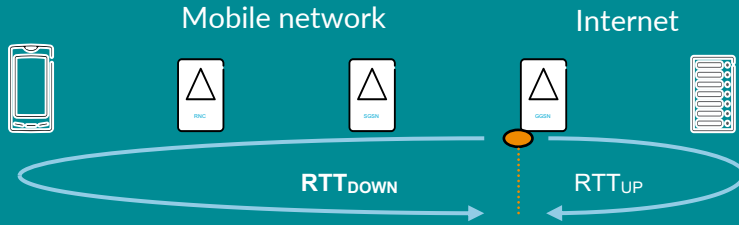
5G Requirements



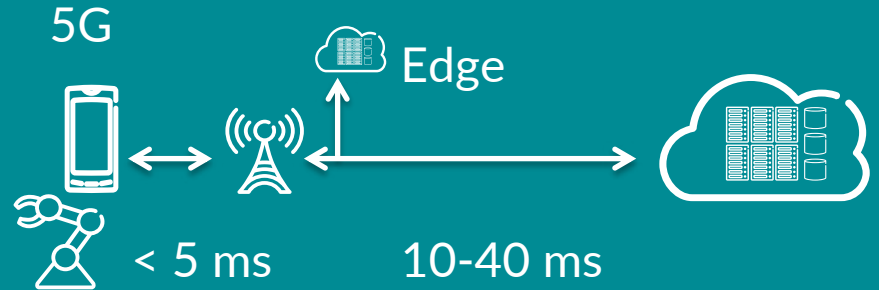
Evolution Towards 6G



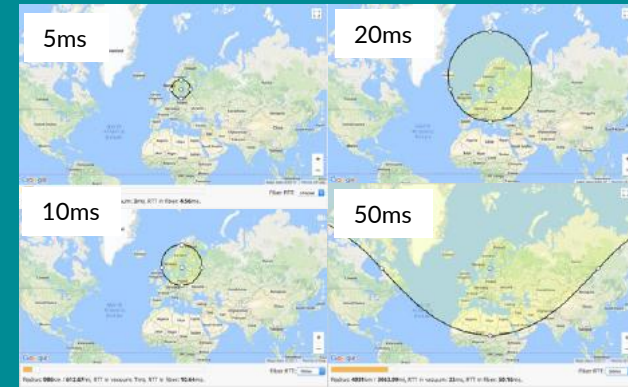
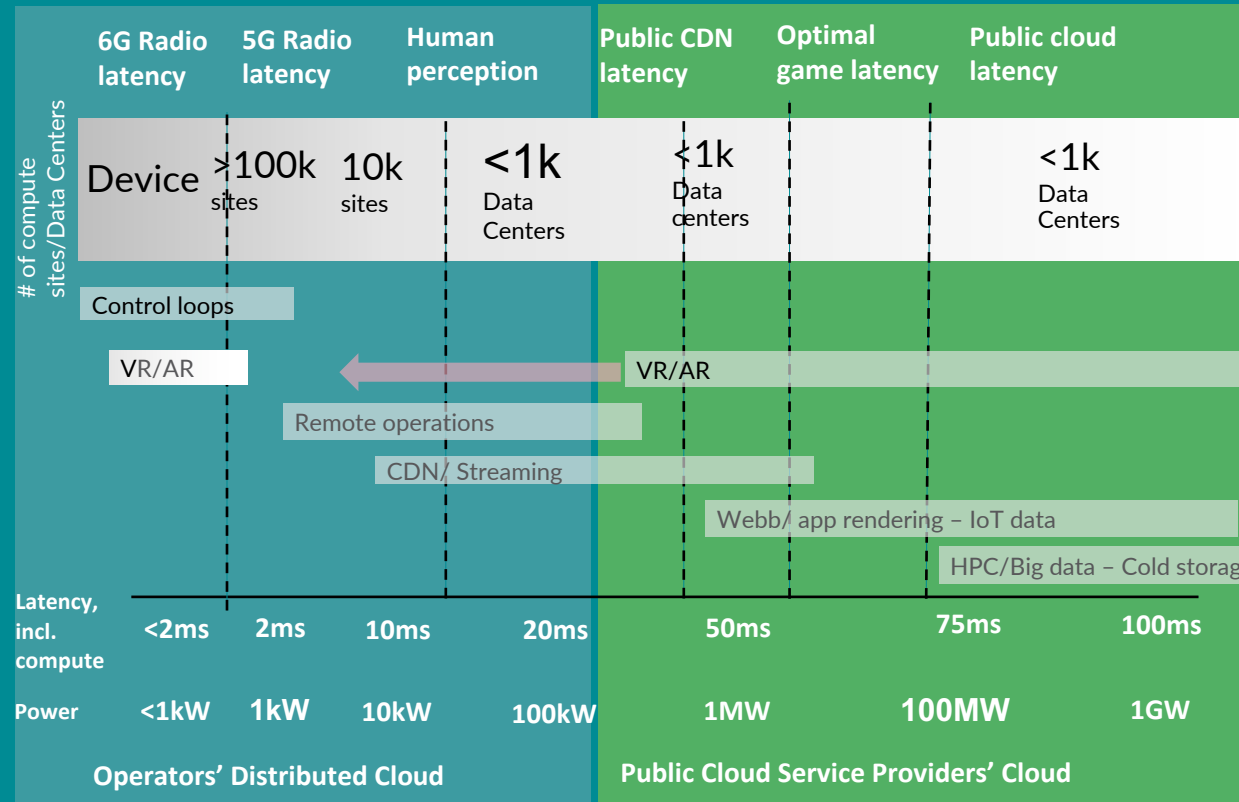
5G/6G networks and edge datacenters



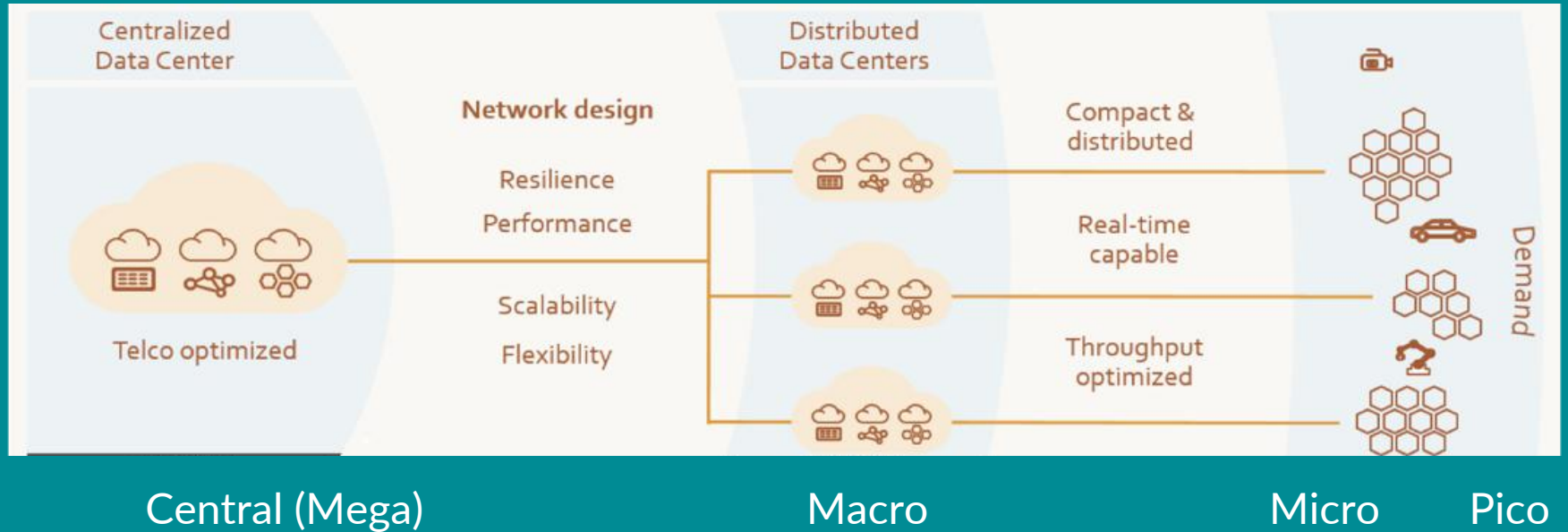
	3G	4G	5G	6G	
RTT_{UP}	20%	50%	80%	95%	Increasing part of the delay
RTT_{DOWN}	80%	50%	20%	5%	Approaching 5% for 6G
RTT_{TOTAL}	200 ms	40 ms	25 ms	21 ms	Depending on many parameters



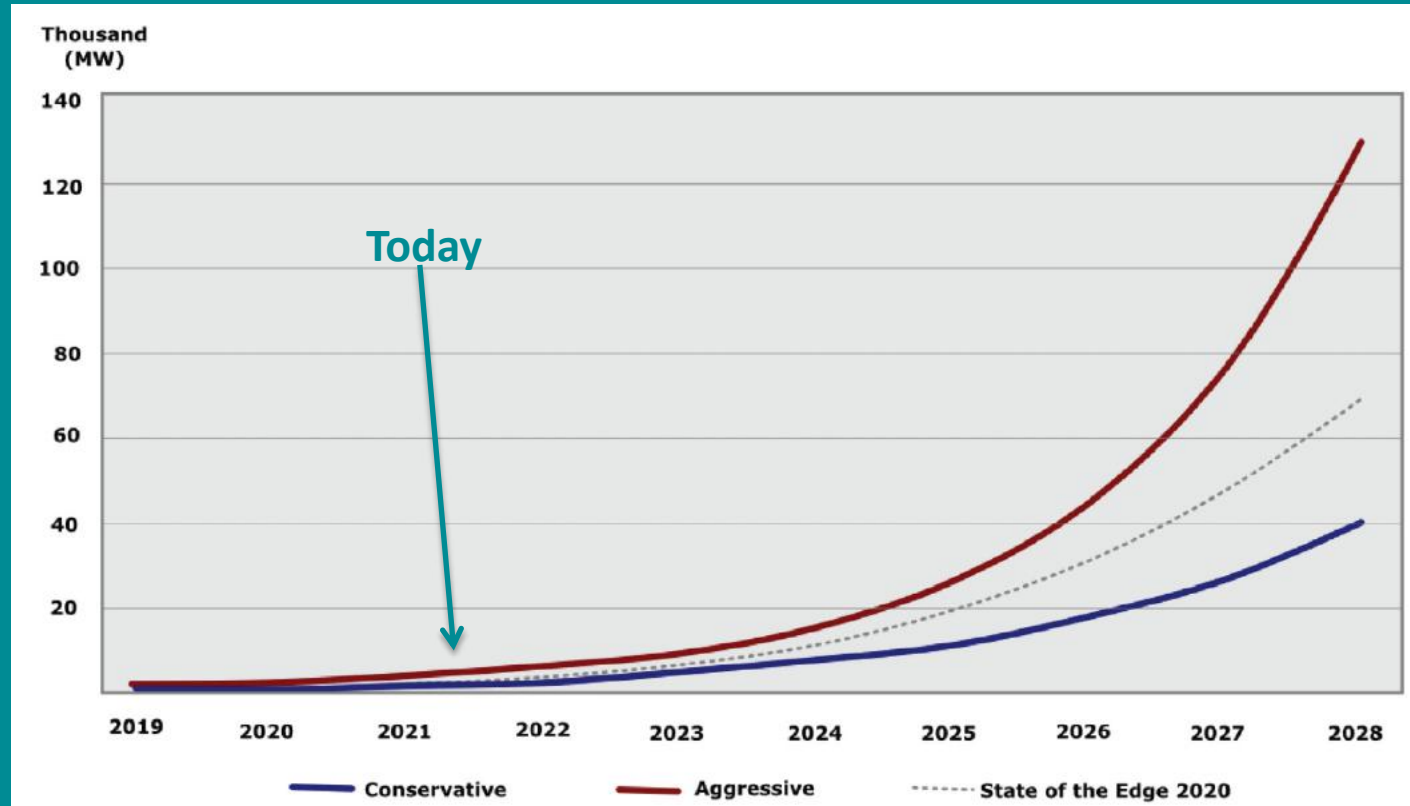
Distributed cloud with latency as driver



5G and 6G will be a network with distributed large scale IT Cloud + Edge to enable the use cases



What is the timing for this?

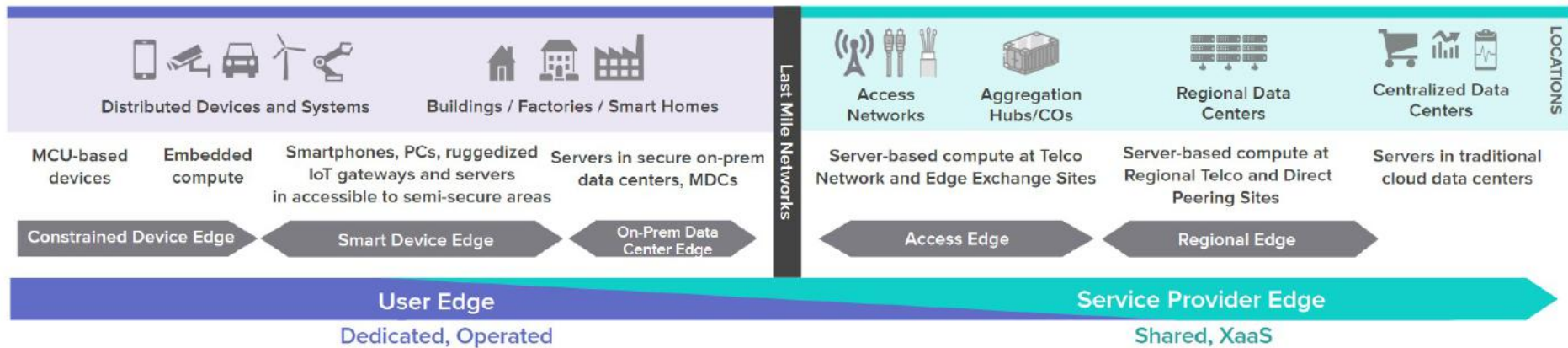




Network edge
computing

What is Edge computing?

Edge computing is about pushing intelligence and processing capabilities closer to the end user or where the data originates or offer off-loading



Definitions

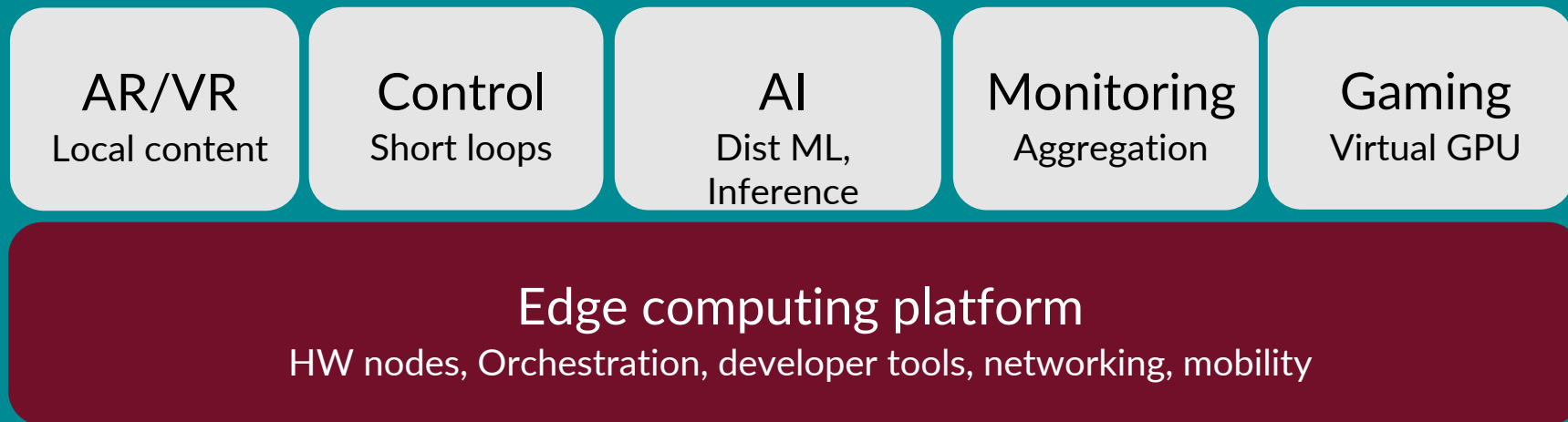
Device edge

Network edge

Internet edge

What is Edge computing?

Edge computing is a platform for many application



Definitions

AI, AR/VR etc on edge platform

Edge platform for AI, AR/VR

Example: Mining and civil engineering



Decision support system for underground

- ✓ For increased safety
- ✓ For improved productivity

Two products

- ✓ Mobilaris Mining Intelligence
- ✓ Mobilaris Onboard

Example: Augmented/mixed reality

Augmented reality is the integration of digital information with the user's environment in real time.

Large number of use cases

- ✓ Connecting remote workers
- ✓ Assisting with complex tasks
- ✓ More efficient warehousing and logistics
- ✓ Enhanced learning outcomes
- ✓ Real-time data & analytics visualization



Source: ER Strategic design

Biggest ever platform for innovation?

- Web browsers and back-end servers made internet an innovation platform
- Apps on mobiles and back-end servers made mobiles an innovation platform

A New Innovation platform



Front-end



Mid-range



Back-end

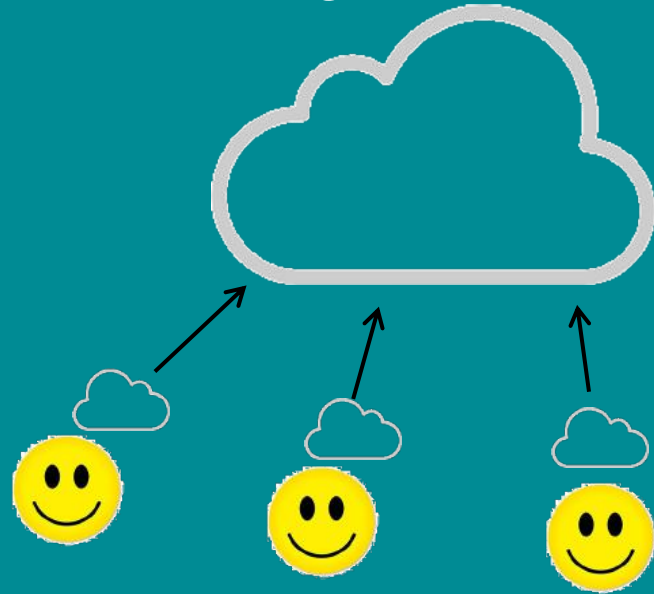
- Edge makes 5G a New innovation platform

Size of Edge?

Edge will not eat the cloud



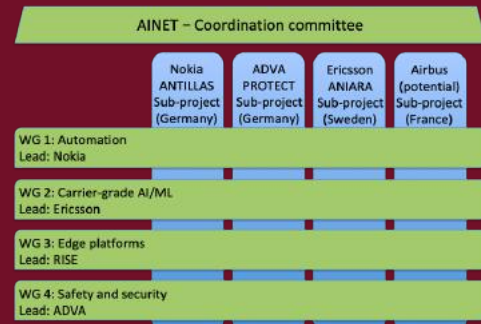
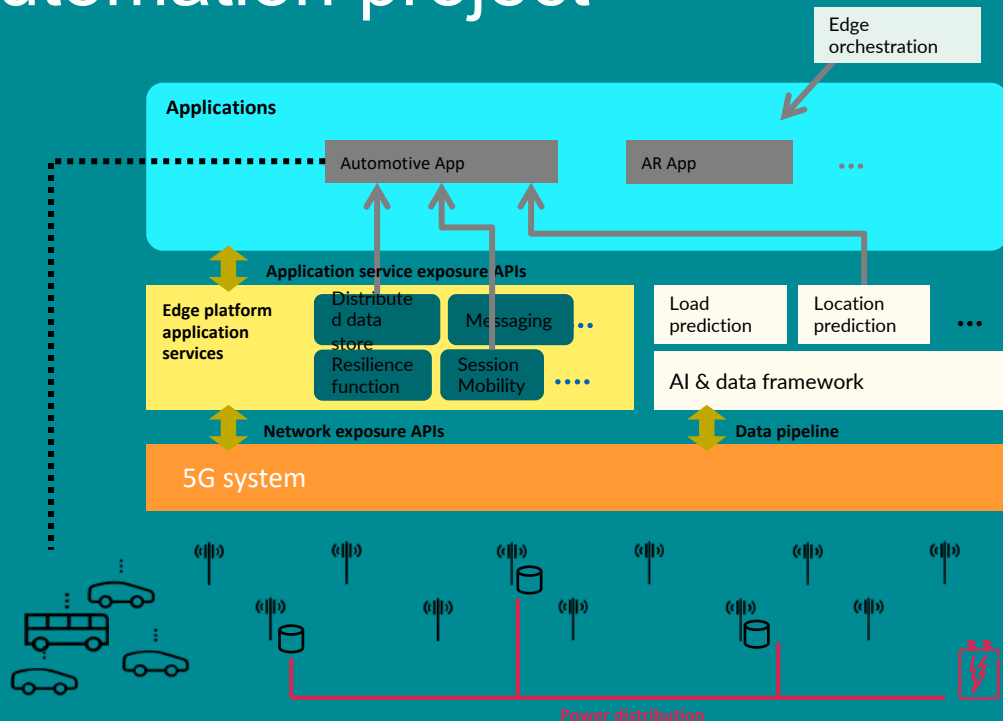
Edge will make the cloud grow





Network edge
node design
study

ANIARA - An Edge network automation project



- An European cluster project on automation of a network of edge datacenters, with orchestration, availability, robustness, optimization and reliability. Ericsson led.
- Celtic Next program. Budget 7 MEuro over 3 years

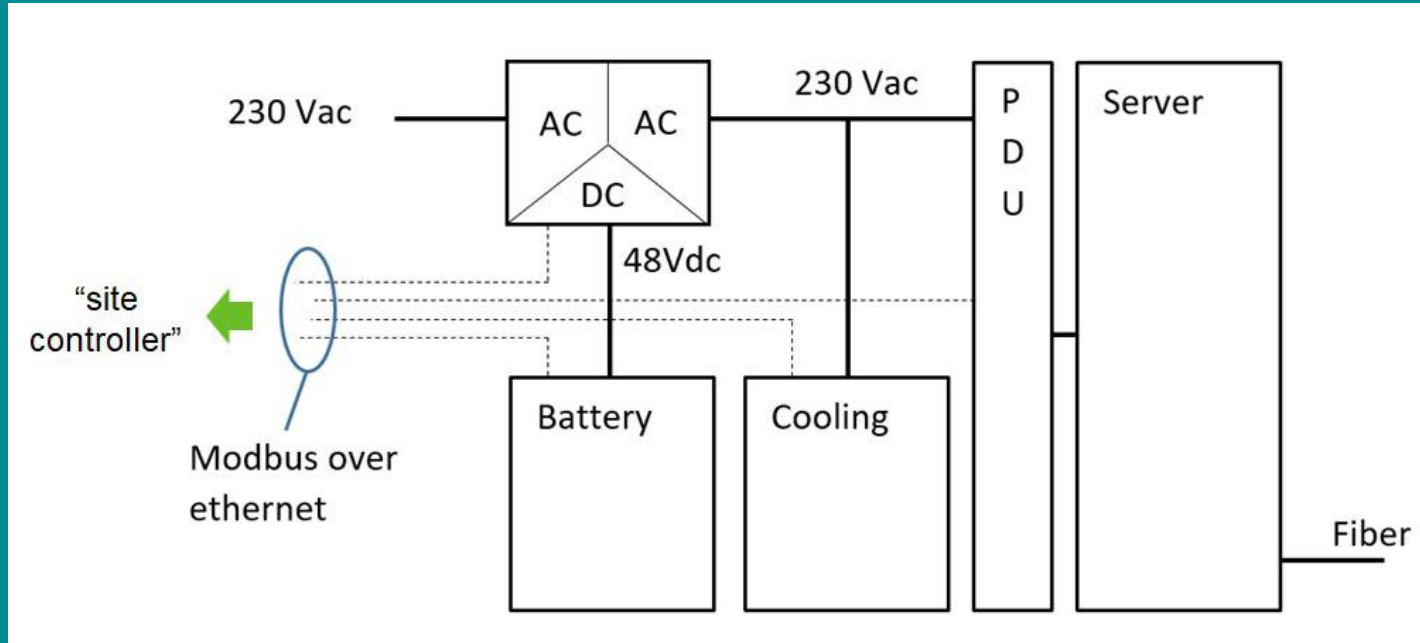


1:st demonstrator (September 2021)

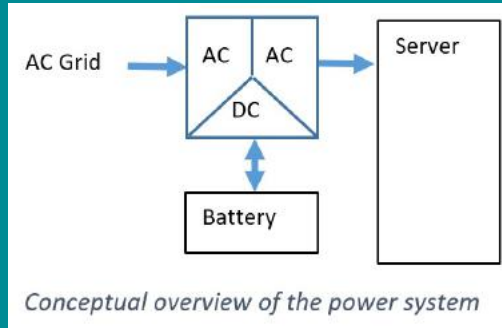
- “Network nodes will be deployed at locations **NOT prepared for the power requirements of edge-centric compute**”
- 1 server rack + 1 power rack + cooling + IP65 enclosure
 - Input Power from the grid – 8kW (Max)
 - Output Peak Power to the server - 12kW (Max)
 - 450 Ah Batteries for supporting peak power to server
 - Direct Free Cooling and active cooling & heat recovery



Power system, basic block diagram

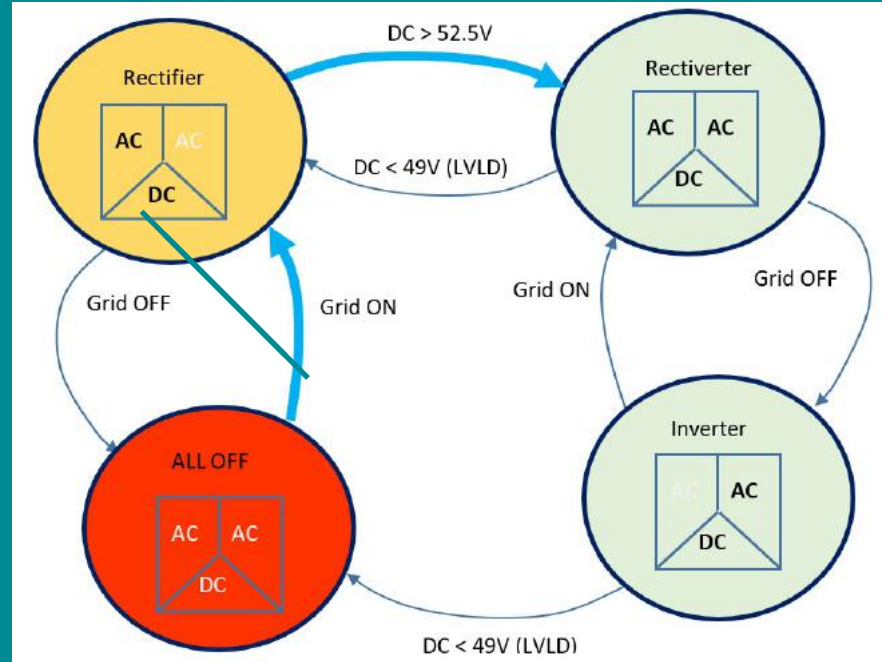


The four states of the power system



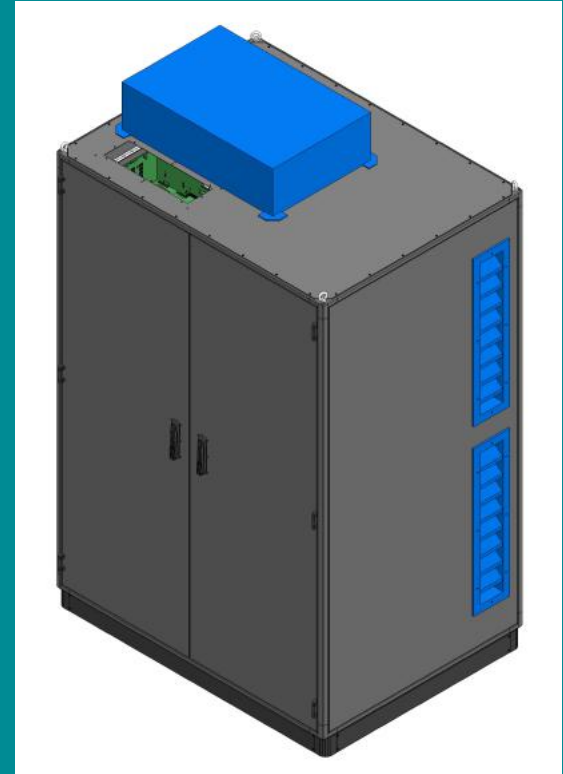
Battery charging

Battery cycling



Enoc edge node enclosure

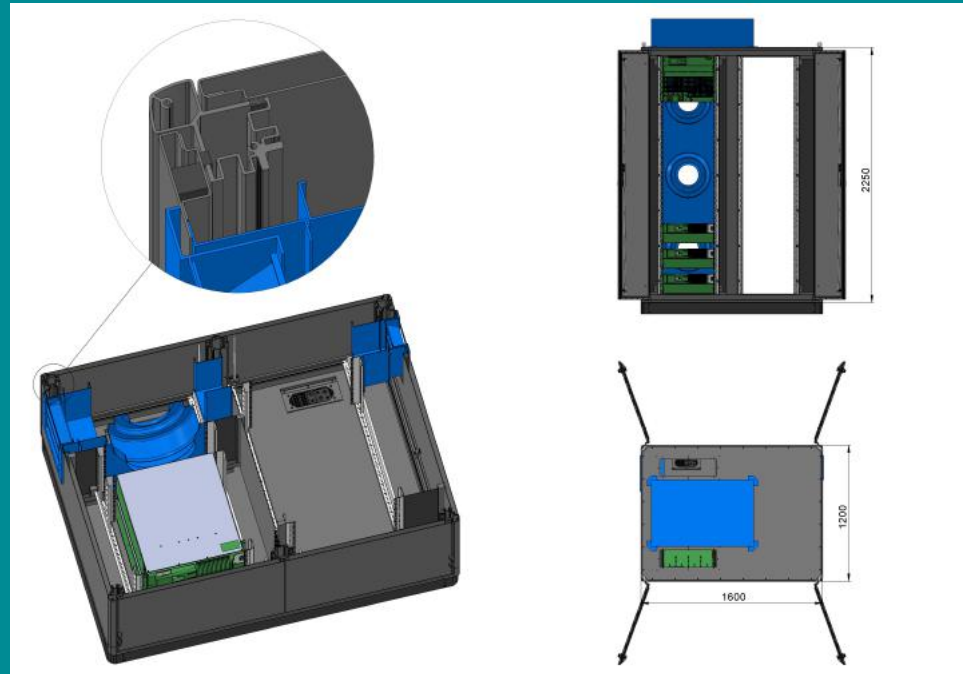
- Outdoor enclosure
- IP 65, water and dust resistant
- Corrosion resistant, aluminium
- Robust, resist vandalism
- Double walled to minimize condensation
- Possible to add insulation if needed
- Modular design, any width/depth/height possible



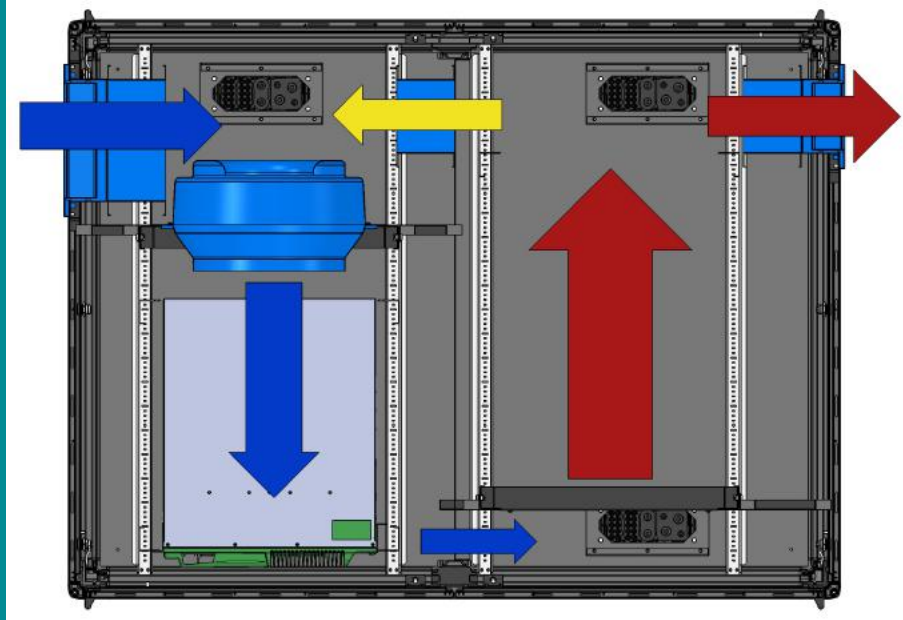
Enoc edge node enclosure

Configuration

- 1600 mm wide
- 1200 mm deep
- 2250 mm high
- 2 compartments
- Left for utility
- Right for active equipment
- 2x 47 HU
- Separate cold/hot air

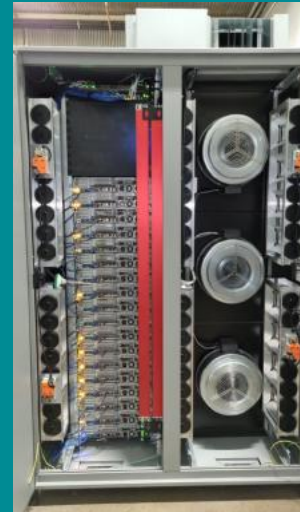
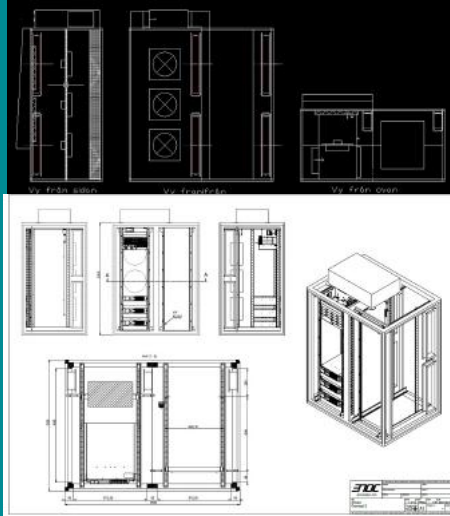


Airflow in the node enclosure



Side and roofpanels adapted to Systemair cooling system

Cooling of the enclosure



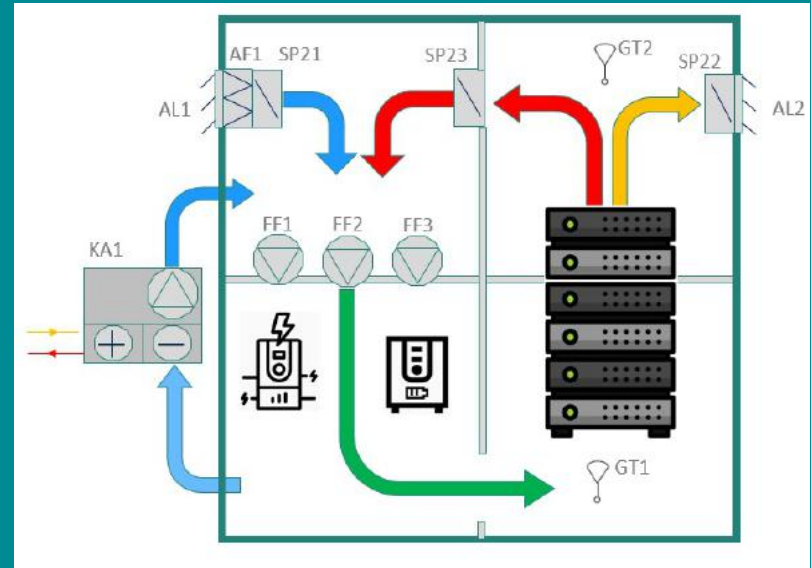
Concept



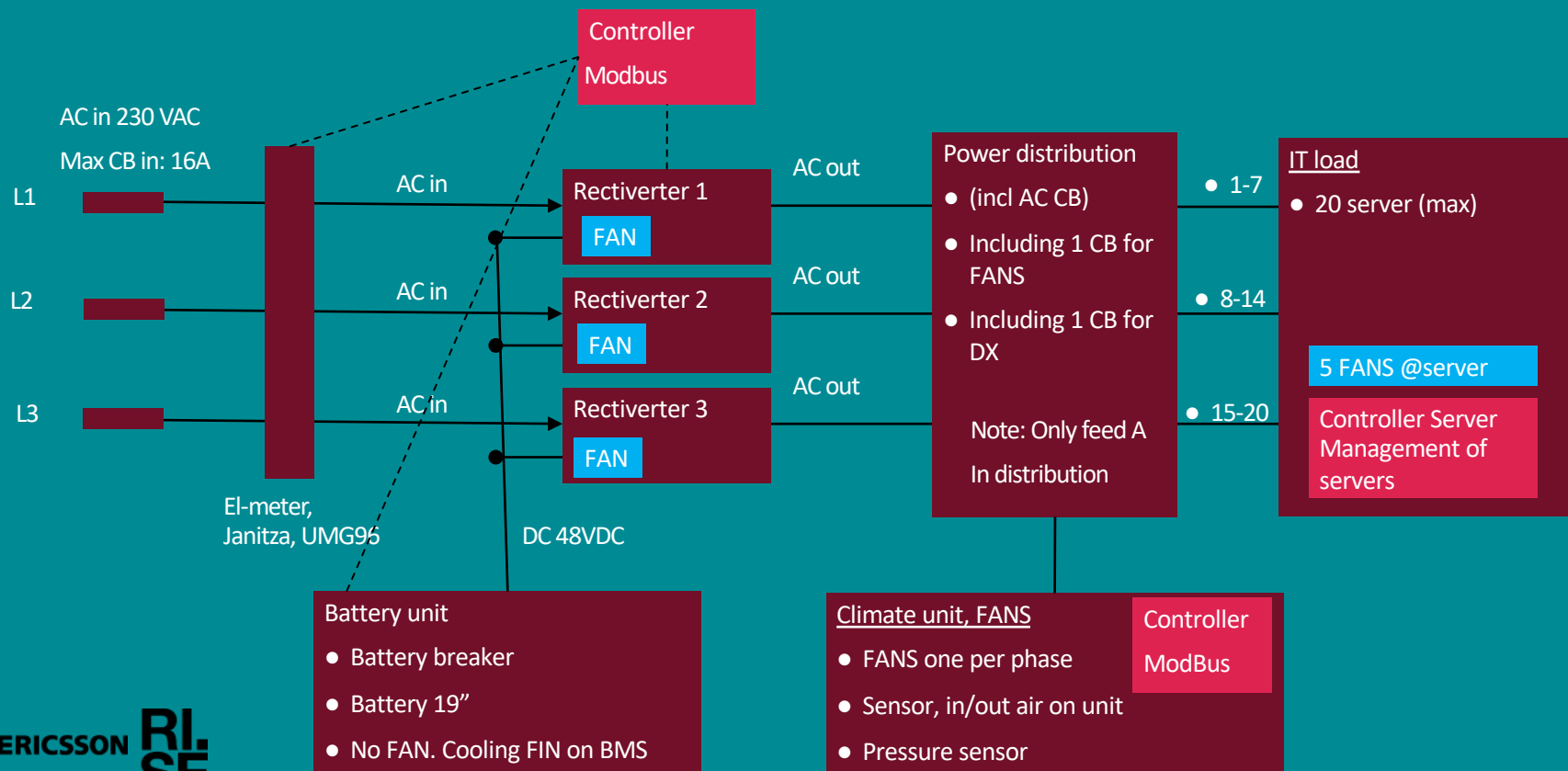
Completion

Cooling Principle; DFC and AC with heat recovery

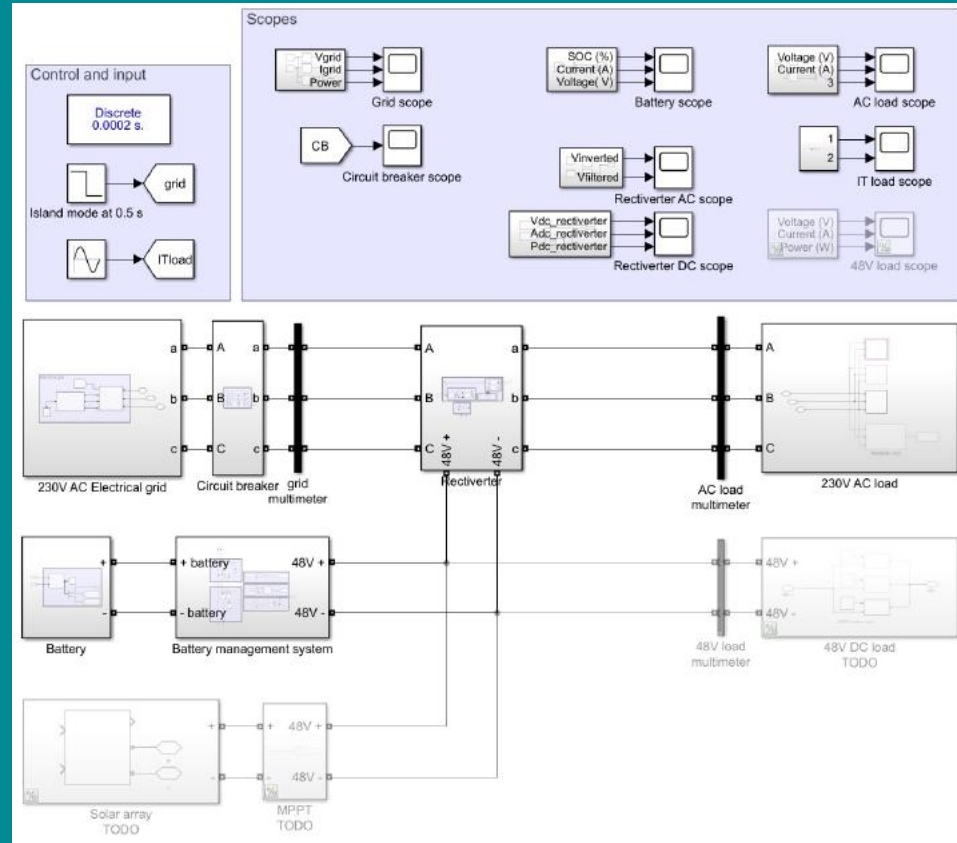
- Direct Free Cooling with outdoor air within A1 Recommended @ Ashrae 9.9 up to 9kW, DFC + AC up to 12kW cooling capacity.
- Energy recovery by air with duct connection and/or water loop connected to other system



Simulation model of the node

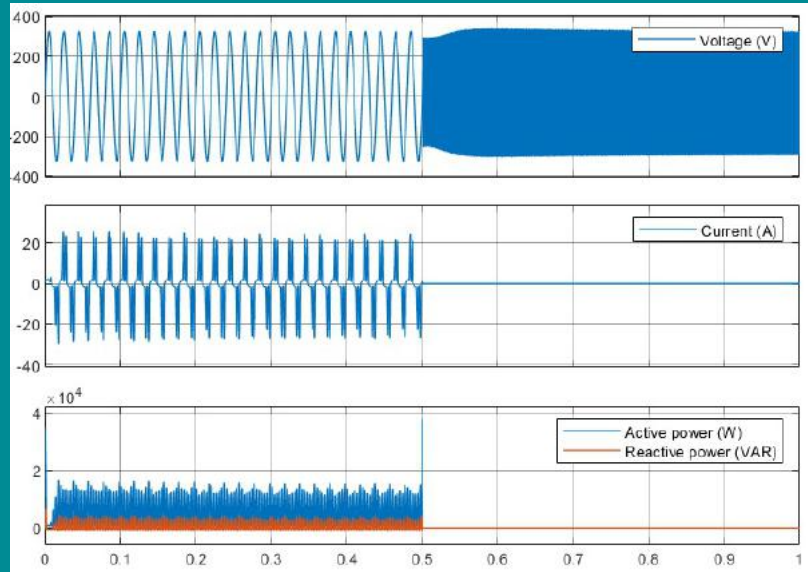


Model overview

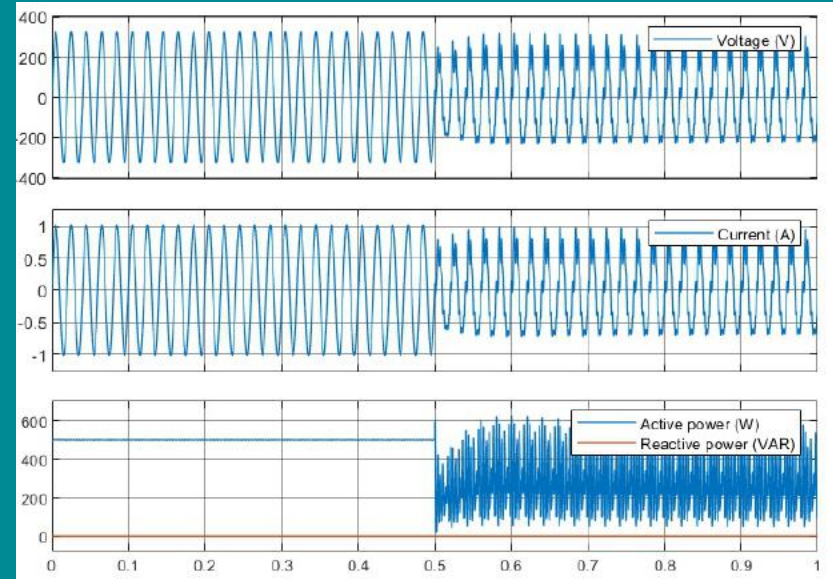


Model capabilities

AC input from grid



AC load





RISE ICE
- Other edge
activities

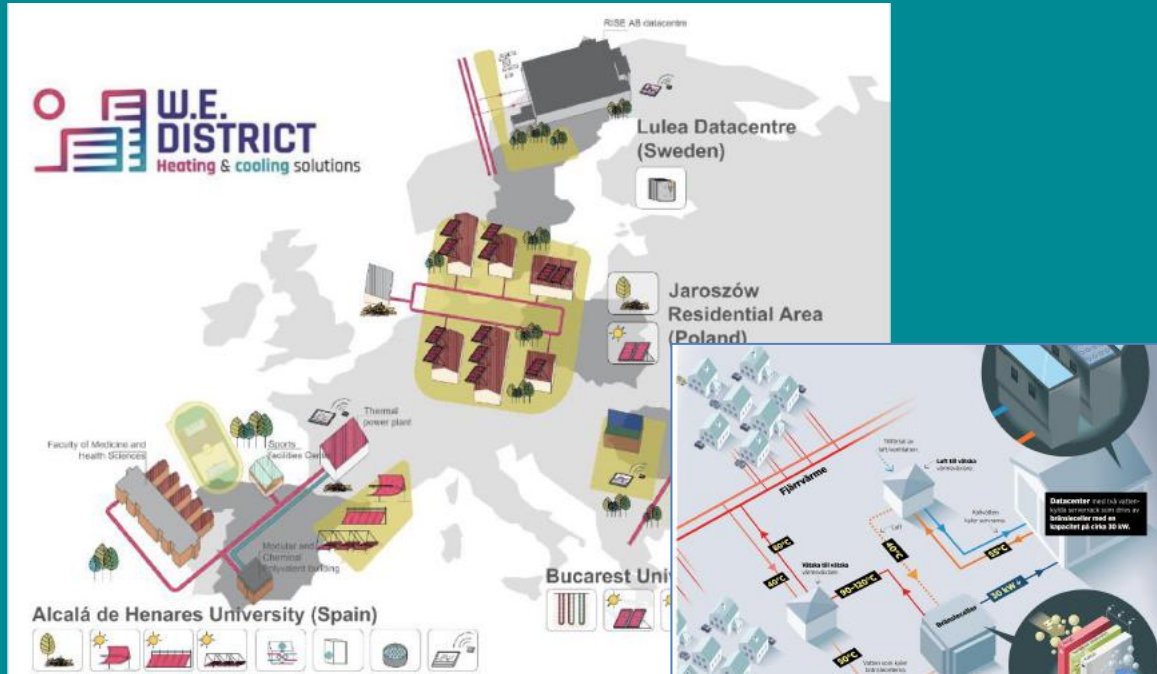
The AutoDC project



The goal is to lower OPEX by making datacenter self-healing, self-optimizing and robust. Use cases are edge DC, rural DCs and mega-scale DCs

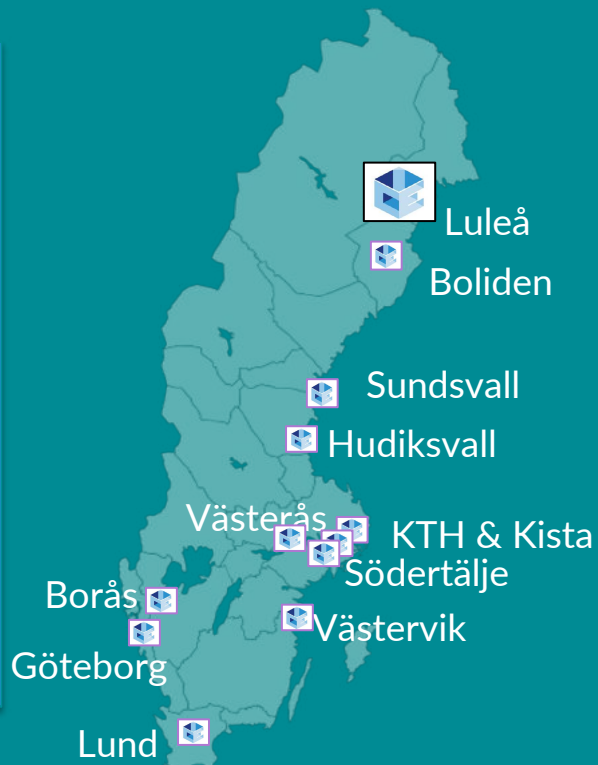
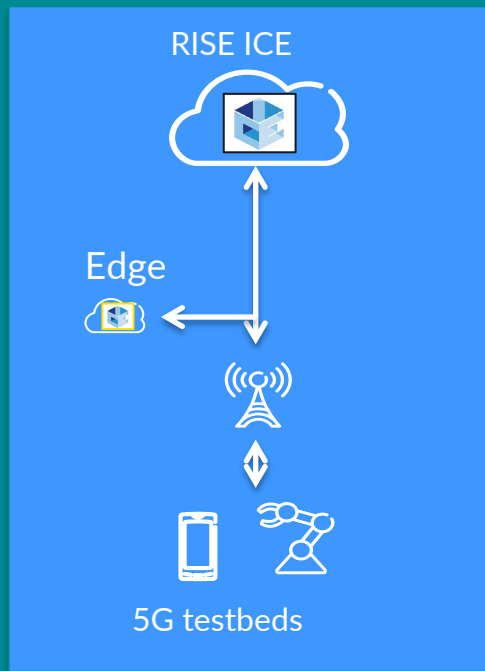
- AutoDC is an ITEA3 project about autonomous datacenters
- Total project is 73 MSEK over 3 years
- Ericsson manage the project and RISE is Swedish coordinator.
- Partners are Ericsson, other Swedish partners, Granlund, Aalto, Orbis and kWSet (Finland) and Canadian partners

WEDISTRICT - EU H2020 project Datacenters and fuel cells



- The project focus is to demonstrate multiple RES based District Heating and/or Cooling systems in Europe.
- The total budget is about 20 MEuro and RISE funding is around 1,2 MEuro.
- Our focus will be the recovery process using liquid cooling and a fuel cell to increase the temperature and use the electricity from the fuel cell for the datacenter

A National Edge application testbed initiative



Objectives

- To expose RISE data platform resources to developers and researchers at 5G testbeds, RISE T&Ds and other testbeds
- To develop technologies, usage, products and services
- To strengthen Swedish companies to compete on the world market
- To enable Sweden to be world leading in different areas for example edge compute, IoT, mobility, AR/VR



Thank you!

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