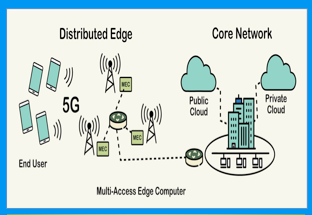
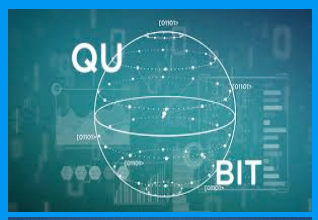
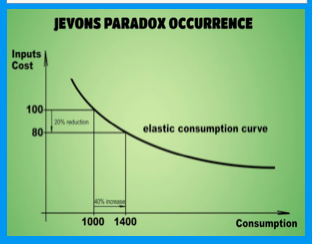
A peek into the future of the datacenter industry

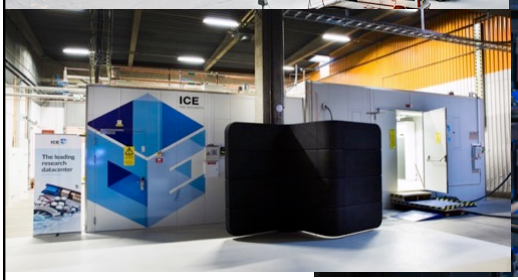
Head of Lab
Tor Björn Minde
RISE ICE datacenter research

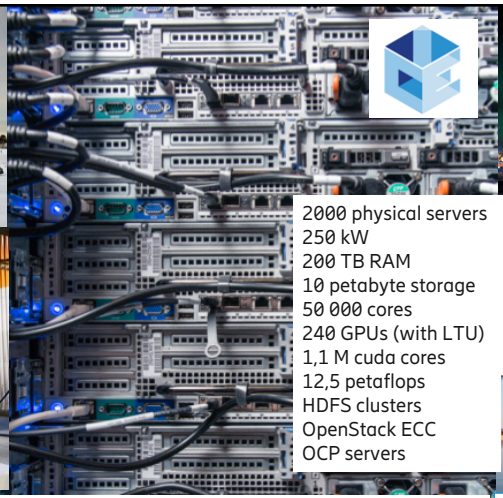






RISE ICE datacenter





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

- 20 projects, from the ground to the cloud
- 25 employees
- 4 MEUR turnover
- Established 2016
- 50 MSEK invested

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

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

2018, 2019, 2020 BDV i-Space GOLD

2016, 2017 BDV i-Space SILVER

DATACLOUD GLOBAL AWARDS 2019

Cluster Management Excellence
STRIVING FOR CLUSTER EXCELLENCE

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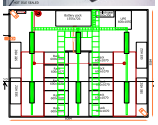
RISE ICE Datacenter test environment

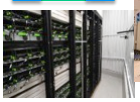
Module 1 & 2 Compute clusters



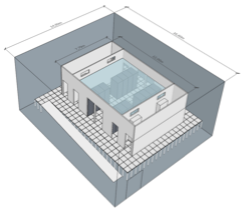
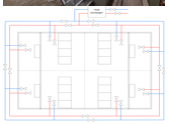



Module 3 OCP Lab + Climate box + Heat box






Module 4 Facility hardware test lab

Edge + wind tunnels + liquid cooling test bed

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FUTURE PREDICTIONS USING SCENARIOS

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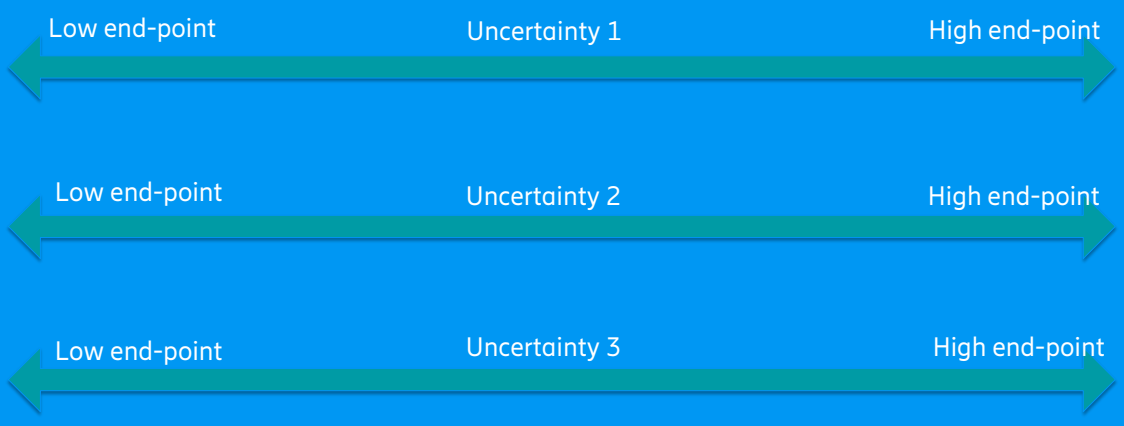
To predict the future with certainty is impossible!

Defining uncertainties



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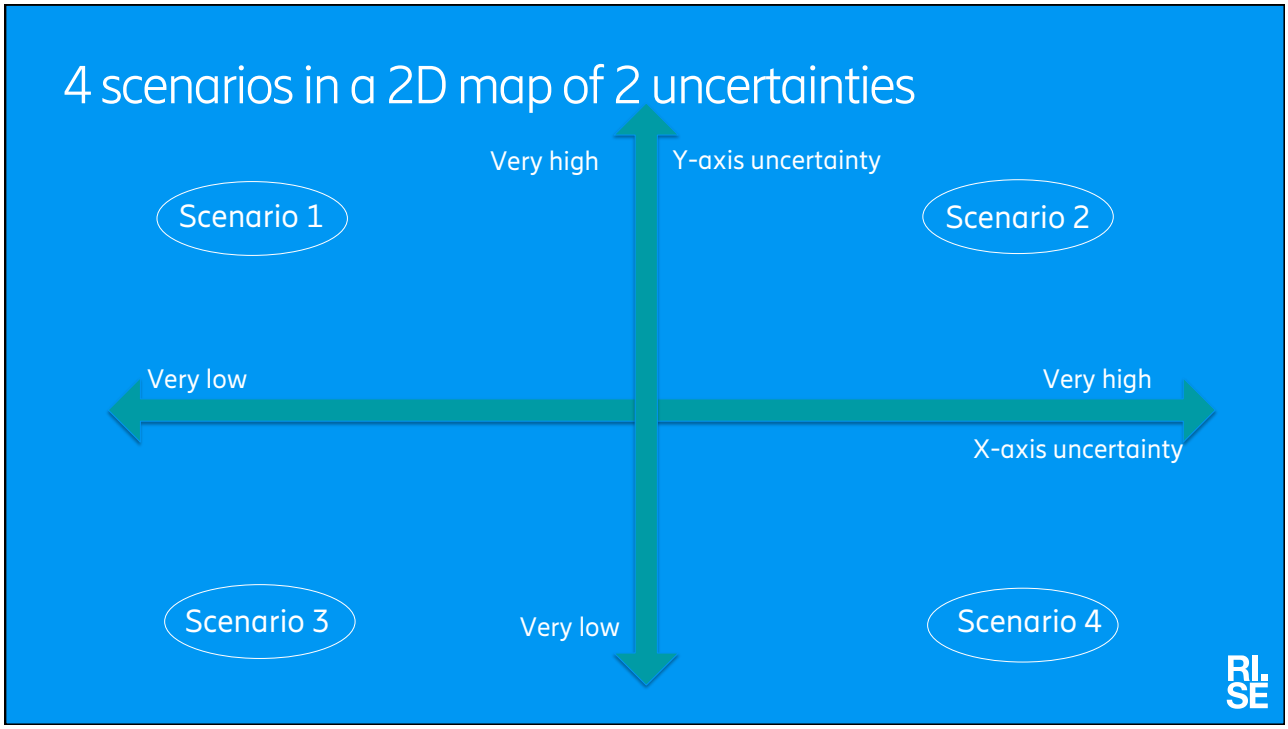
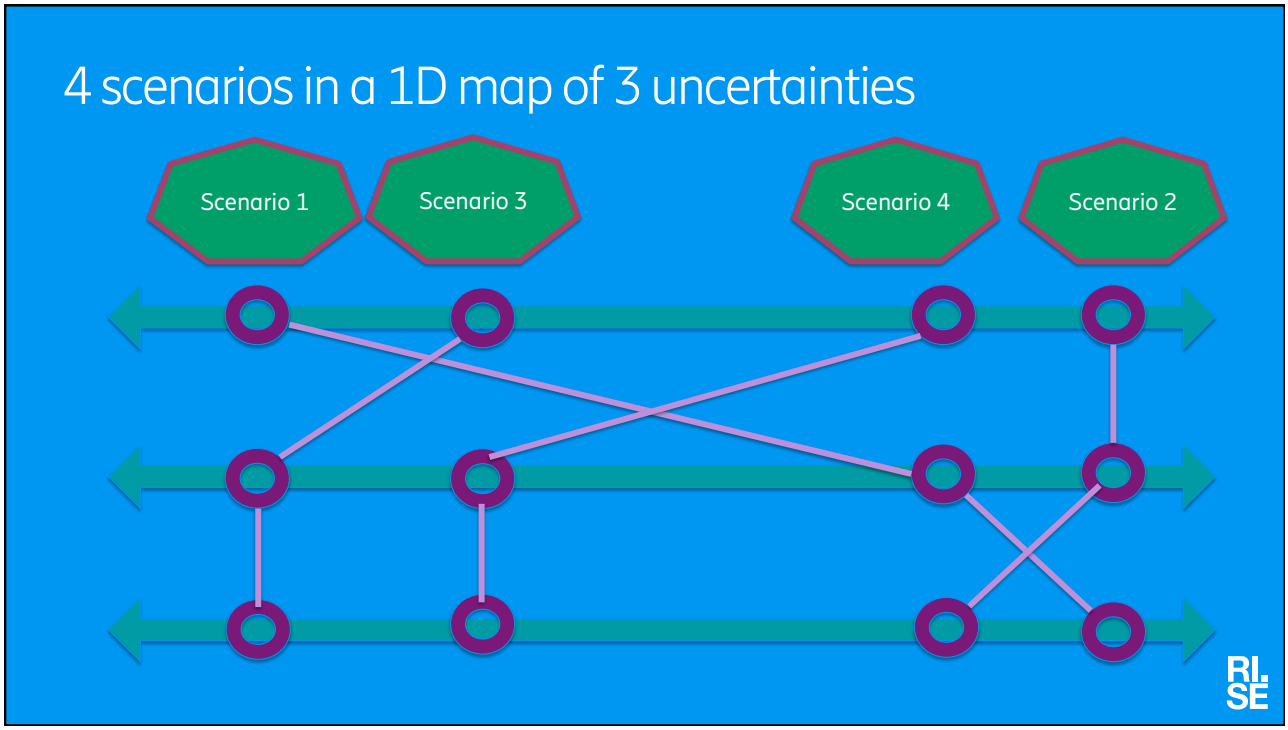

4 scenarios in a 2D map of 2 uncertainties
Very high
Y-axis uncertainty
Scenario 1
Scenario 2
Very low
Very high
X-axis uncertainty
Scenario 3
Very low
Scenario 4


4 scenarios in a 1D map of 3 uncertainties
Scenario 1
Scenario 3
Scenario 4
Scenario 2

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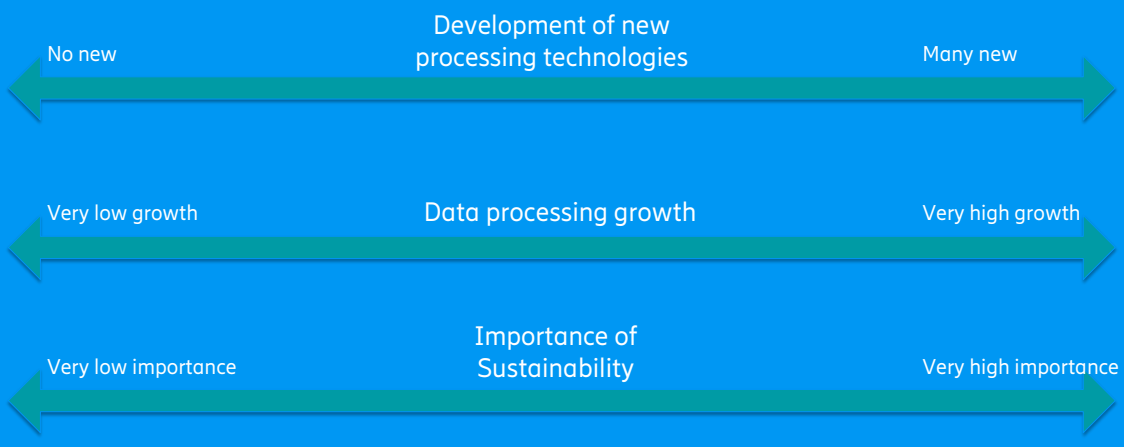
UNCERTAINTY & TRENDS

3 Uncertainties for datacenters



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Resource utilization (Uncertainty 1)

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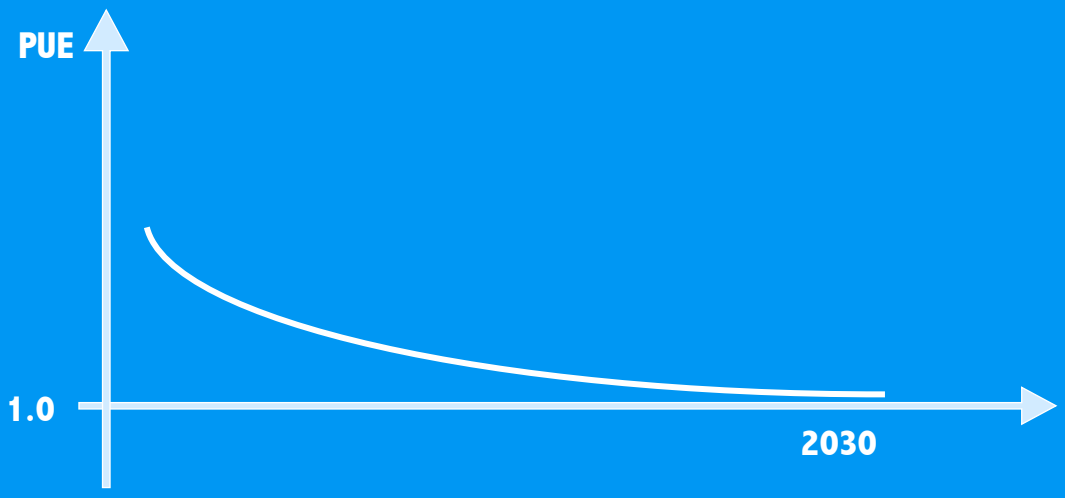
Energy efficiency (Uncertainty 1)



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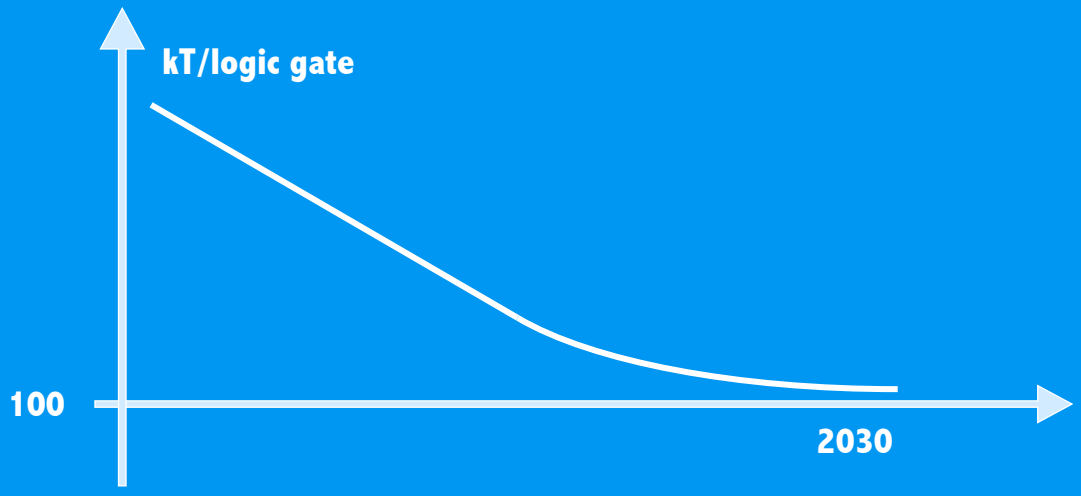
End of Moore's Law (Uncertainty 1)



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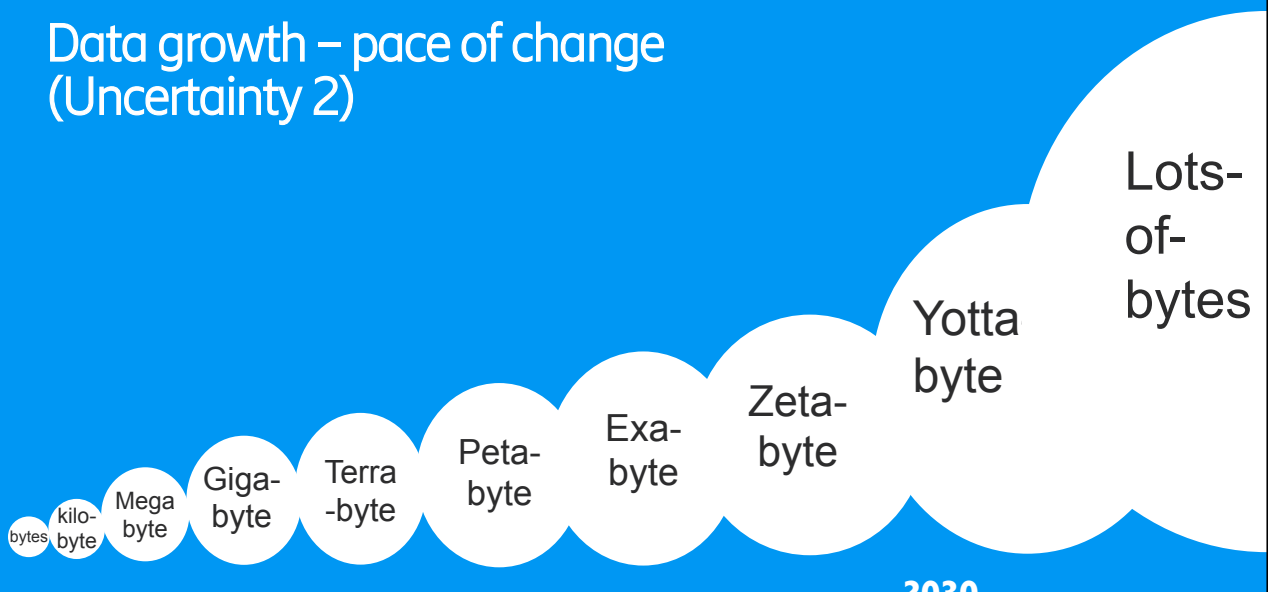
Data growth – pace of change (Uncertainty 2)



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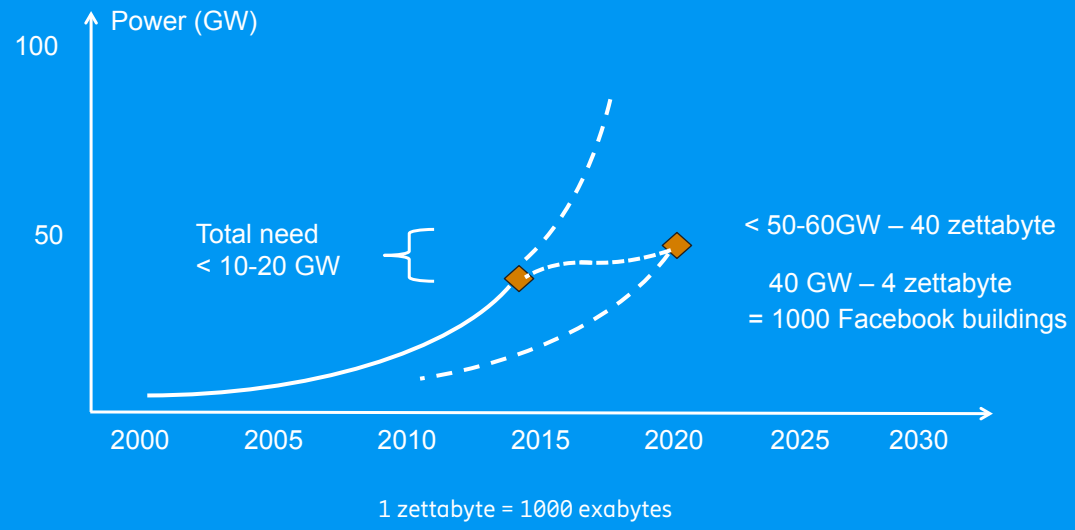
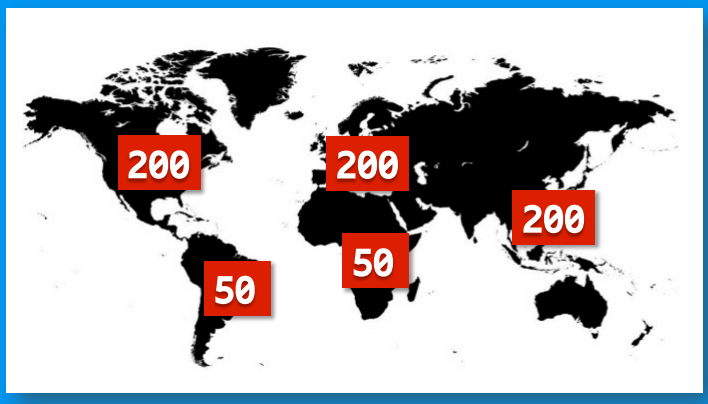
Global power need



1 zettabyte = 1000 exabytes

Source: Länsstyrelsen Norrbotten 2014

Market growth 2014-2020 of new mega datacenters



A total 700 (>5 MW), based on sources from IDC, Gigaom och Datacenter Dynamics.

Source: Länsstyrelsen Norrbotten 2014

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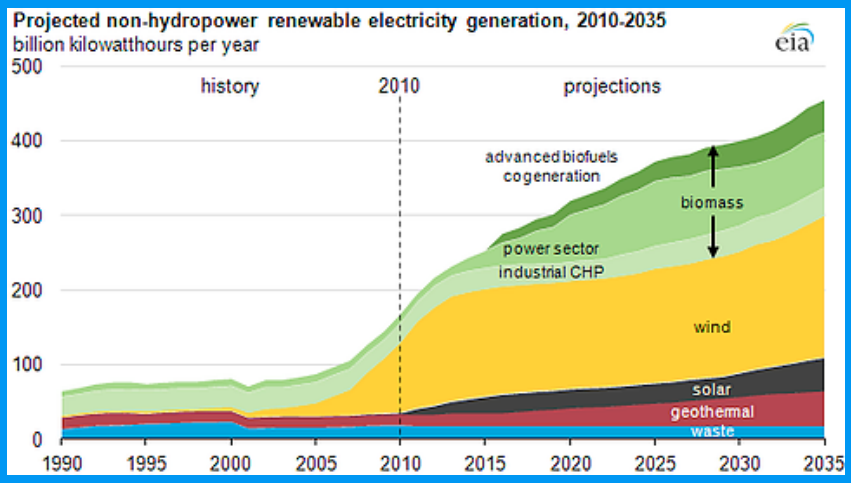
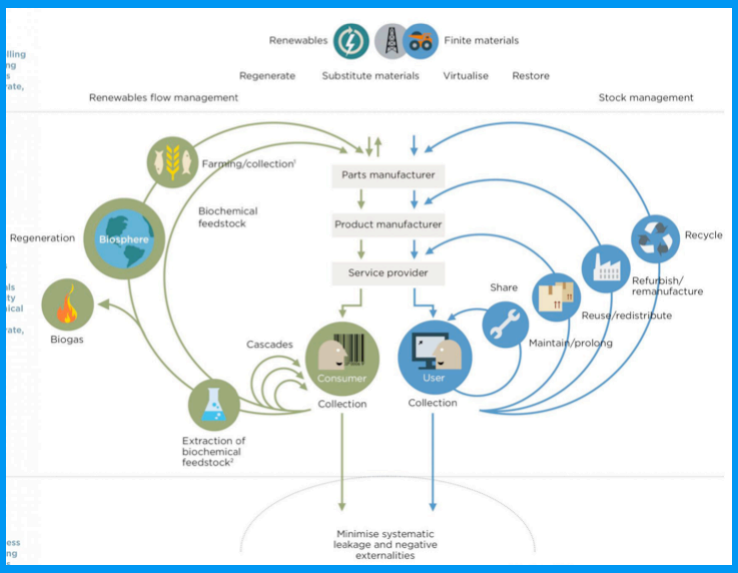
Growth of renewables (Uncertainty 3)



Growth of circular economy (Uncertainty 3)



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BACKGROUND NOTES

5G Requirements

Source: Ericsson

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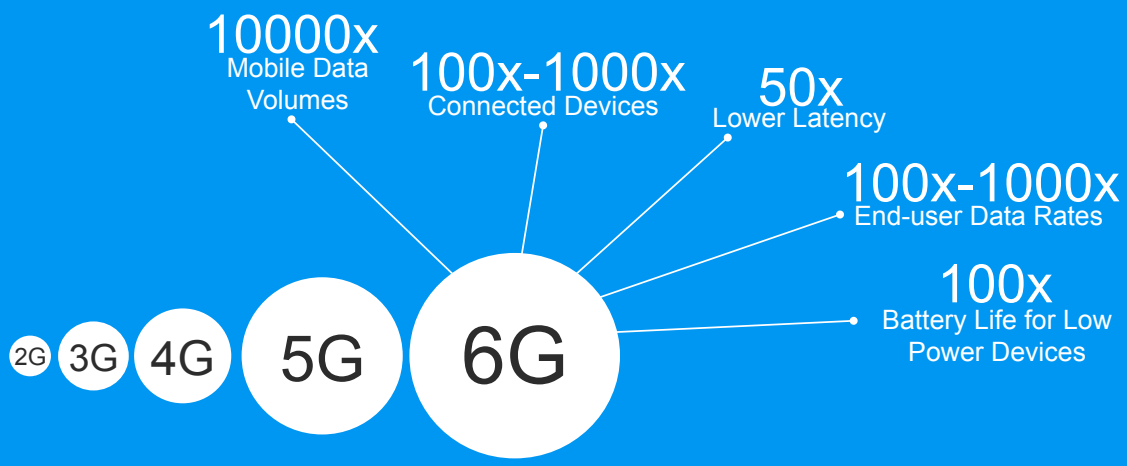
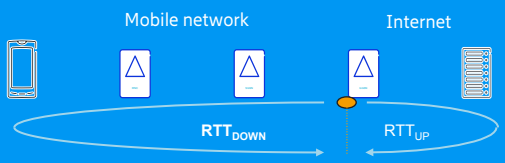
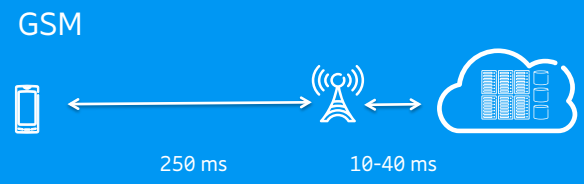
Evolution Towards 6G

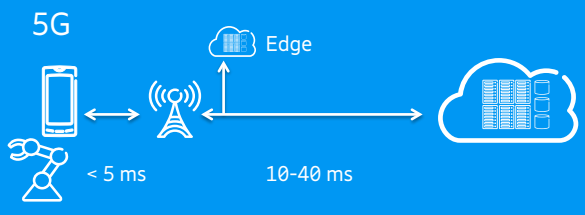


5G/6G networks and edge datacenters



	3G	4G	5G	6G	
RTTUP	20%	50%	80%	95%	Increasing part of the delay
RTTDOWN	80%	50%	20%	5%	Approaching 20% for 5G
RTTTOTAL	200 ms	40 ms	25 ms	21 ms	Depending on many parameters





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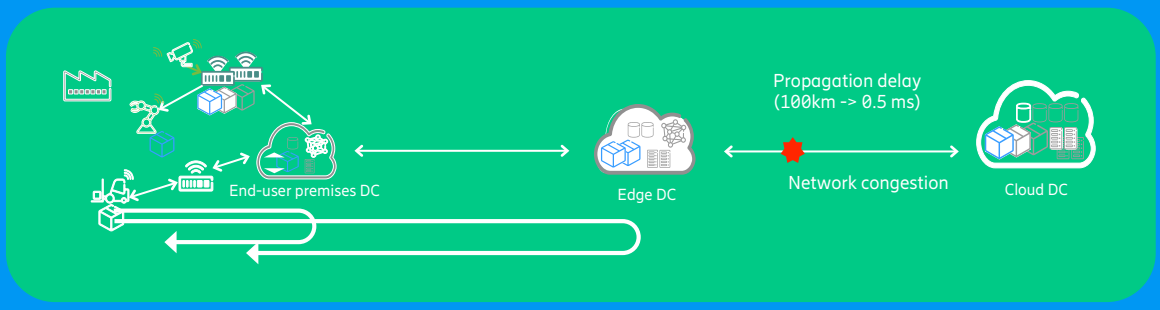
What is Edge computing?

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



End user perspective

- Enhanced user experience
  - Response times, battery life, HW-extensions
- Edge service or edge plan
  - Improves applications marked with an "e" when edge capacity is available
- Virtual hardware (GPU) service
  - Improves e.g. gaming applications with HW-extensions
- Service & HW follows you
  - Edge compute containers moves

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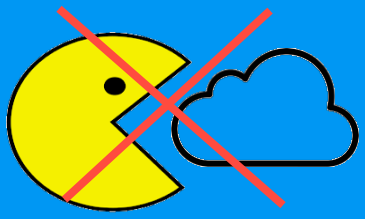
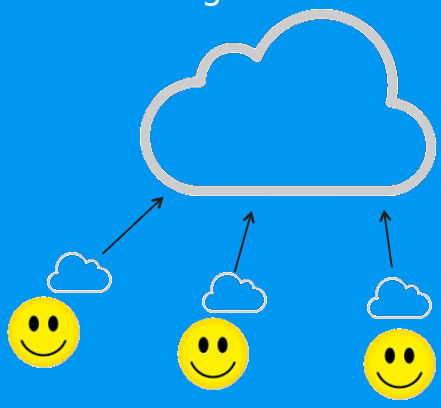
Size of Edge?

Edge will not eat the cloud



Edge will make the cloud grow



Use of Edge and Central cloud

Basic use case characteristics

Type	Response times	Data amount	Traffic amount	Cache	DC location
Cold storage	seconds	Gigabytes	Mb/s		Remote cloud
Off-line big data crunching	seconds	Gigabytes	Gb/s		Remote cloud
Chat/IoT/event type communication	100th milliseconds	kilobytes	kb/s		Remote cloud
Web/app rendering	100th milliseconds	Megabytes	Mb/s	Yes	Remote cloud
Up/Down-link streaming	10th milliseconds	Gigabytes	Mb/s	Yes	mix
Remote operation/ Real-time AV conferencing	10th milliseconds	Megabytes	Mb/s	Yes	mix
Real-time aggregation/ analytics/ VR/ AR	milliseconds	Megabytes	Gb/s	Yes	edge
Transaction/Control loops	milliseconds	kilobytes	kb/s		edge

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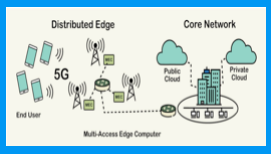
SCENARIOS

Very high growth

Data processing growth

Scenario 1 "Bold"

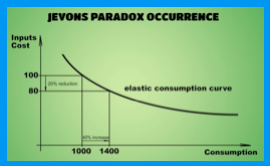


Scenario 2 "Disrupt"

No new

Many new

Development of new processing technologies



Scenario 3 "Status Quo"

Scenario 4 "Reduction"

Very low growth

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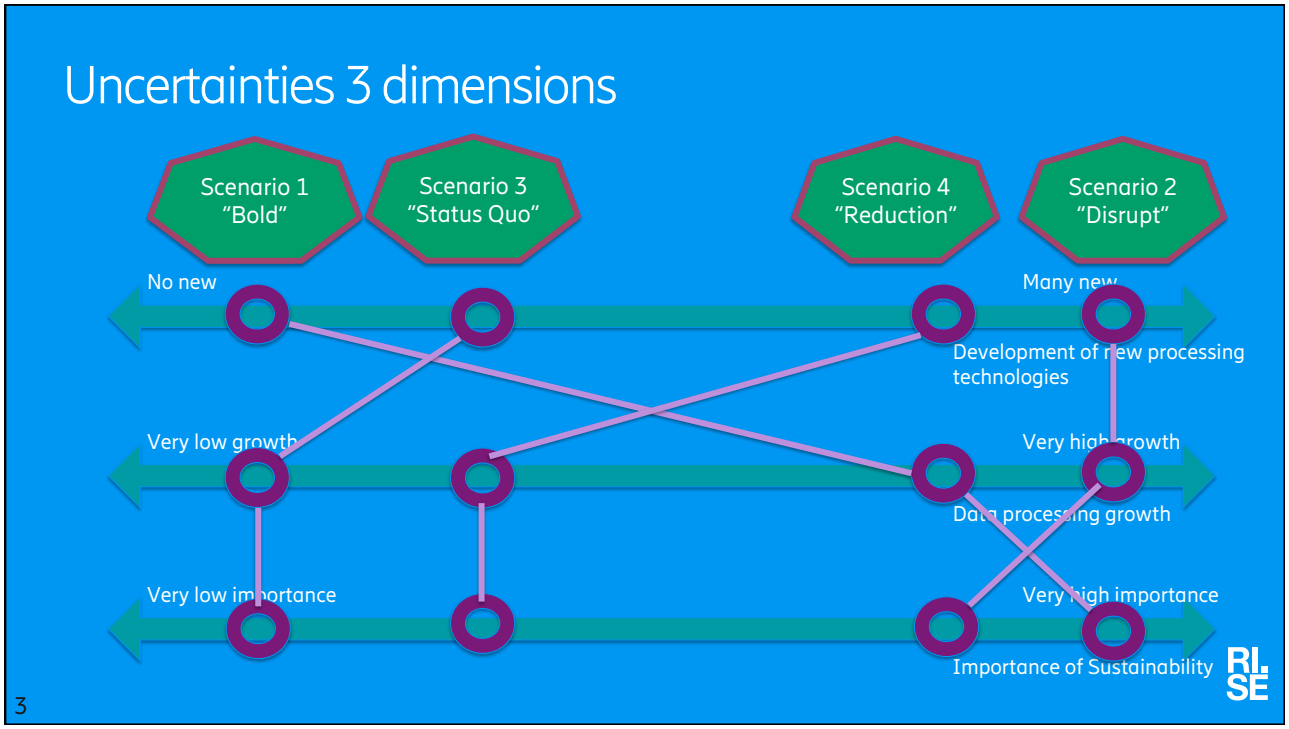
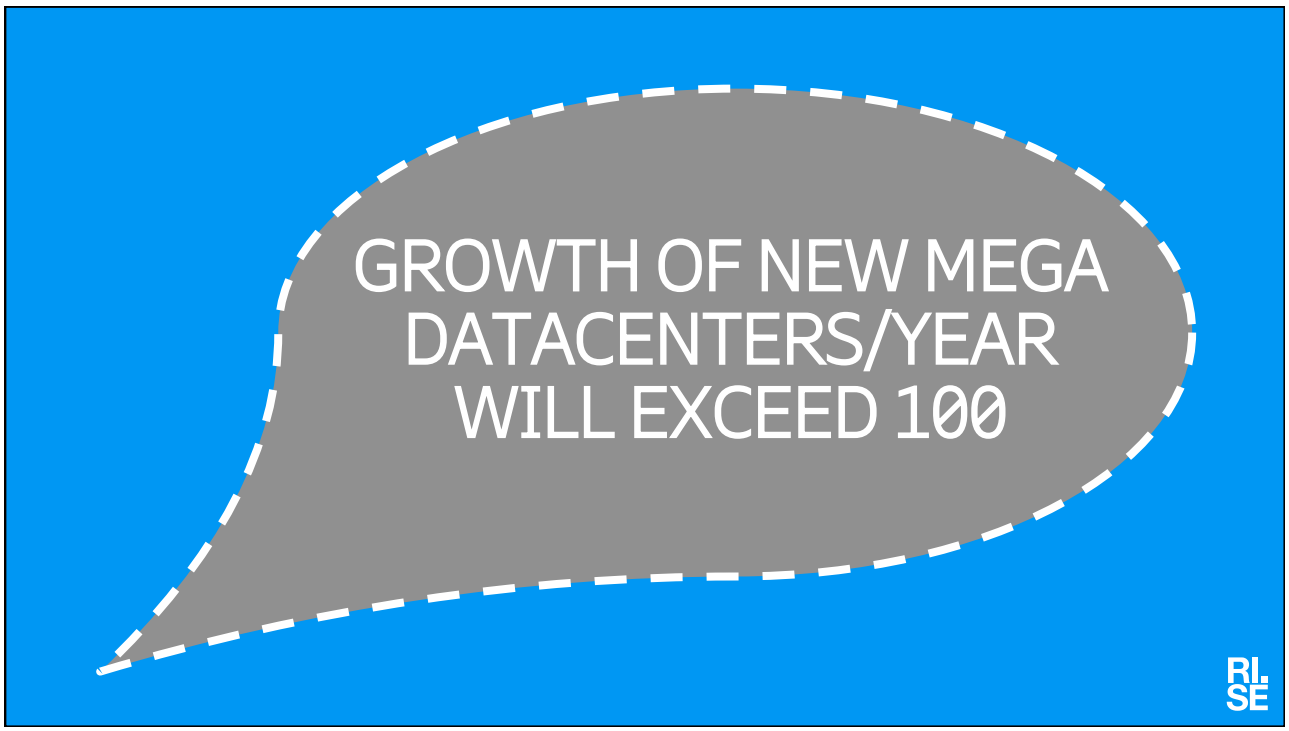

Uncertainties 3 dimensions
Scenario 1 "Bold"
Scenario 3 "Status Quo"
Scenario 4 "Reduction"
Scenario 2 "Disrupt"
No new
Many new
Development of new processing technologies
Very low growth
Very high growth
Data processing growth
Very low importance
Very high importance
Importance of Sustainability
3


BOLD PREDICTIONS 2030+


GROWTH OF NEW MEGA DATACENTERS/YEAR WILL EXCEED 100
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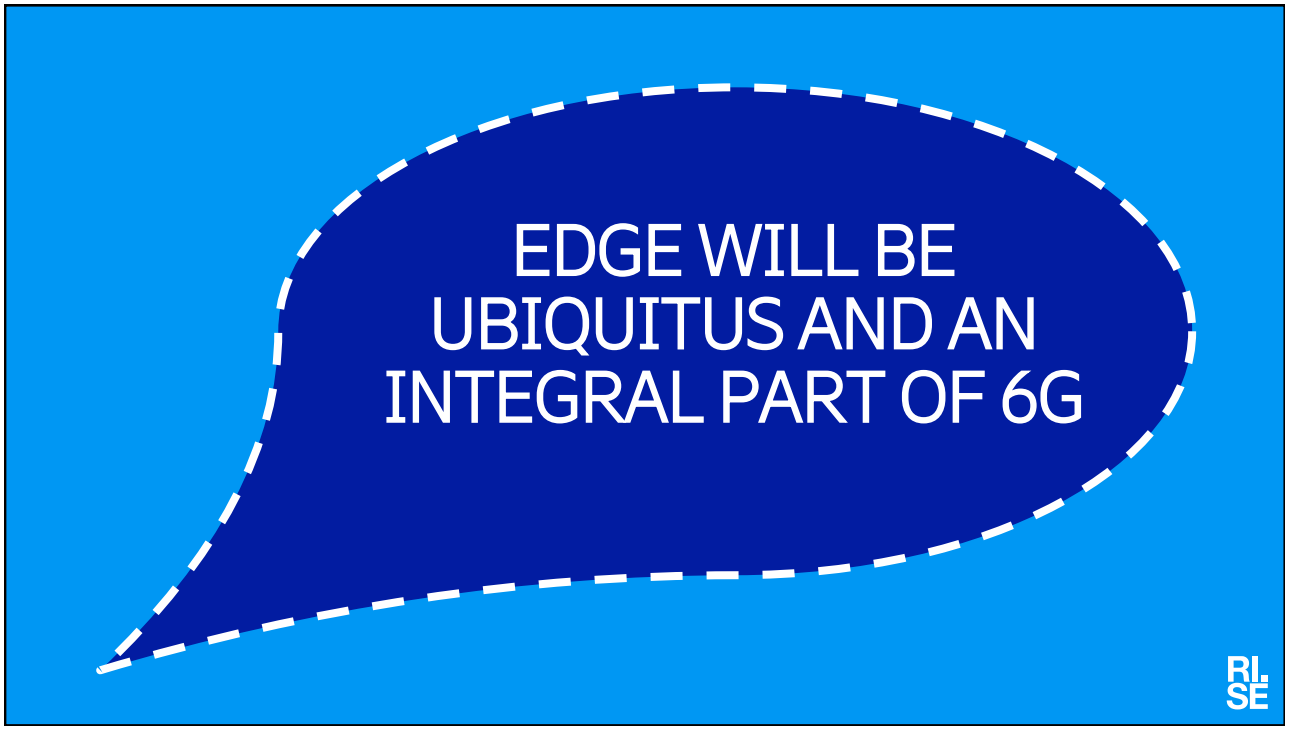
EDGE WILL BE UBIQUITUS AND AN INTEGRAL PART OF 6G
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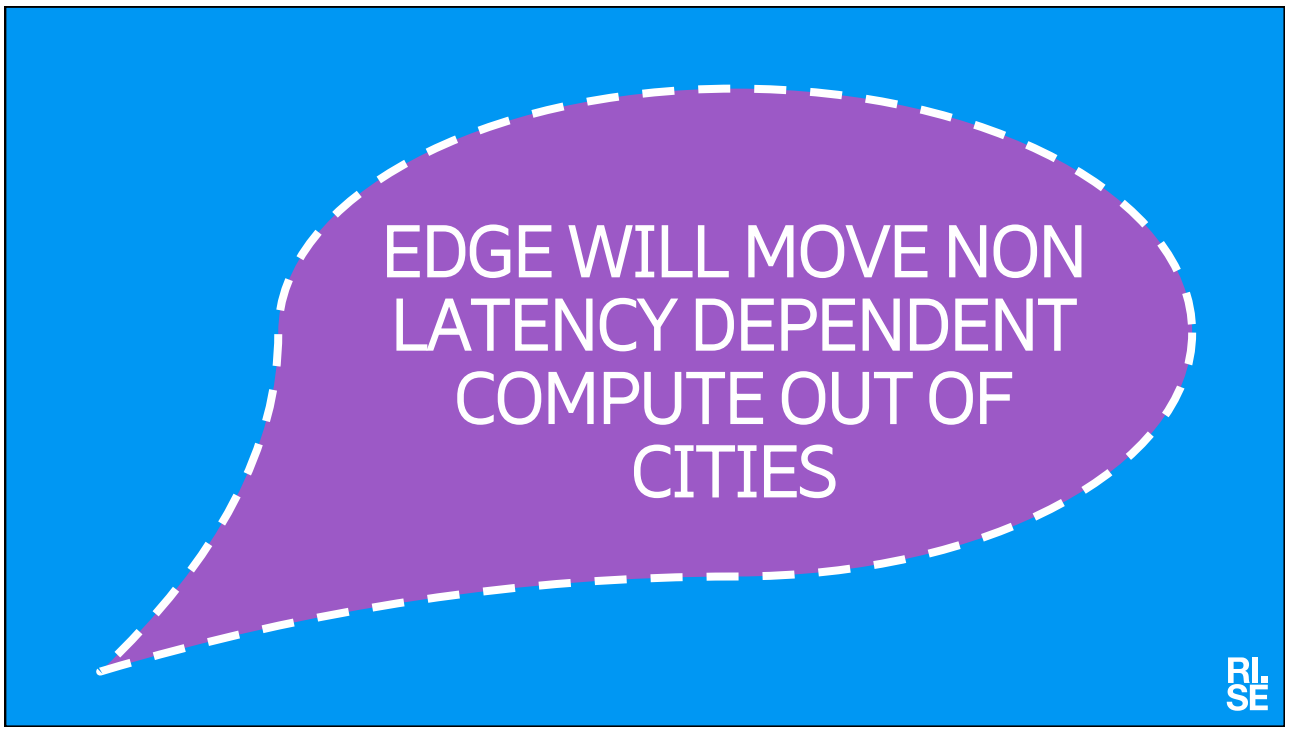
EDGE WILL MOVE NON LATENCY DEPENDENT COMPUTE OUT OF CITIES
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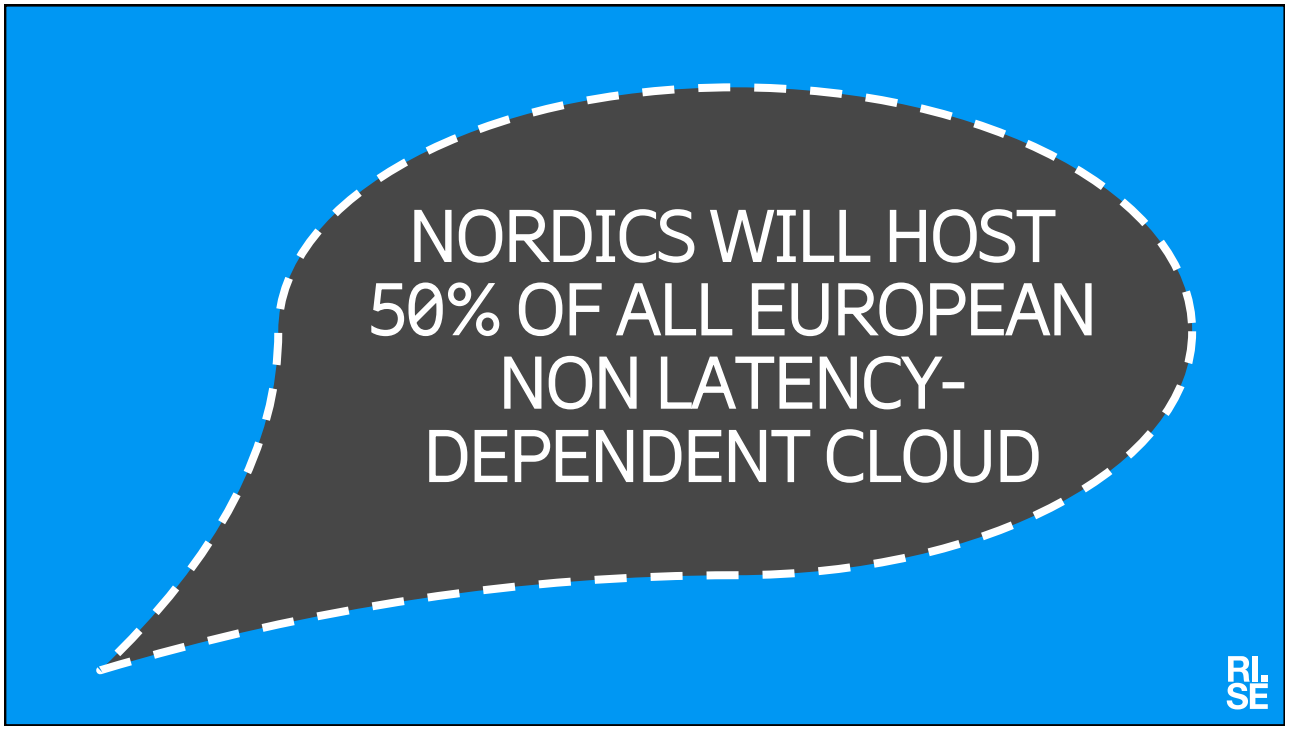
NORDICS WILL HOST 50% OF ALL EUROPEAN NON LATENCY-DEPENDENT CLOUD
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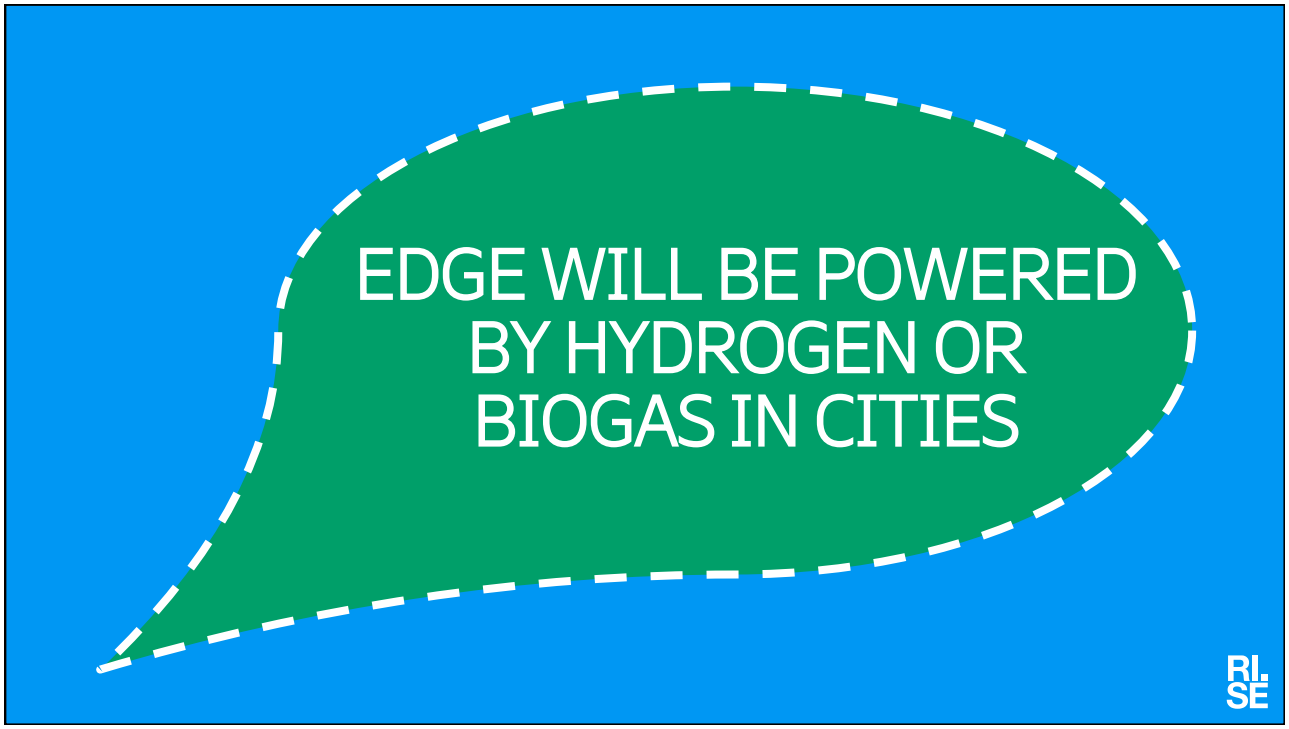
EDGE WILL BE POWERED BY HYDROGEN OR BIOGAS IN CITIES
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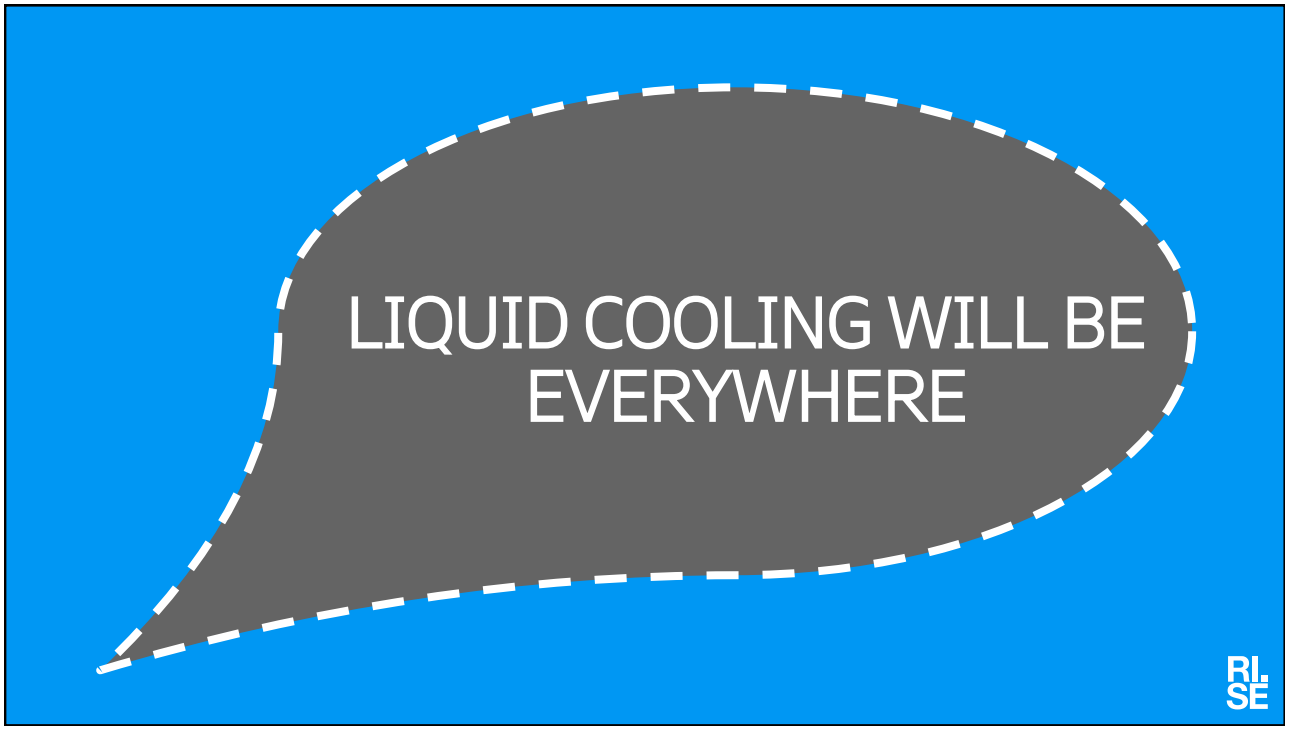
LIQUID COOLING WILL BE EVERYWHERE
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CLOUD SITES WILL BE SELECTED FOR INDUSTRIAL SYMBIOSIS
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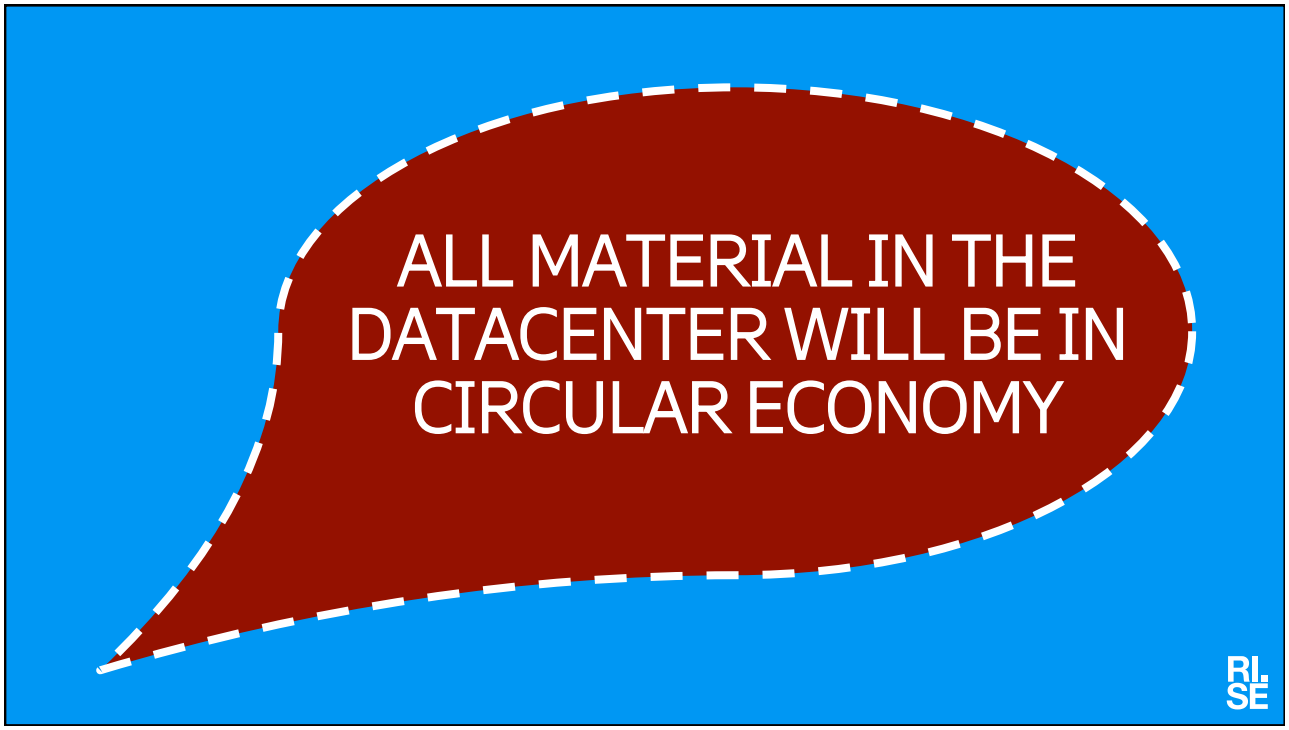
ALL MATERIAL IN THE DATACENTER WILL BE IN CIRCULAR ECONOMY
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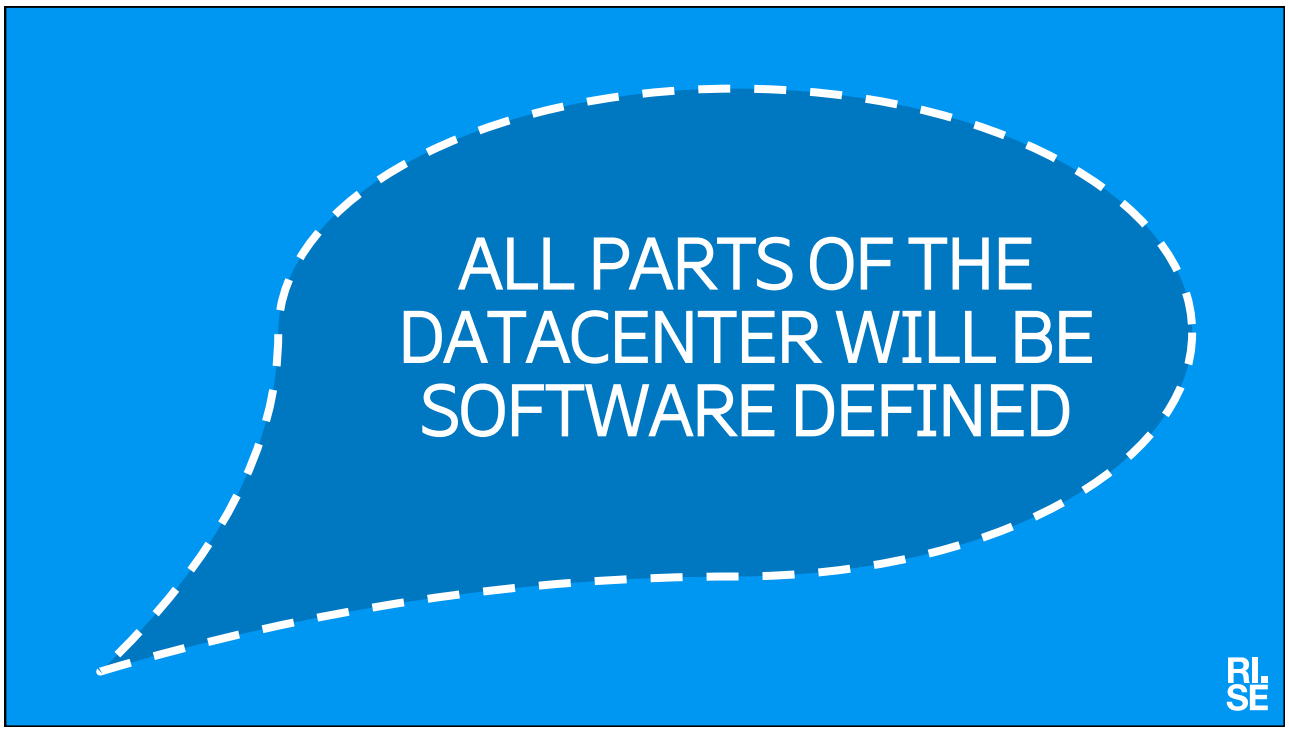
ALL PARTS OF THE DATACENTER WILL BE SOFTWARE DEFINED
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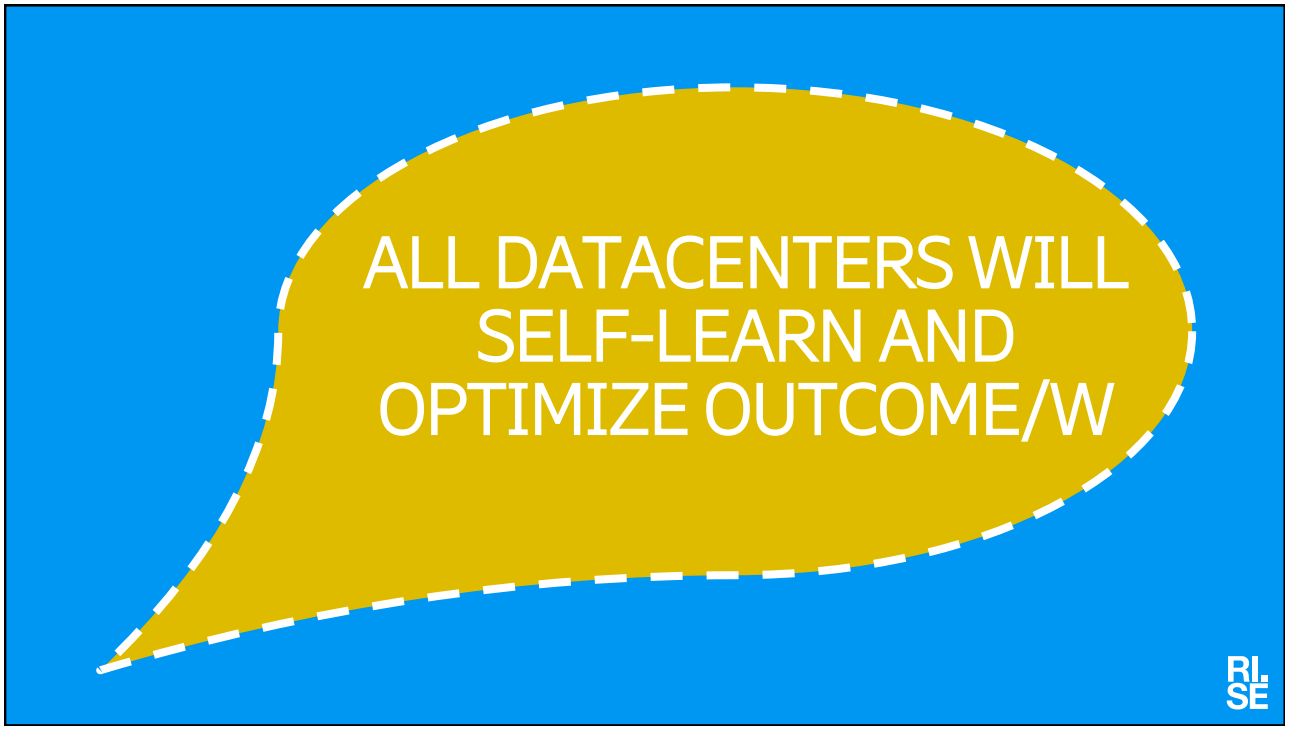
ALL DATACENTERS WILL SELF-LEARN AND OPTIMIZE OUTCOME/W
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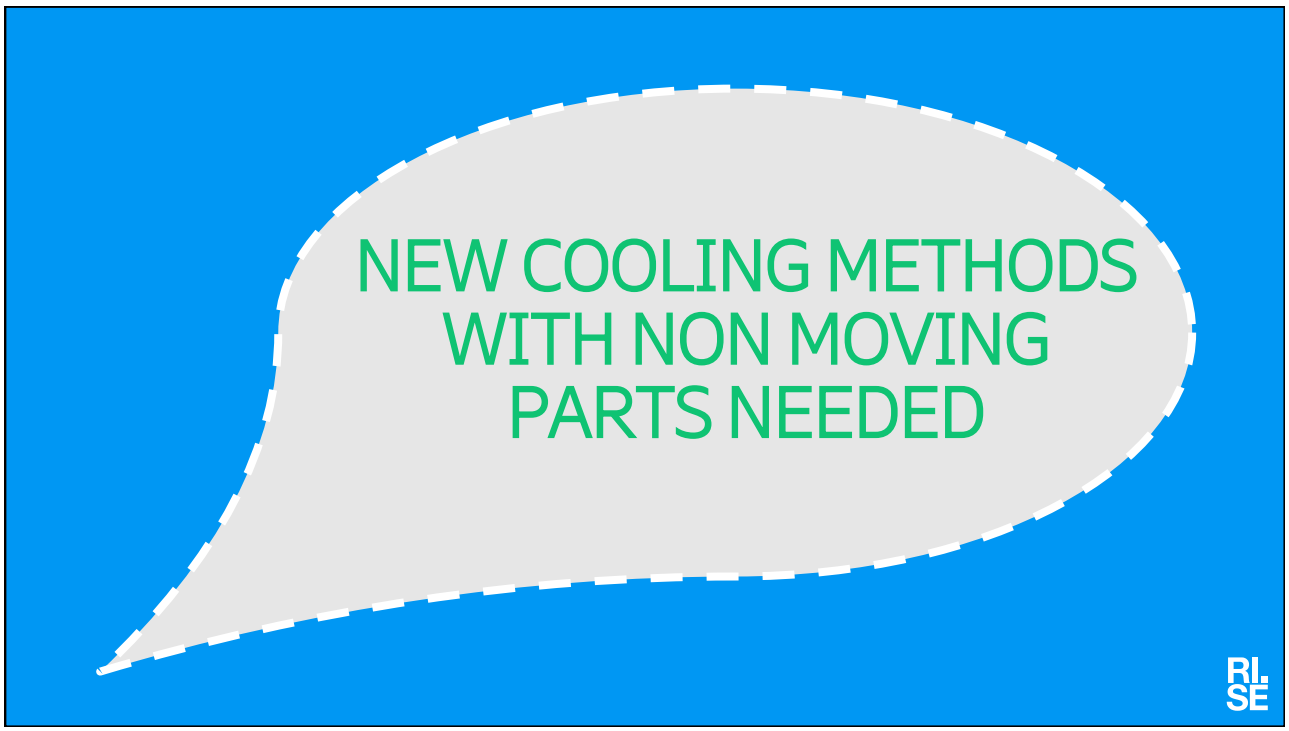
NEW COOLING METHODS WITH NON MOVING PARTS NEEDED
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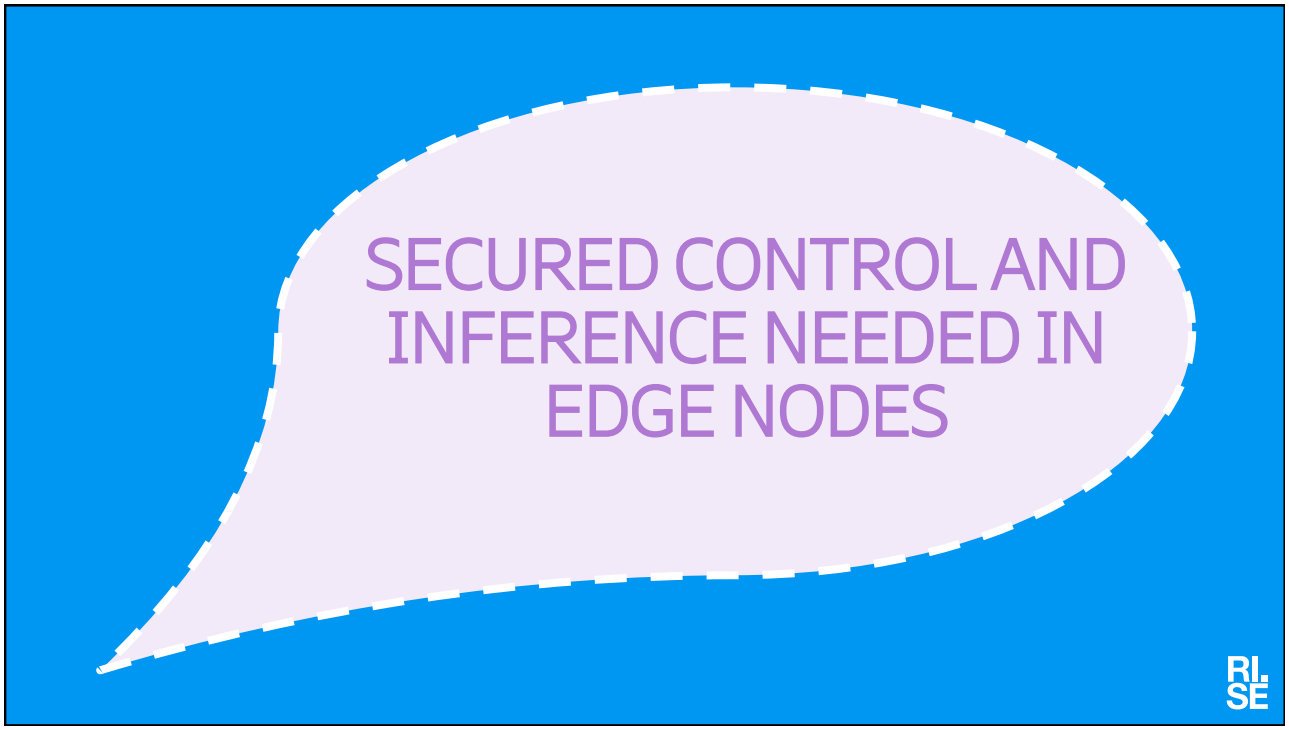
SECURED CONTROL AND INFERENCE NEEDED IN EDGE NODES
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CODE OPTIMIZATION WILL GROW POPULAR AGAIN FOR APPLICATION SOFTWARE

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Thank you!

Tor Björn Minde

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