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Edge Compute

What's Behind The Hype?

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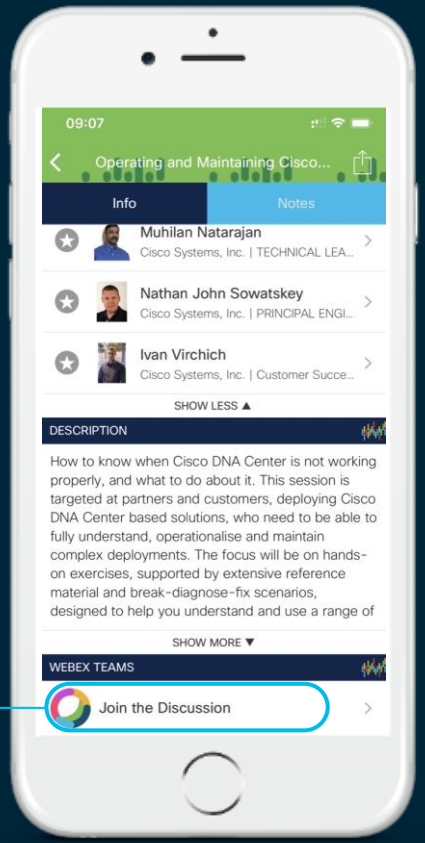


Key Learning Objectives

- Understand the history of Compute and how it relates to Edge Compute
- Understand what (& where) Edge Compute truly is
- Understand key drivers for Edge Compute
- Understand use-cases for Edge Compute
- Understand key drivers for Cisco's Edge Compute Development

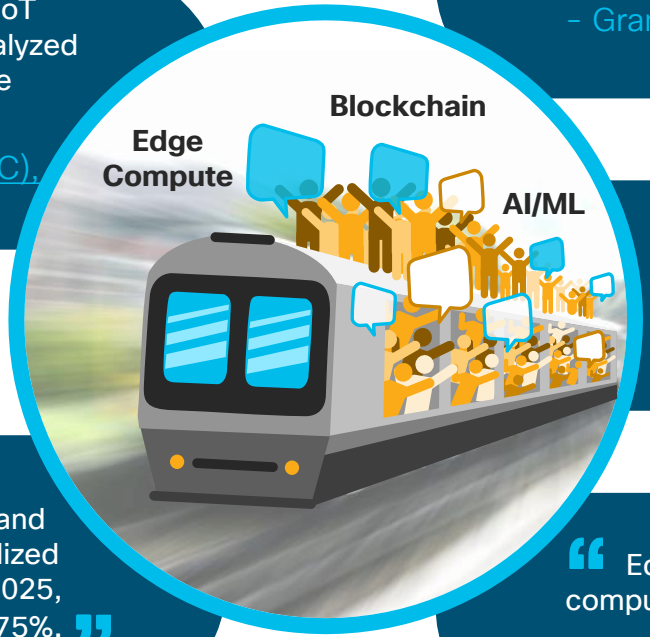
The Hype Train

"45 percent of all data created by IoT devices will be stored, processed, analyzed and acted upon close to or at the edge of a network by 2020"

– International Data Corporation (IDC), Apr 2018

"by 2024 the global edge computing market will reach above $28bn"

– Grand View Research, 2019



"The global edge computing market size is expected to value at USD 3.24 billion by 2025"

– Million In$ights, Mar 2018

"Currently, around 10% of enterprise-generated data is created and processed outside a traditional centralized data center or cloud," says Rao. "By 2025, Gartner predicts this figure will reach 75%."

– Gartner, Oct 2018

"Edge computing will overtake cloud computing by 2025"

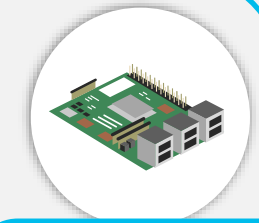
– Linux Foundation, Sep 2019

Decentralized Compute

Mainframe
~$1,000,000

PC
~$5,000

Laptop
~$1,000



“Edge Computing”
~$50

Compute

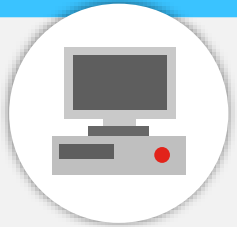
~1945 → ~1990 → ~2005 → ~2015

The history of “ Edge Compute ”

Network

~1980 → ~2000 → ~2010

Diskless Terminals



Thin Clients

Cloud Computing

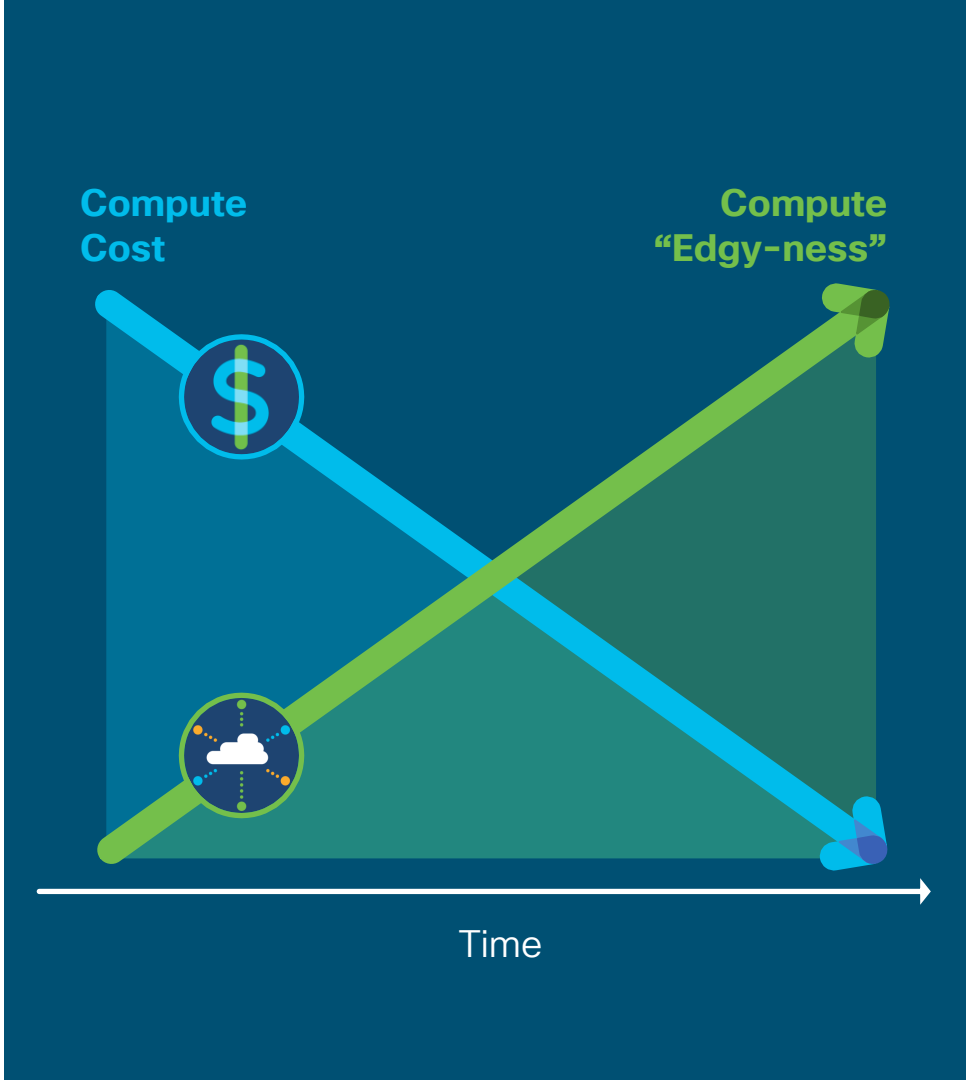
Centralized Compute

Key learnings

Compute cost reduced over time (remember Moore's Law)

Reduced compute cost enabled compute decentralization

Edge Compute = Decentralized Compute = around for decades!



One definition of Edge Computing:

“All computing outside cloud happening at the edge of the network”

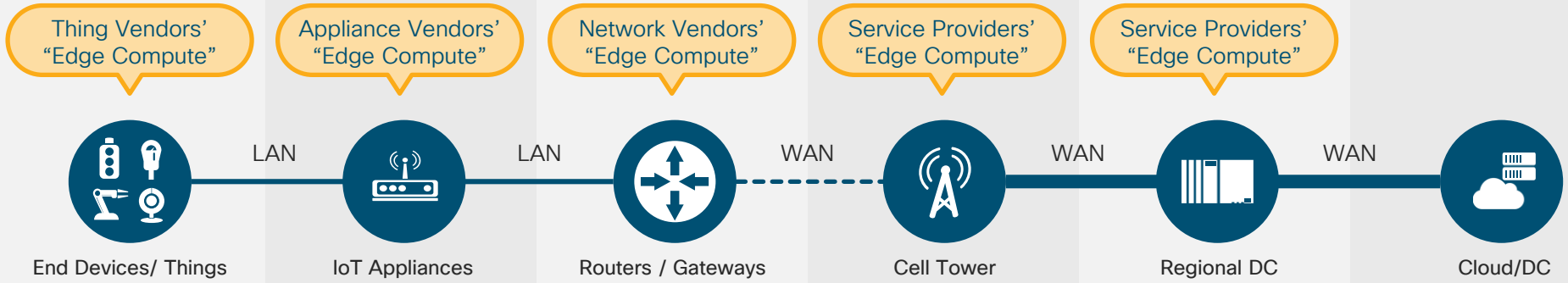
Dr. Karim Arabi – Vice President, Engineering – Qualcomm, Inc., 2015

Let’s play a game: is it “Edge Compute” or not?

Use-case	Is it Compute?	Is it in the Cloud?	Is it Edge Compute?
Service Providers adding servers in their Regional DCs	Yes	No	Yes
Service Providers adding servers next to their 5G Cell Towers	Yes	No	Yes
Routers being able to host docker containers	Yes	No	Yes
IoT gateways aggregating sensor data in a roadside cabinet	Yes	No	Yes
Cameras integrating people & vehicle counting features	Yes	No	Yes
Temperature sensors computing 5 minute averages	Yes	No	Yes
Microwaves regulating power based on the foods’ temperature	Yes	No	Yes

The Problem: it’s a very broad definition!

Where is the Edge?



Industry definition of EDGE

Smarter things	"True Edge" (before WAN)	Service Providers Edge (usually Content Distribution Network)

Distance:*

*NOT drawn to scale, numbers are estimates

1000 Nanoseconds [ns] = 1 Microsecond [µs]

1000 Microseconds [µs] = 1 Millisecond [ms]

1000 Milliseconds [ms] = 1 Second [s]

Why Edge Compute?

Latency
Requirements > Physics!!!

Bandwidth / Cost

Resiliency / Availability

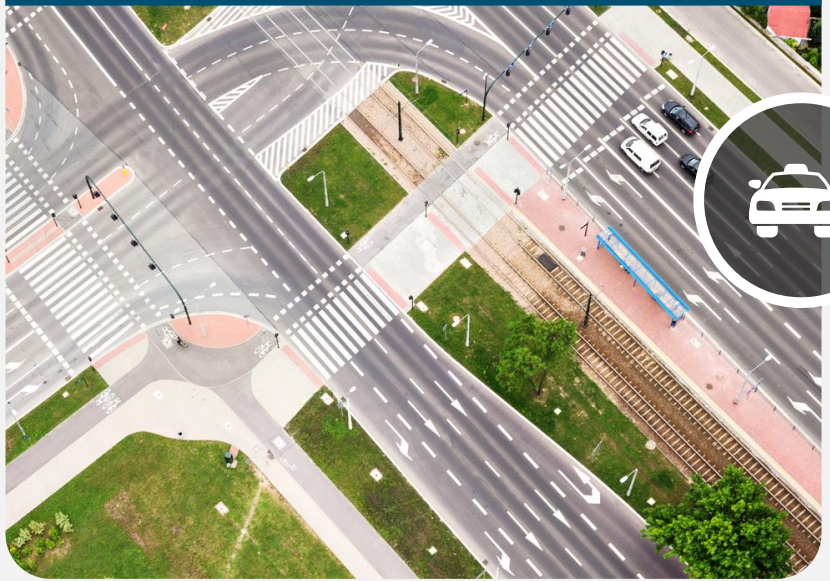
“Because I want to”

Regulatory Compliance

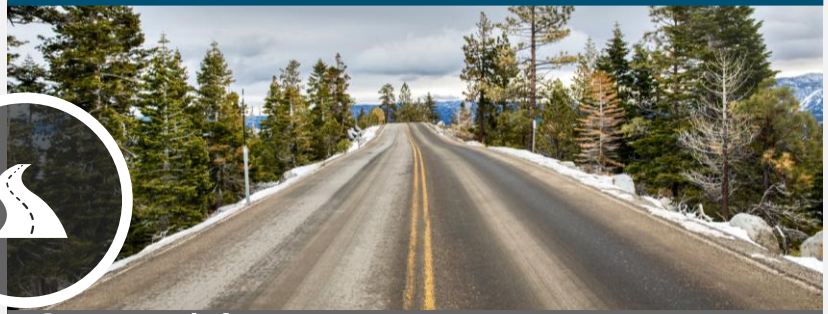
Use Case Example – Latency

Strict requirements for Security applications

Autonomous vehicles applying brakes



DoTs Roadside infrastructure warnings



Some math fun:

Can a “Cloud” in California host apps for DoT Florida?

- DoT requirement: less than 15 ms
- Lightspeed in fiber: ~5 µs/km
- US east coast to west coast: ~5000 km
- Round-Trip latency: 50 ms = NO!

https://wondernetwork.com/pings

Use Case Example – Resiliency / Availability

Critical Infrastructure needs highest level of Availability!

Refinery gas leakage detection system

Close valves without internet access!

Retailers want Point of Sale 100% up!

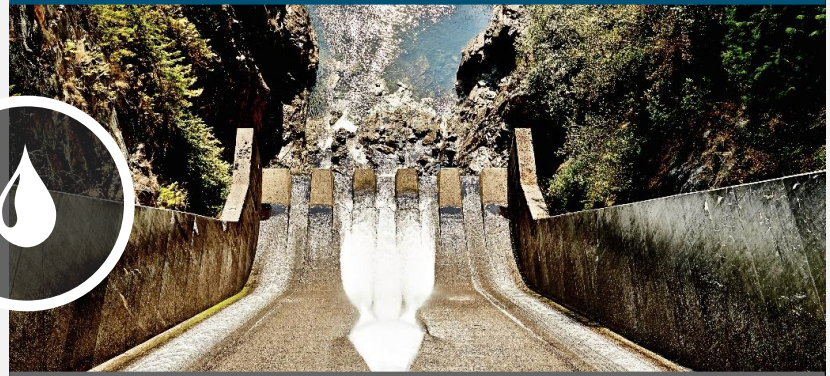
Use Case Example – Regulatory Compliance

Countries instate privacy and data retention laws

EU's General Data Protection Regulation [GDPR]

- Obligation to report leaks of personal data
- Cities don’t store / backhaul video
- Evaluate at edge and backhaul meta data.

Canadas Water Act: National Hydrometric Program



- ~3000 measurement stations nationwide
- Missing data requires justification
- Edge storage ensures data retention

Use Case Example – Bandwidth / Cost

Bandwidth is almost infinite- but comes at a cost!

City deployed CCTV over LTE

- Simplifies deployment – only needs power
- 1 HD camera = 1296 GB / month
- SP LTE cost became prohibitive
- Added Edge Compute to pre-aggregate information

Predictive maintenance of Remote Machine

- Temperature, vibration & current data is important
- High-resolution data (e.g. 1000 per second)
- Data filtering -> only send anomalies & threshold violations

Use Case Example – “Because I want to”

Some users simply prefer to have full control

Manufacturing technicians want to have full control over the machine

Independence from IT

Security & Availability are top of mind

Cisco's guiding Principles around Edge Compute

- Security -> MUST-HAVE foundation!
  - Secure Products (e.g. all connections encrypted)
  - Security Products (e.g. Sentryo a.k.a. Cyber Vision)
- Network -> Natural aggregation point
- Manageability -> Scale
- Standardization -> Improved Quality & Interoperability (e.g. MQTT, Docker)
- Open Ecosystem -> Wide Adoption

Summary

1. Edge Compute has been around for a long time!
2. IoT and lowered compute cost increase “Edgy-ness”
3. Edge Compute is a loosely defined term
4. Use-cases are ubiquitous with various drivers

Call to Action:
Please share your favorite/most interesting edge compute use-case!

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