Open Networking Foundation

Aether™

An Open Source Platform for Private 5G Connected Edge Cloud as a Service

To Accelerate Smart Enterprise Transformation

Guru Parulkar

December 2020

Smart Enterprise Transformation

Adopters see big gains

Harley-Davidson York Factory: Building customized motorcycles

Deployed an IoT network for operations automation

Productivity
Production time for each motorcycle was 21 days
↓ 6 hours

Efficiency
Production costs
↓ 70%

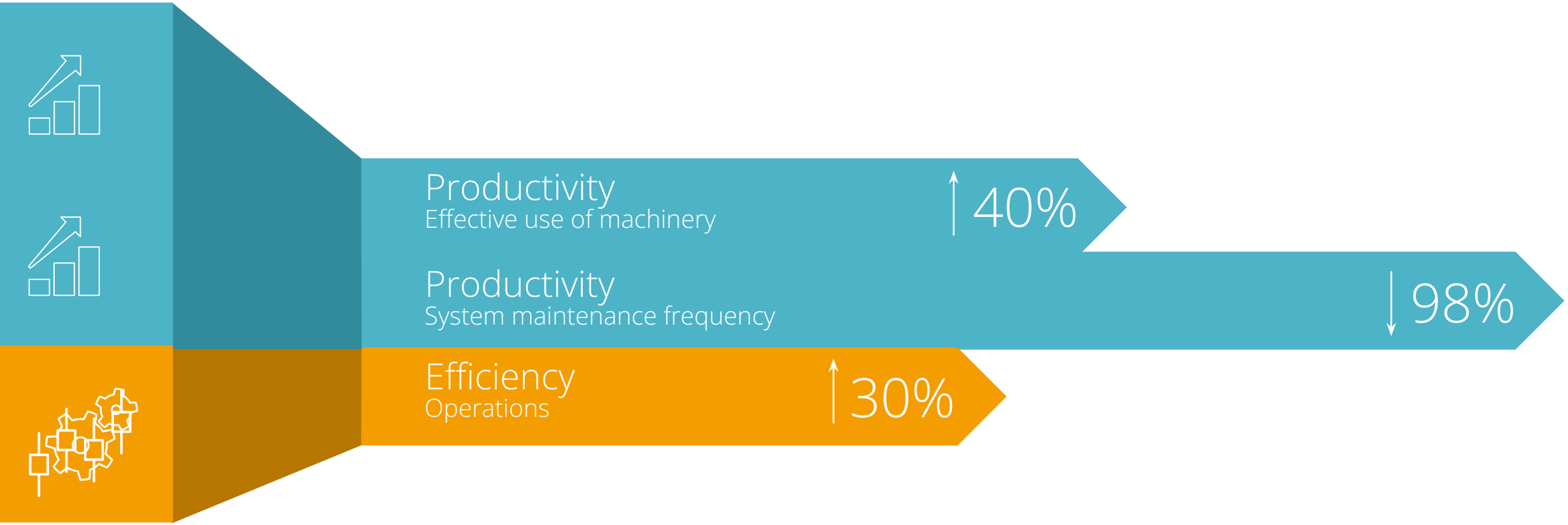
Safety & Security
Worker Injuries
↓ 91%

Flexibility
Bike variations on a single production line
↑ 1,700

Adopters see big gains

Nokia Oulu factory: Manufacturing base station parts

Deployed an LTE-powered mobile private IoT network with edge-cloud for operation automation



Adopters see big gains

Bosch Rexford, Homburg: Factory manufacturing hydraulic valves

Deployed an IoT network with edge cloud for operation automation

Productivity ↑ 10%
Output

Efficiency ↓ 30%
Stock reduction

Efficiency ↑ 500,000€
Savings

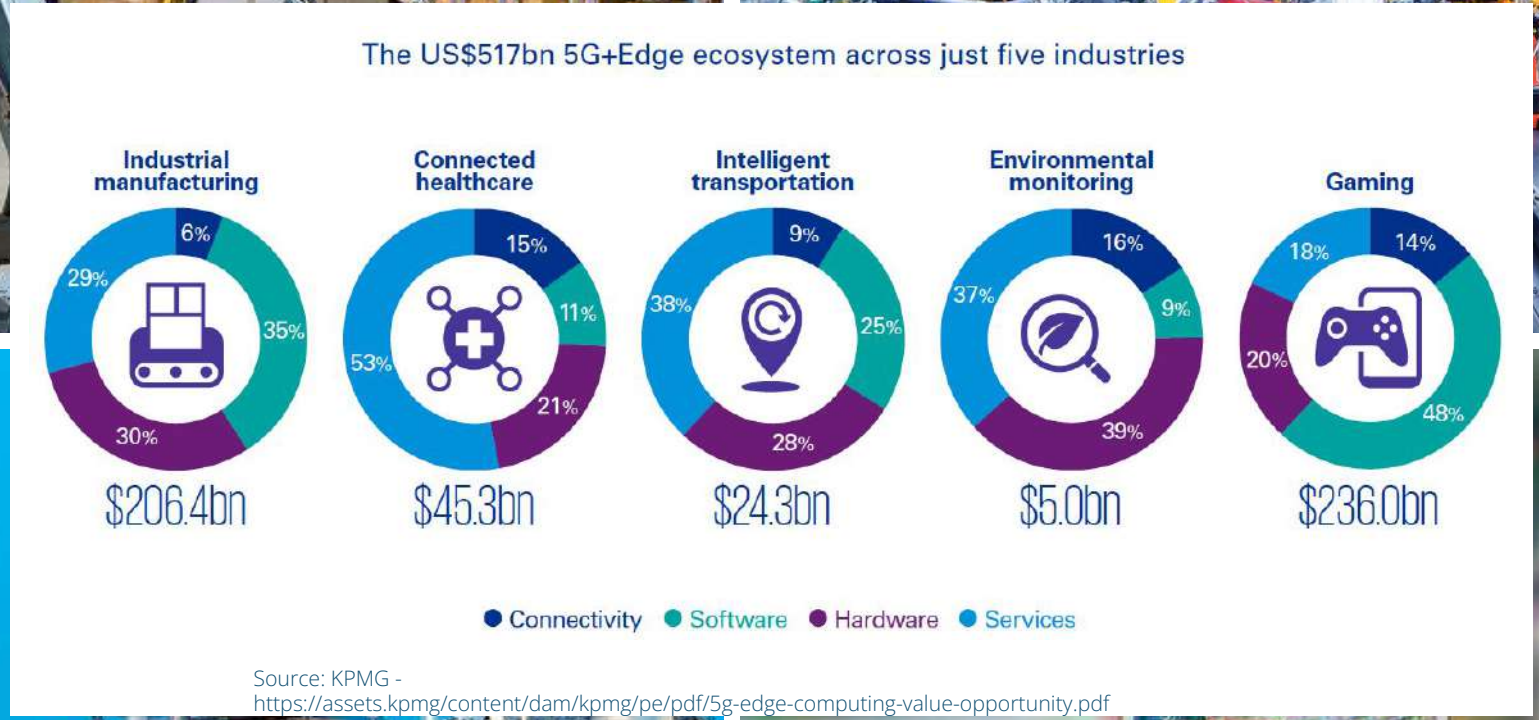
Flexibility ↓ 0 sec
Setup time for producing the 250 variants was reduced from 450 to 0 secs

Smart Enterprise Transformation

is the next big infrastructure build out

5G & edge cloud with IoT, AI/ML & AR/VR will enable transformation

Every enterprise will be impacted, making this a transformational market opportunity



Source: KPMG - https://assets.kpmg/content/dam/kpmg/pe/pdf/5g-edge-computing-value-opportunity.pdf


Current Solutions
What Market Needs
Purpose Built
Closed & Proprietary
General Purpose
Easy to Use
Economical

Current Solutions

Purpose Built
Closed & Proprietary

To create an Android Effect

Proposed Solution
Aether

Open Source

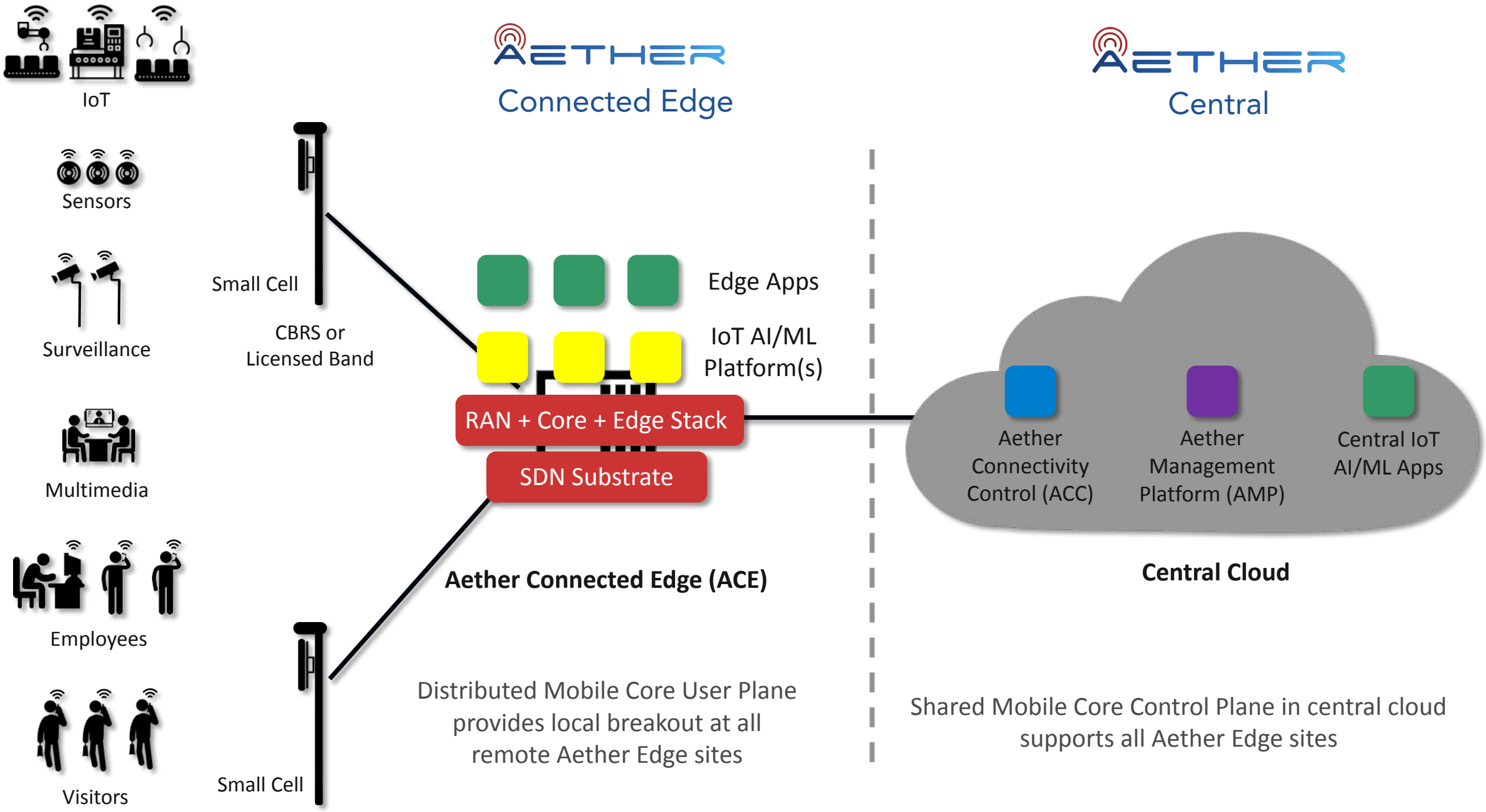
+

General Purpose
Easy to Use
Economical

AETHER

Open Source Platform for
Private 4G/5G Connected Edge Cloud as a Service

with
Fine-Grained Measurement, Closed Loop Control and
Network Verification


IoT
Sensors
Surveillance
Multimedia
Employees
Visitors
Small Cell
CBRS or
Licensed Band
Small Cell
AETHER
Connected Edge
Edge Apps
IoT AI/ML
Platform(s)
RAN + Core + Edge Stack
SDN Substrate
Aether Connected Edge (ACE)
Distributed Mobile Core User Plane
provides local breakout at all
remote Aether Edge sites
AETHER
Central
Aether
Connectivity
Control (ACC)
Aether
Management
Platform (AMP)
Central IoT
AI/ML Apps
Central Cloud
Shared Mobile Core Control Plane in central cloud
supports all Aether Edge sites

Aether Essential Services

for Enabling 5G-Driven Smart Enterprise Initiatives

Connectivity Service

Private 4G/5G/CBRS connectivity, for mission critical applications

Connected Edge Cloud Service

Designed to natively support edge applications and AI/ML for digital transformation projects

End-to-End Slicing

Manage precise interlinked assembly of connectivity and cloud compute for each application

All offered as cloud-managed services

Aether "Essential" Services: Key Attributes

Connectivity Service

Connected Edge Cloud Service

End-to-End Slicing

- Qos and Security Guarantees
- Programmable and Customizable
- Fine-grained visibility
- Closed loop control for resource optimization, trouble shooting, security
- Verifiability

Aether Foundational Technologies

SD-Core: Disaggregated Virtualized Cloud Native Mobile Core

SD-RAN: O-RAN Based Softwere Defined Cloud Native

Containerized and Cloud Native

SDN with Programmable Forwarding

Aether Enables End-to-end Solutions for Enterprises

Enterprise Devices

IoT

Sensors

Surveillance

Multimedia

Employees

Edge App | Edge App | Edge App | Edge App | Edge App | Edge App

AI/ML Platforms | IoT Platforms | Vision Platforms

Enterprise Apps & Third-Party Platforms

AETHER

4G/5G Connected Edge Platform

COTS Edge Optimized Hardware

White box Compute, Networking, NICs & Small Cell Radios with x86/ARM CPUs, GPUs, DPUs, TPUs, P4 silicon

So what is real?

Aether has been operational in pilot deployment since December'19

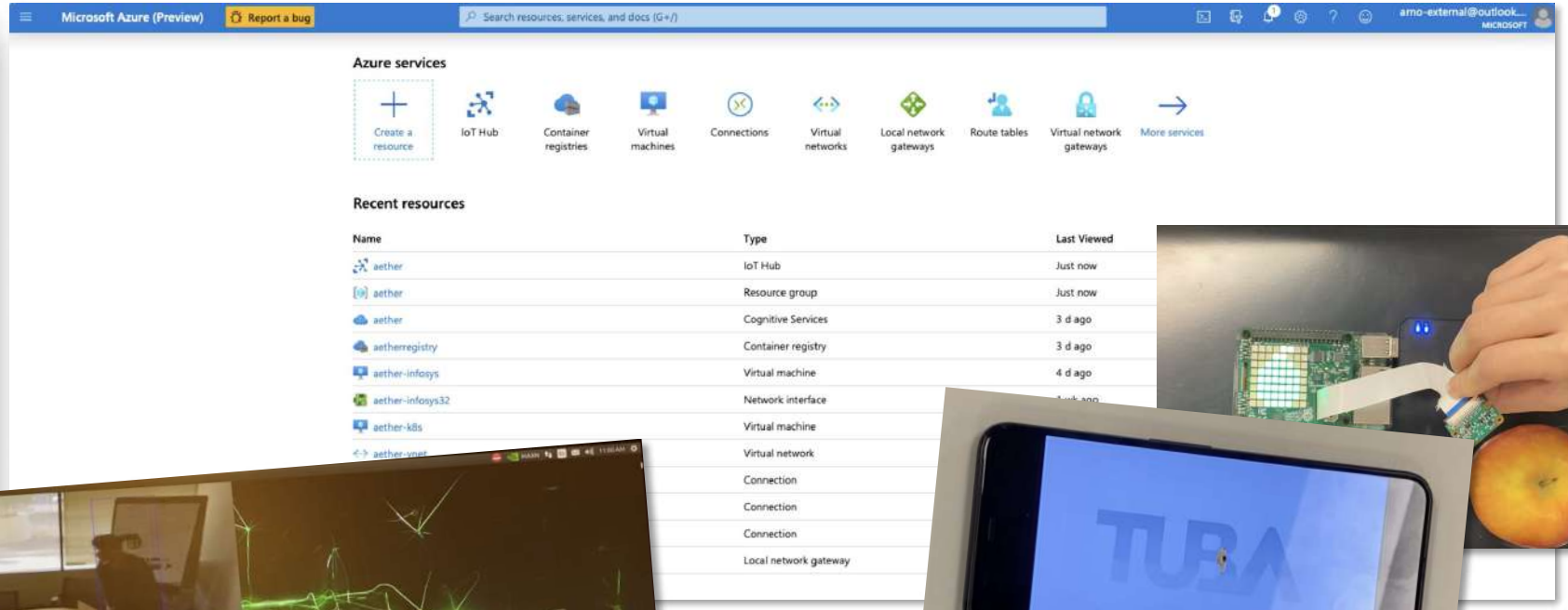
Aether Management Platform (AMP)
Aether Connectivity Control (ACC)

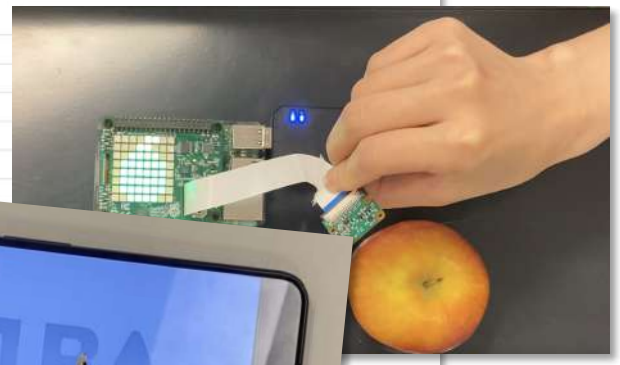
Aether Connected Edge (ACE)

Upcoming ACE Sites: Cornell, Princeton and Stanford

Edge Platforms and Applications Demonstrated

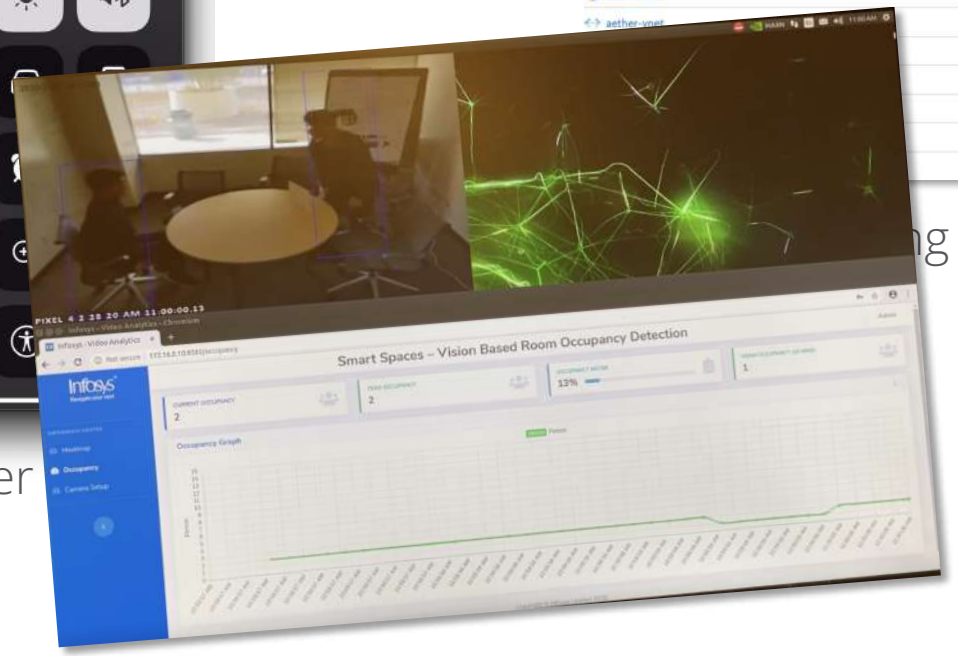
Dual MNO-Aether





ng on Azure Io

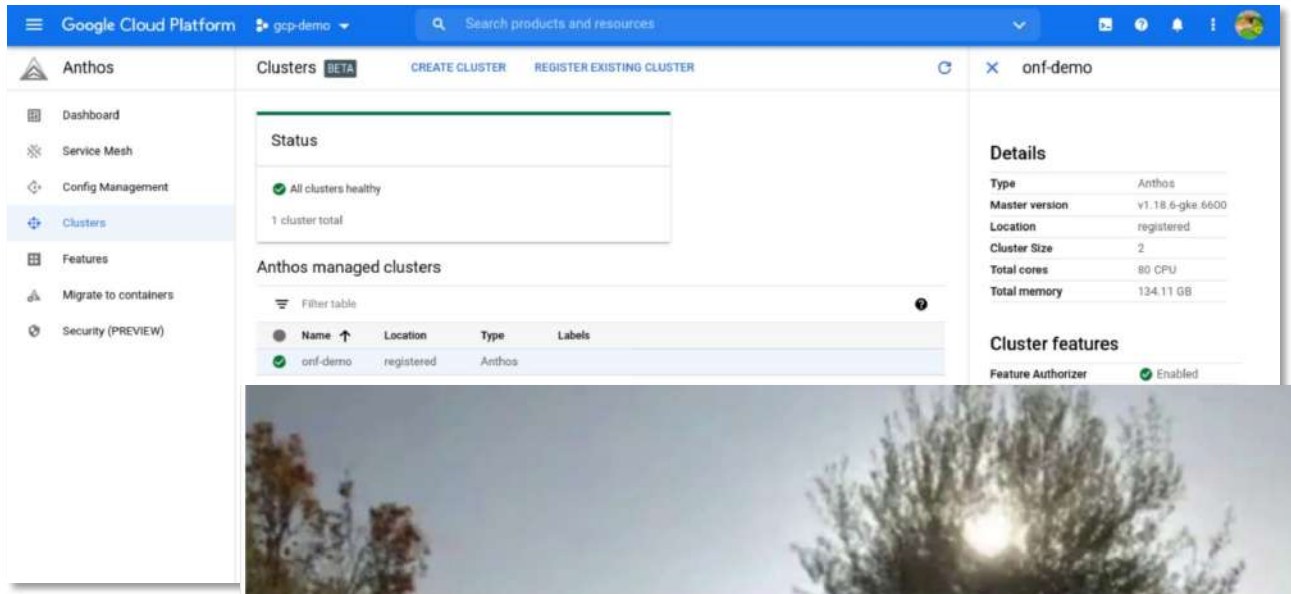
d with ACE

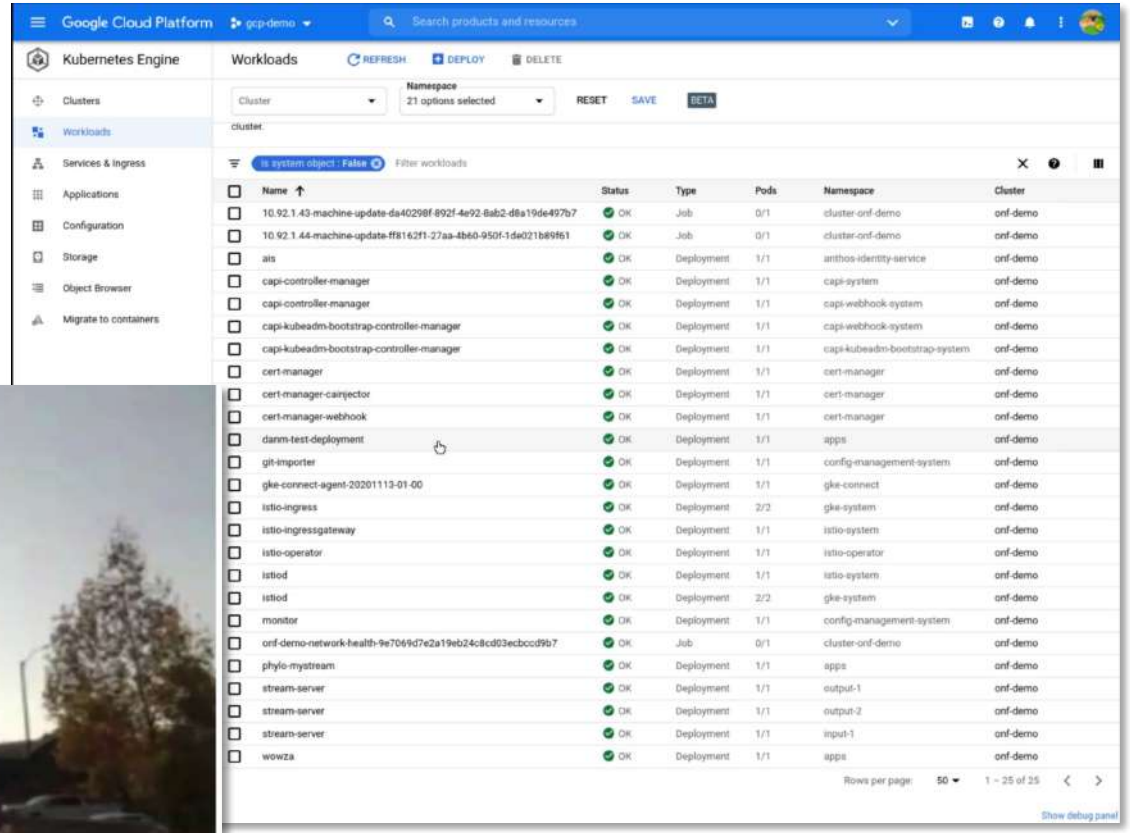


Smart Spaces – Space Occupancy Detection App

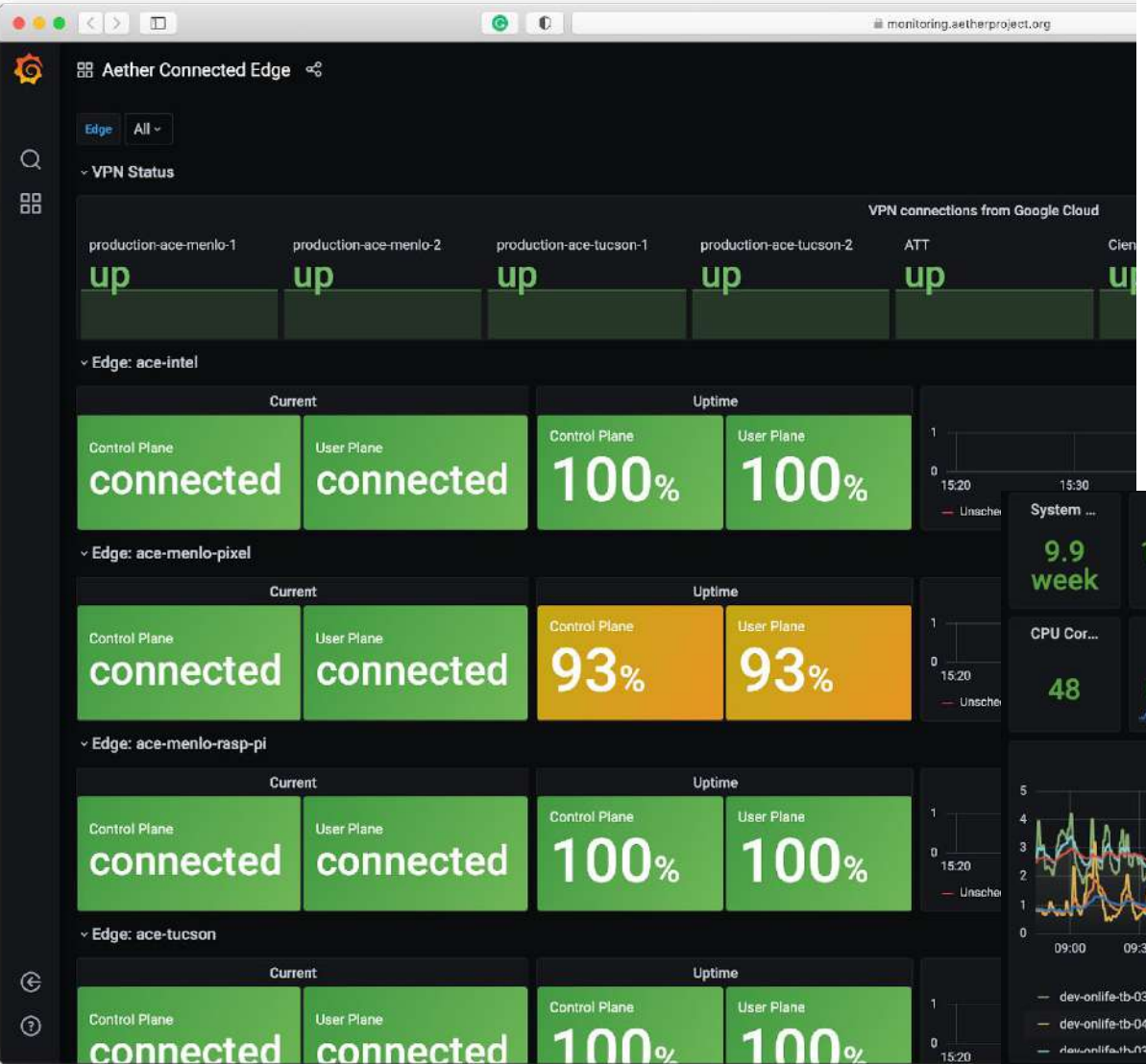
CDN App

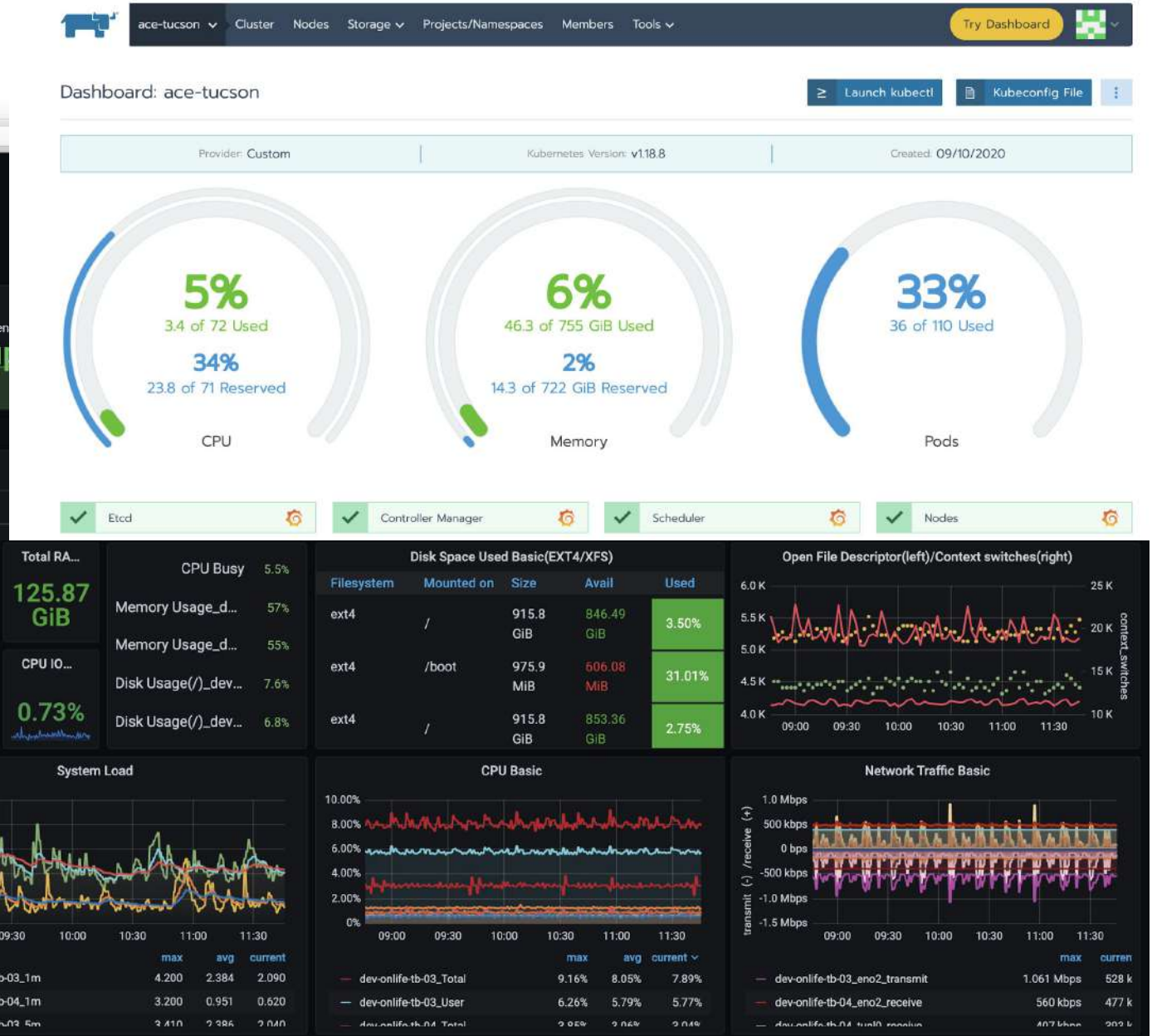
Person Detection App Running on Google Anthos Platform





Aether Operator Dashboards (Pilot Network)





Enterprise Dashboard: Aether Health Monitoring (Coming)

Portal Navigation Menu

Aether at XYZ Corp | Overall Health: Impaired Last Update: Oct 25, 2020 14:45 PST Welcome: A. Joe (Operator) | Log Out

Enterprise Summary: Deployed Sites: 4 | Devices: 1,148 | Radios: 9 | Edge Compute Clusters: 42

Los Angeles — Healthy

New York — Critical

Miami — Impaired

Atlanta — In Maintenance

Health of New York

Connectivity	Devices Count: 454	Operational: 390 Impaired: 64	
	Radios Count: 4	Operational: 3 Impaired: 1	
	Aether Central	Up/Downlink: 75/34 Mbps Latency: 35 ms	
Edge Compute	Metric 1	Measure 1: value Measure 2: value	
	Metric 2	Measure 1: value Measure 2: value	
	Metric 3	Measure 1: value Measure 2: value	
QoS & Slicing	Metric 1	Measure 1: value Measure 2: value	
	Metric 2	Measure 1: value Measure 2: value	
	Metric 3	Measure 1: value Measure 2: value	

Notifications

Active Filters: New York, Connectivity Service

Time Selection: Last 4 hours

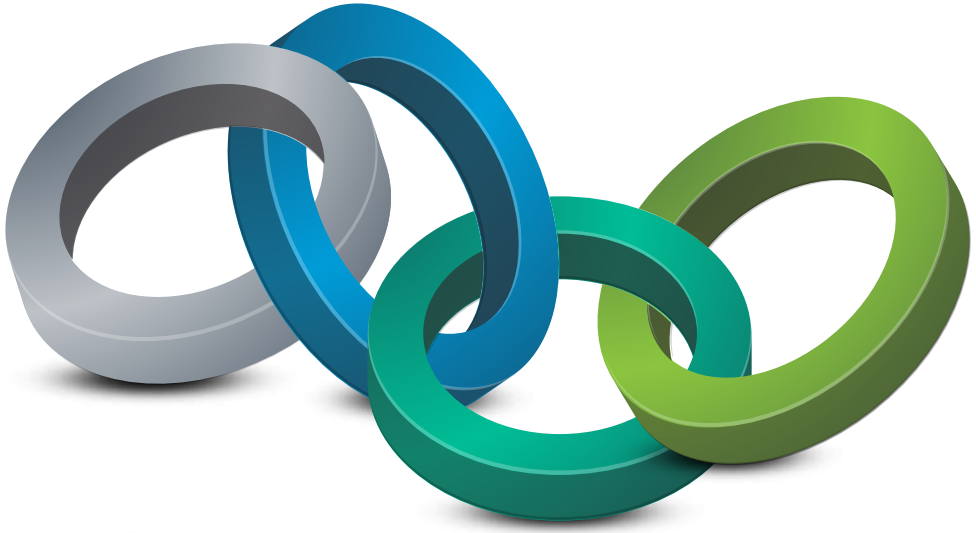
Time Stamp	Importance	Source	Description	Suggested Remedial Action

Filtered event log sorted by time

Get Help

DARPA Funded: Project “Pronto”

$30M funding for three years to build, deploy, and operate a production-ready Aether with fine-grained measurement, closed loop control, and network verification



Cornell University

PRINCETON UNIVERSITY

Stanford University

- Fine-grained measurement
- Network Verifiability: forwarding/sw stack
- Closed-Loop Control

ONF

AETHER

- Software-Defined Edge Cloud Infrastructure
- Software-Defined Disaggregated RAN
- Software-Defined Disaggregated Core
- Edge Cloud Platform Operationalization
- Edge Services

Towards Pre-Production

ONF

Learn More from Experts: Pronto Research

Nick McKeown,
Stanford

December 9th 8:00am Pacific

Jen Rexford,
Princeton

On-Demand on Web

Nate Foster,
Cornell

Learn More from Experts: Aether Platform

Oguz Sunay, ONF

December 9th 8:00am Pacific

Larry Peterson, ONF

December 10th 8:00am Pacific

https://aetherproject.org

Aether Ecosystem

In conclusion ...

Smart Enterprise Transformation
Aether: Private 4G/5G Connected Edge-Cloud-as-a-Service

Innovations

- Private 4G/5G enabled edge cloud
- Local breakout
- Cloud-native connected edge platform with support of multi-cloud
- Cloud based managed service
- End-to-end network slicing
- SDN with programmable forwarding
- Top down network programming and control
- Fine-grained measurement, closed-loop control
- Network verification
- Open source software & COTS hardware

Benefits

Enterprise Value Prop

Compelling Economics
Open Source + COTS
Managed Service
Minimize WAN BW
Monetization via reverse MVNO

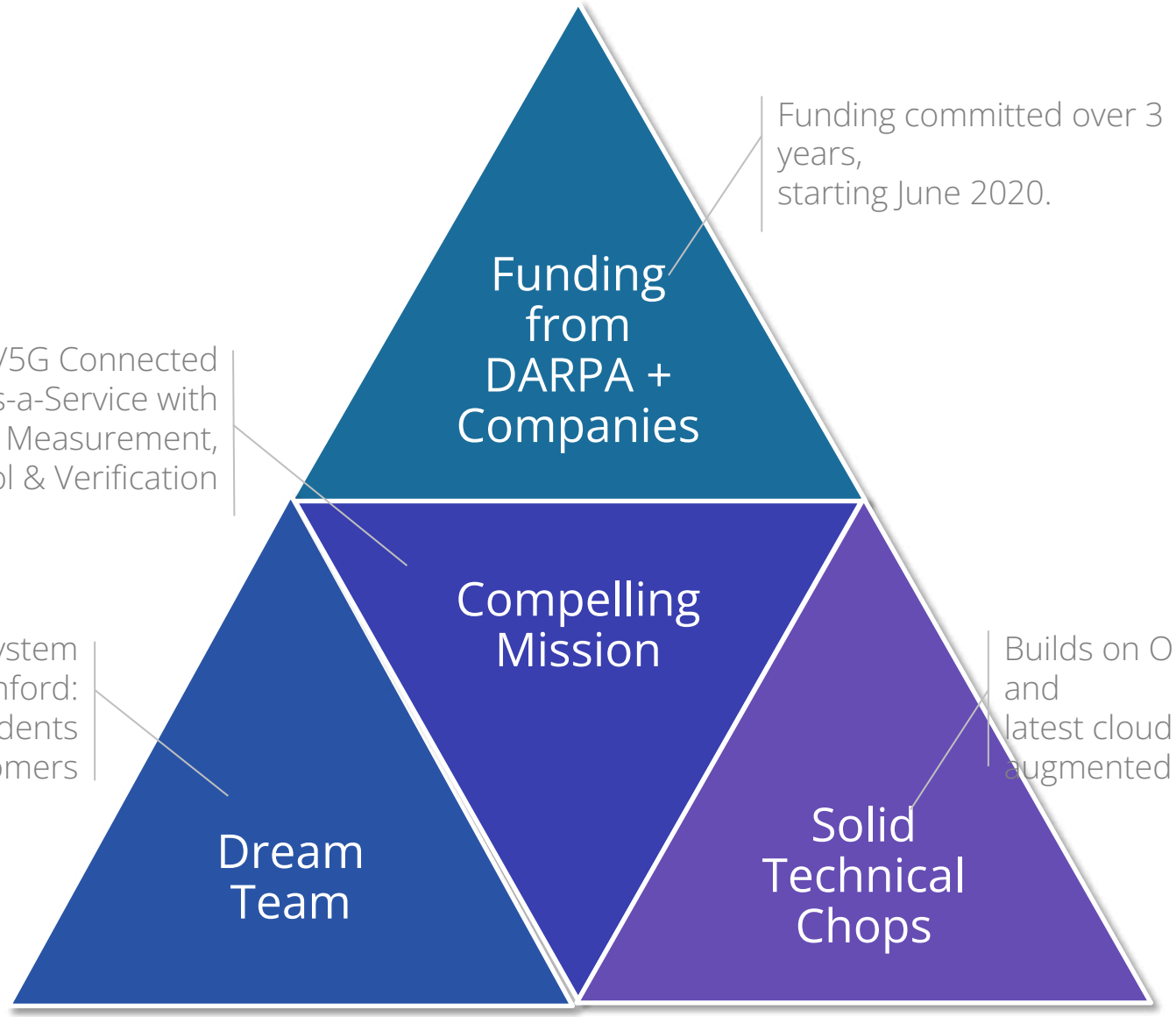
Highly Secure
Mobile cellular like
Programmable access control
Detect and prevent DDOS

Right for Mission Critical Use
Predictable performance
Low latency
Secure

Control of Your Destiny
Top-down programmable control
Fine-grained real time visibility
Innovation in production
Own your data

Platform for Diverse Applications
connectivity + computing
on edge + public/central cloud

Aether: ONF Flagship Project Primed for Big Impact



Funding committed over 3 years,
starting June 2020.

Private 4G/5G Connected EdgeCloud-as-a-Service with Fine-grained Measurement, Closed-Loop Control & Verification

ONF: Software Team, Ecosystem
Cornell, Princeton, Stanford:
Profs, Post-Docs, Students
Campus IT as users/customers

Builds on ONF's in-production platforms and
latest cloud technologies and
augmented by Research

Let us Join Forces to Realize Full Potential of Smart Enterprises

- Enterprises interested in "smart enterprise" transformation
  - Happy to explore Aether Connected Edge deployment for a POC or trial leading to a production deployment
- Ecosystem partners wanting to enable and accelerate "smart enterprise" transformation
  - Happy to integrate your IoT, ML/AI, … platform and applications in Aether
  - Happy to port Aether to your hardware or software platform
- University campuses
  - Happy to support Aether Connected Edge deployment for your research and campus automation
    Replicate and build on what Stanford, Princeton, and Cornell doing
- Open source developers
  - Love to get your help and help you make significant contributions to a significant project

Thank You!

https://aetherproject.org