Private 5G by AWS

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Awaiz Khan

Introductions

Awaiz Khan is a Principal Solutions Architect at Amazon Web Services (AWS), working on 5G Mobile Private Networks and Edge Computing Services. At AWS, he has enabled AWS Private Wireless solution architectures using innovative AWS technologies and authored AWS APN blogs and whitepapers. In the past, he has worked for companies like CommScope, Ruckus Networks, and Qualcomm on Radio Access Network Infrastructure Engineering. He has Chaired various technical working groups and contributed to standardization organizations like Wireless Innovation Forum and OnGo Alliance. He holds a Bachelor's and Master of Science In Electrical Engineering from JMI, New Delhi, and the University of Texas.

AWS solutions for Private Wireless Networks

Multiple options based upon market segmentation, spectrum and geography

FROM CLOUD

AWS Private 5G

Deploy, operate, and scale a private cellular network at an on-premise facility in days instead of months, fully managed service by AWS.

WITH CLOUD

Integrated private wireless

CSP/MSP 4G and 5G private wireless technologies integrated with AWS services, and presented in a portal that allows customers to easily discover the CSP offerings and connect with CSP/MSP partners.

ON CLOUD

Custom private wireless

Customized deployments that allow granular control over architectural decisions including selecting preferred core & radio vendors & working with dedicated SI's to build complex solutions.

AWS Private 5G Components

| Shared spectrum

CBRS 3.55-3.7Ghz (LTE band 48) in the US
Spectrum | Small-cell radio units (RUs) and SIMs

Hardware | LTE Core and RAN Software

Spectrum Access System (SAS) for CBRS operation
Software |

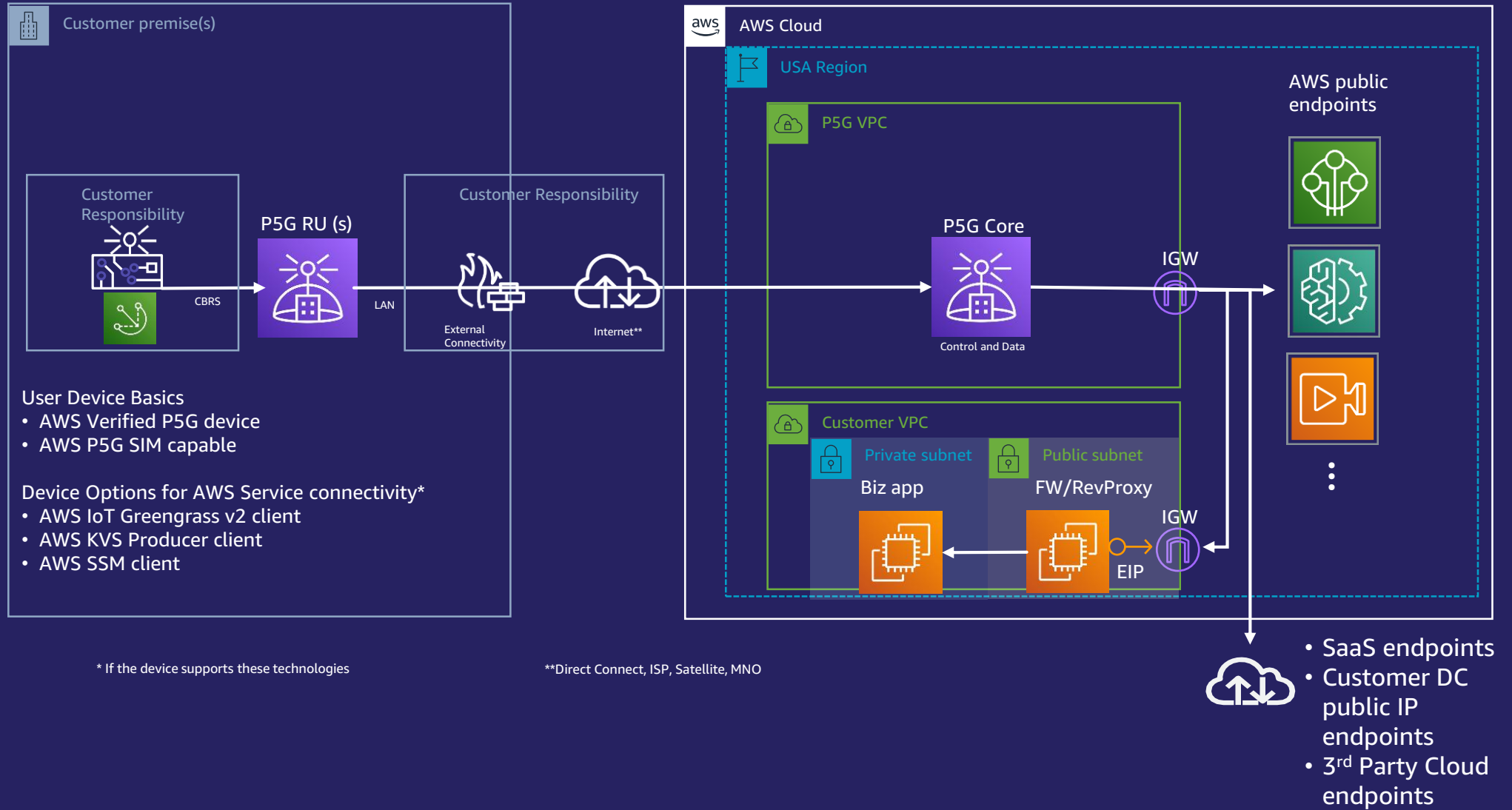Connectivity to AWS Region

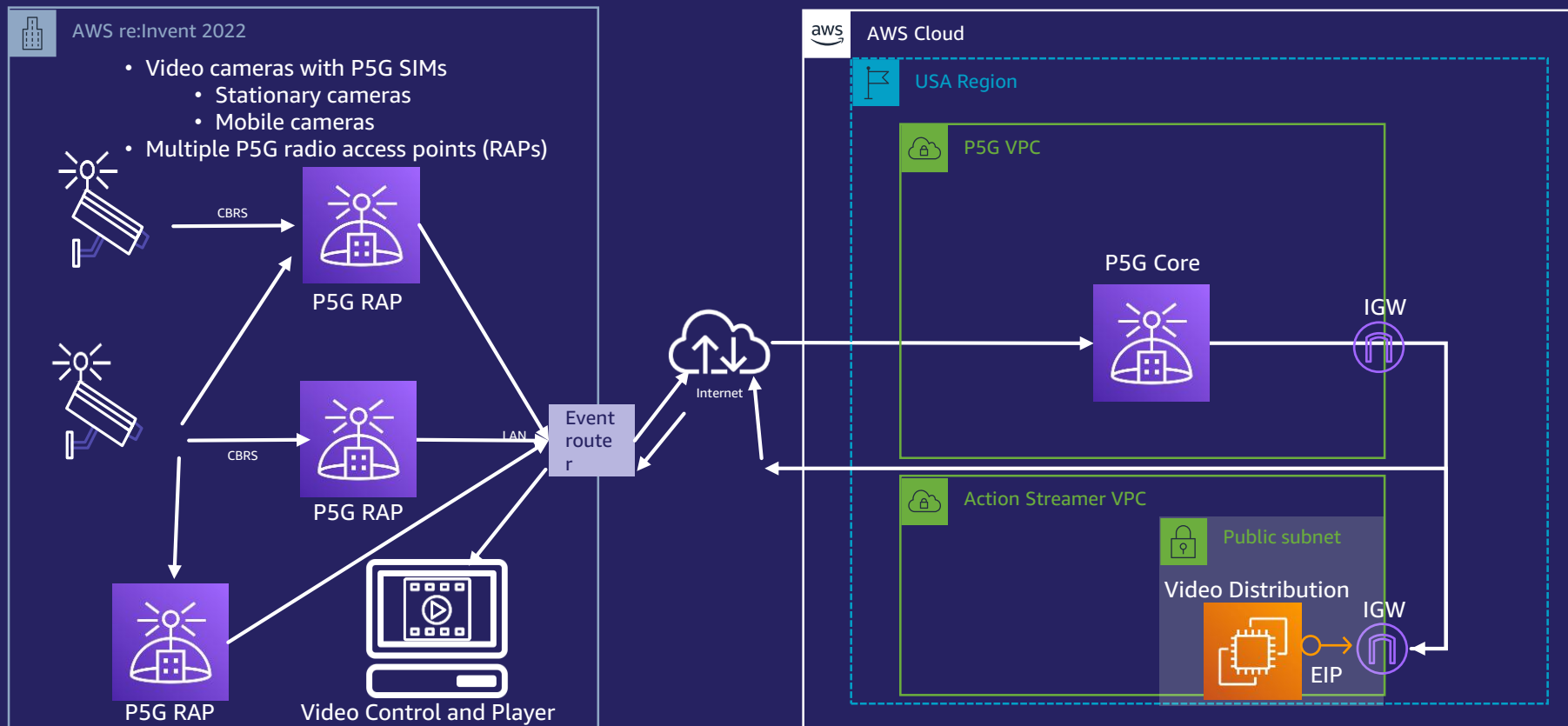IP Address Pool, DHCP Server, DNS

Local Networking

Customer Devices

Provided and managed by AWS Private 5G

Customer provided

AWS Private 5G End-to-End Architecture

Customer premise(s)

Customer Responsibility

P5G RU (s)

CBRS

LAN

Customer Responsibility

External Connectivity

Internet**

AWS Cloud

USA Region

P5G VPC

P5G Core

Control and Data

IGW

AWS public endpoints

Customer VPC

Private subnet	Public subnet
Biz app	FW/RevProxy

EIP

IGW

User Device Basics
- AWS Verified P5G device
- AWS P5G SIM capable

Device Options for AWS Service connectivity*
- AWS IoT Greengrass v2 client
- AWS KVS Producer client
- AWS SSM client

* If the device supports these technologies

**Direct Connect, ISP, Satellite, MNO

- SaaS endpoints
- Customer DC public IP endpoints
- 3rd Party Cloud endpoints

Connecting Video at an Event Venue

aws

AWS FOR TELECOM

AWS Private Wireless
Spotlight on IPW

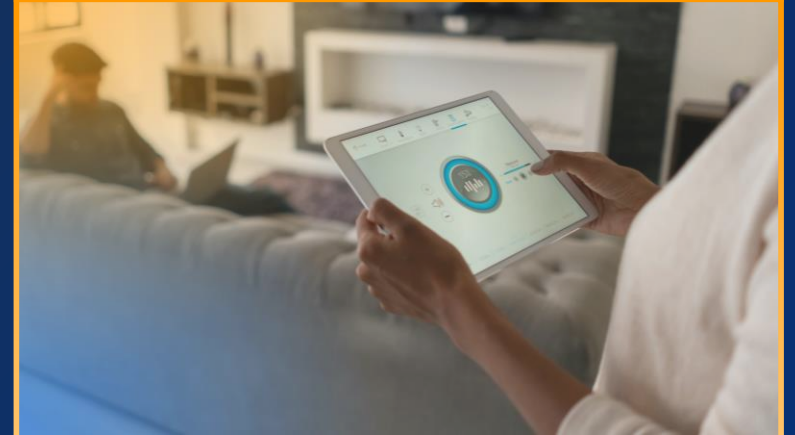# Explore how AWS is

TRANSFORMING TELCOS

Empowering telcos to transform from telco to tech-co while moving core telecom workloads to the cloud to achieve the cost efficiency, agility, resiliency, security, and sustainability they need to stay ahead.

DIGITIZING INDUSTRIES

Working with the telcos to transform and digitize industries – with a smart, agile, real-time communication network, cloud capabilities, and digital applications.

REIMAGINING CONSUMER EXPERIENCE

Discover how AWS and our partners are working with telcos to monetize 5G and create innovative new revenues streams.

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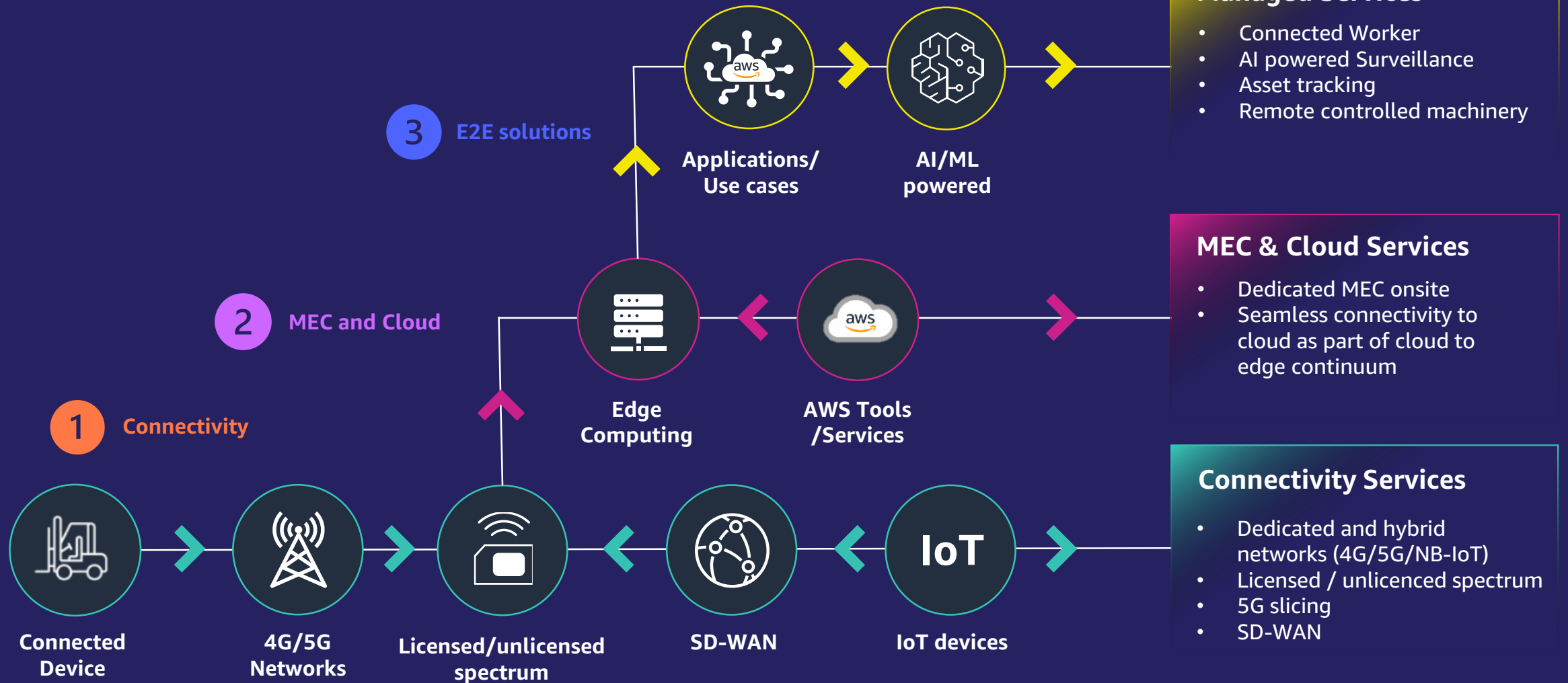
Industries require innovation

Manufacturing
- Manufacturing automation
- Remote robotic control

Energy & utilities
- Grid monitoring, control and protection
- Oil Rig production analytics

Public safety
- Surveillance (Smart cities)
- Infrastructure management & maintenance

Healthcare
- Telemedicine
- Personal health systems

Public transport
- High-mobility connectivity
- Passenger distribution

01
02
03
04
05

Industries require innovation

Media & entertainment ········ Cloud gaming · Augmented/virtual reality

Automotive ········ Autonomous vehicles · Fleet management

Financial services ········ Loan monitoring · Micro-payments on assets

Retail ········ Geo-targeted advertisement precision · Shoppable videos

Agriculture ········ Connected machinery · Farming drones for monitoring

06
07
08
09
10

End to End Private Wireless solutions

AWS Value proposition is beyond connectivity

3 E2E solutions

Applications/
Use cases

AI/ML
powered

Managed Services

- Connected Worker
- AI powered Surveillance
- Asset tracking
- Remote controlled machinery

2 MEC and Cloud

Edge
Computing

AWS Tools
/Services

MEC & Cloud Services

- Dedicated MEC onsite
- Seamless connectivity to cloud as part of cloud to edge continuum

1 Connectivity

Connected
Device

4G/5G
Networks

Licensed/unlicensed
spectrum

SD-WAN

IoT devices

Connectivity Services

- Dedicated and hybrid networks (4G/5G/NB-IoT)
- Licensed / unlicenced spectrum
- 5G slicing
- SD-WAN

Integrated Private Wireless on AWS (IPW)

Multiple options based upon market segmentation, spectrum and geography

- <u>Pre-validated private wireless stack</u>
- Reduction in both time-to-deployment and management complexity
- Ease of discovery and engagement
- Lower computing and storage capital expenditure
- Efficient monetization of unique CSP assets

LAUNCH PARTNERS

Telefónica Tech

KDDI

orange

T Mobile

aws

Integrated Private Wireless partnership tracks

The IPW Program consists of 3 partnership tracks that deliver solutions showcased on the IPW Portal

IPW PORTAL

CSP
- CSP builds/SKU's and GTM
- Orderable from the IPW Portal

Telefónica · T Mobile · T · orange · KDDI

EDGE ISV
- Edge applications and devices ecosystem
- Orderable from the IPW Portal

MEGH COMPUTING · UL · HOLO-LIGHT

MSP
- GSI/ISV/NEP builds and GTM (those that can build and deliver E2E solutions)
- Orderable from the IPW Portal

More announcements to follow
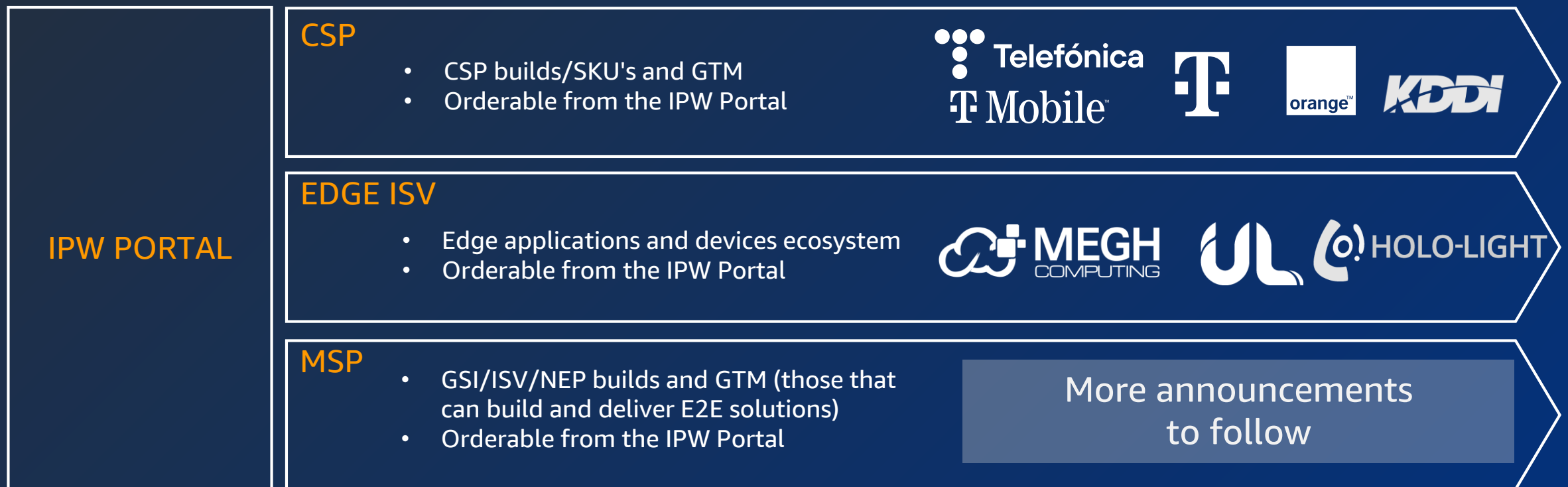
Integrated Private Wireless enablement tracks

In addition to the E2E partnership tracks, 2 enablement tracks support the development and delivery of the E2E solutions

CONNECTIVITY
- ISV onboarding and solution offering (core, RAN, NaaS etc)
- Embedded within CSP and MSP offerings

More announcements to follow

DELIVERY
- Delivery capability track (SI's working to deliver and manage solutions for CSP's)
- Embedded within CSP and MSP offerings

Cross-Vertical use cases running in AWS today

Manufacturing
- Production Optimization
- Digital Twin & Defect Detection on Zero-Defect
- Predictive Maintenance
- Remote Diagnostics and OTA Updates
- Logistics, Inventory and JIT Mgmt.
- Worker Safety

Supply Chain & Logistics
- Smart Warehousing
- Delivery Robots
- Connected Vehicle and Telematics
- Asset tracking & remote device monitoring
- Cold chain optimization

Energy
- Production Optimization
- Equipment Health and Performance
- Production Monitoring and Surveillance
- Refinery Digital Operations and Maintenance
- Smart Power Grids
- Solar Energy Marketplace
- Smart Home Energy Consumption Monitoring
- Smart Gas Meter
- Emission Monitoring and Surveillance
- Connected Field Work

Transport Infrastructure
- Port Video Surveillance
- Connected Port Workers
- Asset Identification & Tracking
- Automated Guided Vehicles (AGV)
- Heavy Equipment Remote Control
- Smart Warehousing
- Drone/UAV Applications
- Airport Terminal Optimizer
- Passenger Airport Journey
- Passenger Monitoring
- Passenger Queue Optimizer
- Personalised Offers

Sports (M&E)
- Video Distribution
- Remote Video Production and Streaming
- Immersive & Interactive Viewer Experience
- Event Statistics Experience
- Statistics and Analytics for Sports Teams
- Crowd Monitoring and Control

Healthcare
- Remote Diagnostics
- Remote Cognitive Assessment
- Remote Caregiving
- Smart Connected Devices
- Immersive Training
- Manufacturing Optimisation
- Supply Chain Resiliency

Education
- Remote Education
- Seamless Connectivity for Schools
- Campus Monitoring & Facilities and Building Management
- VR Interactive Training

Government
- Video Lookahead and Road Safety
- Security and Surveillance
- Immersive Experience Maintenance
- Airspace Security Monitoring
- Building Entry Authentication
- Smart Warehousing

■ video analytics AI/ML use cases

Integrated Private Wireless on AWS
Fast and Secure path to innovation

Fast time-to-value
Build Private Wireless solutions quickly using AWS integrated edge portfolio along with connectivity and application vendors already validated across the AWS edge

Cost flexibility
Leverage cloud economics and AWS native cloud services to build the solution, reducing entry costs and only paying for what is actually used

Gain access to enterprise customers
Leverage the IPW Portal to showcase your solutions so AWS can connect customers to them. Gain access to AWS industry sellers who are engaging industry customers daily

More choice
As Private Wireless solutions become more industry focused, choose from AWS vast partner applications ecosystem to layer on top of the private network for processing data & telemetry at the edge to solve business problems.

Private 5G leveraging AWS Hybrid Edge

Outposts Servers – 2U with Intel Processor

- C6id instances with Intel Xeon Scalable Processors (Ice Lake) with core turbo frequency of 3.5 Ghz

  - Two options: c6id.16xlarge or c6id.32xlarge of capacity

  - Up to 128 vCPU, 256 GiB RAM, 4x 1900 GiB NVMe SSD

- 36 lb

- 2U (3.5") high, 17.5" wide, 30" deep

- 1-2 kVA of AC power

- 10 Gbps uplink speed

- Interface for initial configuration

- Nitro Security Key

How AWS Outposts servers work

AWS Outposts servers allow you to deploy apps using the same Outposts logical constructs as those for Outposts rack

Just like in Region, AWS handles underlying hardware and hypervisor patching and security.

Each server has a unique Outpost-ID. For higher availability, configure application failover over local network paths.

Just like in Region, use tags and tools like AWS CloudFormation to automate provisioning and deployments across global site locations.

AWS Region

Availability Zone — 1

Availability Zone — 2

Outpost
OutpostID-1234
site-abcd

Outpost
OutpostID-5678
site-abcd

x 100s or 1,000s of sites
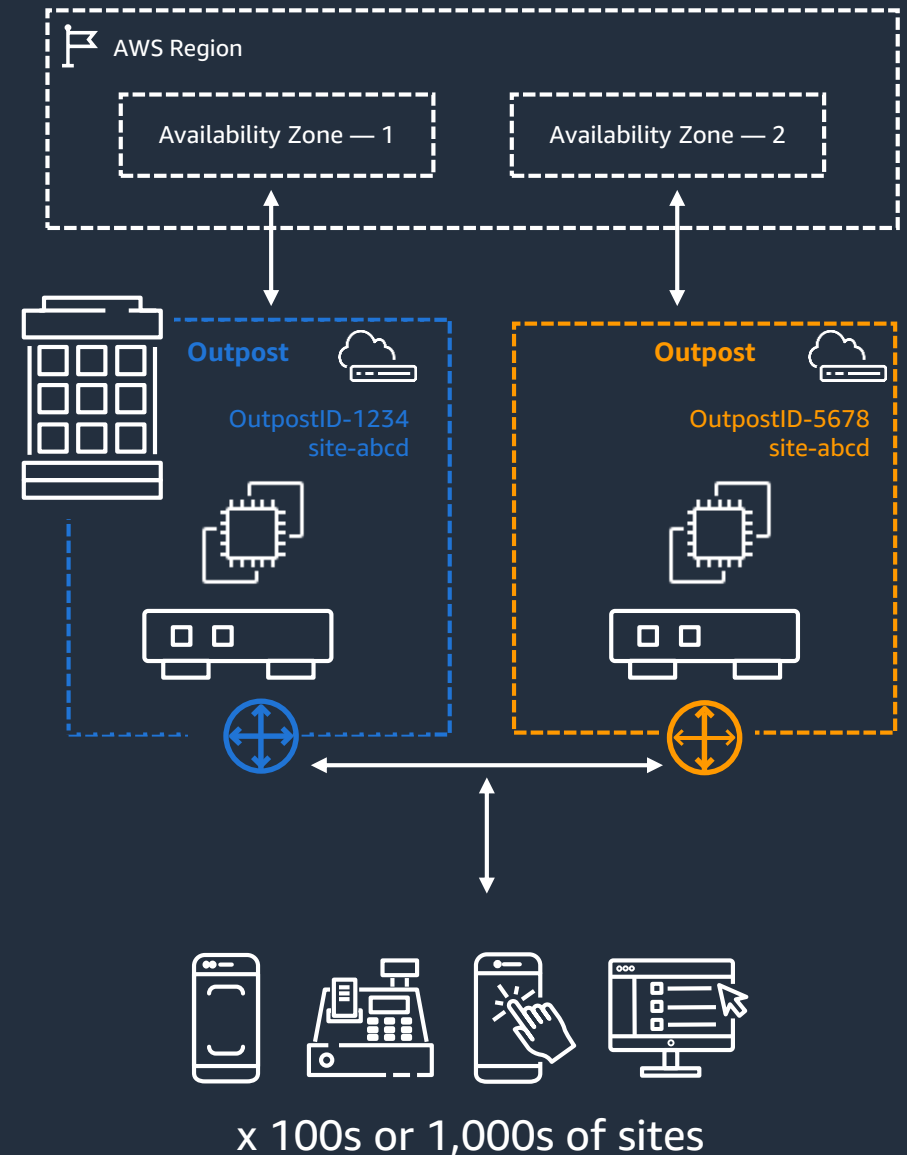
Seamlessly extend your regional VPC

Region

Availability Zone

Availability Zone

Outposts server

VPC

Subnet

Subnet

Subnet
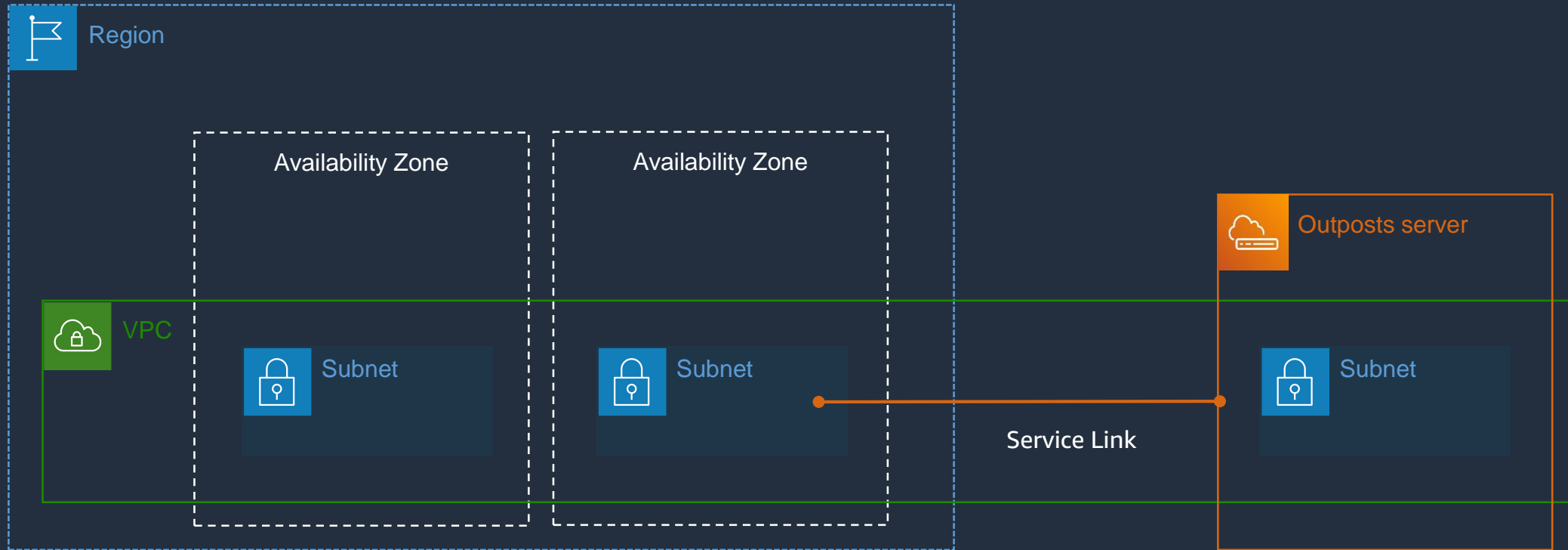
Service Link

Instances on the Outpost server can securely talk to other resources in the VPC through the Service Link

Communicate with your local network using the new Local Network Interface

Local Network Interface (LNI) surfaces a Layer 2 network presence on the local network

Each instance is dual-homed, with a connection to the VPC through an Elastic Network Interface (ENI) and to the local network through the LNI

Configure routing inside the guest operating system to communicate with on-premises resources, or an instance on another Outposts server, over the LNI

Outposts Server

Subnet

Elastic Network Interface (ENI)   Instance   Local Network Interface (LNI)

Outposts Server

Subnet
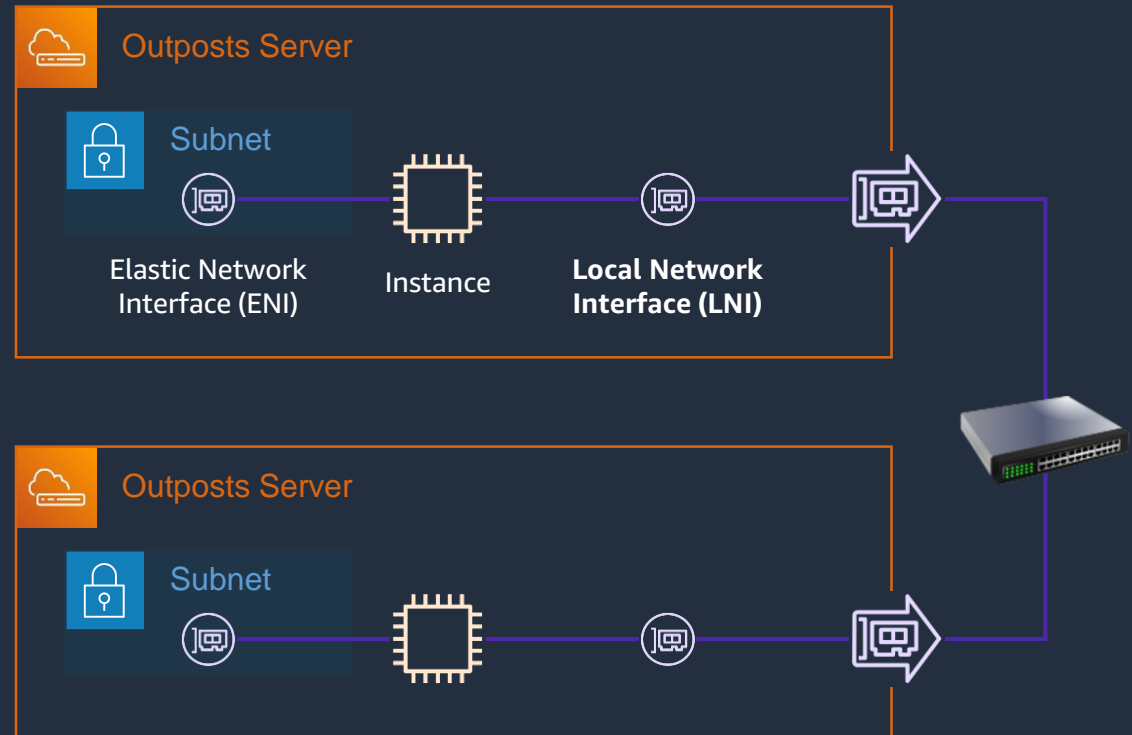
Seamless deployment across on premises and in Region

With services like Amazon EC2 and Amazon ECS, you can run primary on premises and secondary in Region

Design an architecture that meets your space, power, and networking needs at global locations

AWS Region

Availability Zone — 1

Availability Zone — 2

Outpost

OutpostID-1234
site-abcd

Outpost

SubnetID

x 100s or 1,000s of sites

23
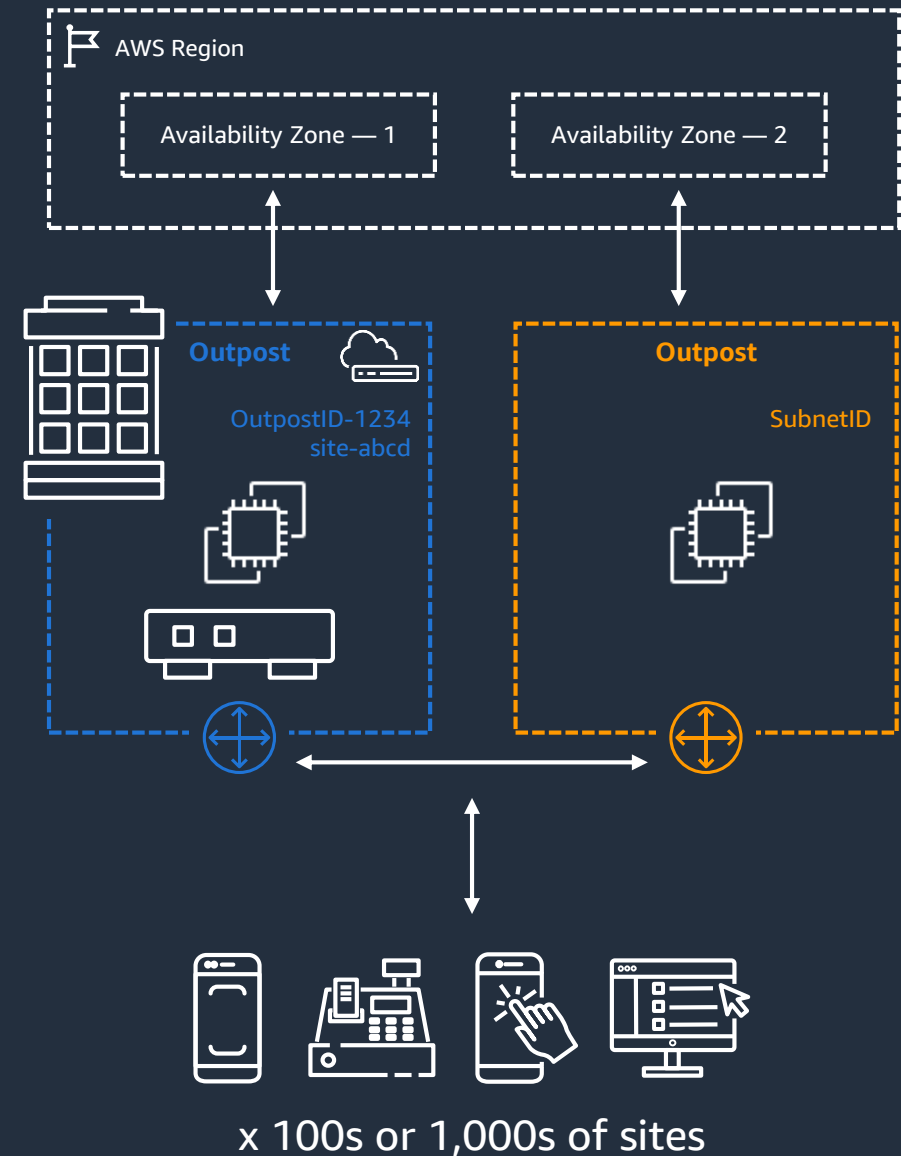
High Availability for 5G Core with AWS Outpost

- Fully automated deployment of 5G Core, RAN NMS and 5G Application

- AWS Outpost 2U Servers with 64vCPUs re-slotted to 8x8 vCPU instances

- Same Server used for implementing user and control plane of 5G core in Active-Active HA architecture including the 5G on-prem applications

- NG FLEX leveraged for selecting the active NGAP end point(AMF)

- Auto Scaling leveraged for instantiating in-region 5G core incase of complete on-prem outage
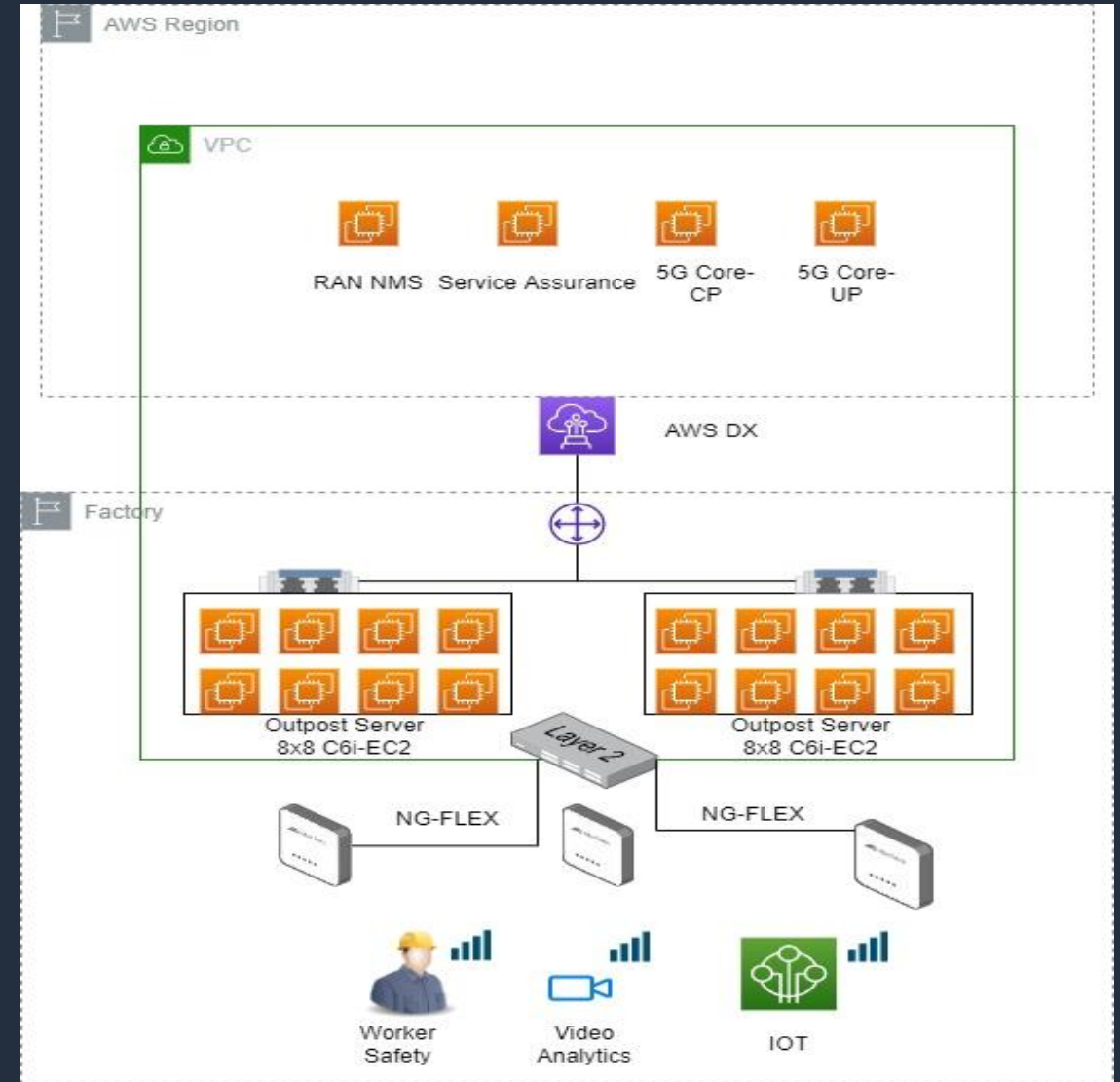
5G Applications

Computer Vision: Asset Tracking and Crowd Management

Use cases:

- Security and safety, PPE compliance, crowd management, object identification, tracking and alarms

Verticals:

- Manufacturing, Retail, M&E, Travel & Hospitality

Solution Partner: ATOS IPSOTEK

ATOS's Computer Vision solution IPSOTEK offers video analytics on footage from multiple cameras in real time and applies the latest AI technology to detect people, actions, objects and events. They can then respond to certain pre-defined criteria by sending an alert to selected personnel or logging the incident for later reporting, turning a camera network into a valuable source of operational intelligence.

https://www.ipsotek.com

Computer Vision: Object Identification and Asset Tracking

Use cases:

- Security and safety, PPE compliance, object identification, tracking and alarms

Verticals:

- Manufacturing, Retail, Travel & Hospitality

Solution Partner: Net4

Net4's video analytics products process every second of footage from multiple cameras in real time and applies the latest AI technology to detect people, actions, objects and events. They can then respond to certain pre-defined criteria by sending an alert to selected personnel or logging the incident for later reporting, turning a camera network into a valuable source of operational intelligence.

https://net4.io/products/net4-vision-video-analytics
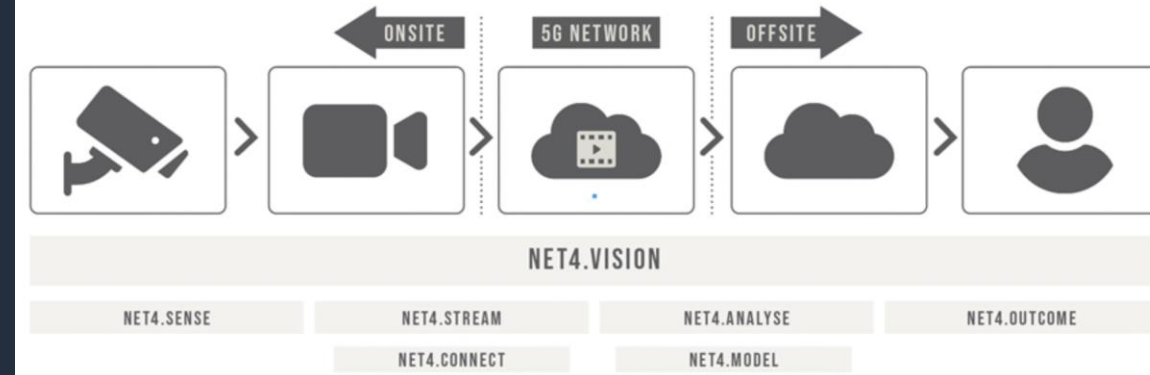
Computer Vision: Object Identification and Asset Tracking

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Solution Partner: Megh

Turn any IP camera into a smart camera, with optimized AI for every video stream and real-time performance, that enables Intrusion, loiter, and proximity detection, people occupancy and tracking, as well as fire and spill detection, monitor keep-out areas, worker fallen, and more.

https://megh.com/vas-suite

Computer Vision: Maximo Visual Inspection Analytics

<u>Use-cases:</u>

- Intelligent asset management, monitoring, and predictive maintenance.
- Industries: manufacturing, energy & utilities, transportation, oil & gas, public sector
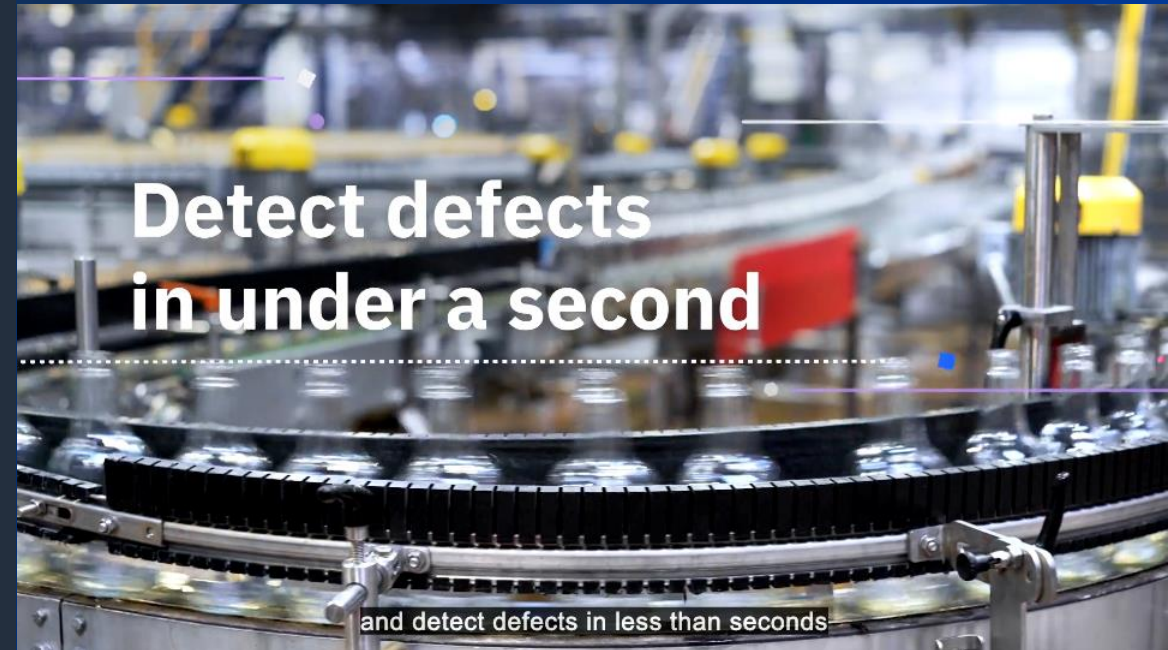
<u>Verticals:</u>

- Manufacturing, Automotive, Power & Utilities

<u>Solution Partner: IBM</u>

Maximo is a single, integrated cloud-based platform that uses AI, IoT and analytics to optimize performance, extend asset lifecycles and reduce operational downtime and costs.

https://www.ibm.com/products/maximo

Detect defects in under a second

and detect defects in less than seconds

Computer Vision: Machine Vision based Quality Assurance

Use case:

- Machine Vision and AI driven Quality Inspection of finished goods in Smart Factory

Verticals:

- Manufacturing, Automotive, Power & Utilities

Solution Partner: TCS

TCS successfully partnered with AWS and Verizon to 5G enable & Deploy Cognitive Quality Assurance Solution for Quality Inspection in high speed assembly line operations. Solutions involve real time video & image processing to detect surface defects on the products. This demonstrates the power of edge processing demanding low latency, high bandwidth.

https://aws.amazon.com/tcs-real-time-quality-inspection/

Computer Vision: Hazard Detection

Use case:

- Hazard detection in industrial environment

Verticals:

- Power & Utilities

Solution Partner: Qrious

Qrious developed a hazard detection system using AI to help detect if people are too close to excavators working in the waste disposal area at a busy resource recovery center. Using computer vision video cameras, it identifies and tracks people and excavators within a specified detection zone and calculates distances between them. The Qrious system can trigger alerts when a person is identified as being too close to an excavator.

https://www.qrious.co.nz

Data & Analytics   AI & Data Science   Customer Engagement

IoT and Robotics: Autonomous Agnostic Robotics

Use cases:

- Surveillance, AGV orchestration, aerial content delivery and monitoring
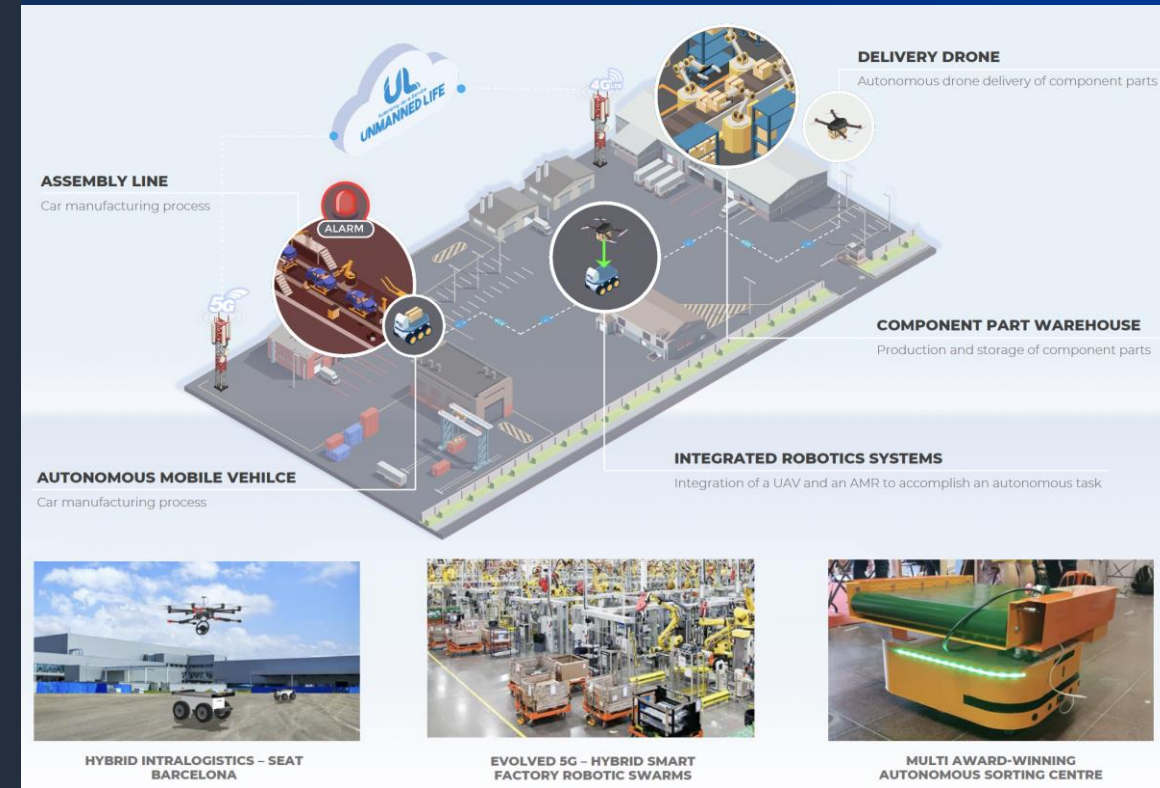
Verticals:

- Travel & Hospitality, Power & Utilities, Agriculture

Solution Partner: Unmanned Life

UnmannedLife intelligent software platform is used to autonomously deploy, control, and orchestrate swarms of robots and AGVs for smart automated industrial environments.

https://unmanned.life

IoT and Robotics: Counter-Drone Security and Surveillance

Use case:

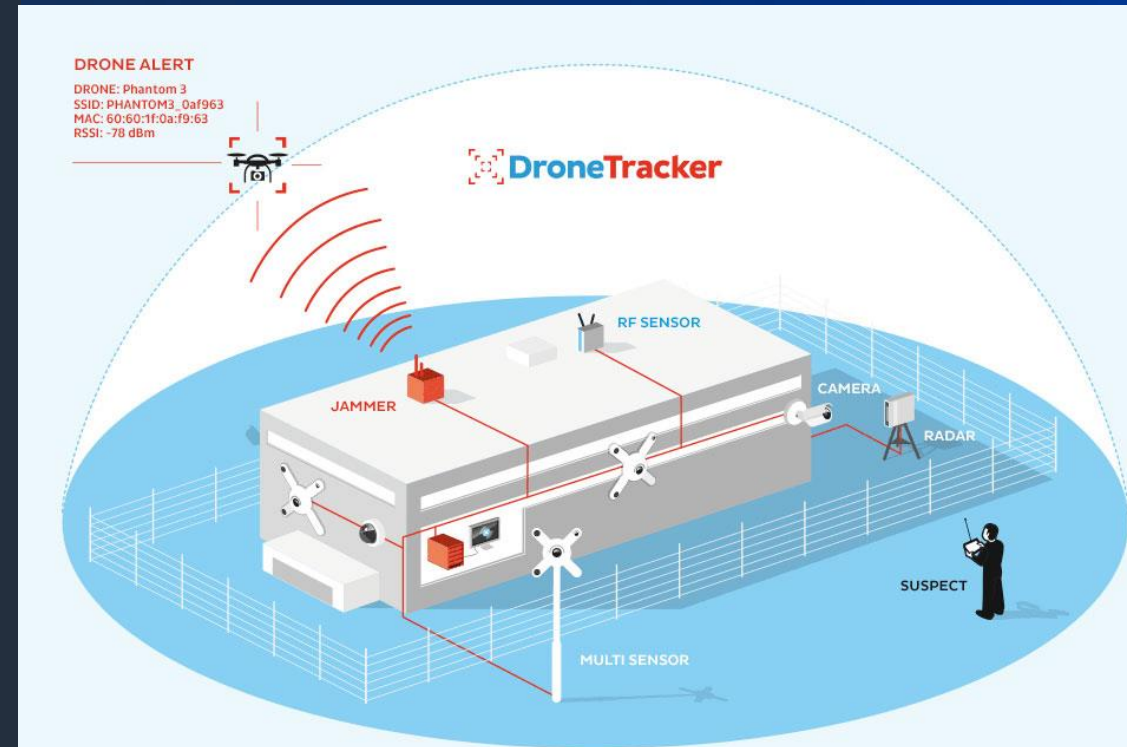- Automated surveillance via sensors and analytics

Verticals:

- Manufacturing, Travel & Hospitality, Power & Utilities

Solution Partner: Dedrone

Various organizations and industries rely on Dedrone Counter-Drone Technology platform for automated, continuous protection of their lower airspace. Dedrone Tracker seamlessly integrates with a variety of cameras, sensing and threat mitigation technologies, enabling users to customize their platform and meet their specific needs and threat level.

https://www.dedrone.com/

Thank You