Unified 5G Edge Operations & Orchestration

Principal Architect – Joe Issac, Wipro Technologies

What is the future …new ecosystem opportunity

Jack uses Joe's gaming system when he is away for work and pays for hourly usage

Bill is able to assess broadband because of a passive reflector erected by his service provider

Wendy's garage has a Edge Stack which is used by a telco to power the 5G network in her suburb

Kumars have recurring revenue from the V2V road side unit they fixed at the corner of their lawn

**Only 5G has the ability to create a world composed of things that is "always connected".
We believe this will present a new ecosystem play opportunity**

Open Source
MANO

Common Challenges Faced by Telecom Operators

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01 **Manual Process**

Telecom Operators are following a manual process in selection of Infrastructure Site for Telecom Infrastructure sharing which involves repeated visits, surveys, manual RF planning

02 **Plethora of Tools**

Currently each stakeholder uses separate tool for acquisition, leasing, buying, billing, maintenance, monitoring etc.

03 **Inaccurate database of Telecom Sites**

Time consuming process in selection of the infra provider on the basis of RF Antenna parameters due to manual updating of site databases

04 **Lack of Parameter Monitoring**

Requirement of Accurate parameter monitoring of site equipment, components, IOT sensors

05 **Lack of Real time Reporting, alerts**

24*7 monitoring and analysis of live and past data is required by various stakeholders for receiving alerts, prediction, root cause analysis

I M P A C T

Increased Operating Expenses

Integration Issues

Increased inefficiencies

Time Consuming

Cumbersome Tasks

Information loss

Cost creep

Resource wastage

Quality of service
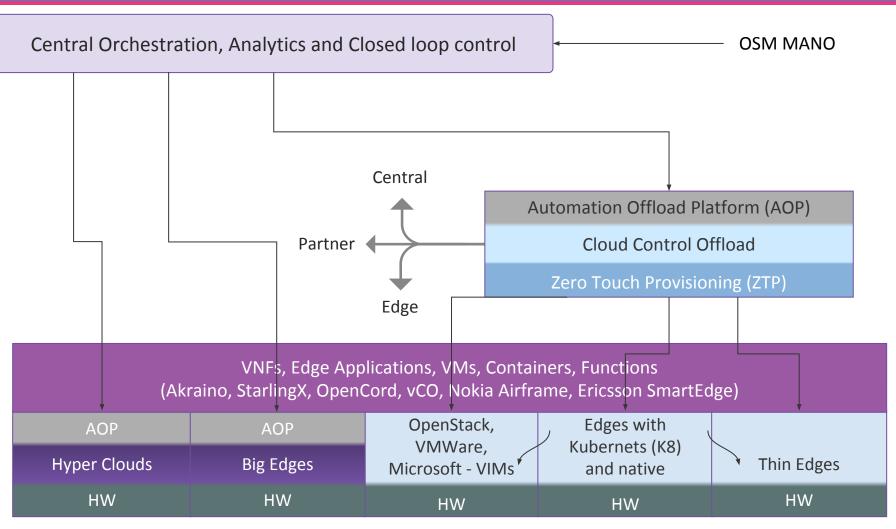
Network Performance

Late reporting, alerts

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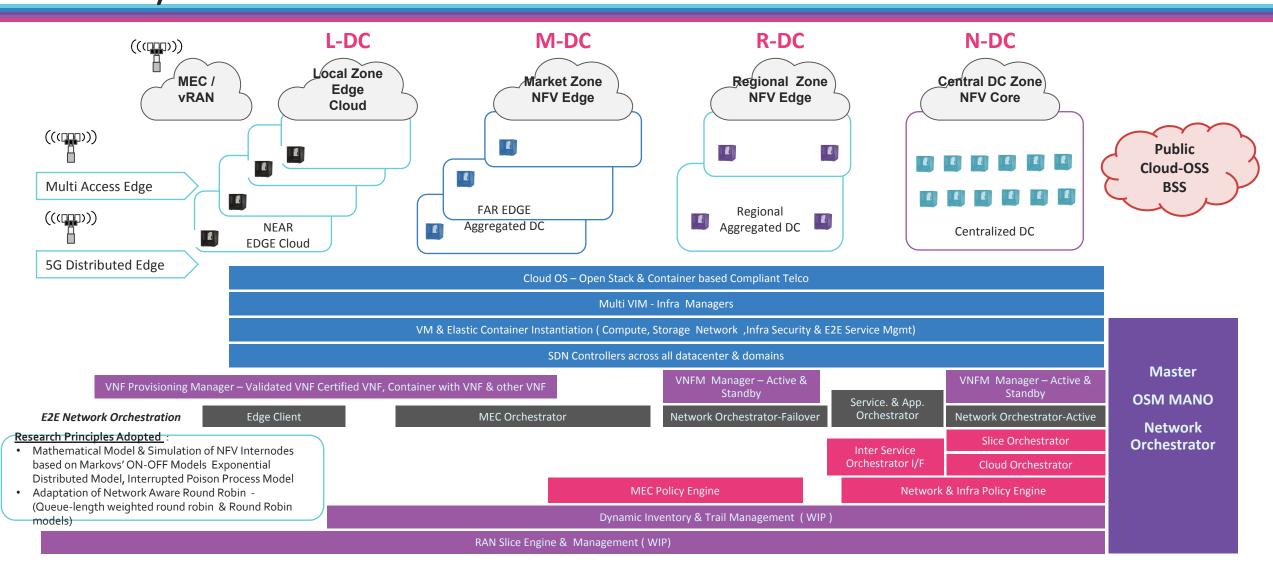
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What is crucial

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Wipro's Ref. - Multi Function Orchestrator Blue Print for 5G/RAN Networks

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L-DC   **M-DC**   **R-DC**   **N-DC**

MEC / vRAN

Local Zone Edge Cloud

Market Zone NFV Edge

Regional Zone NFV Edge

Central DC Zone NFV Core

Public Cloud-OSS BSS

Multi Access Edge

NEAR EDGE Cloud

FAR EDGE Aggregated DC

Regional Aggregated DC

Centralized DC

5G Distributed Edge

Cloud OS – Open Stack & Container based Compliant Telco

Multi VIM - Infra Managers

VM & Elastic Container Instantiation (Compute, Storage Network ,Infra Security & E2E Service Mgmt)

SDN Controllers across all datacenter & domains

VNF Provisioning Manager – Validated VNF Certified VNF, Container with VNF & other VNF

VNFM Manager – Active & Standby

VNFM Manager – Active & Standby

E2E Network Orchestration

Edge Client

MEC Orchestrator

Network Orchestrator-Failover

Service. & App. Orchestrator

Network Orchestrator-Active

Master OSM MANO Network Orchestrator

Research Principles Adopted :
- Mathematical Model & Simulation of NFV Internodes based on Markovs' ON-OFF Models Exponential Distributed Model, Interrupted Poison Process Model
- Adaptation of Network Aware Round Robin - (Queue-length weighted round robin & Round Robin models)

Inter Service Orchestrator I/F

Slice Orchestrator

Cloud Orchestrator

MEC Policy Engine

Network & Infra Policy Engine

Dynamic Inventory & Trail Management (WIP)

RAN Slice Engine & Management (WIP)

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WIP – Work In Progress

Wipro Ref. - OSM Service & Network Orchestration Blue Print

Open Source MANO

Market Place & Digital User Interface

DevOps Jenkins

- Hosts
- Common
- UI
- MON
- SO
- N2VC
- VCA
- RO
- VIM Emulator

Secure Layer Interface

ETSI OSM User Modules

| VNF Package Generator | VNF/NS Catalog Composer | Web browser |

Hybrid OSS Fulfillment & Assurance

| Workflow Engine | Policy Mgmt | Service Mgmt | Config. Mgmt | Alarm Mgt. | Performance | Sec Mgt. |
| Activation Engine | Topology Mgmt | Inventory Mgmt | Provisioning | Fault | Log Mgt. | |

AD/LDAP Integration

NS & NSLCM Orchestrator

API Service & Mgmt End Pt.

Orchestration Engine

Configuration Data Store

Catalog Mgr.

Network Services Composition Engine

Resource Orchestrator Plug-Ins.

Pre & Post VNF Testing Platform

Infra Quality Mgmt Platform

Dynamic Telecom Inventory & Asset Mgmt. , Network Trail Mgmt.

Legacy Interfaces Support

VNF Configuration & Abstraction

- N2VC
- VCA Engine
- VCA Monitoring

Resource Orchestrator

- Resource Orchestrator
- API Service & Utility
- VIM Plug-In (OpenStack,AWS EC2/VPC, Open VIM VMware vCD)
- SDN Plug-In (ODL,ONOS, Floodlight)

External Platforms Integration – E.g. UNICA, MUNIC, AIC, Amazon, Azure etc.

Monitoring

- Core
- Monitoring Tool Plugin
- OpenStack Aodh/Gnocchi
- AWS CloudWatch
- Vmware vRealise Opetations

Legacy NMS

Legacy EMS

Legacy Network

Ve-Vnfm

Nf-Vi

WAN / VNF Inf. Mngr.

CORE NETWORKS

VNF	Domain SDTN-C	vEMS
VN	Access SDN-C	vEMS
VNF	WAN SDN-C	vEMS

MEN & Access

WAN

Data Centre

Transport Optical

VIM POOL

A

B

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Continuous Migration

Extending OSM MANO - 5G Network Layers of Abstraction & Orchestration

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Customer Service

- E2E Customer service In which one or more communication service are key components

E2E Communication Service Inter-CSP

- Specific information exchange service between multiple end points
- May span CSP boundaries

Communication Service Intra-CSP

- Service spanning across network domain between SAPs

Network Slice as a Service (Sequence of NSIs)

- Leverage of one or more NSIs in sequence to support mobility

Network Slice Instance

- Independently manageable logical network, service guaranty between SAPs

Network Subnet Slice Instance

- Subnet level entity to rapidly compose NSI & simplify management

E2E Network service (ETSI –NFV), SDN-R, SDN-C

- Resource layer Orchestrators, Controllers and Managers

DSEP (Digital Services Enablement Platform)

CFSO (Customer Facing Service Orchestrator)

Extending OSM-Service Orchestrator roles

SO (Service Orchestrator – for CS)

SLO ((Mobility) Slice Orchestrator – eCSMF*)

SO (Service Orchestrator – NSMF*)
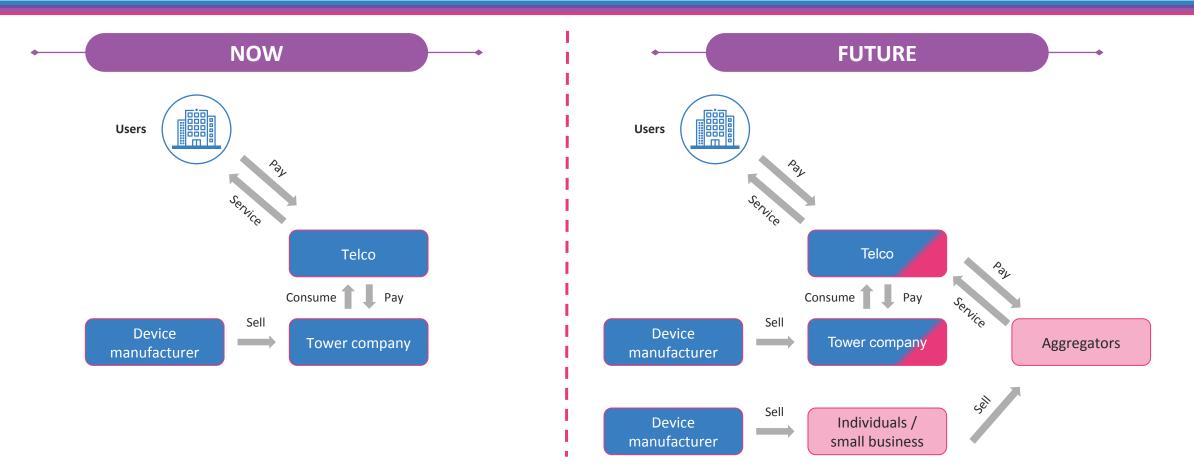
SS-LO (Subnet Slice LC Orchestrator) – NSSMF*

Resource Layer Orchestrators (NFV/SDN)

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* 3GPP CSMF – Communication Service Management Function, NSMF – Network Slice Management Function, NSSMF – Network Slice Subnet Management Function

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5G Unified Edge Platform to address the new ecosystem

NOW

Users

Pay

Service

Telco

Consume | Pay

Device manufacturer → Sell → Tower company

FUTURE

Users

Pay

Service

Telco

Pay

Service

Consume | Pay

Aggregators

Device manufacturer → Sell → Tower company

Device manufacturer → Sell → Individuals / small business → Sell →
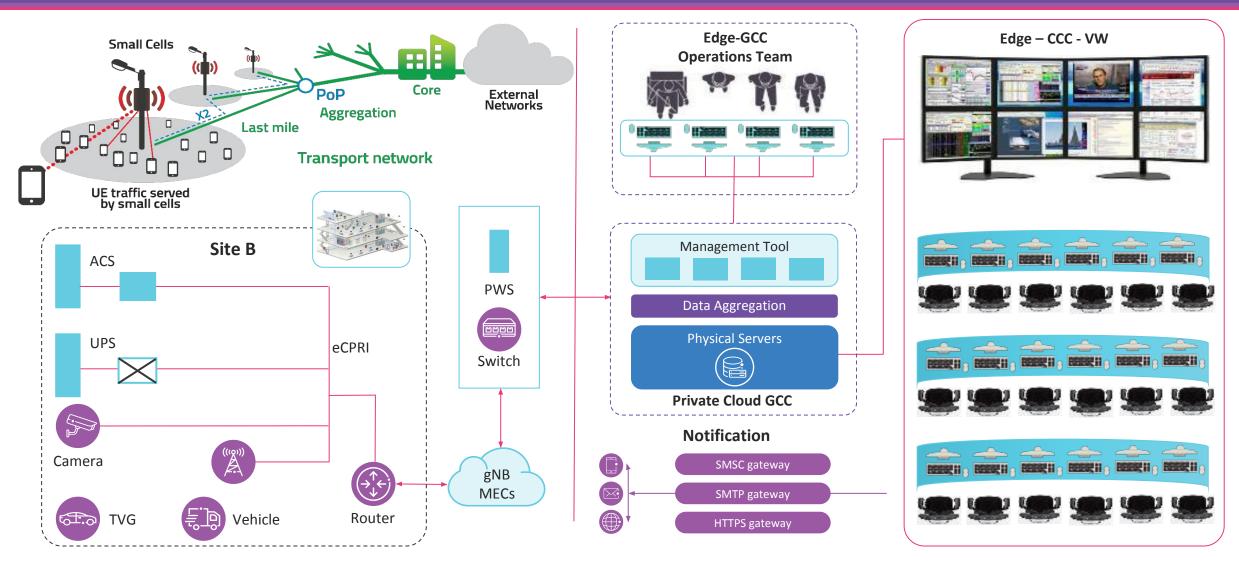
We have developed a platform to address the operational needs covering the commerce and the asset management needs to enable this business model

Open Source MANO
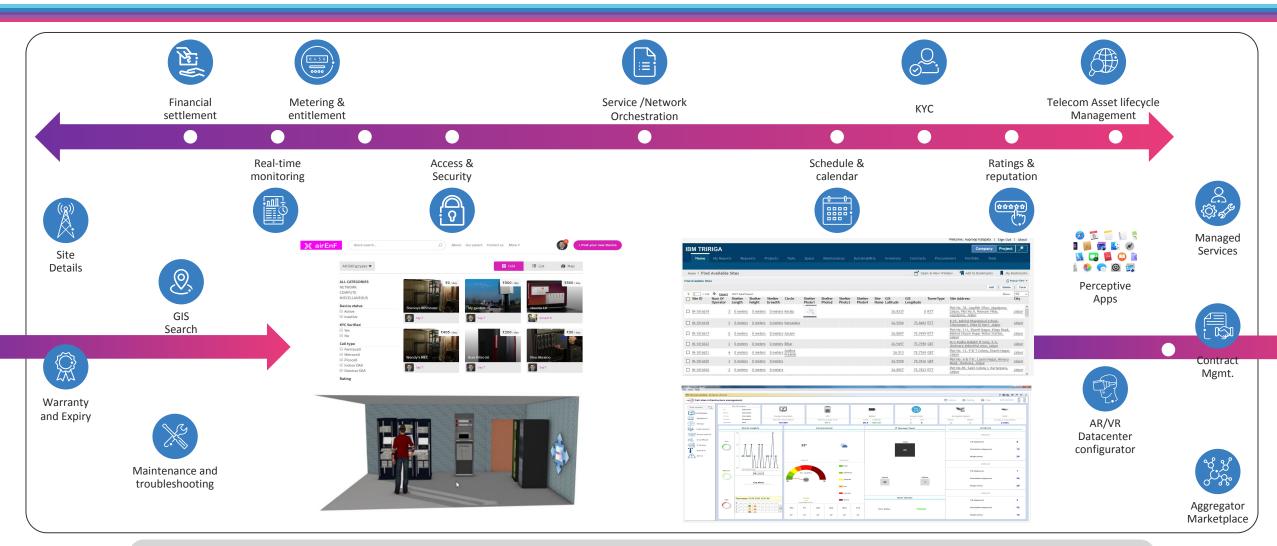
Edge Management Architecture

Edge Aggregation Platform Modules

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Financial settlement

Metering & entitlement

Service /Network Orchestration

KYC

Telecom Asset lifecycle Management

Real-time monitoring

Access & Security

Schedule & calendar

Ratings & reputation

Site Details

GIS Search

Warranty and Expiry

Maintenance and troubleshooting

Managed Services

Perceptive Apps

Contract Mgmt.

AR/VR Datacenter configurator

Aggregator Marketplace

The platform simplifies the Commerce & Lifecycle operations Platform for 5G-Edge Services

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Universal Edge operations platform
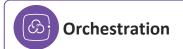
- Delivered from our state-of-the-art Digital Operations Center
- Built on a set of best of breed products tightly pre-integrated
- Predefined rules and intelligence for a wide range of devices
- High level of automation and cognitive capability
- Templatized process, ready for rollout
- Highly Self service driven
- Data export facilities to clouds
- Advanced visualizations

As a service

Application	Orchestration
Platform	Virtual Infrastructure
Network	Physical environment

AI Ops Platform

ITOA

GIS

Blueprints

Billing & Entitlement

Asset & Inventory

SM Process Tool

API Service

Alert Service
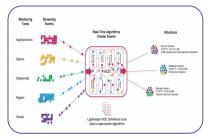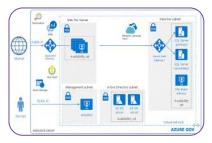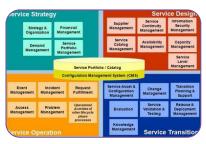
- Scalable to millions of nodes
- External integration to data lifecycle tools
- Security tools integration
- Self service interface
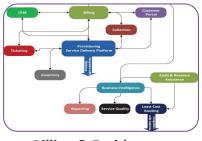
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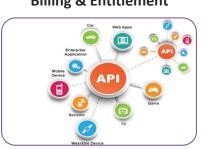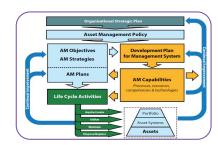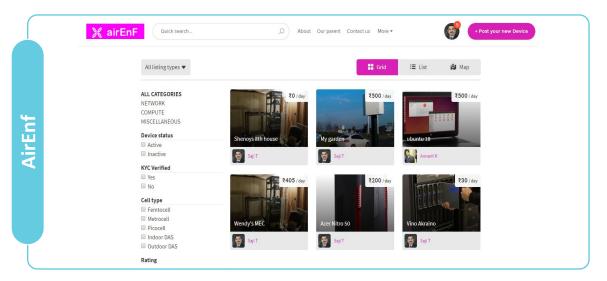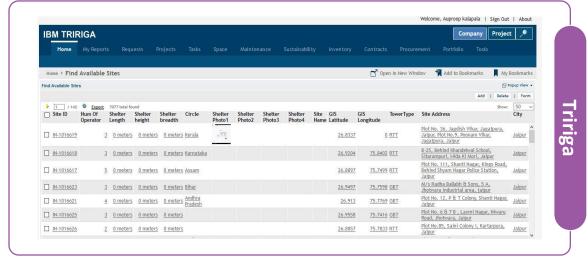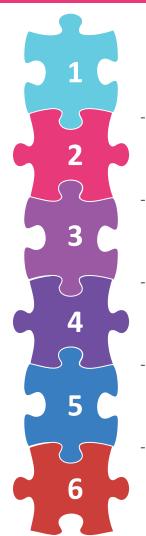
Modules included in the platform

Telco Infra Management and Monitoring

1 Leasing Solution for Infra Providers to do fast analysis of existing network to find the best suitable options available for the new Operators
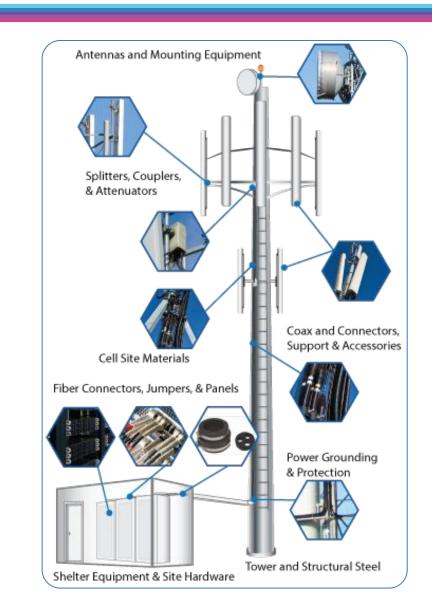
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2 Solution will provide the exact status of the occupants and suggest for the best available space for new upcoming operator replacing RFI (Ready for Infra) survey for finding new spaces

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3 Geolocation data is capable of suggesting the best suitable IP site

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4 The system is capable of identifying the best suitable site and all details related to sites are fetched

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5 Mobile Application is used for collecting the data from field

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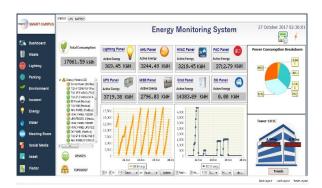**6** Provision of Separate logins for Telecom Operators to check the status of Infra Sites near to planned Nominal

Antennas and Mounting Equipment

Splitters, Couplers, & Attenuators

Cell Site Materials

Fiber Connectors, Jumpers, & Panels

Coax and Connectors, Support & Accessories

Power Grounding & Protection

Shelter Equipment & Site Hardware

Tower and Structural Steel

Remote Telco Management Services

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01	Remote monitoring of critical infra components including Antenna, eCPRI, BBU, Sensors, Gateways, equipment etc.	Impact analysis and scenario simulation	**05**
02	IoT Platform and applications	Incidence Management, Service Management, Contract Management	**06**
03	Asset monitoring & management	Energy efficiency monitoring and management	**07**
04	Solution monitoring and management	Capacity planning and reservations	**08**
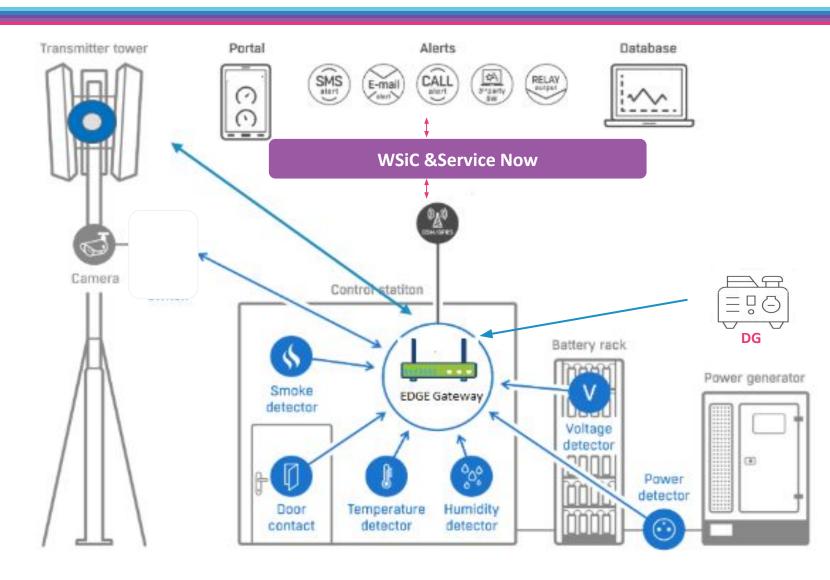
Typical Example - Cell Site Infra. Parameters Monitoring

- **Height of an Antenna**
- **Tilt of an Antenna**
- **Antenna Orientation**
- **Power Monitoring**
  - Main Power Supply
  - UPS Systems
  - Battery Monitoring
  - Solar Cell Monitoring
- **Environmental Monitoring :**
- **Access Control**
- **Surveillance Camera**
- **Air Conditioning**
- **Fuel & DG Monitoring**
- **IT Devices**
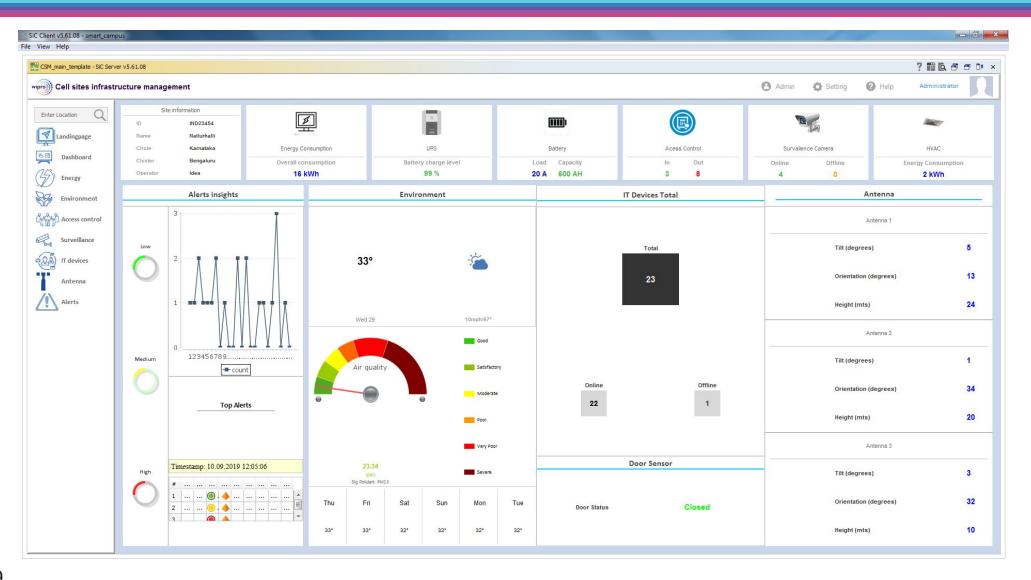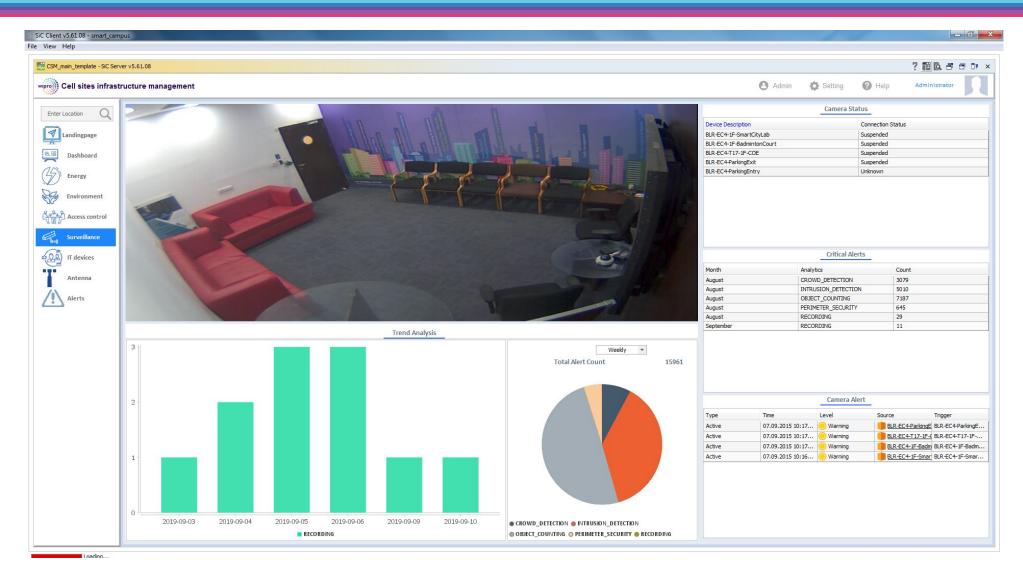- **Temperature monitoring**

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Demo

Edge Operations Dashboard – Cell Site Infra Mgmt.

Edge Operations View – Surveillance & Analytics view

Thank you