altice labs

OSS new challenges and use cases

Cognitive and autonomous operations; Autonomic closed loops; Cognitive network planning and design; Cognitive optimization of operational processes; City governance for smart cities; Industry 4.0 predictive management

White paper

Version 1.0, April 2020

The challenges

The telco's traditional business is changing very fast, mainly due to the evolution of technologies, services, and customer demands. Virtualization (SDN, NVF), with all the inherent flexibility and programmability, 5G with all related network architectures and new services, enabling the increase of more demanding usage scenarios like connected cars, smart cities, IoT, industry 4.0, are becoming the main challenges of the actual communications and digital service providers (CSPs and DSPs). In this context, the CSPs/DSPs have to adapt their processes and applications to provide the best service to the customer, enabling new service adoption while reducing operational costs.

With the current OSS tools and platforms, there is a highly human-dependency, being hard for the operations to assure a high level of quality, speed/time-to-market and capacity to grow while maintaining customer satisfaction. Thus, the operations solutions used by the CSPs/DSPs have to evolve its architecture and paradigms to respond to these new challenges.

At the network level, virtualization and 5G with its flexible and diverse architecture allow very fast adaptations to new customer needs and requirements. The new digital life experience requires a near-real-time (or even real-time) answer from network and services to assure the normal functioning of this new ecosystem.

For the OSSs to be ready to these new challenges it is needed to adopt a cognitive driven approach, complemented with autonomous mechanisms, to bring intelligence to operations, while achieving at the same time the following goals:

- Supporting smooth evolution from traditional CSPs to new digital services, with a non-disruptive roadmap approach;
- Simplifying the “order-to-cash” streamline, by technology consolidation, integration, and automation, reducing Capex and Opex;
- Converging both physical and virtual networks and services, through a unified solution for multi-technology and business (enabling, for example, the evolution to network slicing);
- Increasing business agility at the engineering and operational level, gaining time to market and rapid services adoption;
- Enhance customer experience with real-time intelligent analyses, “closing the loop” from Assurance to Fulfilment;
- Decrease human dependencies with autonomous and cognitive operations based on intelligence.

OSS transformations

The main OSS transformations that are mandatory when 'digitalizing' the DSP/CSP operations through an OSS solution are summarized as follows:

- A cloud-driven architecture: assuring agility and efficiency in the computational infrastructure and also using new deployment models;
- Artificial intelligence: getting value from data using AI infusion and identifying patterns and new decision rules;
- Autonomous mechanisms: sensing and automatically acting based on decision rules and "closing the loop";

Cloud-driven cognitive and autonomous operations bring agility, intelligence, and autonomy going beyond traditional scenarios and giving the operator the means to be ready for the new challenges.

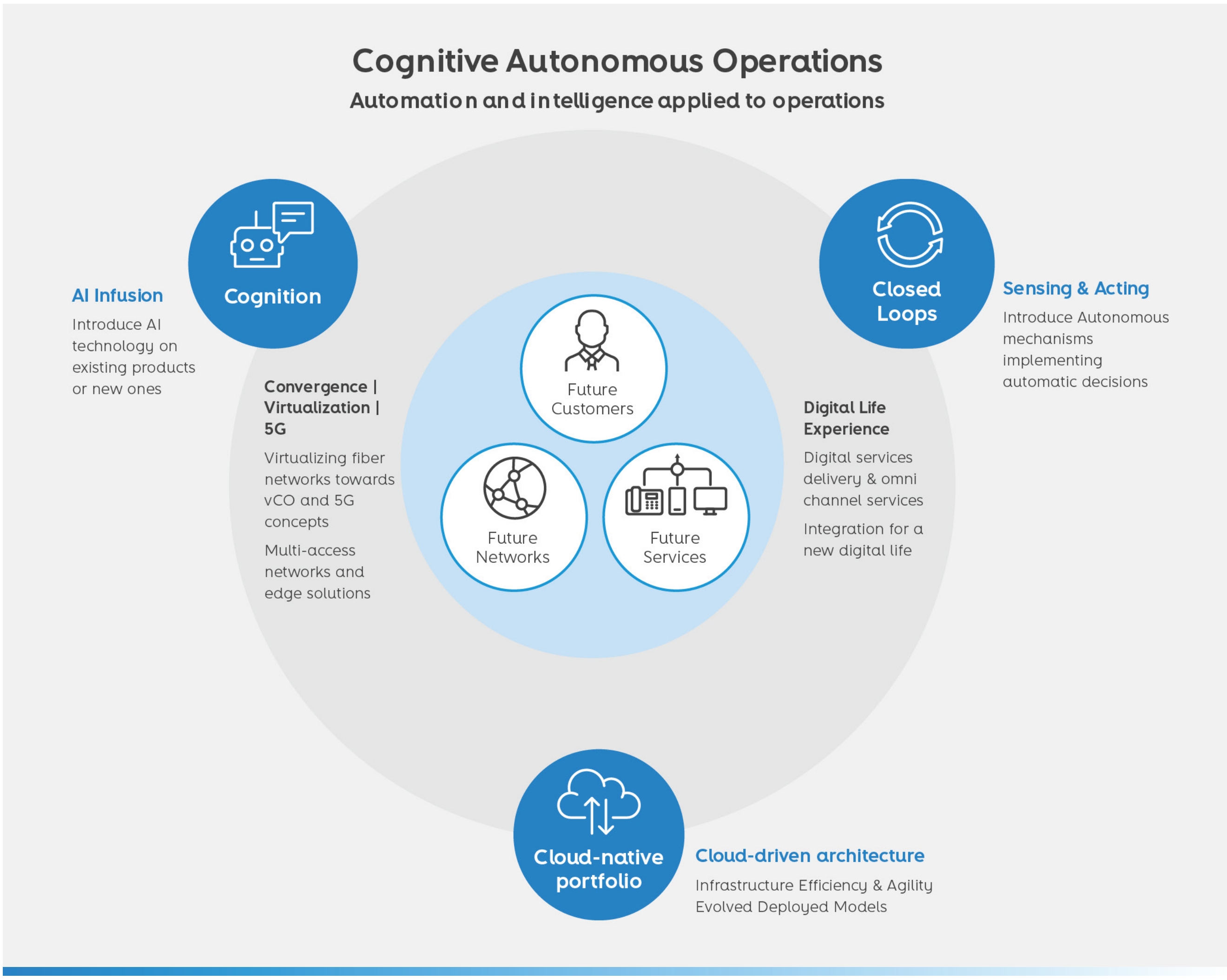


Figure 1 – Cognitive and autonomous operations

Cognitive and autonomous operations can have an initial implementation on top of the current OSSs in place, by adding new cognition modules, as shown in **Figure 2**. This approach will provide more efficiency and autonomy, compared with the more traditional human-based interventions, while having a smooth evolution from the actual solutions. The figure below represents this operation's add-on that integrates with the Assurance (for collecting relevant data) and Fulfilment (for acting) to provide scenarios that will "close the loop".

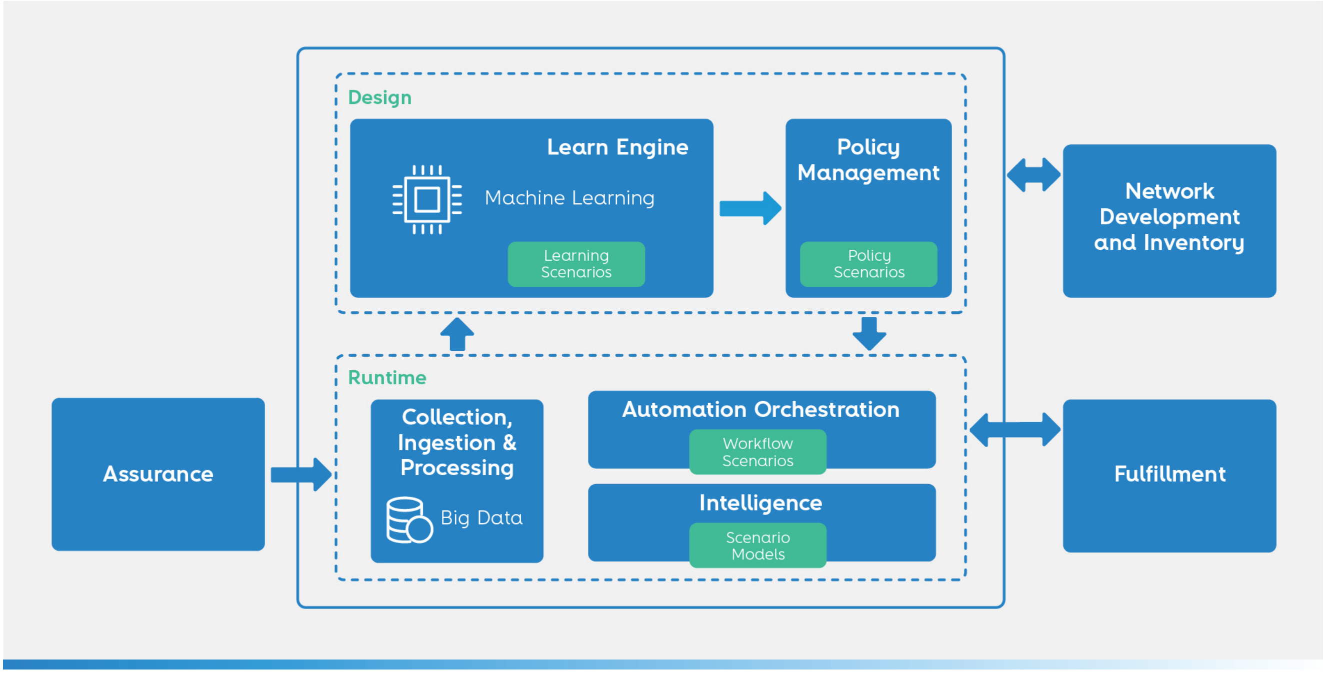
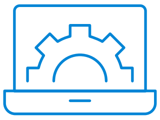


Figure 2 – Autonomous operations concept

Main components

Design

Where it is needed to train the selected scenarios, using machine learning technologies by analyzing relevant collected data, and generating new or enhanced "policy" decisions (like predictive failure alerts, diagnosis algorithms, corrective activities) to influence runtime automation decisions.



Runtime

Where all the data is collected, stored and processed, enabling the execution of programmed workflows for the "closed-loop" scenarios identified, and supported on intelligence decision rules available for them.

This autonomic approach can evolve into broader and more demanding scenarios, with the adoption of an "always sensing, learning and acting" paradigm enabling agile/real- time operations that can scale. For this, it is also needed an internal architecture evolution, also impacting in the legacy solutions, with the following concerns and capabilities

Sensing

A collection of service and network conditions from all layers (physical NEs, virtual infra, SDN controllers, ...) to feed assurance activities.

Analysis

Near real-time and real-time analytics: crossing network information with other sources, creating service and network health information.

Decision

Intelligent decision mechanisms determine actions for self-optimization, self-healing, self-protection.

Actuation

Fulfilment end-to-end orchestration process with service configuration and activation actions transversally over physical or virtualized resources.

With all these transformations, OSS management solutions also need to be able to cope with a huge increase of managed devices and at the same time being able to analyze high amounts of data generated and available for management processes. Operations will be able to act in real-time and take management decisions, to, at least, maintain the level of expected customer experience.

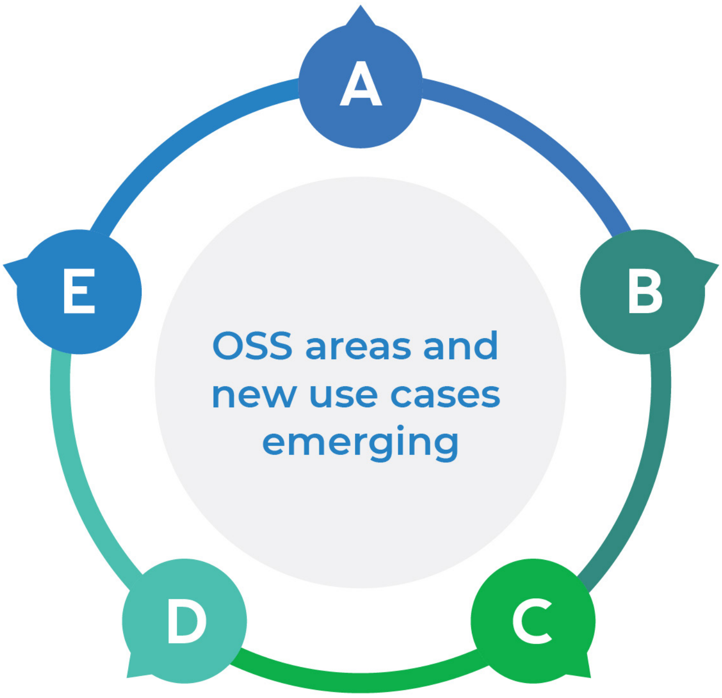
Use cases domains

One way for identifying the most relevant scenarios where the OSS evolution is needed is by finding human interventions that have an important role and where the use of massive collection and processing of data enables complex real-time decisions, critical for the business. These scenarios might come from different domains like problem detection and handling, predictive analyses, diagnose and corrective activities, amongst others. These domains will be the candidates with great potential to get value from data, enabling the adoption of new solutions based on Big Data and AI technologies and bringing high value for the DSP/CSP.

Cognitive customer management, like:

- cognitive call center (with customer impact analysis) also using the support of BOTs;
- reactive to complaints vs proactive communication (increase data analytics from customer to fine-tune root-cause to solve).

AI-assisted network planning (for business decision support)



Improve diagnostics and corrective actions through AI

Cognitive infrastructure management, like:

- planning and construction (design optimization through AI for network development support) and reinforcement learning (continuous model optimization);
- predictive infrastructure maintenance (sensorized infrastructure, e.g. STBs and fiber gateways).

Cognitive service management, like:

- optimization of provision processes;
- predictive and autonomous service operations including problems and performance degradation resolution;
- service impact analysis (changing network topologies on-demand; functions delocalization, etc.) to solve service degradation or unavailability.

Use case #1

cognitive network planning and design

Many organizations consider fiber-based access networks as a major solution to make the most out of the higher-speed available for service usage. Fiber-based networks can be delivered to customer premises through point-to-point (P2P) and point-to-multipoint (P2MP) technologies, which increase the difficulty of planning and design the network, due to the large number of variables to consider. So, to create a cost-effective gigabyte passive optical network/fiber-to-the-home (GPON/FTTH) requires considering as many factors as:

- headend position;
- optical splitter position;
- maximum splitter ratio;
- optical distribution point position;
- maximum distance;
- routes;
- number of surveys to attend;
- accomplish the optical budget.

The two main advantages of automating/optimizing network design are minimizing the Capex and reducing time-to-create from days to hours, and as so, using a cognitive AI-based approach allows the operator to automate the process of planning and design the network. **Figure 3** depicts the process. In this use case, the input data can be the headend position, optical splitter position, etc. Business rules may be the optical budget, or cost of construction, among others. Then, by parsing the information and compute it using an AI/ML approach, the operator will have the hardcopy outputs to analyze the results and change them if needed.

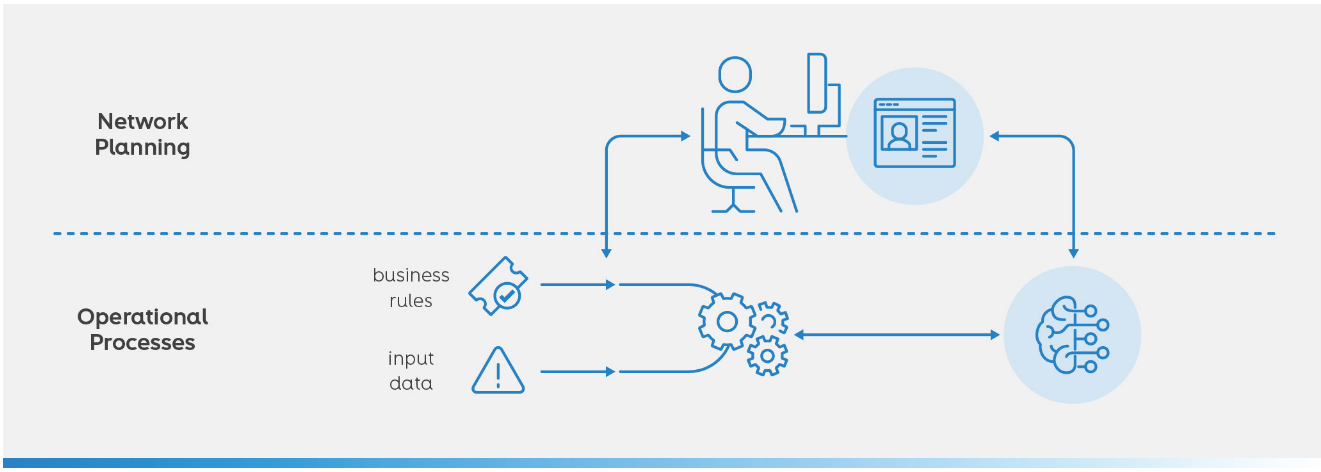


Figure 3 – Data flow

More generally, the system's input data can come from a geographic information system (GIS) database or other sources. This input data contains the infrastructure information: roads, installation points, routes, surveying, among others. Business rules define cost constraints (on placing cable, ducts, equipment, etc.), and the desired ratio of coverage customer.

Given the inputs and business rules, the information is parsed and prepared to be computed by AI/ML algorithms that will give the operator multiple possibilities of how to design the network. The outputs consist of a presentation of the georeferenced view, and the auto-generated results (like the surveying, routes, cable network, optimized BOM, etc.) of the desired network. The operator can change what is presented or even alter business rules and make other adjustments, to have different solutions. The acceptance and adaptations of each project will feed the AI/ML engine to improve the outcome of the next projects, leading to a "smarter" process.

Use case #2
cognitive optimization of provisioning process

Provisioning processes are a critical component of the CSP/DSP ecosystem. They ensure that service instance creation, modification, and termination are successful and done in the most efficient way possible. These processes must be resilient enough to withstand any performance issue, failure or unforeseen behaviour of any of the systems with which they interact. Those systems include other CSP/DSP support systems, service platforms and the managed network that delivers the services to the customers. Additionally, all processes that are related to the workforce must be bulletproof to ensure they spend the least amount of time in the customer premises, to minimize the inherent costs, but also to increase customer satisfaction.

Currently, all these processes and their improvements are designed by analysts and engineers, experts in this field of work. But although having access to a rich set of tools that make their job easier, this is always done through manual analysis. Another aspect is that these processes, being so elaborated and mission-critical, are not modified unless it is absolutely necessary due to the associated risks of such changes. By introducing the concepts of Continuous Integration (CI), Continuous Delivery (CD) to the design, it is possible to automate the process development and release it faster. The process designers are responsible for the management of the CD pipeline, as depicted in **Figure 4**.

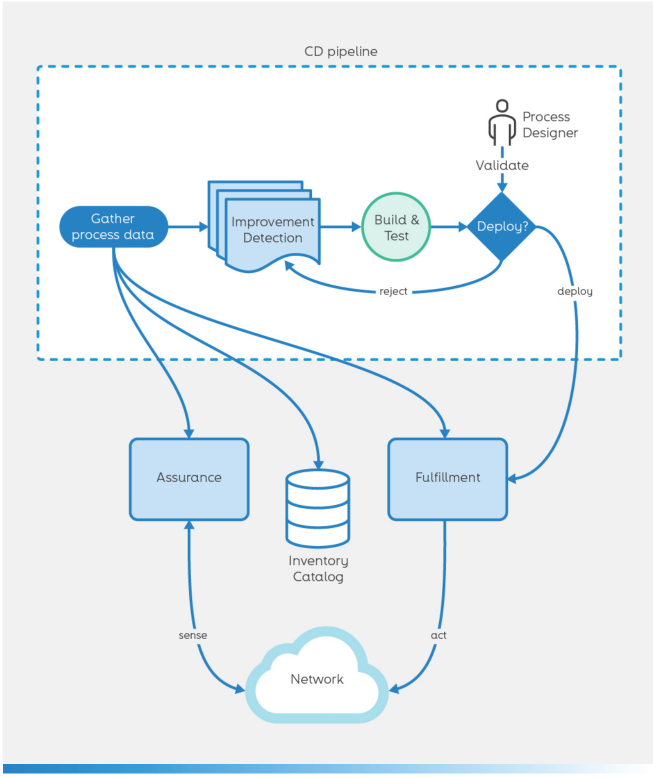


Figure 4 – CD pipeline

The objective of cognitive process optimization is to allow these improvements to be added using an automated approach, shifting from a reactive to a proactive perspective, as mentioned before. This shift is achieved via AI/ML, by continuously monitoring the overall performance of the processes associated with on-boarded services, and issuing improvement suggestions to the process designers along with the justification for these suggestions. For example, an improvement can be changing the order in which specific network elements are configured, or adjust a simple communication timeout. If the designer approves the change, it will be propagated directly to the pipeline and deployed into the live environment.

Engineers and analysts responsible for those processes will have access to a tool to aid them in the difficult task of process optimization, being able to focus more on the validation and approval of the suggested improvements rather than discovering and implementing these improvements themselves.

Use case #3
autonomic closed-loop

It is undeniable that our world is continuously changing and the dynamics in which we spend our daily lives will take us into unimaginable paths. New technologies like 5G and mass internet of things (IoT) devices will introduce new paradigms in the assurance field, supported by increasingly virtualized, programmatic networks and a massive array of data analytics. The most advanced network operation centers (NOCs) have started, in recent years, the path of automation, supported by basic rules and constraints. Nonetheless, this automation is not yet able to, autonomously, detect the cause of a failure, trigger more advanced troubleshooting processes or even act on the network to provide a better quality of experience.

If, on the one hand, network operators are incessantly overflown with information like network and network topology, alarms, performance measures, on the other, they suffer the absence of effective diagnostic and issues resolution. Without a quick and effective diagnose, the meantime to repair (MTTR) is penalized and can cause not only network and service unavailability but also affect customer satisfaction. For example, in a typical scenario, a network operations engineer must access multiple systems and knowledge bases to diagnose a problem and to identify the root cause. Simultaneously, network technicians must search if there is already a trouble ticket (TTK) opened for that problem and, if not, one must be created. Additionally, the right resolution must be applied or, if not possible, the ticket must escalate to the next support tier. Not only is this process lengthy, inefficient and tedious, but it also presents a more dramatic issue – it is not scalable.

Faced with this dilemma, cognitive operations appear as a new era and the necessary path to take. In this new paradigm, the implementation of closed loops enables the full path automation, from sensing to confirming and then acting.

Network technician's workforce is supported by a new set of exceptional tools that will:

- Be able to predict problems before they impact customer service;
- Enable a 360-degree view of the problem, with details of the alarms, performance measures, related TTKs, recent change requests on the component, weather information, social buzz, service impact analysis and more (as shown on **Figure 5**);
- Track actions that are taken autonomously on the network by reconfiguring or repairing in case of failure;
- Access advanced troubleshooting issues that autonomously diagnose problems by pointing to root causes and possible action for resolution;
- Make use of bots that guide the resolution process.

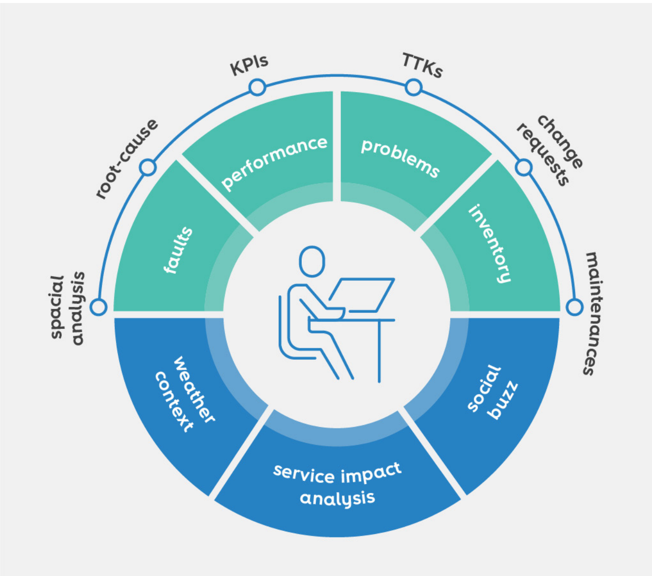


Figure 5 – A 360-degree view

From sensing to acting, the whole process can be completely autonomous or require human action in case of uncertainty or confirmation of the next step to take.

However, the decision to depend on whether or not a human intervention is necessary should be based on analytical criteria and the level of confidence, which can be obtained from the feedback of the sense-confirm-act cycle. If this value is above a predefined threshold, full automation is suggested. On the other hand, a degradation on this rate might indicate that the flow may require a human review.

Use case #4
city governance center for smart cities

Population growth rates in urban areas predict that the complex ecosystem will become more and more unsustainable, with the increase of environmental deterioration, traffic congestion, resource exhaustion, demanding urgent solutions to deal with the optimization of resources in a more ecological environment.

The solutions that are being studied and started to be implemented in several cities, most of them using IoT technology as the basic infrastructure, must be able to cope with different domains that today are seen as independent vertical ecosystems.

Examples of several implementation scenarios can be found in different municipalities

Smart street lighting

Where there is a variation on the level of intensity in the public lights according to the external environment like weather conditions, people's presence and proximity, programmed public events and others

Smart electricity management

By using smart meters and actuators in a mesh network where electricity can be increased to places where is more needed in a specific occasion or even autocorrect possible cuts in particular areas

Smart waste

By using garbage sensors to detect if a garbage container is almost full or even to predict when it will be full, also helping in pest control management

Water management

By detecting leaks and failures

Traffic control

By detecting and controlling congestion

Smart parking

By having parking meter and parking spots sensors, informing when a specific parking space is free or will be free to be used

Environment management

By collecting / tracking air quality

Smart buildings

Public safety

...

The number of scenarios where IoT vertical solutions are being implemented in the field is increasing rapidly. To optimize the management of these separate domains, a central governance center must be implemented, similar to the current Telco's SOC/NOC centers. These city governance centers will have a 360-degree view of everything happening in the urban environment, collecting and processing data and events from these IoT 'networks', and centralizing all the needed operational activities. Additionally, potentiated by this integrated view, new synergies can be implemented to enhance operational efficiency. For instance, the allocation of the field teams could be driven by the already known faults to be repaired and the needed cross-domains maintenance activities in the same geographical area.

This cross-sectional view, as well as the ability to access cross data between the various domains, enable the identification and implementation of future added-value use cases.

Use case #5
industry 4.0 predictive management

The emerging of 5G mobile networks will be the major contribution to enable the fourth industrial revolution, by combining high bandwidth and low-latency in a highly reliable mobile network. Industry 4.0 will be introduced to new automated manufacturing processes and also new connectivity needs between involved actors (systems, machines, and people).

A “smart factory” will use massive IoT solutions to track and manage manufactured goods, with products being monitored at every stage of production and distribution. It will start with the management of the supply chain, including integration with ERP systems, tracking all the manufacturing process (from the assembly line to product completion), all the way until delivery to the customer, and including distribution. This process will result in a high amount of data collected from sensors (monitoring manufacture machines, environment conditions, etc.), and this data can be processed by an AI system to enable new management scenarios that enhance manufacture productivity. For instance, the prediction of a machine malfunction in the near future, improvement of quality control, optimization of spare parts delivery, energy consumption management, etc.

Robotics, along with Augmented Reality/Virtual Reality (AR/VR) technology, will allow many manual activities to evolve by introducing automation or at least new tools that will facilitate human intervention. For example, a manual repair of a specific machine can be conducted by an AR/VR system, or even allowing to perform safety-critical activities using robots that can be remotely controlled in real-time.

This advanced ecosystem needs not only a highly reliable 5G communication infrastructure and actors that are ready and in place to use this technology but also an integrated platform capable of collecting high amounts of data, with intelligence and decision-making capabilities, to enable a highly efficient industrial process. An Industry 4.0 Operational Platforms of the future has to be ready to deliver a high-value solution for this type of ecosystem. Given the similarity of requirements and evolutionary aspects, of tomorrow’s OSS platforms, their use could also be prepared and also applied in Industry 4.0 scenarios.

Altice Labs OSS solution

Altice Labs "NOSSIS One" solution is a new generation of OSSs that focuses on agility, operations efficiency, and customer experience to help the operator achieving digital transformation. Through an open and modular architecture, it is responsible for a complete set of operational processes, at network and service level, that covers the main activity cycles, providing agility with fast delivery tasks, contributing to enhancing the customer experience.

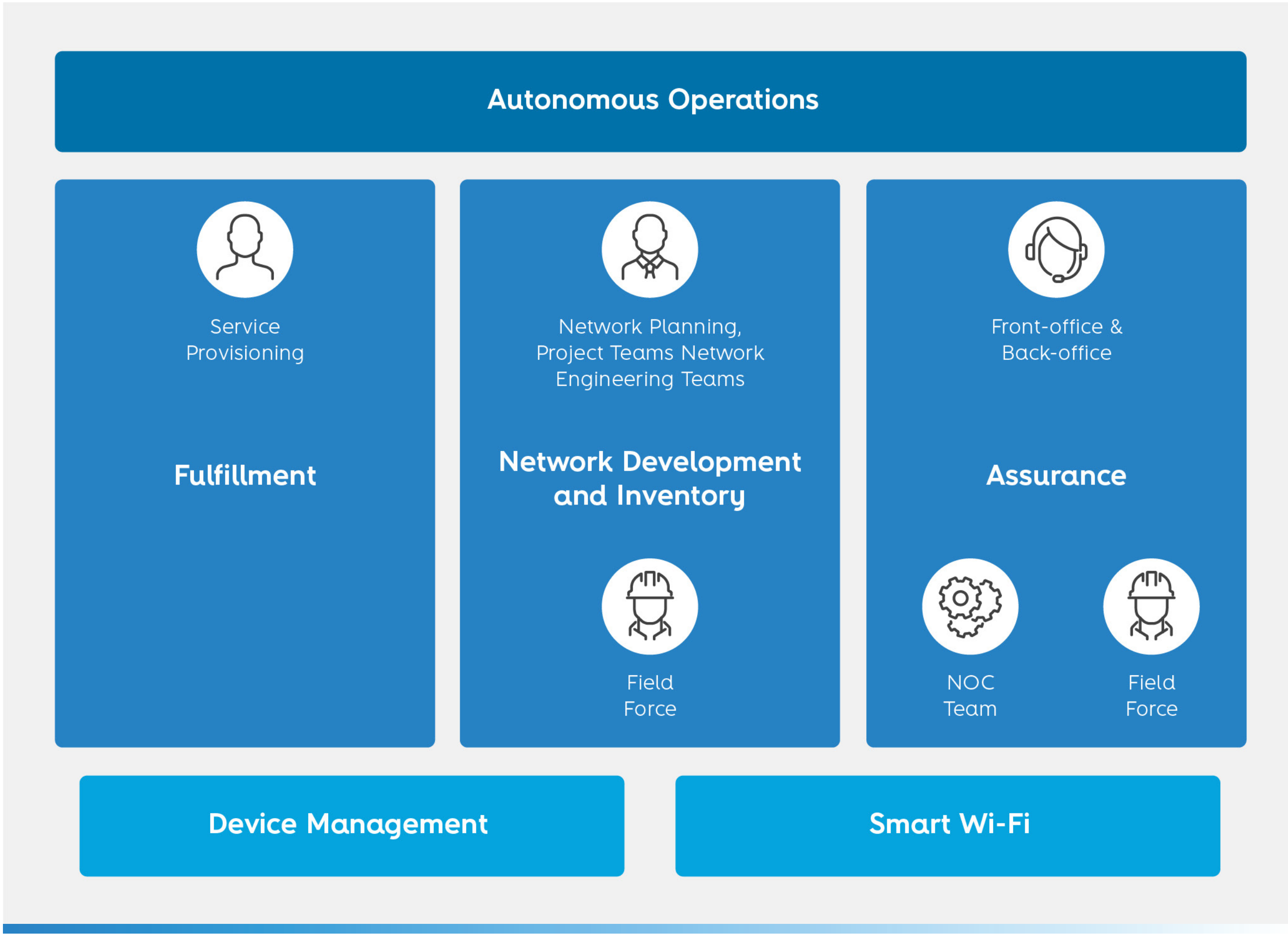


Figure 6 – NOSSIS One architecture

NOSSIS One enables:

- Hybrid ecosystems support (management and maintenance of traditional and virtualized networks in an integrated way as well as of the services supported on it);
- Architectural agility through a microservices architecture, with a “cloudification” approach and exposure of APIs enabling fast integration;
- Cognitive infusion through capabilities supported by AI technology and ML techniques, to provide autonomous mechanisms optimizing processes and operations efficiency;
- Autonomic closed-control loops, with automated and intelligent self-healing, self-optimization and self-protection (self-x) of services, to guarantee service availability and maximize assets usage efficiency;
- Intelligent decision mechanisms using data sensing information and knowledge learning for determining actions for self-x scenarios;
- Unified e2e processes for multiple technology & business segments (B2B, B2C);
- Unified asset mediation to integrate with the resource and service assets independently of technologies and vendors, either for actuation and sensing;
- Ability to promote excellence in operational efficiency, reducing costs while increasing speed and agility for new service creation and high automation of service provision.

The future of operations is data-driven, intelligent and autonomous. In a word, it is cognitive. Following this vision, Altice Labs OSS solution is becoming a cognitive-infused service platform, able to create new operational insights and create conditions for autonomous decision or advanced human decision support, a new dimension of operational efficiency.

References

T. McElligott, “Frameworks and Standards are Required for AI,” TM Forum, 2019. [Online]. Available: https://inform.tmforum.org/insights/2019/09/frameworks-and-standards-are-required-for-ai/.

U. Mangla, S. Sadagopan, and M. Thomas, “Cognitive Network and Service Operations,” IBM Telecommunications, Media and Entertainment. 2017.

Acronyms

AI	Artificial Intelligence
API	Application Programming Interface
AR/VR	Augmented Reality/Virtual Reality
B2B	Business-To-Business
B2C	Business-To-Consumer
BOM	Bill Of Materials
BOT	Web Robot
Capex	Capital Expenditure
CI/CD	Continuous Integration, Continuous Delivery
CSP	Customer Service Provider
DSP	Digital Service Provider
E2E	End-to-End
FTTH	Fiber To The Home
GIS	Geographic Information System
GPON	Gigabit Passive Optical Network
IoT	Internet of Things
KPI	Key Performance Indicator
ML	Machine Learning
MTTR	Mean Time To Repair
NE	Network Element
NFV	Network Function Virtualization
NOC	Network Operation Center
Opex	Operational Expenditure
OSS	Operations Support Systems
P2P	Point-To-Point
RFID	Radio Frequency Identification
SDN	Software-Defined Networks
SOC	Service Operation Center
STB	Set-Top-Box
TTK	Trouble Ticket

Contacts

Address
Rua Eng. José Ferreira Pinto Basto
3810 - 106 Aveiro (PORTUGAL)

Phone
+351 234 403 200

Media
contact@alticelabs.com
www.alticelabs.com