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# OSS for Lean Operators

2020

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Telefónica, Internet Para Todos (IpT), Facebook and everis have decided to launch the next-generation operation support systems (OSS), pioneering in creating a new open source-based stack, which will enable the new operator IpT to operate its hybrid network.

IpT is a social responsibility initiative by Telefónica to take broadband Internet and value-added services to the most remote areas where telecommunications are not usually available and generate new business opportunities for the company.

The nature of IpT as a company and its business model require low-cost structures, without affecting the network's quality and services, thus making it a lean operator. To this end, it must rely on disruptive technologies, such as artificial intelligence, advanced network analytics, machine learning and open-source solutions.

Furthermore, this next-generation OSS must be flexible and open enough to foster new business models among the ecosystem of participating partners: traditional network operators, IpT and providers that implement and integrate network and IT solutions. These business models will be a must in the near future in order to tap into the monetisation opportunities that will become available with 5G and virtualised networks.

IpT therefore requires a high degree of innovation to respond to the need for efficiency and flexibility, and allows Telefónica to try new technologies and paradigms that are subsequently applied in their local operations.



# 01

## Current issues

# 01

## Current issues

The telecommunications industry is welcoming and adopting next generations and network technologies, such as 5G, vRAN/OpenRAN and SDN, which represent an opportunity for unprecedented growth in which Operational Support Systems (OSS) will play a key role in monetising these opportunities at scale.

Current OSSs are from a time when operators' main business was to build and operate the network and their role was to make network operation as efficient and reliable as possible. These OSSs can be characterised as follows:

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• **Vertical application:** Most of the OSSs created until a few days ago consist of vertical applications that cover a specific functional area and are integrated horizontally to interoperate. This approach implies that the changes needed to implement new services are slow, costly and complex.
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• **High degree of manual configuration:** Traditional OSSs are often based on Command-Line Interfaces (CLI) for executing activities and solving specific issues. This requires numerous validations and manual tasks to ensure the end-to-end operation of a given process.
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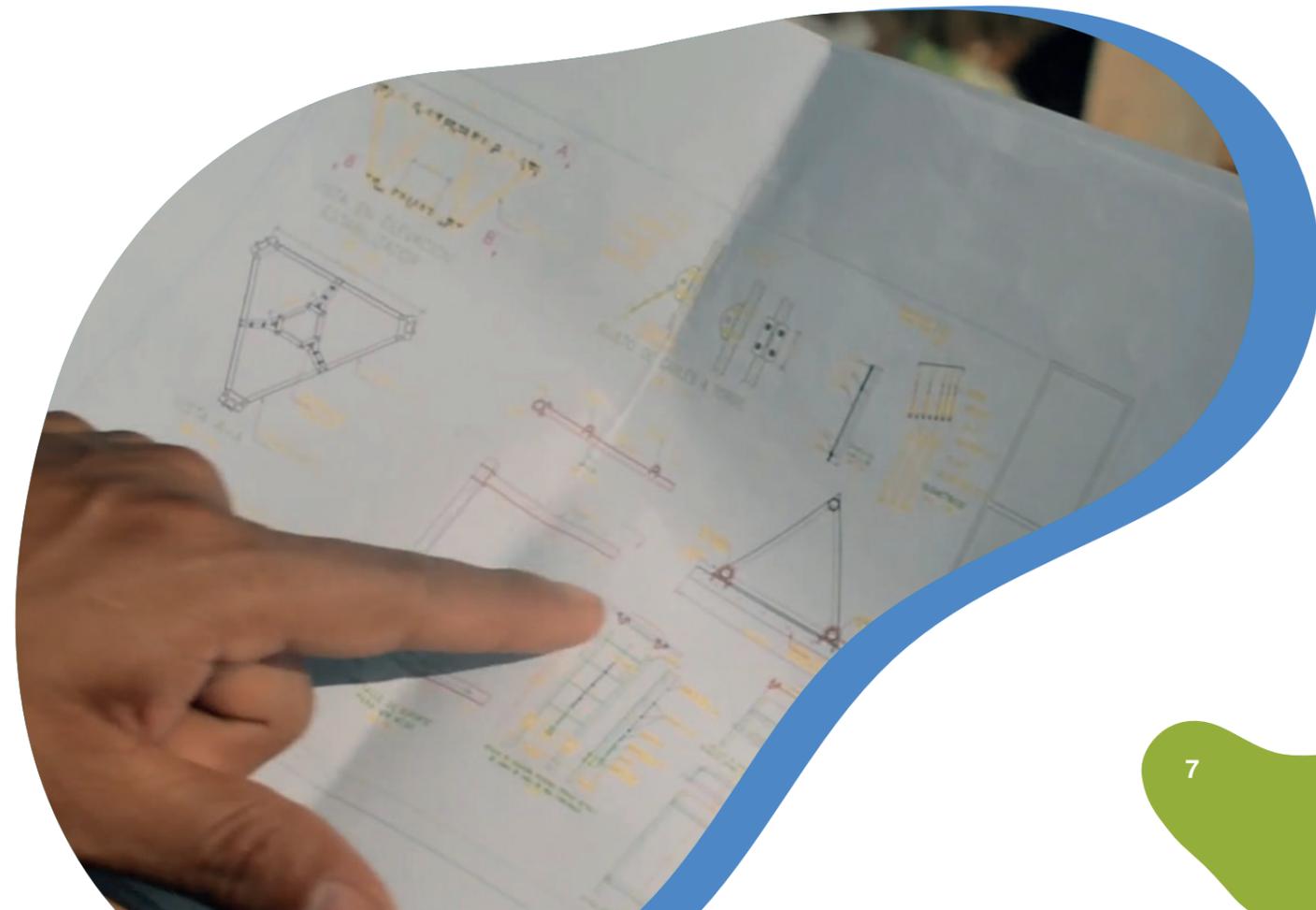
• **Isolated and inconsistent data pools:** OSSs' vertical nature causes us to have distorted ideas of the network, which are specific to a given functional area. Furthermore, there is a lack of consistency, making it difficult to combine such ideas to have a more holistic idea of the network.
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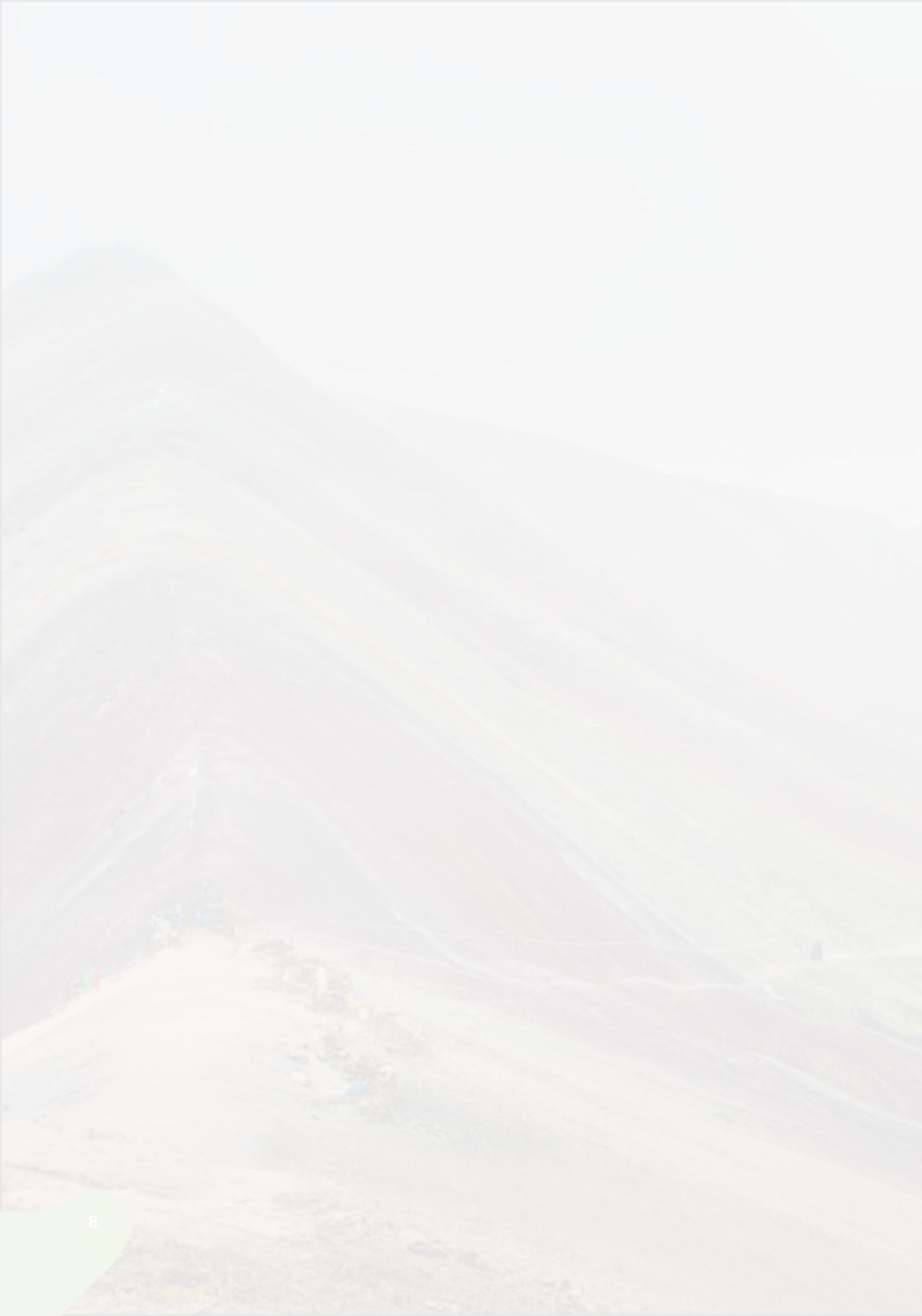
• **Slow, costly integration:** Traditional OSSs lack the ability to display their capacities via well-defined interfaces, thus requiring many end-to-end integrations, which are costly and not very usable.
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• **High implementation cost:** The traditional model is based on vertical applications that integrate Commercial and off the Shelf (COTS) software and custom developments to cover a functional area, which require a high investment to cover each part individually.

However, in the current digital wave we are experiencing, we can observe that operators' business is considerably more complex and dynamic, and to this end, OSSs' role is broader. New OSSs' role is to connect business, client and partner systems to the underlying infrastructure provided by digital and connectivity services.

It is apparent that a new, more radical approach is needed for operators to achieve their efficiency and agility objectives. A next-generation OSS is needed, which adopts new technologies and architectural patterns, such as data analytics, microservice-based approaches, OPEN APIs, open source, virtualisation and cloud architectures.





02

Opportunity

# 02 Opportunity

Telco operators of the future will need to be agile, flexible and efficient. New products and services will be co-created with the clients themselves to cover a unique, specific need. Offers will be created based on multiple partners' products and services and partners will share catalogue data and use in an open, reliable way. Pay-per-use, As-a-Service and revenue sharing models will have to be supported and will require flexible contract and licensing models.

The time it takes to implement new functionalities is one of the essential aspects for improving agility. Today's telecommunications industry operates on a timescale in which network software changes are performed every so many months and require long periods of testing and certification. Next-generation OSSs will have to work on a different timescale.

- They will have to be able to on-board new functionalities or services while adapting systems very little.
- On-boarding, testing and verifying new features will be low cost and their automation will be necessary.
- Releases will be even more frequent, even daily, meaning that the DevOps paradigm may need to be adopted.

In this context, next-generation OSSs have to respond to the efficiency, flexibility and agility required by new business models and network technologies. We have structured this into the following three pillars:



## 1. Agility: Be more agile managing new services

- Interoperable architecture enabling plug and play for new components.
- Use open APIs to ensure interoperability between components.
- Continuous development and integration of new applications with open interfaces.
- Minimise operating environment complexity.
- DevOps Model with a holistic view of all processes.



## 2. Operating efficiency: Mass automation of operating processes

- Manage data-driven decision making processes.
- Unique view with feedback and automatic integration between all processes and services.
- Exploit AI/ML to automate processes and implement predictive analysis capabilities.
- Support automation to generate close-control-loop operations.



## 3.3. Cost-efficiency: Minimise the cost structure

- Initial investment is minimised by using platforms that grow as needed.
- Cost scaling linked to increased needs and actual resource use observed.
- Analytics and integration architecture that can minimise adaptation, evolution and maintenance efforts and costs.





03

Strategy

# 03 Strategy

Innovation strategy will be based on design principles that enable the flexibility, agility and efficiency required and will materialise as a foundation architecture comprising several uncoupled horizontal levels. The functional models that cover the OSS perimeter will be built on this functional architecture in accordance with the operator's specific use case.

## 3.1 Design guidelines

This next-generation OSS is based on the following design principles:

- **Event-Driven Architecture:** Data as the core of a common architecture on which the microservices that support the operating processes are built.
- **Automation / Zero Touch Operation / AI Op:** Generate automation in the operating processes with data-based actions (Closed-Loop AI operation).
- **Cloud:** Distributed and scalable models with cloud resources.
- **Open-Source Solutions:** Open solutions that allow solution integration.
- **Network virtualisation:** New SW-based network services that operate in synergy with IT systems.
- **Security:** Ensure data security and protection.
- **DevOps:** Continuous evolution models CI/CD.

## Event Driven Architecture:

Event-driven architecture's objective is to establish information and data as the centre of the operation so that applications can be created around them. Said applications can aggregate and process all business data (batch loading, data streaming, manual uploads) and operating data in an integrated manner, setting automatic processes that support the operating processes.

This architecture provides flexibility to grow sustainably in the functional domains needed for the operation. It provides the following characteristics:

- **Customer-centred:** We can identify our customers' experience with aggregated and integrated data.
- **Real Time:** Having real-time events to decide when and how to perform actions.
- **Scalability:** Event-driven architecture is based on open code and is on the cloud, and scalability is one of its attributes.
- **Automation:** Enables automatic decision making based on the full network information.
- **Predictive analytics:** Provides data enriched by machine learning-based predictive analytics.



### Automation, Zero Touch Operation:

Operators face a huge challenge in terms of automation, taking into account the complex nature of current hybrid networks and the operating processes they require. Furthermore, the arrival of 5G leads us to a more dispersed mobile access network with a higher number of network elements, where data volume deriving from such will be increased by several orders of magnitude.

A Zero-Touch and Data-Driven Operation supported by disruptive technologies will be the only way to scale the operation and provide it with the flexibility that new network technologies will require.

Use cases must be implemented and more technologies that combine Data Analytics and different types of Artificial Intelligence must be gradually included to achieve Zero-Touch Operations:

- Managing large volumes of data and detecting anomaly patterns.
- Predicting and preventing network outages and service degradation.
- Monitoring the experience perceived by the client (QoE) and proactively acting to improve it.
- Automatically resolving, scaling and self-recovering from service outages based on network alarms and events.

### Cloud movement

The main benefit of taking OSSs to the cloud is being able to dynamically scale in accordance with the infrastructure resource demand. We must not forget that it will also reduce the Time-To-Market by launching new services and provide greater flexibility when assigning capital expenditure (CAPEX) for new high-risk services

Next-generation OSSs' horizontal nature and degree of coupling will allow transitioning through scenarios in which some components belong on-premise, like those that need data to be handled in real time and are even closer to the network, and others in the cloud, which could be public, private or a combination of both, according to both.

### OpenSource

The importance of open-source solutions, and the communities they have created, has grown exponentially in the OSS ecosystem in recent years. These open-source groups work in areas that complement the role of other industry fora and standards bodies such as TM Forum or 3GPP.

There are different types of open-source next-generation OSS projects:

- **Components:** They address an architectural issue or specific functional area where open-source solutions can be consumed as an atomic entity (e.g. Apache Project, ELK, Camunda BPM).
- **Platforms:** They provide a platform whose scope covers several components as a framework and can satisfy the needs of a wide range of operators (ONAP, ETSIT-OSM, OpenStack).
- **Open-source platforms:** They provide access to platforms where interoperability and integration between different platforms and components can be tested and validated (e.g. LFN-OPNFV).

For the OSS domain, the first type is the one that is best suited initially, but as we go down towards the virtualised infrastructure and function management and operation level, the latter two scenarios are applied more.

Open-source solutions enable innovation based on an agile, iterative model and mean numerous benefits for vendors and operators alike, i.e. they are a way of sharing investment or are a route for solving common problems quickly, simply, ensuring quality.

Furthermore, communities and consortia Such as Telecom Infra Project (TIP), ETSI-OSM or Linux Foundation Networking (LFN) enable different collaborative projects that can generate an end-to-end view in a certain domain and break silos.

### Network virtualisation:

New next-generation OSS must be prepared to be integrated with platforms that manage end-to-end virtualised network functions (VNFs) and drivers that can program networking devices as software elements.

To this end, all management abilities from the IT world must be taken to the new services and network functions.

### Security and privacy

Data must always be protected and secure with different levels of anonymisation or coding in accordance with the nature and privacy requirements for each data type.

Similarly, APIs that display event-driven architecture must be secured via open standards or mechanisms that ensure secure access to the ecosystem of partners that participate in the operation.

### DevOps

A delivery and operation model based on DevOps practice is needed to respond to the agility and elasticity challenges required by the project. This practice can work alongside the development and operations teams on a CI/CD model.

With this model, products are evolved based on the actual business needs with shorter development cycles, quicker innovation and greater efficiency and without large economic barriers to the integration of new functionalities.

Additionally, the use of DevOps entails cultural and architectural challenges. An agile management platform is needed to visualise the product backlog, dashboards and executive reports, as well as the Kanban operations management boards, on which all project members can monitor the plan and actions transparently.

### 3.2 Foundation architecture

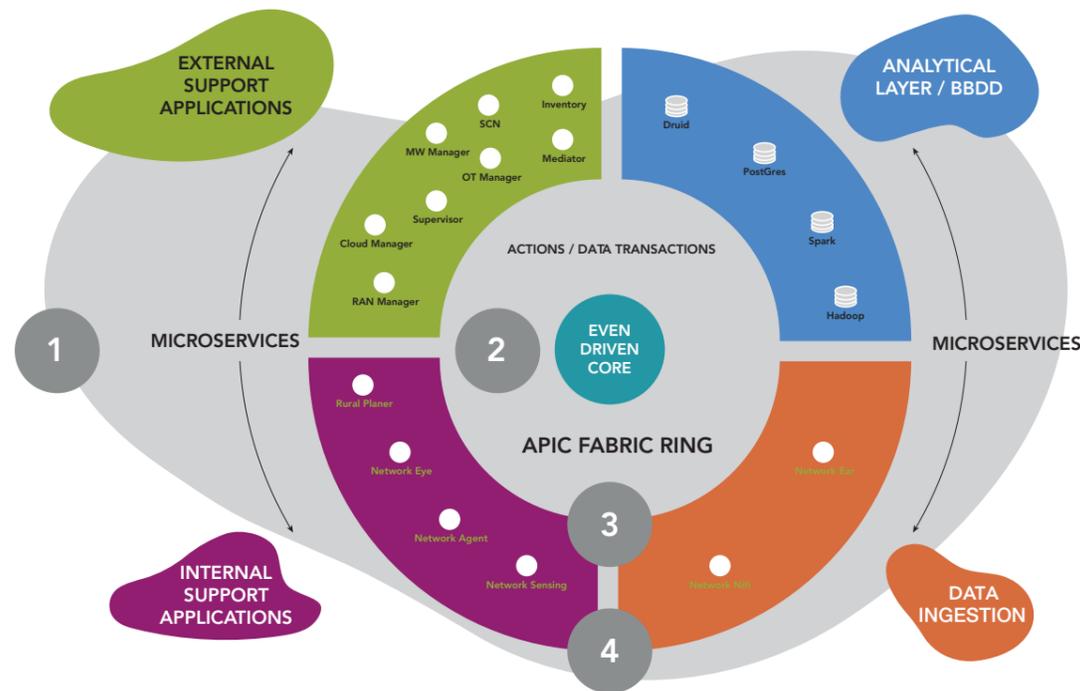
Foundation architecture represents the analytical core (cognitive layer) and the uncoupling and integration layer (event-driven architecture) on which the different functional modules that support the operation are implemented and enable the Closed-Loop Automation or Zero-Touch Operation concept.

It enables KPI/KQI monitoring/reports, identifying KPI/KQI degradation, generating/enriching/notifying alarms, among others. This architecture is the basis for supporting different network lifecycle management processes as well as providing flexibility to develop it based on new business requirements.

Foundation architecture is based on the following design principles:

- **Customer-Centred:** We can identify our customers' experience with aggregated and integrated data.
- **Real-Time:** Having real-time events to decide when and how to perform actions.
- **Scalability:** Event-driven architecture is based on open code and is on the cloud, and scalability is one of its attributes.
- **Automation:** Enables automatic decision making based on the full network information.
- **Predictive analytics:** Provides data enriched by machine learning-based predictive analytics.
- **Uncoupling and integration architecture:** Can minimise dependency between components and handle different evolution rhythms.
- **Functional modules on the foundation architecture:** Use cases can be deployed gradually on it.





### Event-driven architecture

Allows bidirectional communication between functional models and the cognitive architecture. It is composed of:

- **Integration microservices:** They are automatic processes that synchronise data from different modules via a message queue or by accessing the data library corresponding to each use case. The microservice architecture provides flexibility and scalability.
- **API Management:** It can uncouple the functionalities implemented and define how to display the data to the internal components and external platforms in a standardised manner, thus centralising communication, homogenising the interaction method and data model between the various actors.

### Cognitive layer

The cognitive layer consists of different horizontal components and can exploit the data on all operation flows. Furthermore, it is a data source for predictive algorithms that automates the operation via business rules and policies.

It is composed of the following components:

- **Ingestion:** Sources are consumed and modelled in “real time” to later be published in the solution’s message bus. To this end, the data from network managers (PM/FM/IM/CM), Quality of Service (QoS), data dictionaries and catalogues in their different formats (SNMP/CORBA/XML/CSV) are available in the architecture to be processed and reused in their different use cases. This design means that the data is ingested just once and is available for all use cases that require it.
- **Processing:** On this layer, there are stream and batch data processing engines and it is where the calculations, methodologies, aggregations, enrichments, etc., are implemented which support the requirements for each use case. On this layer, KPI/KQI/CEI are enriched with network, location and user data, correlation rules are implemented and alarms are generated. Machine Learning, capacity planning, automated RCA could be implemented in this area in accordance with the project needs.
- **Analytical data store:** It comprises one or several libraries that store the calculated indicators, alarms and generally all data so that it can be viewed via the visualisation tool or external applications. Different technologies will be used as a data library depending on the nature of the data and its consumption method, such as:
  - Time series databases: They are especially useful for handling metrics (e.g. performance indicators or service quality).
  - Data warehouses: Proven efficient in managing and processing data batches. They are useful for offline analysis like capacity planning, prioritising network rollouts based on business data, etc.
- **Visualisation:** Data can be explored and exploited via a graphical login interface with access to the data visualisation dashboards and the use cases implemented. This layer supports the visualisation dashboards, among others, to analyse user types, evolution, devices or business or technical KPIs, on a general and individual scale.
- **Cloud:** All architecture components can be deployed on a virtualised infrastructure or on public or private cloud environments. The developed microservices, use cases that are implemented and utilities that are installed will be orchestrated by Kubernetes, except those incompatible with this technology.



**04**

**Use  
cases**

# 04 Use cases

This new OSS architecture approach is especially applicable to operators that seek the following objectives:

- Low-cost structures, which enable competitive prices.
- Network quality so as not to breach regulatory body requirements.
- Business models based on partner ecosystems.
- Innovation and agility in evolution.

Different types of Mobile Virtual Network Operators (MVNO), i.e. operators who deal with wholesale business, pure infrastructure operators or mobile telephony operators in rural areas, can undoubtedly cover their agility, efficiency and flexibility objectives from the moment this new OSS approach is adopted.

## 4.1 Case study: Internet Para Todos Peru

Internet Para Todos (IpT) is an initiative promoted by Telefónica Perú and Telefónica Global to expand 3G and 4G mobile broadband service coverage to the most remote areas where telecommunications are not usually available in the bid to have a social impact in these regions and generate new business opportunities for the company.

Thanks to the current legislation on rural mobile operators, IpT will be responsible for deploying the mobile network infrastructure based on a new model that enables it to operate as a low-cost operator without affecting quality.

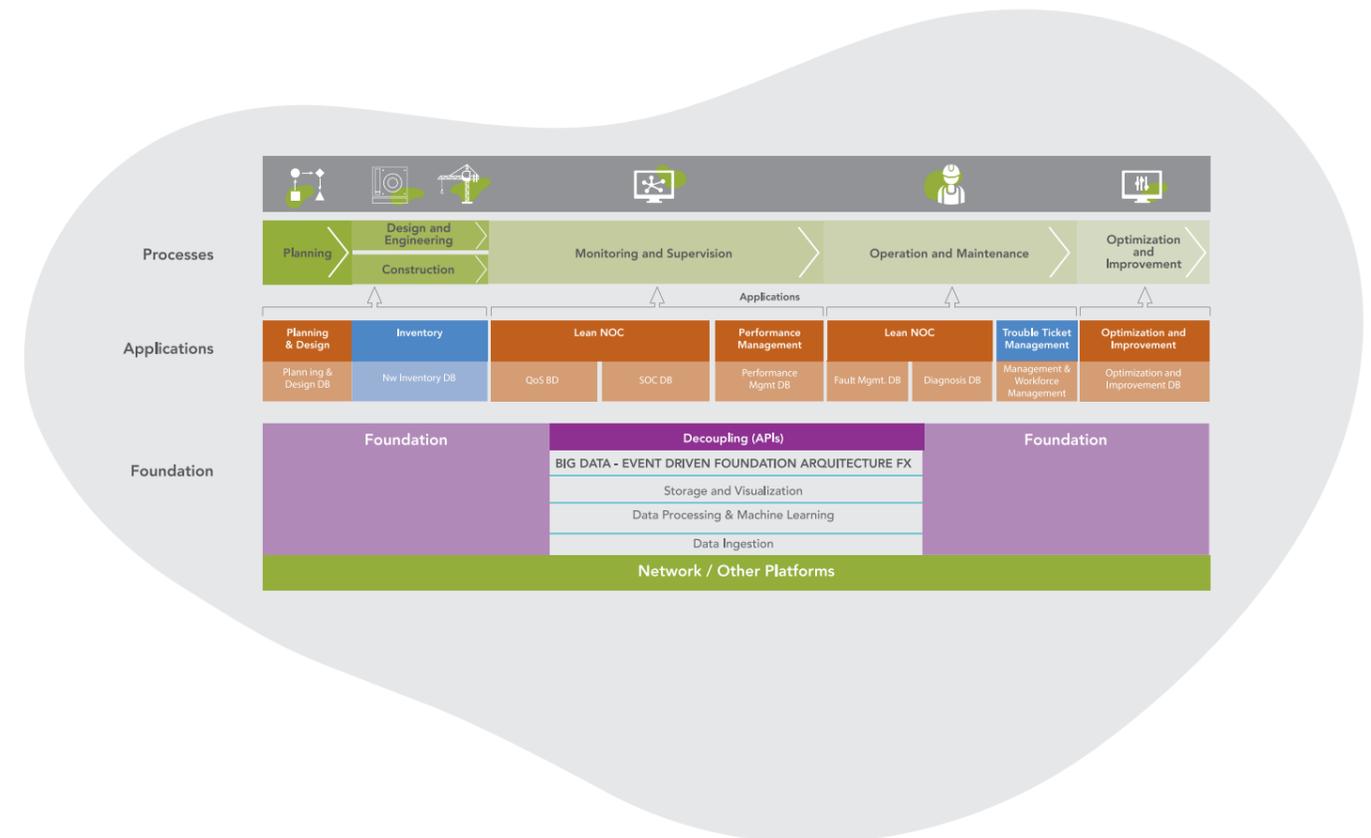
As part of its launch and expansion plan, IpT needs to define, build and begin operations for a new stack of IT systems whose function is to support all processes related to deploying a mobile network infrastructure in rural areas, covering IpT's needs regarding operations support systems (OSS).

It is important to highlight that IpT aims for a sustainable, open model that allows the activities and operative processes implemented to grow efficiently, based on an initial basic, cost-optimised implementation.

To cover this need, and taking advantage of the operator's greenfield nature, an innovative and disruptive OSS strategy was selected, based on the foundation architecture and design principles described above.

## 4.2 Vertical applications

The functional (vertical) applications and models are deployed progressively, prioritising the most critical use cases for the deployment and network operations. To this end, the functional models Inventory, Workforce Management (WFM) and Lean Network Operation Centre (NOC) have been prioritised.



### Inventory

IpT's main activity is linked to mobile infrastructure management with a Rural Mobile Infrastructure Operator model, for which an inventory solution is needed, which can manage all elements associated with the deployments within the IpT Perú perimeter.

To this end, an initial implementation that was fairly light in terms of functionality and indeed costs was proposed and a backlog of functionalities to be implemented in subsequent sprints was defined.

Selecting the inventory tool was a critical matter. To this end, an assessment process based on technical and functional criteria was carried out:

TECHNICAL	FUNCTIONAL
<ul style="list-style-type: none"> <li>• Security</li> <li>• Integration</li> <li>• Execution</li> <li>• Operation</li> <li>• Infraestructure</li> <li>• Development</li> </ul>	<ul style="list-style-type: none"> <li>• Characteristics required by IpT, such as:               <ul style="list-style-type: none"> <li>- Infrastructure inventory</li> <li>- Hierarchical inventory</li> <li>- Ability to support access networks</li> <li>- Visualisation</li> <li>- Registry</li> </ul> </li> </ul>

The following two tools best covered the assessment criteria:

- **Active and Available Inventory (A&AI):** It is an ONAP subsystem that provides real-time views of the resources and services and their relationships. AAI does not only consist of a registry of active available and assigned elements, it also keeps updated views of the multidimensional relationships between these assets, including its relevance for different ONAP components. In its Telco Lab, everis uncoupled A&AI from the ONAP architecture, generating a stand-alone accelerator that minimises implementation times and covers the objectives expected for IpT.
- **Facebook IM:** A Facebook tool that provides a hierarchical resource inventory with a graphical interface and which provides capacities to link elements. everis is collaborating within the framework of Facebook Connectivity's Telecom Infra Project to develop and improve this module, which is also considered a valid alternative for the objectives put forward by IpT.

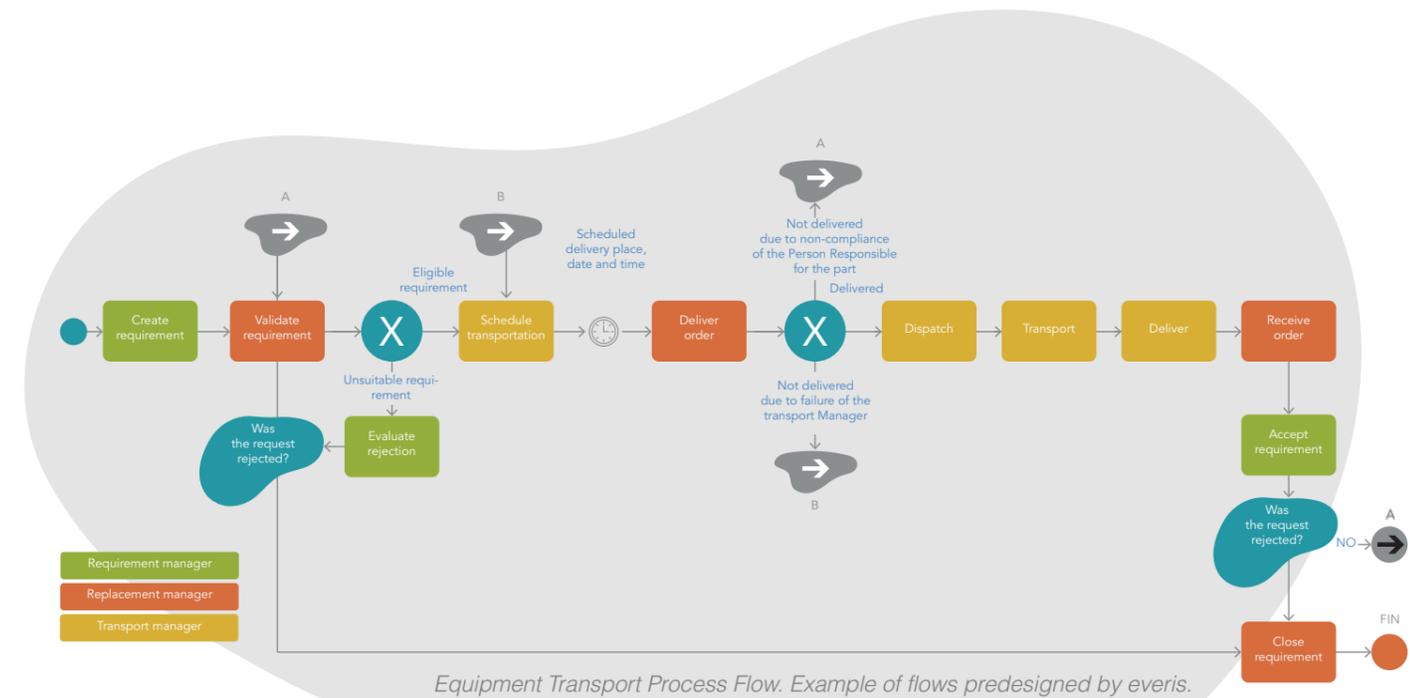
### Work Flow Management

As the company responsible for the mobile infrastructure deployment operation, IpT needs to have a Work Flow Management solution that can manage all work from operating processes associated with network deployment and maintenance.

For this module, everis initially proposed JIRA, an open and flexible solution, which is not designed for specific processes and which would enable a holistic view of the business (common management of logistics, procurement, operation and maintenance processes, etc.).

everis gave the project access to flows predesigned in JIRA, which included processes prioritised by IpT:

- In-situ maintenance and infrastructure deployment (both programmed and non-programmed).
- Spare parts, spare part transport and team transport.



Equipment Transport Process Flow. Example of flows predesigned by everis.

On the other hand, based on the partnership between everis and Facebook, enriching the processes implemented in Jira was proposed with help from FBC Platform in specific points where this tool may significantly strengthen some functionalities' performance.

## Lean NOC

The Lean NOC model's objective is to aggregate network operation data related to the different infrastructure elements to be managed by IpT (including access, transport and energy) therefore enabling a comprehensive view of the network situation in order to automate the operating processes for securing the network.

In view of technology enablement, the Lean NOC considers the following:

- Identifying and integrating platforms that generate events with foundation architecture.
- Ingesting data from different platforms covering the corresponding automations.
- Storing the data captured in the data structures designed.
- Processing information via AI/ML algorithms that resolve actual problems and new storage in accordance with needs.
- Presenting a visualisation layer and displaying other modules via microservices.
- Implementing business rules and policies that can automate assurance operations materialising the close-control-loop concept.
- Depending on the needs, this information will be stored again to finally act as an input to the visualisation layer, as well as the microservices that should be used for integration with other services.

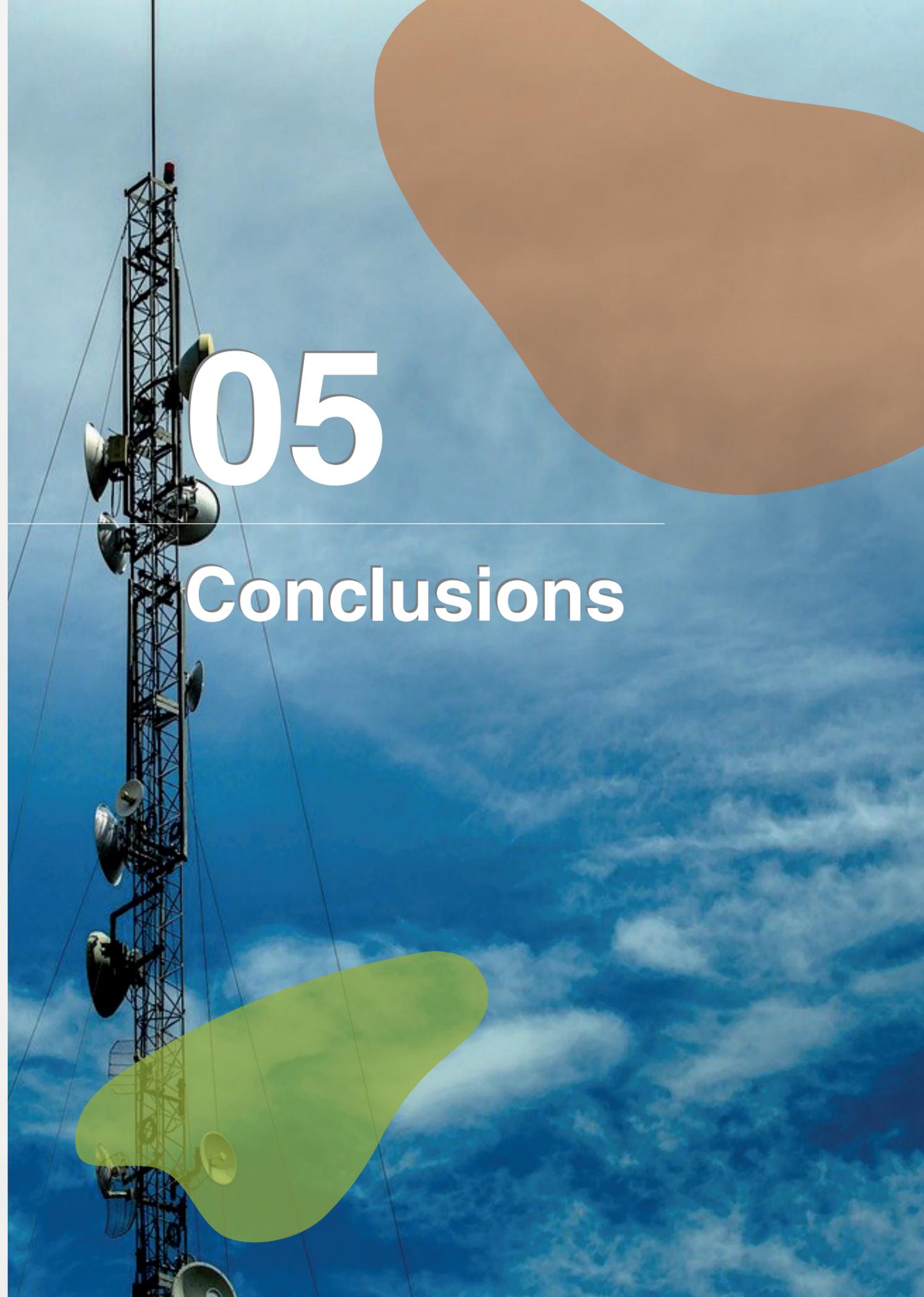
This architecture enables a series of use cases in IpT:

- Alarm and Event Management: It covers all activities needed to manage the millions of event and alarm records that the network generates to suitably coordinate the assistance groups and promote them being resolved:
  - Collecting events and alarms.
  - Adding and deleting alarms.
  - Categorising and prioritising.
  - Event correlation.
  - Alarm enrichment.

- Incident management: It includes the comprehensive model to register, allocate, classify and describe failure attention and solution, covering the automatic cases that are obtained from event correlation and manual cases that are generated by lines.

- Criticality and incident type.
- Determining the impact and the single point of failure.
- Automatic recovery actions.
- Troubleshooting process.
- Recording and documenting failure's cause and effect.
- Creating work flows.

- Complex Event Processing (CEP): It is an everis accelerator implemented with the data structures and formats needed to configure and store the complex event definitions that are required. Furthermore, it provides mechanisms to generate and configure alarms when KPI/KQI degradation or alarms from managers are identified.



05

Conclusions

## 05

## Conclusions

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- Nowadays, operators' business is much more dynamic and complex, and it therefore requires a next-generation OSS that covers the business's agility, flexibility and efficiency requirements.
- Design principles and new technologies such as data analytics, AI/ML, microservices, network virtualisation, open source and cloud will be technological enablers and will be combined in this next-generation of OSSs.
- In the new OSS approach, vertical applications are replaced by a horizontal analytical core on which uncoupled functional modules are built, which support the operation and enable new business models based on partner ecosystems.
- Data play a key role in this approach and data analytics and AI/ML are critical in making the concepts Zero Touch Operation and Close-Control-Loop a reality, which in turn make operating new network technologies viable.
- New low-cost operators or those that focus on a specific niche market are clear candidates to benefit from this approach so as to take advantage of the business opportunities offered by new network technologies (5G, vRAN/ OpenRAN, SDN).
- Operators like Internet Para Todos (IpT) can act like a test bank to experiment and test new technologies and paradigms that are later applied to traditional B2C/B2B network operators.

