



Research

Exhibition

Preparing the future

Research Exhibition book

Digital edition 2021 - March 23rd and 24th

This book contains all the sheets of the demonstrations and conferencies presented at the Research Exhibition.

March 18th, 2021 version



In this book you will find all the sheets of the selected demonstrations for the Research Exhibit 2021.

All of the titles in the summary are clickable links. All contributors' names are also clickable. It will lead you to your email for a quick contact.

The demonstrations and conferencies are classified according to three themes:

9 conferencies

Ambiente intelligence

- C01 - Sensitive, soft and distributed artificial intelligence
- C02 - Detect and characterize cognitive and emotional states
- C03 - AI in Every day's Financial Life: from Europe to Africa

Telco of the future

- C04 - New perspectives for network resilience
- C05 - Foresight 2030: which networks to cope with the world's transitions?
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Responsible digital

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Ambiente intelligence

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Telco of the future

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Responsible digital

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- 024 - Voice Bot in Wolof
- 025 - Ecodesign for Cloud Native Software
- 026 - IoT for Environmental Leverage
- 027 - Enhanced Data Analytics
- 028 - Adaptative Threat Detection
- 029 - IP over LPWAN

Sensitive, soft and distributed artificial intelligence

The dazzling progress of Artificial Intelligence raises many hopes for solving some major problems of humanity, for example in the fields of health or environment, but also raises many fears, such as that of the establishment of a society of surveillance. In line with Orange's raison d'être: «We are the trusted actor who gives each and everyone the keys to a responsible digital world», the conference introduces an approach to Artificial Intelligence that attempts to reconcile technological performance and ethical performance by articulating three major current trends in its development.

Contact

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Conferenciaries

[Return to summary](#)

Detect and characterize cognitive and emotional states

Emotion is a key dimension of user experience, customer relationship, employee well-being; it therefore seems natural to look into the measurement of indicators of emotional state, linked to cognitive state. This also responds to a strong trend that we are observing: more and more tools for measuring emotions (watches, EEG headsets) are being announced and released on the market. But what about their relevance, particularly in the context of Orange services? What do they really measure? Through some significant results from our laboratories, the different measurement approaches (subjective, physiological and behavioral) of emotional and cognitive states are presented. The results underline the complexity of such a measurement and the questions it raises.

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AI in Every day's Financial Life: from Europe to Africa

C-03

Clients' transactions data can serve financial actors in many different ways, they can be a game changer. Today, financial related research and applications focus mainly on clients' profiling, fraud detection or automatic trading optimizations – all of which consider large financial institutions as primary beneficiaries. What about other actors, like the end users themselves? It is their financial behavior traces that are being analyzed after all! What do the scientific community, including Orange, do in the subject of user-centric financial data mining?

Contact

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New perspectives for network resilience

C-04

Few minutes to learn about telecom network resilience. What stakes and technological challenges? How Orange labs research is acting ?

Contact

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Foresight 2030: which networks to cope with the world's transitions?

C-05

The world is currently facing many transitions and our lifestyle, like all economic sectors, will have to adapt. Nevertheless, as many sustainable development goals defined by the United Nations are anchored on digital services, societal stakes are particularly important to network operators. Foreseeing how our networks will cope with the environmental, societal and geopolitical transitions is of utmost importance. As we have started building our own vision of the digital ecosystem by 2030, our objective is to enlarge the debate within Orange and beyond. Indeed, thanks to our collective intelligence and faced with the numerous challenges that lie ahead, can we find a way to a sustainable and attractive future by 2030?

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The 6G construction

C-06

« 6G » : Since recently, this term appears more and more in research publications and conferences, but also in general media. This naturally raises questions, like the followings:

- Why talking about 6G now, when 5G has just been launched?
- When will 6G be available?
- Which new usages will it enable compared to 5G? with which technologies? How is a mobile network technology built?
- Given the debates around 5G, will we make 6G as we made the previous generations?
- What does Orange on 6G ?

This talk will provide our insights, as a player involved in the 6G research and construction process.

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Ecological transition: consumers' aspirations and practices

C-07

To meet the challenges of the ecological transition, all stakeholders are urged to transform their practices. On the consumer side, this translates into numerous invitations to change their daily habits. We are thus observing the emergence of an «ecological habitus», a change in attitudes in consumption behaviours, which is deployed in various ways depending on social categories. To what extent does this habitus concern digital practices? We are observing, in public discourses, the deployment of an abundant array of digital eco-gestures, to which aware consumers often struggle to give meaning and make room in their digital practices.

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Artificial intelligence Law

C-08

Artificial intelligence is a reality that is present and that will continue to prevail, even if there is still a lot to be expected from its applications. European and international institutions have begun to assess the economic, social and societal implications of a technological revolution that will mark the 21st century. This conference is devoted to its legal implications. Without claiming to conceive abstractly of a new normative order, it is a question of taking the measure of current situations, testing the adaptability of current rules, preparing the directions to be taken and the choices to be made, and questioning the methods, between an ethical approach and a regulatory approach.

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Assessing the data economy

C-09

It is generally accepted today that the last decade marked the advent of data. The production of a wide variety of data has gone hand-in-hand with the digitisation of society: personal data, sales data, performance data, data from connected devices, etc. The logical consequence of this movement is that we have entered into a new 'data economy' that takes over from the knowledge and information economy. The data economy is regularly presented as one of the main sources of value creation, a force for innovation and a driver of major transformation in the economy as a whole. But what do we mean by the data economy? What is the value from data based on and what types of assets does it correspond to?

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Federated Acoustic Intelligence

Detect daily events while respecting privacy thanks to embedded sounds recognition and federated learning.

The sound classification makes it possible to recognize sounds in different contexts – domestic, industry, transport, ... - to enrich our futur services based on ambient intelligence. This demonstration shows the use of this technology in a senior residence context. We have prototyped an end-to-end system of which a cat-shaped device to embody the concept of sound recognition. Indeed, the cat is a companion who listens and reacts to sounds while remaining discreet. The embedded recognition models allows for the respect of privacy. It shortens the processing time and reduces the need for connectivity. It also improves energy efficiency of the system. The federated learning is also a way to respect privacy by keeping data where they have been collected while maintaining the recognition performances.

Co-innovation

- Partnership Feichter Electronics

Patents registred

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Intelligence Ambiante

[Return to summary](#)

Enhance tracability and collaboration in the industry 4.0 through digital twin tracking and federation.

Powered by the Internet of Things, Industry 4.0 is now a reality, allowing for improved, self-monitored and optimized production cycles. Thing'in the future, the platform of digital twins for IoT, supports and widens the vision of industry 4.0 by integrating it in its global scope.

Thing in the future includes real-time tracking capabilities, enabling efficient production management for the industry. Digital twin tracking in Thing'in is time and location-aware. Combined with the graph of things and fine-grained Building Information Model capabilities, Thing in the future allows to detect when the status of a twin changes and notify its operators, for instance when a production piece changes location or when its treatment deadline has exceeded.

Thing in the future also facilitates cross-enterprise collaboration and communication (e.g. with suppliers). Each stakeholder can manage its own securized instance of Thing'In, on premise or in the cloud. Federated instances are connected together, achieving the vision of a globally connected graph of things, where actors of the industry can use private or share digital twins depending on their use case.

Co-innovation

- PhD with Institut de Recherche en Informatique et Systèmes Aléatoires (IRISA) for the work on the temporal graph

- MO.DI.FLU project funded by BPI France and the Brittany - Pays de Loire regions in partnership with Prolann, IRISA and Axalon.

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Scan, detect and protect from radio vulnerabilities and attacks inside the home network.

More and more devices from our daily life, sometimes gifted by loved ones, become connected. These objects are sources of insecurity we are not always aware of. Thus, a vacuum cleaner, a lamp or an apparently harmless toy can transmit or receive radio signals without even being connected to the Livebox. For a long time, the approach consisted in increasing the security of devices designed by Orange (Set-Top-Box, Livebox, etc.). However, as a socially responsible company, it is now necessary to go further so that our customers can regain control of their radio environment. To do so, Orange has patented an intelligent radio wave scanner capable of mapping, detecting and countering the vulnerabilities and threats lurking within radio range. Thanks to it, users can protect themselves from a compromise of devices with a low level of security or will be warned in the event of an attack from a malicious neighbor or burglar.

Patents registred

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AI Secured Smart Building

Pro-actively assist users with in situ adaptable AI.

The use of embedded and distributed Artificial Intelligence (AI) in a smart building allows to offer new services closer to the users, particularly in the field of security: more responsive security adapted to different areas, less cloud dependent identification of inappropriate users' behavior. The demonstrator presents a first embodiment of the possibilities offered by the use of embedded AI in connected and distributed objects as close as possible to usage thanks to an open source «edge computing» infrastructure and energy-autonomous nano-computers. The AI functions used to ensure the security of the premises are based in particular on image analysis (detection of objects, semantic description of the environment, fire detection and detection of the posture of people) and on the analysis of vibrations produced on building doors. Applications like those in building management leverage the information published by AIs in the edge computing infrastructure to proactively assist people in the smart building.

Co-innovation

- Open Source project Eclipse ioFog with Edgeworx
- Cooperation with GIPSA-lab Université Grenoble-Alpes, Capgemini, CEA Liten and e-Peas

Patents registred

- 3

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Sensitive and Context Aware Workspace

Understand how aggregating physical and digital workplaces information may simplify employees daily life.

The emergence of ambient intelligence technologies makes it possible to model a person's context in real time. Digital Personal Life, Digital Enterprise and Decision & Knowledge research domains want to provide an «augmented» view of the workspace by aggregating locations environmental data and workstations data too. This aim is supported by the Home'in platform latest evolution, that can expose an aggregated description of such a unified context towards future services.

By relying on this new platform, service designers will be able to benefit from pre-integrated components allowing, amongst other things, to:

- aggregate feedback from digital probes related to workstation activities, including current tasks and subjects discussed, the properties of a document being edited, and more
- assess spatial information such as the number of people in the room and their posture
- enrich the context with inferred data, starting with physical proximity, compliance with business or safety rules, semantic analysis or activity on a terminal

As this platform is scalable, new components will be integrated as needed or as technology evolves. Through scenarios, the demonstration illustrates how new services, by relying on enriched context information, can improve the daily lives of employees.

Patents registred

- 6

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Facilitate citizen participation vis-à-vis city stakeholders

« Thing in the city » is a service based on the sharing of the digital representation of objects from public spaces, assigned to the various players in the city (or concessionaires).

Today the «objects» in the public spaces (equipments, roads, connected objects...) are under different responsibilities, constantly evolving, and exercised at different territorial levels (town hall, inter-municipal, concessionaires, Telecom operators...). By relying on the platform « Thing in the Future », a range of opportunities are available to the players : facilitating access to digital services as close as possible to the user, process optimization. The challenge is to allow the citizen to be «the player of his city» to benefit from local services without having the knowledge about “territorial millefeuille” complexity, while improving the processes of the actors. The feedback of participatory information is illustrated on the territory of the city of Meylan.

Co-innovation

- Partenariat avec ville de Meylan

Contact

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Understand how the company works with HR Big Data.

In a large company, skills are varied and dispersed throughout the organization. It can be difficult to know where a specific skill is, especially as skills change over time. Also finding people working on similar projects in different divisions is just as difficult. In this presentation, the Pleiade tool links entities and projects to themes, represented by skills and keywords. Thus employees visualize, in the form of networks or word's cloud :

- The entities contributing to the company's projects
- The themes addressed by the projects
- Teams developing a given skill

These possibilities are offered by the semantic analysis of the company's big data and allow to better model and understand its way of working. Pleiade is now at a stage of maturity that allows to test, with you the first use cases. Contact us to work together on your co-innovation needs.

Note : this work respects the constraints related to the General Regulation for the Protection of Personal Data.

Patents registred

- 1

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Home Activity Simulator

008

Generate synthetic datasets of daily living at home.

To design a home that is aware of its occupant's ambient context, we typically use artificial intelligence tools that require massive and varied training datasets. Collecting these datasets in real settings is unfortunately quite expensive.

"Home Activity Simulator" proposes to construct these datasets, not by instrumenting real homes, but rather by reproducing them in a 3D simulation, which is much less expensive and much more flexible. Virtual occupants, controlled by automatic planning techniques, perform sequences of daily living activities, while interacting with simulated sensors and objects.

To evaluate the credibility, and thus usefulness, of data generated by those simulated interactions, we compare performances of a human activity recognition system, between synthetic data and real data. This tool can benefit researchers and designers of intelligent home systems to develop, improve, and test their innovations.

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Intelligent Sound Capture

009

Improve user experience by applying Deep Neural Networks to Acoustic Array Processing.

Recently, natural language processing has shown tremendous improvements, most notably due to deep neural networks. Hence, new services or uses may now be envisioned, such as talking to your smartphone or your car, or automatically transcribe speech (for example, the new YouTube subtitle functionality). While this vocal interaction is somehow taken for granted, it actually requires advanced array signal processing when one is far from the recording device. By suppressing the surrounding noise, this processing cleans up the recorded voice, allowing a faithful transcription. In this demonstration, we focus on the use of Deep Neural Networks in the array processing chain, particularly on applying DNNs to speech source separation. Through the Alexa protocol which certifies that a device is efficient enough when heavy noise is present, we show the added value of artificial intelligence compared to standard beamforming, especially when the speaker is far from the device.

Patents registred

- 1

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Fine-grained understanding of opinions expressed in customer comments, whatever the language.

Analyzing opinions expressed in customer feedback is commonly accepted to leverage enhanced Customer Experience. This analysis can be achieved with different granularity levels:

- Is the comment globally positive, negative or mixed?
- Which aspects are mentioned, with which polarity?

Thanks to the latest outcomes of Research in Natural Language Processing, it is now possible to perform fine-grained analysis of opinions and to precisely detect their targets, by identifying the words on which the opinion is expressed.

Alongside, recent neural network approaches allow language to be efficiently modeled through multilingual representations.

Hence, it becomes possible to learn opinion mining models with the ability to process several languages simultaneously, and even to process data in new languages for which no sample was provided for training. We show how this can be applied to process customer feedback expressed in several languages from the Orange footprint.

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Telco of the Future

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Crowdsourced Quality of Experience Monitoring

011

Open quality of experience data for everyone.

Internet encryption is blinding traffic monitoring techniques in networks. This is hindering our capability of pro-actively managing our customer experiences. Relevant monitoring data (e.g. web page load time, video rebuffering occurrences) is however abundantly available to content and application providers. Under the excuse of privacy protection such data is retained under their own control, possibly as part of data retention strategies. Some key content and application providers even provide monitoring portals to network operators, possibly with some bias in the way data is processed and presented. In this demo, using decentralized computing and non-intrusive probes, we show that it's possible to build a participative solution that allows any interested party (end-users, regulation bodies, but also network operators, ...) to access relevant unbiased QoE statistics.

Co-innovation

- ANR project O'Browser with INRIA

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Mobile Investments Optimization

012

Analyze et optimize multi-generation mobile networks evolution strategies.

Mobile affiliates from the Orange Group face a multi-generation context (2G, 3G, 4G, 5G) and have to plan long-term network evolution strategies, typically on a 5-year time-horizon when considering master plans. Relying on three main intertwined dynamics (network investments, spectrum usage and customers' repartition within retail offers) and often driven by various types of guidelines (strategic ambitions, budget or regulatory constraints), finding the « best » evolution strategies is a complex problem of high economical stake.

MIS-Optimizer is a decision-aid tool for mobile network investments strategies analysis and optimization. Based on a mathematical core integrating these dynamics and several scenarios of guidelines, it aims at computing the mobile evolution strategy that yields to a minimum amount of investments. The optimized strategies produced by the tool, as well as key indicators related to network performance, customers or budget are provided to the decision-maker thanks to a user friendly WEB interface.

Today, MIS-Optimizer is ready for use and must be evaluated through field experiments with affiliates. You are currently working in network planning or strategy entities on access network or marketing side? Then contact us for a trial of MIS-Optimizer tool and discover its powerfull optimizations.

Co-innovation

- PhD with Avignon Laboratory in informatics (LIA)

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Federated AI for alerts

Use the potential of Artificial Intelligence for improving the reactivity of alerts for mobile networks.

Why an AI represents an asset for rapid signalling of the alerts in mobile network data?

Our approach admits close-to-real time and local processing (edge mode, as close as possible to antennas) of a mobile network usage dataset, by sharing computed models during the learning phase (during the learning phase, only the model parameters are exchanged with neighboring relays).

Compared to classical centralised AI, three major points of improvement are:

- sensitive data protection (no data circulation in the network);
- computation speed (local calculus and mutualisation of detection models between relays);
- energy efficiency (no data transmissions nor climatization of a centralised server).

The AI is applicable to numerous services at Orange and in other domains (health, transports, finances, etc.).

Co-innovation

- ANR Flash DISCRET with Gustave Eiffel University and Technology University of Troyes

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Fault Diagnosis Discovery

Simplify the discovery of new diagnoses in access networks.

An efficient network fault diagnosis system plays a central role for Orange: it allows a better customer experience and enables a prompt troubleshooting. However, due to an ever growing complexity of networks, the maintenance of a fault diagnosis system becomes in turn more and more complex, especially for creating new diagnosis rules.

To help the discovery of new fault patterns in fixed access networks, we developed a machine learning model based on the “zero-shot learning” paradigm. The specificity of this approach is to run a data exploratory analysis which is guided by a previous knowledge we have on known diagnoses. By applying this method on FTTH data, we were able to highlight new fault patterns which can then be used to build new diagnosis rules and troubleshooting actions.

Co-innovation

- PhD with IMT Atlantique

Patents registered

- 1

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Enable programmable hardware resources for 5G RAN Cloud performance.

Cloud RAN consists of deporting and pooling radio processing on shared servers for a better use of computing resources, more agile operations and thus optimizing costs and energy performance. Some of these processes at the radio physical layer are highly demanding in terms of computing power, which implies high energy consumption. Our approach enables the automatic activation of hardware programmable acceleration resources that are better suited to these processes in terms of performance and energy efficiency. The decoder function associated to the standardized 5G LDPC (Low-Density Parity-Check) forward error correction codes is offloaded on these hardware acceleration resources. Kubernetes-based orchestration is made compatible with the use of an edge computing accelerated heterogeneous infrastructure (CPU, GPU, FPGA) that can be distributed at the edge of the operator's network. This prefigures future Cloud RAN 5G orchestration such as approaches recommended in the O-RAN consortium. Eventually, these infrastructures will be able to accommodate other functions at the edge, like traffic steering, data processing and applications distributed as close as possible to the end-user.

Co-innovation

- IRT b<>com project with Nokia Bell Labs

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5G Beamforming indoor

Simulate beamforming all the way into buildings to optimize 5G coverage.

Beamforming increases effective throughputs by adapting, in real time, the radio morphology of the antennas to the targeted mobile and to the surrounding urban architecture. The optimal deployment of these new technologies requires much more accurate simulations of the propagation of radio waves. Indeed we must be able to anticipate how the surrounding buildings will facilitate or, on the contrary, hinder, the formation of beams, eventually affecting the ability of the antennas to «hit the mark». Orange has been anticipating this change for more than five years and is presenting the only propagation model to date, which is capable of supplying engineering tools with beamforming coverages, fully penetrating buildings where floorplans are available.

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5G Deployment Automation Service

017

Propose to our customers an OpenSource and openness 5G platform to automatically deploy their service and run experimentations.

Beyond improving consumer mobile networks, the 5G performance allows many innovative services in various business fields. In order to accelerate the development of these services, the European commission is funding some experimental platform projects based on 5G technology. The European 5G EVE project is one of them. Our demonstration shows how one vertical sector industry can easily deploy its service and run one experiment on the 5G EVE platform, as well as collect and analyze the performance results. In our demonstration, the vertical could be the Saint-Malo tourist office, which would like to offer one virtual visit of its city.

The demonstration focuses on the 3 different steps allowing him to experience this virtual tour service, which are:

- The use of the portal, aiming at declaring the experience design and the key performance indicators to analyze;
- The automatic deployment of the main components designing the experiment and the 5G network infrastructure;
- The experimentation and the data collection used for the service performance analysis.

The design, the deployment and the operation of the 5G EVE platform are based on the integration and the development of Open Source components, provided by some communities / alliances.

Orange contributes to develop and to operate the 5G EVE French cluster that allows us to increase our expertise in the network virtualization domain and to better understand the needs that our customers are waiting for the 5G.

Co-innovation

- H2020 European project 5G EVE with the IRT b<>com

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5G Quality of Experience Management

018

Forecast and correct the degradation of QoE in 5G slices.

Beyond improving mobile networks, 5G performances and in particular slicing enable many innovative use cases in various sectors such as health. Preserving the quality level of 5G service can be vital in certain contexts such as in case of a connected ambulance. This is a challenge that SliceNet project has been given the opportunity to tackle. A mechanism that aims to predict and correct QoE degradation in 5G has been developed and tested. The targeted scenario begins with a collection and streaming of patient's data from multiple IoT devices and sensors when the ambulance arrives on the place of the incident. Thanks to the developed machine learning model it is possible to predict future degradations of the quality perceived on provisioned E2E slice. The process is automatically triggered and engages involved layers to make effective all necessary changes to the infrastructure.

Co-innovation

- H2020 European Project SLICENET with Dell, Nextworks, Creative Systems Engineering, Universitat Politècnica de Catalunya

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Characterize network resilience in real-time with AI techniques.

Cutting-edge technologies such as network functions virtualization (NFV), raise several questions regarding to resilience management.

This demo presents a tool to characterize network resilience in real-time for container-based services. Network resilience is assessed based on deviations from a nominal state, or reference, for each network layer involved in the end-to-end service delivering. The tool can collect in real-time hundreds of metrics characterizing the state of the underlying infrastructure, containerization layer and end to end service. This demo will be focused on:

- 1) Detection and characterization of network deviations from a nominal state by means of deep learning techniques. This approach allows to identify anomalies when this deviation becomes meaningful.
- 2) Real-time radiography generation to provide a global supervision tailored on the context of the fault. The tool shows the state of physical and virtual layers in a vIMS service, offering a vision on each vIMS function and also resources underneath (e.g. cpu, memory, disk, etc.). This compact radiography representation provides an insight in real-time of the impact of metrics deviations on the service layer.

Co-innovation

- Cooperation with CNAM

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To automatically deploy remote, distributed and centralized RAN units using ONAP.

The virtualization of the Radio Access Network (a.k.a. Cloud RAN) consists of deploying and pooling the radio processing units on centralized servers in order to optimize radio resources utilization, and to achieve costs reduction and energy savings. This new architecture brings a major challenge, since there is a trade-off between the centralization benefits and the fronthaul cost to carry the radio signals from antennas to the computing servers. Today, RAN functions as well as those of the mobile core network have to be adapted and deployed on the fly according to service needs on Cloud infrastructures.

The main innovation of this demo is the proposal and implementation of an optimized and high-performance functional split (based on 3GPP 7.3 split) using open source OAI (Open Air Interface) code. The proposed split keeps the low functions of the physical layer as close as possible to the antennas within a Remote Unit (RU), but moves the upper functions of the physical layer (in particular the channel coding function), as well as those of radio link control and scheduling, higher in the network within a so-called Distributed Unit (DU). Packet convergence and data adaptation functions are then placed on a Centralized Unit (CU). The implemented split shows a significant fronthaul cost reduction as well as a decreased latency when processing of radio frames. Furthermore, the implemented solution relies on containerized RU, DU and CU units and shows how an end-to-end network, involving both Core and RAN, can be automatically deployed on a Cloud infrastructure (e.g. based on Kubernetes) from a service order coming from the core commerce layer. The service order embeds the customer requirements that are converted into deployment orders to be executed by an orchestration platform, namely ONAP (Open Network Automation Platform).

Patents registred

- 2

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Open Digital Architecture initiatives

021

Federate and integrate the solutions of operators and editors.

The Orange group operates in 8 countries in Europe and 19 in Africa and the Middle East. Our IT solutions (Information System) are very diverse. Their evolutions are too often dependent on what the software editor offers or otherwise require long and expensive integration times. In addition, the software transformation of networks and 5G brings business opportunities and innovative services to both mass market (B2C) and enterprise (B2B). To benefit from this, a network as good as it is is not enough, we also need an IT capable of keeping up with the rapid evolution of offers and of managing value chains with partners. We must therefore break free from the proprietary and rigid software stacks of software editors and train the ecosystem towards modular multi-vendor IS, which can be composed as desired and easy to test and deploy. This is the ambition set within TMForum, the ODA - Open Digital Architecture initiative whose layered approach decouples the commercial aspects from the technical aspects of the network. ODA also relies on the implementation of modular components and the exposure of open and secure interfaces between them (APIs). Orange is an active contributor to ODA working groups and to the development of a reference implementation and its promotion. In this context, we explore in research the development of a disruptive commercial catalog (ODACAT) based on the three levels: offers, products and services with a bottom up approach, that is to say that the products are defined from network capacity.

Our demo shows our progress in the development of this catalog. At the target, Orange marketers will be notified as soon as a new feature is activated in the network and will immediately be able to update the catalog of offers. Thus the time to market will be reduced to the great benefit of customers.

Co-innovation

- TM Forum

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Proactive Fiber Break Prediction

022

Classify fiber optic movements based on the state of polarization .

The requirements for future 5G networks create new challenges to ensure the reliability of communication infrastructures at an affordable cost. This is particularly true at the optical physical layer where the usual protection mechanism - called dedicated 1+1 optical protection - causes 50% of the network capacity to be put on standby and duplicates a large part of the resources deployed to enable path separation.

A solution to circumvent this infrastructure overcost while maintaining high availability is to rely on a proactive restoration mechanism where monitoring triggers the configuration of a new route before the failure occurs.

In this framework, we present a method that relies on polarization state monitoring (SOP) via a standard coherent receiver coupled with machine learning for proactive fiber break detection. This method allows a low-complexity real-time detection integrated in the network elements.

We describe the design of the machine learning classifier based on relational data for the construction and automatic selection of variables. We show that the classifier, using a limited subset of variables, can achieve an event classification accuracy of more than 99% for the conditions tested.

Co-innovation

- Projet européen Celtic SENDATE avec Nokia Bell Labs

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Energy Efficient IoT

Boost the energy efficiency of connected objects thanks to our smart network.

Responsible Digital

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Today, to double the data rate of a device, one needs to double its antennas and double or complexify its radio frequency amplifiers. This approach is too costly and energy-greedy for connected objects.

To avoid this effect, we present an innovative object sending 2 messages with 1 amplifier and 1 antenna only. It emits the 1st message as usual and sends the 2nd one without emitting anything else! How? It reconfigures the radiation of its antenna. Each radiation pattern has a “meaning” in bits. At the network side, a 5G antenna is smart enough to recognize a pattern and understand its meaning. This innovation is based on spatial modulation, compact reconfigurable antennas of objects and beamforming.

However, we can go even further!

Today, we get rid of amplifiers, we stop emitting and only keep reconfiguring the antenna. We obtain the first high rate energy-free communicating tag, detectable either by the network or a smartphone. Here is the 1st demonstration of a tag that communicates by recycling the signal emitted by an Ericsson antenna from Orange 5G commercial network.

Co-innovation

- ANR SpatialModulation Project with l’IMT-Atlantique, l’Institut Langevin, l’IN-SA Rennes, ATOS and CentraleSupélec

Patents registred

- 13

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Voice Bot in Wolof

024

Propose a case study of the use of vocal bot, in Wolof, the language of the majority of Senegalese speakers.

Voice interactions are more and more appreciated by users for their practicality and playfulness.

They are essential to enable an illiterate public to access digital services.

In Africa, the illiteracy rate is high and the official language, usually French or English, is spoken by only a minority of the population. Hence the importance of developing a voice bot in the local language, which allows for a much broader target audience.

This project allows to:

- describe the promise of voice technologies applied to the African context ((vehicular languages, about 2000 dialects, high illiteracy rate...))
- explain the technical specificities induced by work on under-endowed vehicular languages (weak corpus, random spelling, plurilingualism, etc...)
- prove the effectiveness of a voice bot in local language.

This test was conducted in collaboration with Orange Senegal, with a voice bot in Wolof (spoken by 90% of Senegalese) on the Orange Senegal customer loyalty program.

This device could be extended to other sub Saharan languages.

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Ecodesign for Cloud Native Software

025

Measure Energy Consumption of Cloud Native Applications.

As its usage increases, the environmental impact of the digital sector also registers an exponential growth. Reducing the energy consumption of the software running in Datacenter is of paramount importance, which requires being able to measure it. Today's state of the art applications are composed of several software components which are hosted on a shared infrastructure, based on containers, and whose deployment is highly dynamic. In these settings it is currently not possible to have a consolidated estimation of the energy consumption of a whole application.

We propose an energy monitoring solution for these applications, with several levels of granularity. Integrating energy measurements into the monitoring of hosting platforms has many important benefits: it allows detecting energy hungry components, identifying and evaluating best practices and investigating the right balance between energy and performance.

Co-innovation

- Cooperation with INRIA Lille

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IoT for Environmental Leverage

026

A replicable solution to acquire and analyze data in order to evaluate the ports environmental impact

The European research project Pixel associates 15 partners. Its main objective is to provide technical and scientific solution to evaluate the port environmental impact. The project is organized around 3 main topics:

- Identify and define the algorithms and scientific models we will use to evaluate the different components of the environmental impact of the port activity ;
- Build an open source and replicable platform with the capability to acquire heterogeneous data and to standardize them. The platform provides the capabilities to allow the scientific algorithms and models to exploit those data ;
- The full solution is deployed and tested in the infrastructure of our 4 pilot ports with 4 main use cases : port environmental impact measurement, energy needs management, intermodal transport, port-city integration.

Co-innovation

- H2020 European Project PIXEL with le Grand Port Maritime de Bordeaux and CATIE

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Enhanced Data Analytics

027

Improve data retention period in privacy-friendly data analytics.

Welcome to a new world where Orange is a Mobile Data Broker, publicly and continuously broadcasting its knowledge about individuals' location, while fully protecting their privacy. Any third party can now play with those data to make any kind of analytics related to people's movement. During this demonstration, you will play the role of Tony, Paris 2024 Olympic Games CEO, and see how, using this new service, he can better understand the way visitors have moved during the Olympic Games competitions. This new world is made possible thanks to the association of two complementary techniques using our core data network: on the one hand some dedicated structured data sets that are behind today's OBS Flux Vision, on the other hand innovative advanced cryptographic mechanisms customized to be specifically applied to those structured data sets. This additional encryption procedure eliminates any possible data leakage risk. The data can now be securely stored for as long as it is needed.

Co-innovation

- European project H2020 PAPAYA

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Make Networks smarter to counter cyber threats.

ThreatNet solution analyzes and detects cyber threats on networks. It is based on very high-speed and multi-service live networks probe ExNet already used by many of the group's countries for Quality of Service issues (DiagNet).

The flexibility and reliability of its modular and dynamic component chaining approach allows to efficiently compose threat detection and analysis scenarios. New algorithms can be easily integrated into the system thanks to an internal API. So, security actors such as the Security Operations Center or the Computer Emergency Response Team will analyze dynamically their networks and will be able to meet their evolving protection target (virus infection and propagation, compromise's indicators, bots, data leaks, phishing,...). ThreatNet is also capable of leveraging data from Threat Intelligence sources.

Thanks scalability, ThreatNet can be deployed on business networks as well as Operator like Orange.

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Deliver the secure, feature-rich and standard Internet protocols over energy-efficient and resource-constrained IoT networks.

IoT networks are diverse. Some have emerged from the electronics industry and operate on unlicensed bands. Others have been defined as variations of the telecom cellular networks. Both types have their own benefits and their preferred use cases. Unfortunately, their application programming interfaces (API) and their security models are different. In this demo, we show that standard, secure application protocols known in the Internet can be used over constrained IoT networks. One example is a service connectivity link for network boxes in the field: in case of primary link failure, it allows diagnosing the problem and often restoring the service without sending a technician to the equipment. Likewise, a networking equipment can be turned off to save energy, then restarted remotely over a low-power IoT network. Tiny IoT sensors living out of a small battery also benefit from being able to run secure web applications without the need to develop custom applications for their unique network API's.

Co-innovation

- Cooperation with Acklio

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