Hello Future Articles Archive

Year: 2021

Welcome to the Hello Future articles archive for the year 2021. This document compiles all articles published during this period, reflecting the ideas, innovations, and insights that defined the year.

The purpose of this archive is to preserve and share significant contributions from the Hello Future community, while providing an overview of developments and trends.

1. Hello Future
2. Digital culture

The digital twin is making itself useful in shipbuilding, wind power, train stations, and medicine

Digital culture | Article

The digital twin is making itself useful in shipbuilding, wind power, train stations, and medicine
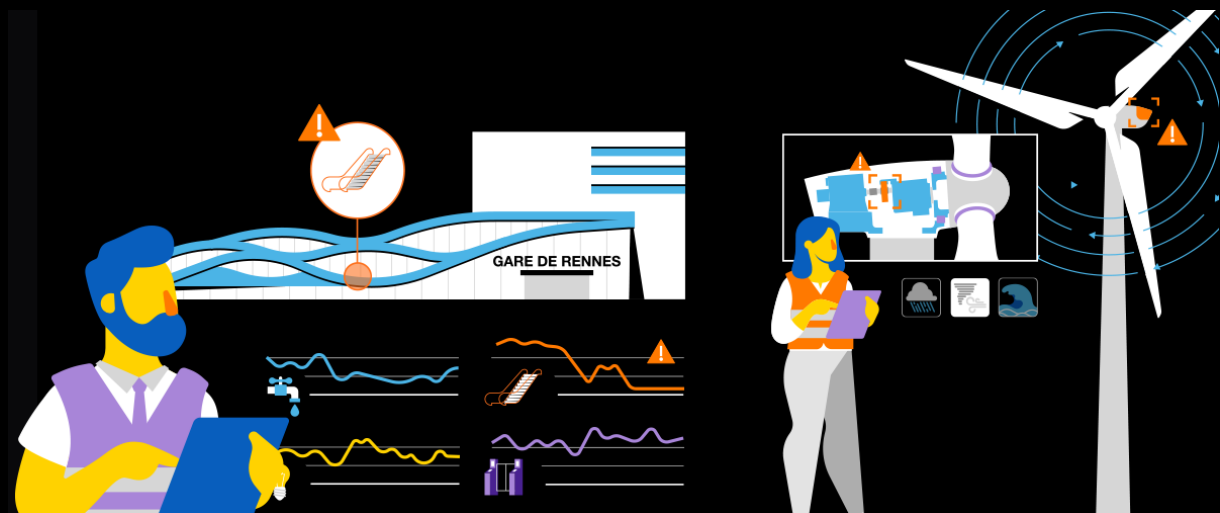
Friday 4th of June 2021

Virtual, evolving, interactive replicas of real systems, digital twins are being developed in many fields. They can help to reduce design costs and to optimise the operation and maintenance of their physical counterparts.
"One of the digital twin's strengths is that it introduces a new way of working; it facilitates the sharing of information as well as the pooling of skills and experience."

A digital twin is a virtual replica of a specific object, system or process, reproducing its operation and components thanks to a set of digital models, thus making it possible to simulate its behaviour and evolution in interaction with its environment, as well as throughout its entire lifecycle.

Parts and devices, industrial machines and production lines, buildings, urban infrastructures and energy systems, human organs and social organisations… nowadays nothing can escape being mirrored.

This technology – implemented alongside other innovations such as the Internet of Things, extended reality, data analysis and machine learning – is now becoming highly popular in many areas.

Shipbuilding: reducing submarine design time

Digital twins are used in the shipbuilding industry at different stages of a ship's life. During the design phase, they make it possible to speed up the various development stages and to make better decisions whilst also reducing costs (due to less physical testing) as well as improvi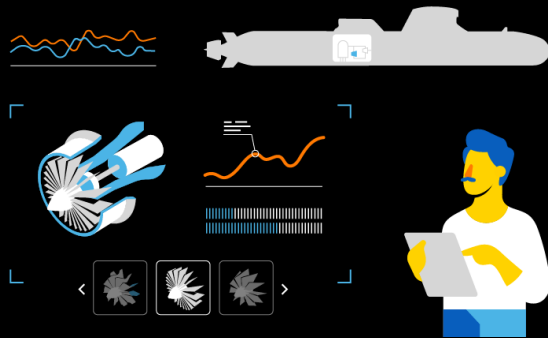ng cooperation within the company and amongst manufacturers. One of the digital twin's strengths is that it introduces a new way of working; it facilitates the sharing of information as well as the pooling of skills and experience.

Faster as well as better design, this is what is illustrated by the Twin Ship project carried out by Naval Group. The company, which specialises in defence shipbuilding, has developed the digital twin of the propulsion chain of a French navy nuclear attack submarine by modelling all of its components. "The digital twin makes it possible to optimise design choices, to review a large number of architectural hypotheses. This would be very difficult to do by hand if we did not have this tool that predicts the performances associated with each setup being tested", the programme supervisor explains to French business magazine Usine Nouvelle. Thanks to this technology, bench testing time has been reduced from eighteen to three months.

Energy: facilitating the operation of wind farms

For a wind farm manager, one great challenge is to reduce running and maintenance costs whilst ensuring that the wind turbines work well under all circumstances. This is essential in maintaining electricity production, and to achieve this, they must constantly monitor the turbines' structural condition. However, inspections are costly, complex and sometimes risky, especially when the farms are in dangerous places such as remote areas with extreme weather conditions or in the middle of the ocean…
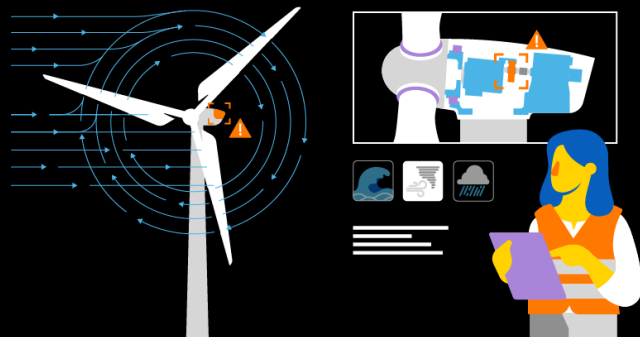
With a digital twin, technicians no longer need to brave the elements to monitor a wind turbine. Its digital replica enables them to follow its performance in real time, to plan

maintenance activities according to the actual situation and forecasts made thanks to machine learning algorithms, to assess the risks of breakdowns so as to prevent them and, when necessary, to take action more efficiently.

In Brittany, engineering company Cervval, France Énergies Marines (the French institute for energy transition dedicated to offshore renewable energies) and IMT Atlantique engineering school have launched the SubSEE 4D project to facilitate the operation of wind farms using a solution that couples a digital twin with deep learning methods. This solution is based on 3D-modeling of the wind farms, updated with sub-marine images, behaviour simulations, and the evolution of their submarine components according to sea conditions for example.

Transport: optimising rail network management
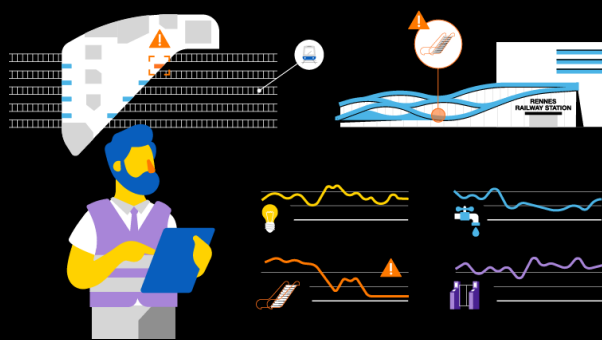
In June 2020, SNCF Gares & Connexions signed a 12-year partnership with Dalkia and Lille software publisher Stereograph, to carry out an ambitious project: to build digital twins of the French railway company's main 122 stations as a first step, then of all 3,000 of its stations on the national territory. The idea being to bring together all of the data relating to the stations' condition and evolution into a single platform, to create a BIM GEM (see box) that "will make it possible to have a real time and long term overview of the rail network."

In the scope of this project, the 3D models of the stations will be linked to historical data and operational data (from sensors or from the various SNCF services). Cross-analysis of these elements should enable the provision of decision aids (for modernising stations for example), facilitation of occupancy contract management, optimisation of energy consumption, or the development of a predictive maintenance strategy.

Medicine: better treatment of heart disease
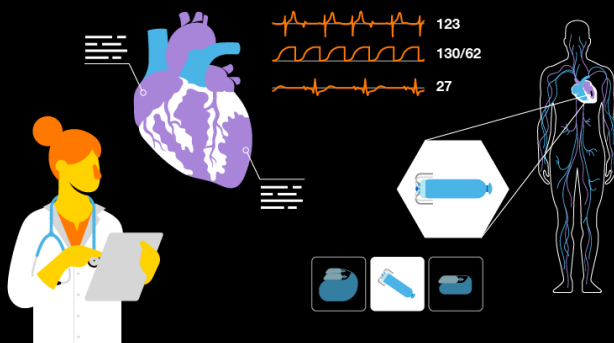
The digital twin is also tackling an "organic machine": the human body. For example, it can faithfully reproduce the heart's structure and operation, enabling simulation of medical treatment or surgery in order to assess their efficiency and foresee any potential side effects or complications. The aims being pursued are those of helping surgeons to prepare an operation, to predict the evolution of a disease, or to improve care personalisation. But one of the current challenges is to be able to accelerate (and reduce the costs of) clinical trials and drug approval procedures.

Coordinated by the French National institute for research in digital science and technology (Inria), the SimCardioTest project "aims to accelerate the adoption of digital simulation for the design of cardiac drugs and medical devices". For this purpose, the consortium, which brings together 10 partners from 6 countries, must demonstrate the feasibility and the advantages of in silico clinical trials (whereby in silico means that they are performed using complex computer calculations or computer models).

In the same vein, the mission of The Living Heart, developed by Dassault Systèmes, is to "to develop and validate highly accurate personalized digital human heart models" that will serve as a basis for cardiovascular in silico medicine. The French software company has incorporated the development of a digital twin of the human body, designed with its 3DEXPERIENCE platform, into its strategic guidelines. It is currently working with the Food and Drug Administration (FDA, United States) to look into the possibility of using its 3D model of a heart and be able to demonstrate the security and efficiency of new medical devices.

What is BIM GEM?

BIM (Building Information Modelling) is an approach, which consists in listing and modelling all of the technical information relating to a building with a view to its construction. The acronym describes both the process (of data production, management, exchange, etc.) and the resulting digital model, which is accessible by all of the project's stakeholders. As for BIM GEM, for "Gestion de patrimoine, Exploitation, Maintenance" (Asset management, Operation, Maintenance), it refers to the use and updating of the model's data for operation and maintenance of the building once it has been constructed.

1. Hello Future
2. Networks and IT

Better compression and streaming to improve the audiovisual experience

Networks and IT | Article

Better compression and streaming to improve the audiovisual experience

Friday 11th of June 2021

With growth and improvements in the uses of audiovisual content thanks to 5G, how it is distributed has become a major issue for the ecosystem. The development of new data compression technologies and streaming protocols is improving the entertainment experience and services offered to customers.
"Combining new CMAF and Low Latency technologies into a single low-latency format for an optimal live experience."

While streaming audiovisual content may look simple to consumers, in reality, there are a number of complex technical stages and challenges that it has to go through before it reaches its destination at the highest quality.

Put simply, the distribution of live and on-demand audiovisual content involves a range of technologies, including those to compress the audiovisual data, before it can be sent through the appropriate distribution protocol depending on the transmission mediums used — such as 4G, 5G or fibre.

New uses and services

Increased connectivity across all networks has allowed new use cases to be identified and innovative audiovisual services to be developed in response with 5G networks at the forefront of this change. At Orange, innovation teams are leading projects in this area with two objectives.

"On the one hand, it's about identifying solutions that can improve service quality for live TV services using 5G, and making them work for 4G networks to optimise what's already there", explains Emmanuel Gouleau, Service Architect at Orange.

"On the other hand, we're developing audiovisual services that really take advantage of the increased speeds we see with 5G, such as immersive and 360° content. This type of

content will be available on the move with 5G as it is currently, at 3.6 GHz, but will increase in spectrum over time to 26 GHz in busy public places."

Optimising the transport channels

Alongside and in line with 5G developments, Orange's Research teams are monitoring the tools and standards that govern content distribution, from encryption to transport, including taking part in ecosystem standardisation bodies such as the Moving Picture Expert Group (MPEG), which looks at video file compression, and the International Telecommunication Union (ITU). The related technical environment is dense and constantly evolving, with new transport formats and compression technologies emerging on a regular basis.

When it comes to transport in particular, there are currently two coexistent and traditional technical channels. "Internet Protocol television (IPTV) is primarily used for live content watched exclusively on set-top boxes, and quality is guaranteed", explains Sylvain Kervadec and Pierre Ruellou, expert engineers at Orange Innovation. "Over-the-top (OTT), on the other hand, distributes content to mobile devices via the Internet, and does not offer any bandwidth guarantees. For these OTT technologies, we use adaptive streaming, which causes latency in live content. Our aim is to reduce this delay by working on the transport layer of audiovisual signals, with the implementation of new protocols and technologies. This primarily involves Low Latency and Common Media Application Format (CMAF), which will enable us to move towards one single format for all devices instead of the different transport methods currently required for the Android and iOS systems. The perfect solution would be combining CMAF and Low Latency into a single low-latency format for an optimal live experience resembling what you get with IPTV. We're also working to bring these new OTT formats to set-top boxes to replace IPTV."

Ever-increasing compression capabilities

Compression is another area where innovation is ongoing and we are seeing regular developments. The standards evolve every ten years on average, with a twofold gain each time. In other words, the same quality data travels twice as quickly — a key development given the explosion of traffic and the emergence of new 4K/8K and virtual reality use cases, which are extremely intensive in terms of video capabilities. Today, the standard in place for services up to high definition is the MPEG-4 Advanced Video Coding (AVC, or H.264 as it is referred to by the ITU Telecommunication Standardization Sector). Orange has used the MPEG-H High Efficiency Video Coding (HEVC or H.265) standard, which emerged in 2013, in the last two generations of set-top boxes, allowing new ultra-high definition/4K services to be introduced. A further barrier was broken in 2020 with the MPEG-I Versatile Video Coding (VVC or H.266) codecs increasing performance compared to those that came before. Studies are to be conducted within the Group to assess the efficacy of these new technologies, as well as their impact on the existing ecosystem and their potential for the future of audiovisual services.

Multicast ABR testing

One final key issue is the need to optimise bandwidth in line with these different developments. Today, in the world of IPTV, content is delivered in the form of multicast streams — in other words, it only needs to be transmitted to the network once to be made available to millions of viewers. The OTT universe works based on unicast transmission, whereby content has to be delivered once for every person that wants to watch it, reducing transmission speeds. Orange's innovation teams are working to streamline this method by experimenting with Multicast Adaptive Bitrate (ABR) streaming technology. If successful, this would allow multicast capabilities to be deployed in OTT services using devices as close as possible to the customer. The future is bright for the distribution of audiovisual content.

CNCF: A Co-Innovation Space at the Heart of the Cloud Native Revolution

Data | Article

CNCF: A Co-Innovation Space at the Heart of the Cloud Native Revolution

Friday 18th of June 2021

We are hearing more and more about the cloud in the digital environment. Our data, music, movies, games and apps are now accessible from the cloud, and it won't be long before our networks follow this trend. The cloud takes advantage of computing power and storage offered by remote servers. In this context, "Cloud Native" refers to how applications are designed, deployed and managed in the cloud in order to leverage all its properties: resilience, availability, scalability and so on.
Since its creation in 2015, the CNCF (Cloud Native Computing Foundation) has established itself as the benchmark space for co-innovation in this area. Orange joined this ecosystem—which brings together tech players and end-users to focus on major innovation projects—in May 2021.
"The Cloud Native revolution pervades culture, practices and business models as well as the means of providing, deploying and leveraging services."

Cloud Native technologies enable companies to enhance their business agility and innovation, helping them adapt to their market. Cloud Native is an extension of the infrastructure services provided by cloud computing, including access to storage, memory, networks and so on, in an 'as-a-Service' model. "Cloud Native promotes agile and modular

architectures—all with their own lifecycles—that can be distributed in scalable environments. Companies can build and use elastic applications in modern and dynamic cloud environments," explains Philippe Ensarguet, Chief Technology Officer at Orange Business Services (see 'Find Out More' section).

More Than an Evolution

Cloud Native is a key topic for telecoms carriers, requiring a change in culture that is not always easy. "For telecom operators going digital such as Orange, Cloud Native is the pivot and the starting point for a new era affecting every facet of the business, including skills, culture, practices, tools, economic and operational models and so on," Philippe Ensarguet emphasizes.

At the Heart of the Cloud Native Ecosystem

Orange joined the CNCF to overcome this challenge. Part of the Linux Foundation, this organization federates and stimulates the Cloud Native ecosystem. Philippe Ensarguet says that "The CNCF has managed to bring together a set of players in an open-source environment, allowing them to cooperate in assembling the fundamental building blocks of Cloud Native. It goes without saying that among those involved are leading tech players, but user communities also take part — companies that deploy and use the technologies designed by the Foundation, who thereby contribute to and produce new building blocks themselves. These users are recognized for their commitment every year. For instance, Spotify, which was recently granted a Top End User Award by the Foundation, has made more than 27,000 contributions on 13 projects hosted by the CNCF since it became a member in 2018.

Innovation, Training, Sharing

In addition to Kubernetes, which has become the core runtime engine for Cloud Native, the CNCF hosts several open-source innovation projects that have already been widely adopted, such as the Prometheus monitoring and alerting system and the Open Policy Agent security policy engine.

Beyond that, the Foundation is a unique space of information, education and exchange, enabling its members to take ownership of and develop their own Cloud Native practices and culture. The CNCF offers recognized training and certification programs and hosts regular events such as KubeCon + CloudNativeCon Europe, which brought together more than 27,000 participants for its week-long 2021 edition.

"Along with Kubernetes, the Cloud Native cornerstone is the new operating system for the cloud," Philippe Ensarguet concludes. Its implementation is an additional step in the softwarization of our industries, which, from Orange's standpoint, permeates our network, digital, data and AI footprint. By joining the CNCF, the Group is positioning itself within an

already dynamic ecosystem that continues to develop its structure. Orange intends to fully play its part and contribute to this ecosystem."

Find Out More

The cloud initially relied on virtualization technologies. These enable multiple execution environments to run on a single physical machine, meaning businesses gain the processing capabilities they need with fewer servers. But simply putting an application in the cloud doesn't make it Cloud Native. Previously, it was a matter of manipulating one-size-fits-all services, where any change to a line of code required redeploying the entire service.

Cloud Native technologies enable the implementation of loosely coupled systems that are resilient and manageable in equal measure. When combined with a robust automation system, these systems allow for automated deployments and updates.

MWC 2021: Stand-alone 5G Reduces Latency for Industry 4.0 Ecosystems

Tuesday 29th of June 2021

At the Mobile World Congress, Orange demonstrates the maturity of network slicing for enterprise applications with a concrete end-to-end use case.
"What we have shown today is that this technology is mature enough to consider commercial deployment as early as 2022."

The small robot moves around the demo area easily, controlled remotely via the 5G SA (StandAlone) network. Suddenly, its gestures become slower, its interaction deteriorates and there is a bigger delay between the order and the action: latency is at play. For demonstration purposes, data traffic was artificially increased on the network, creating congestion. Nonetheless, measuring constants (delay, latency) detects a degradation in service quality and triggers the alarm on the Assurance platform that informs the Orchestrator. In a few dozen seconds, it creates a dedicated portion of the network: a new slice. Now that it has its own network, the robot no longer suffers the effects of congestion and returns to optimum performance.

Latency: A Critical Business Issue
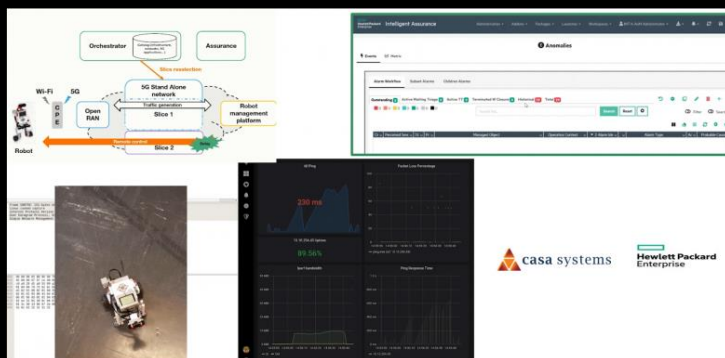
Philippe Hémon, multi-service network access control team leader at Orange Innovation Networks, explains: "We often cite unrivaled throughput as the advantage of 5G, but that's not everything. Latency—the speed of interaction between a robot and the platform controlling it, for example—is a real technological challenge for Industry 4.0 ecosystems. It is even critical for some sectors, such as connected cars." On-demand generation of application networks is a solution that is now available to these companies, thanks to next-generation 5G technology called StandAlone. Radio software, the network core: everything runs in a virtualized network.

More than 5G

Aside from the frequencies, cloud and edge computing capabilities make it possible to create new slices in real time. Until now, it took between 10 and 15 minutes to create a virtual network. Split into a multitude of small software packages, the native cloud applications are smaller, and therefore faster to deploy on the network. These software packages can be distributed geographically, for optimal positioning in the carrier's infrastructures, or even as close as possible to the company. They can be activated or deactivated in a few dozen seconds, automatically and without human intervention. This performance gain, combined with network customization, fits in particularly well with the expectations of many professional sectors. However, many software instantiations across many sites means that network management becomes more complex. Automation is therefore essential for analyzing performance, identifying problems and taking the necessary actions.

Bringing Technology out of the Lab

The demo at the MWC, in collaboration with several industrial partners, including HPE and Casa Systems, illustrates this combination of 5G, cloud computing and automation. "This demonstration involves a simple remote-controlled robot, but we have to imagine all the uses that will soon become a reality on production lines. What we have shown today is that all the technological building blocks are available, allowing the industries to prepare for their future uses."

1. Hello Future
2. Artificial intelligence

Self-supervised learning paves the way for a common-sense AI

Artificial intelligence | Article

Self-supervised learning paves the way for a common-sense AI

Friday 2nd of July 2021

After having facilitated major advances in natural language processing, self-supervised learning is now being applied to computer vision. This method of machine learning, which does not require manual labelling of data, could help to close the gap between human intelligence and artificial intelligence.
"The final version of the SEER model has reached an accuracy rate of 84.2%."

In March 2021, the Facebook Artificial Intelligence Research (FAIR) laboratories unveiled a new computer vision model developed in cooperation with the French National Institute for Research in Digital Science and Technology (Inria).

The particularity of this model, named "SEER" (for Self-supERvised), is that it has been pretrained on one billion random, unlabelled Instagram images, thanks to self-supervised learning (SSL).

According to Facebook, this method of machine learning makes it possible to tackle tasks that greatly exceed the current capacities of artificial intelligence (AI) and it is the beginning of a new era for computer vision.

In a blog post, Yann LeCun, Chief AI Scientist at Facebook, states that self-supervised learning is "one of the most promising ways to build … background knowledge and approximate a form of common sense in AI systems." This common sense, "the dark matter of artificial intelligence", helps humans to acquire new skills without an overly long learning period.

Automatic labelling

Self-supervised learning (SSL) is a learning method in which training data is labelled automatically.

Unlike unsupervised learning, SSL is still based on annotations and metadata, but these metadata are generated autonomously by the AI system by exploiting the underlying structure of the data and their relationships.

The technique usually consists in taking an input dataset and obscuring part of it. The SSL algorithm must then analyse the data that has remained visible in order to predict the hidden data (or certain properties of the hidden data). In doing so, it creates the labels that will enable it to learn.

Self-supervised learning has several benefits. The first is obvious, as data labelling is a major bottleneck for supervised learning.

In order to be efficient, machine learning algorithms (deep ones in particular) require huge amounts of data that have been selected and annotated by humans beforehand.

This is an extremely long and costly process. In some areas, such as medicine, which require specific expertise and where data is sometimes rare, it can be highly complex.

SSL makes it possible to avoid this obstacle, as the model can be trained on a large amount of data with no curation or manual labelling.

As emphasised by Facebook, this approach could also limit the coding of biases, which can occur at these stages, and sometimes improve labelling (in medical imaging for example).

Broadly speaking, SSL enables the AI community to work with larger and more diverse datasets as well as to create and deploy models faster.

Spectacular breakthroughs

Self-supervised approaches have enabled major advances in Natural Language Processing (NLP) where pretraining artificial neural networks on very large text corpora has led to breakthroughs in several areas, such as machine translation or question-response systems.

Word2Vec is a good example of the use of SSL. This family of word-embedding models developed by researchers at Google relies on two-layer artificial neural networks to represent words using vectors and attempt to predict a word based on its context (Continuous Bag of Words, CBOW) and vice-versa (Skip-gram model).

SSL has also made it possible to train a new generation of language models based on a Transformer architecture of which BERT, also developed by Google, is a good example.

Unlike Word2Vec, BERT is a contextual representation model. Thus, where Word2Vec generates a single vector for each word (the word "Orange" will have the same representation even though it can refer to a colour, a fruit, a city, or a company), BERT can generate several vectors according to the context in which the word is used.

First of all, the model is pretrained on huge unlabelled text datasets (all of the Wikipedia pages in English, for example).

Then it is fine-tuned, meaning it is retrained on a smaller quantity of data, for a specific task (such as sentiment analysis or text generation). This method makes it much more precise in its results and quicker to learn than its predecessors.

What's more, it is capable of specialising in many tasks, with little data, and it outperforms existing specialised models in many cases. Thanks to the open version published by Google, BERT has given rise to several derivatives.

From natural language processing to computer vision

Self-supervised learning may have enabled natural language processing to make progress, however the techniques used cannot easily be transposed to new areas, such as computer vision.

Yann LeCun writes that this can be explained mainly by the fact that it is much more difficult to efficiently represent uncertainty in image prediction than it is in word prediction.

"When the missing word cannot be predicted exactly […], the system can associate a score or a probability to all possible words in the vocabulary […]." This is not possible with computer vision. "We cannot list all possible video frames and associate a score to each of them, because there is an infinite number of them."

The ingredients of the SEER recipe

To solve the problem, Facebook has developed the SEER model, which combines several innovations concocted within its laboratories.

First ingredient: SwAV, developed in cooperation with Inria, is an online clustering algorithm, which benefits from contrasting methods to cluster images sharing visual characteristics without requiring explicit comparison of a multitude of image pairs.

Contrast learning makes it possible to train a model to recognise the similarities and differences between images – and thereby learn the invariable characteristics of an object – by comparing pairs of images that have been transformed or taken at different angles.

It is a very efficient method for learning visual concepts without supervision, but the comparison process requires an extremely high amount of calculation time, hence the search for an alternative. With SwAV, Facebook claims to have achieved good performances all the while dividing the model's learning time by six.

However, if we wish to train a big model on large databases, it is also necessary to have the appropriate architecture. Facebook has turned to another recent innovation from its AI research laboratory FAIR: RegNets, a family of Convolutional Neural Networks (ConvNets) that can be scaled with billions of parameters and optimised to adapt to various runtime environments and memory limits.

The final ingredient that has made SEER possible: VISSL, a versatile open-source toolbox for self-supervised learning applied to images.

According to Facebook, the final version of the SEER model (1.3 billion parameters, 1 billion random images, 512 processors) has reached 84.2 % top-1 accuracy on ImageNet, the reference database where research teams from all over the world assess the accuracy of their models. This rate represents the proportion of correct predictions. "Top-1 accuracy" means that the first answer given by the model, the one with the highest probability, is indeed the expected answer (whereas "top-5 accuracy" takes into account the first five answers given by the model). The score obtained by SEER places it in the highest performing self-supervised models and not very far behind the best supervised models, which can achieve around 90.50 % top-1.

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1. Hello Future
2. Research

Air at the center of optical fibers to guide light

Research | Article

Air at the center of optical fibers to guide light

Friday 3rd of September 2021

With requirements for very high-speed internet on the increase, several research teams are developing a new generation of optical fibers called "hollow-core fibers" that could help to improve certain properties of light propagation compared to conventional glass fibers. This technology, whose performances are progressing rapidly, could be used in low latency communications in 5G networks for example, or in certain optical instruments in medicine or in industry that require high optical power.
"Guiding light through air could make it possible to be freed of the limits of glass and thus open up a whole range of possibilities."

The use of silica glass in optical fibers has had profound impacts in many areas, from telecommunications to imaging, through cutting, laser welding, or lighting. In the area of telecommunications, single-mode fibers are solid glass tubes that enable the transmission of data at very high speeds over long distances.

Over the last half a century, glass fibers have facilitated the technological feats necessary for connecting continents and now each and every one of us. Around 500 kilometers of fiber are produced every year. Subject to the limitations inherent to the properties of glass, light propagation can have technical limits. The diffusion of light in glass can have strong optical power impacts.

Guiding light through air – that is the principal of hollow-core fibers – could make it possible to be freed of this limit and thus open up a whole range of possibilities.

Hollow-core fibers vs. conventional fibers

An optical fiber is made up of a core in which light travels, of a tube that keeps the light within the core, and a protective layer. Whereas conventional fibers are generally made up of a silica core, hollow fibers are composed of a hollow core surrounded by several air channels (also known as microstructured fibers).

The light-guidance properties of this category of fibers comes from their structure rather than from the properties of the material used in the core. They are dependent notably on the number of tubes surrounding the core, on their diameter, and their spacing. By varying these values, it is possible to then vary many parameters. Several types of microstructure have thus been developed over time, as is described in this history drawn up by the Optical Society.

Fast progress

Although the propagation loss rates of hollow-core fibers were initially much higher than those of conventional fibers, several methods have been developed to reduce this gap. Over the past few years, research teams have revealed hollow-core fibers that have highly reduced loss, getting closer to the performances of glass fibers, and at wavelengths that are appropriate for several commercial applications.

In a study published in "Nature Communications", researchers from the University of Southampton in the United Kingdom claim that it is possible to overcome the attenuation limit set by glass thanks to a new family of hollow fibers that have been under development for over ten years within the Optoelectronics Research Centre under the name "Nested Antiresonant Nodeless Fibers" (NANFs).

They have developed three hollow-core fibers with wavelengths between 600 and 1,100 nm (non-telecoms application) which they claim have losses comparable or lower than is achievable in solid glass fibers. For information they specify that "while the minimum absolute loss achieved at 1550 nm (telecoms application) is only 0.142 dB/km7, the lowest reported loss at the shorter technologically relevant wavelengths of 1060, 830, and 630 nm increase to 0.57, 1.6, and 4.5 dB km−1 respectively". Records at this level can only be achieved with very high quality fibers.

Telecommunications: from 5G networks to high frequency trading

These advances allow us to imagine the possibility of developing fibers of this type for telecommunications in the coming years. An important part of the research and development being carried out on hollow-core fibers is effectively dedicated to their applications for telecommunications, whereby several data transmission experiments have been carried out over the past few years to reduce latency. In effect, the refractive index of air (around 1) being less than that of silica (around 1.5), light travels faster through a hollow-core fiber.

In June 2021, British telecoms operator BT announced that it had started trials with a 10-kilometer-long hollow-core fiber cable provided by Lumenisity, a Southampton University spin-off company. This cable is to be used for testing a variety of use cases, in particular in the area of 5G networks or that of ultra-secure communications, such as Quantum Key Distribution (QKD). According to BT, this technology could potentially

reduce latency by up to 50%, which "would enable a variety of benefits, from high-frequency trading to lowering mobile network costs".

In fact, hollow-core fiber is already being used to connect the Chicago and New York stock exchanges where "high-frequency traders" are constantly pushing back the limits (in particular thanks to algorithms) to reduce the time needed to complete transactions and gain an edge on rivals.

Improving endoscopic instruments in medicine

Today, optical fiber is used in medicine as much for diagnosis as for treatment. Among other things it has enabled the development of new endoscopic instruments that help to improve the quality of surgery whilst making it less invasive. Researchers from the University of Bath (United Kingdom) are studying how hollow-core fiber could facilitate the improvement of spectroscopy techniques (the study of electromagnetic radiation emitted, absorbed, or diffused by matter), specifically Raman instruments used in endoscopy.

Raman spectroscopy is based on the analysis of the interaction of light with molecules in order to retrieve information on the composition or characteristics of a sample. More specifically, this technique makes it possible to determine the vibrational signature of a molecule that has been excited by a monochromatic light (guided by fiber optic cables), which provides information on its structure and its mode of interaction with surrounding molecules. In conjunction with other tools, in medical diagnosis this can help identify certain diseases; for example, doctors are hopeful that Raman spectroscopy will be used to better detect cancers.

Currently, the glass composing the core of the fiber used in Raman probes generates a background noise that can drown out the target signal. The research team therefore hopes that a hollow-core fiber will make it possible to minimize this noise. Other tools could also benefit from these new advances in the design of optical fibers, particularly environmental sensors and the high-power lasers used in industry.

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Digital identity: towards a European digital wallet?

Data | Article

Digital identity: towards a European digital wallet?

Friday 10th of September 2021 - Updated on Wednesday 22nd of June 2022

The European Commission is preparing a digital safe that will enable citizens to store their identity papers and other personal documents. This will be coupled with a digital identity service that is recognized by all Member States, with two key challenges: trust and interoperability.
"With this identification that is recognized across the whole European Union, businesses can offer a wide range of new services."

After the European health pass that entered into force on 1st July, the European Commission is planning to set up a European digital identity wallet for the 27 Member States of the European Union as early as next year. According to the first elements revealed on June 3rd, this wallet will be accessible to all citizens as well as residents and businesses in the EU. It will enable people to identify themselves and securely access public and private online services that require strong authentication. A citizen located in another country will be able to open a bank account, rent an apartment (by presenting their tax declaration), or enroll in a university more easily.

This digital identity will be provided by the country of origin with the guarantee that it has been handed over personally; it will be in the form of a wallet stored on a cellphone or other personal device. Within this digital safe, the citizen can upload, store, and use their personal data such as their driver's license, a diploma, bank card, or medical prescription. The examples provided by the Commission of what the wallet will enable include not only the possibility to check in faster at the airport, but also to avoid queuing at the car rental counter. The customer will have to have previously provided all the elements requested such as their passport, driver's license, and bank card, then all they have to do is pick up the key from the car park and start the car with their smartphone.

"Citizens will have control of their data"

With this identification that is recognized across the whole European Union, businesses should gain new market opportunities by offering a wide range of new services based on this authentication building block, according to EU Commissioner for Internal Market, Thierry Breton. As for privacy, Brussels states that "citizens will have control of their data". They will be able to "choose which aspects of their identity, data and certificates they share with third parties, and to keep track of such sharing". What's more, the wallet will be able to prove a specific attribute of a person, such as their age, without revealing their identity or other personal data. In terms of dates, the Commission has invited all Member States to immediately start preparatory work in order to set up a shared "toolbox" by September 2022. This toolbox should include the technical architecture, standards, and guidelines for best practices. The Commission will propose "the standards, technical specifications, and operational aspects capable of guaranteeing that Member States' digital identity wallets will have the highest levels of security". According to an article in the Financial Times, the application would require a biometric check such as a fingerprint or retina scanning. Once the technical framework has been agreed, it can be tested in pilot projects.

The challenge of interoperability

The European Union is however not starting from scratch. It can rely on the existing legal and technical framework of the eIDAS regulation, dedicated to electronic identification, trust services, and electronic documents. Adopted in 2014, this regulation aims to establish "an interoperability framework for the different systems implemented in Member States in order to promote the development of a digital trust market", as is explained by the French National Cybersecurity Agency (ANSSI). On the technical side, ANSSI has brought together the different standards used by the regulation into a documentary database. The eIDAS framework enables the issuing of qualified certificates for electronic signatures, electronic seals, and website authentication. However, "there is no requirement for Member States to develop a national digital ID and to make it interoperable with the ones of other Member States, which leads to high discrepancies between countries", deplores the Commission. The regulation does not contain provisions relating to the use of such an identification for private services or for mobile terminals, which leads to differences between countries. Today, 19 digital identification systems are used by 14 countries, covering nearly 60 % of the EU population, "but the uptake rate of this systems is low, their use is cumbersome, and their commercial use limited".

In France it is called FranceConnect. Launched in 2016, this online authentication system guarantees user identity based on existing accounts (for which identity has already been verified); these include France's tax website impots.gouv.fr, its healthcare system ameli.fr, postal service L'Identité Numérique La Poste, and MobileConnect et moi, Orange's authentication solution.

Although 26 million French people have already created an account on FranceConnect enabling them to access over 900 public service websites, the system is being ignored by businesses, according to "Les Echos".

Digital compass

Deployment of the future wallet and its associated legislation should harmonize practices and facilitate the adoption of a universal digital identity. The Commission thus hopes to meet the objectives of its digital compass, which stipulates that by 2030 all key public services are to be available online, all citizens are to have access to their digital medical records, and 80 % of citizens should be using digital ID.

With this initiative, the Commission is also trying to pull the rug from under GAFA's feet. The digital giants offer "social login" modules, such as Facebook Connect, to register on other websites with a user account.

With Apple Wallet and Google Pay, they also offer virtual wallets for storing bank cards, loyalty cards, and any other personal documents, with the risk that the associated data be used for marketing or commercial purposes.

As an answer to the issue of sovereignty, the European wallet, which would necessarily comply with GDPR requirements, would enable citizens to take back control of part of their personal data. It could nevertheless be subject to an appeal by civil society, like that of French association La Quadrature du Net, which filed proceedings against the French health pass, proceedings that have since been rejected by the French Council of State.

– European Commission presentation of the European digital identity wallet project

– ANSSI presentation of the eIDAS regulation

– Documentary database related to the eIDAS regulation

– Hello Future article on the Mobile Connect et Moi authentication solution by Orange

– Les Echos article (in French) on FranceConnect

– The European Commission's "digital compass"

– La Quadrature du Net proceedings against the French health pass (in French)

Ewattch: Improving the performance of industrial sites at minimum cost

Internet of things | Article

Ewattch: Improving the performance of industrial sites at minimum cost

Monday 20th of September 2021 - Updated on Wednesday 22nd of June 2022

The winner of Orange's Datavenue Challenge in the Smart Industry category, Ewattch, has devised a way to modernize industrial sites quickly and easily. At SIDO 2021, the French company will demonstrate a sensor solution that is comprehensive, cost-effective and quick to deploy.
"With Ewattch, we'll demonstrate how even a 40-year-old machine can become connected."

Today, industry in Europe faces an undeniable reality: With a century-old legacy, the vast majority of its factories are aging. For many manufacturers, cutting costs, surviving international competition and the need for remote supervision during the health crisis has meant starting the digitalization process, and that is before we even talk about Industry 4.0. "For those looking to optimize production and reduce energy consumption, data generation is a must," explains Nicolas Babel, CEO and Founder of Ewattch. What we are proving with Ewattch is that this does not necessarily require heavy investment or mean you have to replace all your machines. We develop comprehensive solutions, including everything from the sensors themselves to the software platform that manages them. At SIDO 2021, we will present an example of a ready-to-use industrial kit. And we'll demonstrate how even a 40-year-old machine can become connected."

A modular solution

The sensors, which are deployed throughout sites, can measure machine function (e.g. the number of units produced, cycle time, energy consumption, operating status) or collect data on quality (e.g. temperature, humidity, CO_2 levels). Ewattch uses edge computing to avoid overloading the network or servers, meaning raw data is not processed in the cloud, but pre-processed as close as possible to the sensor that collects it. The relevant indicators are then sent back through the network to the monitoring tool. Instead of the classic dashboard, Ewattch has boldly opted to display this data in 3D, with screens in plants providing real-time information in order to ensure the immediate uptake and effective use of the tool by all employees. As it controls most of the value chain, Ewattch can quickly adapt its solution. Its

kits cater to a wide range of different fields, such as plastics, metallurgy, stamping machines, bakeries, water management and the list goes on.

Supported by a reliable network

As well as being able to mix multiple types of measurements, Ewattch sensors are also one of the few multiprotocol sensors on the market. To transfer the collected data, they use either the 4G network or, more recently, Orange's IoT network, LoRaWAN. Thanks to the product's modularity, Ewattch can provide its customers with specific guidance, right down to the choice of network, depending on their use case and requirements. "It's reassuring for manufacturers to know they can count on a trusted carrier. Data security, network control and network availability in factories are key considerations in this sector where the stakes are often very high. A partner like Orange gives us greater credibility in terms of the network."

A young yet fast-growing company

It was after Ewattch's victory in the 2021 edition of Orange's Datavenue Challenge that the two companies joined forces. "We only started collaborating with Orange recently, but it is looking very promising. By pooling our expertise, we can provide an end-to-end solution to meet the challenges of modernizing industrial sites. We hope to bring this relationship to fruition soon, by establishing concrete partnerships." Having recently fundraised €3.5 million and launched a subsidiary in Benelux (with two more in the pipeline for 2022 in the German and Italian markets), Ewattch intends to thrive in Europe and continue innovating to make Factory 4.0 a reality.

A Lab for Testing the Benefits of Edge Computing on a 5G Network

Networks and IT | Article

A Lab for Testing the Benefits of Edge Computing on a 5G Network

Wednesday 22nd of September 2021 - Updated on Wednesday 22nd of June 2022

In partnership with Google Cloud, Orange 5G Lab is opening its doors to companies, publishers and app developers who want to explore the potential of edge computing. The goal is to assess this technology with a view to developing the use cases of tomorrow. "Processing capabilities can be hosted in the same place as the data is produced"

Edge computing is a decentralized cloud computing model that brings data processing and storage closer to the users and machines that produce and/or consume it. Gone are the days where data must travel across the network to a centralized data center. Now, data can be processed locally, meeting the requirements of emerging use cases thanks to faster response times (in milliseconds), increased capacity for processing large volumes of data without saturating the network, the option of heightened security for sensitive and personal data, and strengthened business resilience, with no disruption in case of problems connecting to the "central" cloud.

These benefits are of interest to a range of stakeholders, from the B2B sector (industry, commerce, smart cities and healthcare) to the consumer market (smartphones, connected homes, online gaming, and virtual and augmented reality applications). Edge computing provides these stakeholders with real-time services that require guaranteed quality of service: control of robots, autonomous vehicles and drones; real-time video analysis and facial recognition for video surveillance or fire detection; real-time production quality analysis in industry; or, in the future, telemedicine and telesurgery.

A Clear Synergy with 5G

The 5G network is expected to support the deployment of these services, thanks to its lower latency and improved data throughput speeds. These benefits are maximized when 5G is paired with edge computing, since local processing means nothing is transmitted through the Internet or the cloud. By favoring this way of processing, edge computing reduces the number of intermediaries involved in the data "journey" while enabling applications to

function optimally. For example, in the events industry, harnessing this 5G/edge computing synergy will enrich the audience's experience by allowing shows to be filmed in 360° and broadcast in real time.

Tailor-Made Distributed Architecture Solutions

How is this technology implemented? "Processing capabilities can be hosted in the same place as the data is produced (in a factory or warehouse, for example) with the data sources connected directly via wired LAN, Wi-Fi or private cellular network. This is what is known as 'customer edge computing,'" explains Nathalie Ghinsberg, Operational Manager of the Innovation Future Connectivity Business Portfolio at Orange Innovation. "These capabilities can also be hosted at the core of the carrier network, in the carrier nodes that are located throughout the region. In this case, we're referring to 'network edge computing.'" This solution is ideal for users who cannot set up a dedicated infrastructure on their website, or even for consumer use cases such as online gaming or virtual or augmented reality applications.

Green Light for Testing

Orange has signed a partnership agreement with Google Cloud on data, AI, cloud and edge computing. Against this backdrop, on September 22, the two partners unveiled the first Edge Computing Lab. The lab welcomes businesses and developers who wish to implement and carry out end-to-end testing on services hosted at the edge, using the Google Cloud solution and capitalizing on Orange's top-class 5G network. The goal is clear: to support the edge computing ecosystem as it matures and to encourage uptake of this technology through real-world testing, while helping to grow the range of use cases.

The lab, located on the Orange innovation campus in Châtillon, near Paris, boasts a 5G network and an edge computing node supported by the Google Cloud solution. Made up of multiple microprocessors and graphics cards to provide computing power, this mini data center can host third-party applications and make them accessible from the on-site 5G terminals. Any interested developers and companies can request access to the lab. Priority will logically be given to projects with large data volumes to process, low-latency requirements or enhanced security needs.

Gwenaëlle Delsart, Program Director of the Edge Computing – Smart Content Delivery Program at Orange Innovation, says that "This Lab is not the end goal in itself. This is just a first step before supporting these companies through pilots and on to commercial offers."

Flexibility, Security and Environmental Impact

"Although current testing is carried out using a single node, we will deploy other nodes in the technology commercialization phase in order to fully meet our customers' expectations," adds Delsart.

In the case of network edge computing, this flexibility enables infrastructures to be shared by multiple customers while maintaining advanced data security and watertight separation between environments. This sharing is also seen in resource and cost optimization. Lastly, since limiting environmental impact is a critical issue in network development and in mass data flows, edge computing is set to scale back energy consumption to meet real needs.

Learn more about Orange 5G Lab: https://5glab.orange.com/en/

Measuring and guiding: How data has contributed to tackling the health crisis

Data | Article

Measuring and guiding: How data has contributed to tackling the health crisis

Monday 27th of September 2021

Data and AI have been at the heart of the scientific response to the COVID-19 pandemic, enabling epidemiological models to be developed and changes in population mobility to be measured. This is one of the key findings of the white paper recently published by Sofrecom.
"Paradoxically, the crisis has also had positive impacts. It has accelerated innovation"

How can we predict the evolution of a pandemic — a complex phenomenon involving a mix of biological and social considerations? How can we provide the political authorities with matrices to assess the effectiveness of health measures? Data and AI, or Data Intelligence, offers concrete solutions to these new challenges imposed by the health crisis, including epidemiological forecasting models, data analysis of the French population's mobility and spatiotemporal mapping of the spread of the virus.

"The pandemic has had catastrophic consequences for our economy and society. But we had to confront it and find innovative solutions as a matter of urgency. And, paradoxically, the crisis has also had positive impacts. It has accelerated innovation and strengthened the use of digital tools, including data and AI," said Samia Bendali-Amor, IT & Network Services Director at Sofrecom.

Measuring population mobility

Mobile data analysis has emerged as an essential tool since the start of the pandemic. In 2020, while countries around the world were making the decision to lock down one after another, there was an urgent need to measure changes in population mobility in order to ascertain the extent to which these restrictions were being adhered to and their effect on the spread of the virus. Cell phone data has proven to be an essential tool for studying mobility, with a 102% penetration rate and 5.1 billion unique subscribers worldwide.

Guiding public decision-making

A large community of scientists and private companies has mobilized to make this data readily available. In March 2020, the INSERM-Orange Labs consortium launched the EVALCOVID-19 project, funded by the French National Research Agency, to study changes in the mobility behavior of the French population and its impacts. For instance, analyzing anonymized cell phone data through Orange Business Services' Flux Vision tool revealed a 65% decrease in mobility during the first lockdown, particularly work- and school-related travel. It also noted that this decrease varied according to geographical and socio-economic factors. This work led to an article being published in the prestigious scientific journal, The Lancet Digital Health. Flux Vision has also been used by the authorities in other European and African countries to guide health decisions.

The ethical issue at the heart of the matter

"While the current crisis provides an opportunity to demonstrate the value of these mobility indicators, it also highlights issues surrounding their governance," says Stefania Rubrichi, Data and AI Expert at Orange Innovation. "These indicators, which were developed based on our customers' habits, are indeed very sensitive in terms of how the data is collected, stored, used and even shared. All of this raises legitimate legal, economic and ethical questions." In order to address these questions, Orange set up a Data and AI Ethics Council in March 2021.

1. Hello Future
2. Artificial intelligence

Chatbots are redefining interactions between customers and advisors

Artificial intelligence | Article

Chatbots are redefining interactions between customers and advisors

Monday 11th of October 2021 - Updated on Wednesday 22nd of June 2022

Chatbots continue to amaze us! They are now able to collaborate with customer advisors to improve productivity and customer satisfaction, as explained in the White Paper "Défis et progrès à l'ère des données et de l'intelligence artificielle" (Challenges and progress in the era of data and artificial intelligence), published by Sofrecom, an engineering subsidiary of Orange.
"By 2023, over 50% of customer interactions at Orange will be handled via a chatbot."

Who hasn't come across a "chatbot" when making with a complaint or help request? They have become an effective first port of call before an advisor intervenes. And companies have capitalized on this value. They are willing to invest generously in this conversational artificial intelligence (AI) to improve its performance. In doing so, customers get an increasingly comprehensive experience, where humans and tech work hand in hand. Beyond "pop-up" text chatbots, the evolution of bots toward using voice and image is promising.

From text to voice and image

"Orange aims to handle more than 50% of customer interactions via a chatbot," says Clément Aincy, Managing Consultant at Sofrecom. These chatbots play a key role in simplifying digital experiences and empowering customers. The focus is now firmly on this technology. Thanks to AI, 40% of customer service calls are set to be automated.

Newly mature technologies allow for customized voice experiences with "callbots." Trained to have an optimal understanding of natural human language and a range of customer requests, these callbots can call customers to perform tasks such as invoice recovery. Finally, with the current boom in video calls, bots that combine computer vision and augmented reality are set to become an additional asset for simplifying the user experience. They will be useful for making it easier to install and troubleshoot Wi-Fi hubs by

superimposing an illustration onto a real-time smartphone image of the hardware to show what needs to be connected where.

Achieving a new synergy between advisors and chatbots

In addition to these technological advances, bots are transforming the role of customer advisors. In the current setup, chatbots are the first line of communication in customer relations and take care of simple tasks, freeing up advisors so they can focus on solving more complex issues. Chatbots can route customer requests to the best-qualified agents and detect feelings of dissatisfaction in customers, at which point the chatbot transfers the customer to an advisor, as is the case at Orange Bank with IBM Watson technology. Some solutions, such as LivePerson, even enable the advisor to invite a chatbot into their conversation with a customer. The customer's experience is smoother, faster and more efficient.

What about digital duos?

Training a chatbot still has to be left to the experts. However, major progress could be made via a two-way collaboration between chatbots and advisors. The latest developments in so-called "generative" chatbot AI are opening up new horizons. This generative AI feeds on unstructured data and can therefore be trained on huge databases. On its own, and without necessarily having been pre-trained, generative AI is capable of handling increasingly complex customer service interactions. In a trial run by Amazon, with the aim of training AI on 5 million responses extracted from 350,000 chats with customers, the advisor could select or modify a response suggested by the chatbot, without detracting from the overall understanding.

According to Clément Aincy, "this suggests that, although AI currently assists advisors, in future, advisors will support chatbots in their customer interactions and will even create their own digital doppelganger based on their behavior and communication styles, like a form of reverse personalization."

AI for predictive building maintenance from Sitowie

Digital culture | Article

AI for predictive building maintenance from Sitowie

Friday 15th of October 2021 - Updated on Tuesday 14th of June 2022

Constructing and maintaining buildings requires significant investment. The start-up Sitowie, winner of the third edition of the Orange's Women Start program, has developed innovative technologies to anticipate the aging of real estate and to optimize the corresponding maintenance work.
"Our customers build up a well-structured, reliable and accessible property database. They know how their buildings are aging and how they will age over time."

For Pauline Koch, a professional architect and CEO & Founder of Sitowie (one of the six start-ups selected in the third edition of the Women Start program organized by Orange), it was becoming difficult to design, construct and even manage buildings without knowing how they would age. "In France, we don't have the data to tell us how buildings are aging," she explains. "Moreover, the current trend is to construct new buildings that are increasingly unsustainable even though our global context shows us that resources are becoming scarce," she continues.
In the face of these findings, Pauline Koch decided to study a master's degree at the *École des Ponts ParisTech* (a prestigious French grande école specializing in engineering) to hone her skills in new technologies and, in particular, work on building sustainability. It was then that she presented her first research project, which aimed to simulate the aging of reinforced concrete facades in 3D. This scientific approach later enabled her, with the help of a 3D model, to reveal the effects of wind on a facade as well as the consequences of solar radiation on joints.

From 2D to 3D

In an industry where work is often still carried out using 2D section drawings, "BIM" ("Building Information Modelling") has introduced 3D models to the world of architecture. Many customers, mainly wealth managers, wish to simulate the aging of their real estate. "3D models allow us to create a property database, simulate aging and thus optimize the maintenance and investment budgets of customer's real estate. Thanks to this new technology, we are moving from a curative to a predictive approach," the entrepreneur explains. "Customers are no longer waiting for a problem to appear before they can fix it. Interventions are made well in advance, which has a significant impact on budgets. Savings can be as high as 40%," she says.

SaaS Platforms, AI, machine learning and professional expertise

Sitowie's solution is an SaaS ("Software as a Service") platform, called "Prédibat", which can be accessed via an Internet browser. It combines AI with professional expertise and other technological building blocks (materials science, civil engineering, life cycle analysis and so on). There are no mysteries. Degradation is explained.

To produce this result, several types of data are collected. Firstly, maintenance work previously carried out by customers is obtained from their accounts, which gives access to the details of operations. Then open source data is collected, such as the address, year of construction, types of materials and height of the building.

"Our customers therefore build up a well-structured, reliable and accessible property database. They know how each element of their buildings are aging, and how they will age over time," says Pauline Koch.

Moreover, the platform integrates parameters such as the carbon footprint of the maintenance, for example, and then adopts the best maintenance and investment strategy. These innovations are becoming vital in light of the increasingly restrictive regulations regarding the environmental performance of buildings.

Decision-making support

Finally, Sitowie supports its customers, providing services that include supplying and optimizing maintenance plans. "Our 'probabilistic' approach provides an indication of when a problem will occur in a building," explains Pauline Koch. This is essential information when you have real estate of several thousand square meters that requires you to justify costs (often millions of euros) and to convince financial backers to grant budgets for certain buildings, or parts of a building, rather than others.

Eye Health at Work Supported by a Chatbot

Digital culture | Article

Eye Health at Work Supported by a Chatbot

Friday 15th of October 2021 - Updated on Tuesday 14th of June 2022

The start-ups YesWeShare and Coach For Eyes have recently joined forces to create a chatbot specialized in eye health at work. They are among the winners selected by Orange as part of the third edition of its Women Start program.
"The chatbot gives employees advice on how to protect their eyes, focusing on three topics: ergonomics, good visual habits and eye exercises"

"Companies provide employees with computers but give them no guidance on best practices for avoiding eye damage," says Nathalie Willart, orthoptist and Founder of Coach For Eyes. "In companies today, more than 70% of employees complain of eyestrain," she adds. This issue is exacerbated by employees' overexposure to digital technology.

Combination of two skillsets

To prevent the risks inherent in these working methods, two start-ups have combined their skills: Coach For Eyes, a specialist in visual health issues, which has developed a smartphone application and a webapp, and YesWeShare, a specialist in impact chatbots, enriched with artificial intelligence and micro-learning. The result is "Vizybot", a solution dedicated to companies to protect the eyes of their employees. This innovative chatbot in terms of visual health at work aims to neutralize visual disorders of employees facing digital technology.

First Eye Health Pilot Test at Orange

The chatbot was pilot-tested at Orange and implemented on tools that employees were very familiar with, such as Teams and Webex.
Twice a week, employees receive advice through these messaging platforms on how to protect their eyes, focusing on three topics. The first is ergonomics — users must ensure that they have an optimal setup. In particular, they should have an appropriate screen height and brightness. The second relates to good visual habits, including blinking and regularly giving your eyes a break from the screen. The third suggests a series of eye exercises to

help strengthen or relax your eye muscles. "We currently have an engagement rate of about 70%" says Nathalie Willart.

Users really enjoy the microlearning approach, because it allows for quick conversations (from 30 seconds to 2 minutes) that are interactive and tailored to the issues they may have encountered. "The technology used by this chatbot allows for up-and-down communication," says Gaëlle Bassuel, CEO of YesWeShare. "while respecting confidentiality, the anonymous statistical data can be used to guide occupational medicine and preventionists in their action plans," she explains. "The tone is playful and humorous, without ever making our interlocutors feel guilty or stigmatizing them," adds Nathalie Willaert.

Chatbots Are Not Doctors

In accordance with the law, the chatbot never provides medical advice; it simply offers information, empowering users to change their habits and, if necessary, it refers them to medical practitioners or occupational health services when issues stray outside the bounds of the chatbot's knowledge.

To develop this chatbot, the two CEOs developed a technical specification revolving in particular around security, so that it can be installed in companies' information systems.

In the long run, this tool will help prevent disorders caused by excessive screen time. This chatbot has already attracted a lot of customers, from occupational health and safety teams in large companies such as Orange, to stock and mutual insurance companies, given the importance of eye health beyond the world of work, in the context of a worldwide increase in myopia.

1. Hello Future
2. Research

The Growing Transmission Capacities of Multicore Fiber

Research | Article

The Growing Transmission Capacities of Multicore Fiber

Friday 15th of October 2021

Faced with exponential growth in network traffic, research efforts are ramping up to increase fiber optic transmission capabilities. Recent experiments carried out on a seven-core fiber have yielded interesting results on the potential of this technology. "The rollout of multicore fiber as part of 5G is possible, but not for a long time. Short term, this technology seems more suitable for data centers or submarine cables."

With the explosion of digital traffic—driven by more people working remotely, increased use of e-commerce, photo and video sharing, streaming and so on—and the ever-increasing number of applications constantly consuming more bandwidth, optical transport networks are under intense pressure. This underlying trend, amplified by the pandemic, is forcing network carriers to explore new avenues to increase optical fiber transmission capacity. "Until now, the use of increasingly advanced WDM technologies enabled greater throughput per channel, which, consequently, mitigated the high pressure on networks," states Erwan Pincemin, Research and Development Engineer at Orange. "But with capacity growth of 25%–30% per year, and even 40% in some network carriers, limits are quickly reached."

Fiber: A Vast Field of Research

For decades, researchers have been working on new generations of fiber optic to increase transmission throughput. Following on from traditional fibers made up of a single silica core (single mode or multimode), research has become focused once again on multicore fibers — technology that emerged decades ago. The aim? A fiber optic cable with several cores, enabling more information to be transmitted at the same time, results in increased transmission capacity. "One of the first examples of this dates back to the 1990s," points out Noëlla Evanno, who is in charge of studies on optical fibers and cables at Orange. "It had four cores and was in the shape of a four-leaf clover. It had been designed by CNET in Lannion. This fiber allowed transmission throughput to be increased. Since then, technology has progressed with publications now referencing fiber cables with up to 19 cores."

A Great Leap Forward

Last August, Orange Poland conducted tests on a seven-core photonic crystal fiber (with air voids running along the length of the fiber) that was 1.5 km in length. It was developed by InPhoTech using ICE6 800G optical data transmission technology from Infinera. By using two channels to send data at speeds of 1.6 TB/s through each of the seven cores simultaneously, these tests revealed several interesting results, including a total transmission of 11.2 TB/s versus 1.6 TB/s in a single core. This is therefore a real step forward not only for customers, who could benefit from greater throughput and more services, but also for network carriers. It remains to be proven whether these results, obtained under laboratory conditions, can be achieved in reality.

Feasibility Yet to Be Proven

There are still many steps to be taken between laboratory testing and rollout. "This type of experiment is necessary to understand the performance of a new technology," explains Evanno. "But to make it a real technological breakthrough, we need to be sure of its technical-economic feasibility." We are only in the early stages, with the Polish experiment having been carried out over a distance of just 0.93 miles. One of the main challenges is to extend the reach of this multicore fiber across hundreds of miles. For Pincemin, "An interesting study would start off by doping multicore fiber with rare-earth elements (erbium/ytterbium). This would make the fiber active and therefore produce multicore optical amplifiers with reduced energy consumption, making it very useful for future submarine optical cables."

Promising, But Not for All Uses

Researchers and carriers must now continue their work to determine the most relevant application areas for multicore fiber. "Single-core fibers are continuing to advance and are still very efficient for long-distance, land-based networks," says Evanno. "The use of this new technology as part of 5G is still possible, but not for years. Short term, multicore fiber seems to be more suitable for rollout in data centers, as the distances involved are short, which reduces interference problems." Submarine cables, the backbone of the global Internet, comprise another area of application offering an interesting outlook for multicore fiber. "These submarine cables have limited capacity due to energy constraints," explains Pincemin. A multicore fiber cable with amplifiers that consume much less energy would address these concerns and would also address the space constraints of these cables."

1. Hello Future
2. Digital culture

Digital culture | Article

Using Blockchain and Machine Learning to Protect Copyrights

Friday 22nd of October 2021 - Updated on Tuesday 14th of June 2022

From creating certificates of authenticity to dispute management through the sale of NFTs ("Non Fongible Token"), authors of images are now benefiting from the first ethical image bank created by the start-up Pictia. Selected through the third edition of the Women Start program organized by Orange, the company offers a complete, secure and reliable service to protect and manage copyrights, thanks to new technologies.

"It's difficult for authors to protect their images in the digital age. Pictia provides them with solutions through a variety of technologies!"

Creators have a hard time protecting their works in the digital age, with images being published on the Internet without authors' permission or being misused to feed fake news.

The sheer number of images posted online every day and the high cost of protection tools currently on the market make this task even more difficult! "Authenticating an image costs €10 and a digital report to establish fraudulent use, made by a bailiff, is about €350," explains Julie-Sarah Marguet, CEO and Co-Founder of Pictia. "Moreover, with hundreds of millions of images circulating the Internet, image banks, which manage copyrights, are unable to find the source of everything," she adds.

It's difficult for authors to protect their images in the digital age. Pictia provides them with solutions through a variety of technologies!

Authors therefore have no guarantee that their rights will be adhered to. Due to lack of evidence, they often prefer to abandon any legal proceedings.

As a result, Pictia created a platform that brings together all the protection and copyright management services available, thanks to blockchain technology. It is possible to certify images, sell NFTs, user licenses and have access to image protection services on the web. Authors can subscribe to benefit from a complete, secure and reliable service.

For example, for certificates of authenticity, each document shows the date and time and has an imprint containing the author's name through a KYC ("Know Your Customer") system. After a Pictia partner company verifies this identity, a certificate is registered in a

blockchain. The author of images may choose to sell them through NFTs to collectors and market licenses for their use. Licensees obtain exclusive images with the assurance of copyright protection.

This platform also allows the sites where images are used without permission to be identified. "A formal notice is then sent to the site owner," says Marguet. Pictia markets this digital report service, including to Orange's legal department, via Chainote, a dedicated platform.
Starting next September, the start-up will market its marketplace to the general public, currently open in beta version to photographers.

Today, INA ('Institut National de l'Audiovisuel' — the French national audiovisual institute) wishes to use the services developed by Pictia to commercialize and protect its photographic content. Other stakeholders such as RMN ('Réunion des Musées Nationaux et du Grand Palais' — the organization for the national museums of France) or AFP ('Agence France-Presse' — French news agency) might even want to use them!

1. Hello Future
2. Digital culture

A journey into the metaverse: marketing opportunities in a connected and persistent world

Digital culture | Article

A journey into the metaverse: marketing opportunities in a connected and persistent world

Friday 29th of October 2021 - Updated on Wednesday 22nd of June 2022

For several months now, the concept of the metaverse has been making waves. Much more than a fashion phenomenon, 3D virtual universes foreshadow an evolution from Web 2.0 to Web 3.0, which should heavily impact the economy and our lifestyles.
"Tomorrow, your avatar will be able to visit a virtual store and allow you to virtually test and then physically order real products."

There is no academic consensus on the definition of the metaverse, except that it is certainly the future of the internet. Facebook, the video game Fortnite, Microsoft… Each stakeholder seems to be designing their own vision of the metaverse. For Matthew Ball, author of the book Metaverse Primer and speaker at the Orange Silicon Valley Hello Show in early October 2021, "the Metaverse is a massively scaled and interoperable network of real-time rendered, persistent 3D virtual worlds that support continuity of identity, history, objects, and payments, can be experienced synchronously by an effectively unlimited number of users."

The beginnings of a new world

The term metaverse, a contraction of "meta" and "universe," refers to a virtual world in the science fiction novel *Snow Crash*, where it first appeared in 1992. The concept was given a notable incarnation in 2006 with the virtual universe Second Life, which became popular with individuals, companies and brands who explored its use to open virtual stores, organize events, hold training, do marketing, etc. The arrival of social networks, however, plunged Second Life into obscurity.

For their part, video games have been seeking to offer players a more immersive and social experience for decades, with the addition of features that enrich player interaction. Games

such as Dark Age of Camelot, Eve Online and, more recently, Fortnite, have developed metaverse features by immersing their users in a persistent world that allows you to customize the environment, avatars and the game. The movie industry is also pursuing this quest for immersion with blockbuster films such as The Matrix, Toy Story, Spiderman in 3D or shown via complementary virtual reality experiences. This is thanks to creation tools shared with video games, such as the "Unreal" and "Unity" 3D rendering engines, and which make it possible to easily transfer 3D, AR, and VR elements to digital media.

Breaking down technological barriers

While speed, low latency and the need to display millions of polygons in 3D environments have long limited the uses of the metaverse, the progress made in recent years on augmented reality and virtual reality (AR/VR) opens up the field of possibilities in the private and professional spheres. Virtual reality headsets and augmented reality glasses allow for immersion in the physical sense of the term. This offers economic opportunities: e-commerce, product placement, virtual shopping, virtual events, work meetings in a virtual space, etc.

Luxury brands, in particular, are already at the forefront. Many of them have created virtual worlds to increase their visibility, capture a new audience and facilitate purchases — like the Italian fashion house Gucci or even Balenciaga during the pandemic. "Tomorrow, your avatar will be able to go to a virtual store in a metaverse and allow you, from a cellphone, tablet or VR headset, to virtually test and try out and then physically order real products," emphasizes Morgan Bouchet, Digital Content & Innovation Director at Orange, in charge of Metaverse & XR activities. "You will also be able to virtually dress your avatar (a figure that resembles you) and personalize it, to stand out from others in the virtual world." The 5G network will be able to carry the required amount of 3D data with low latency.

On the road to immersion!

A digital operator such as Orange has long been engaged in research to study how its products and services will in future be able to embrace the immersion habits of its customers, to the point of imagining and preparing a totally augmented and intelligent world. "In B2C, we support our clients in new forms of use and entertainment through AR/VR/360° technologies," explains Morgan Bouchet. "Live concert broadcasts in a virtual environment, immersive video to watch a soccer game or immerse yourself in a 360° documentary with dolphins… We have also reintegrated part of the Orange TV services' ecosystem into our "Immersive Now" beta platform, an Orange virtual exhibition, allowing our test customers, wearing their Oculus Quest headsets or simply via their cellphone/tablet, to experience 2D content immersed in an idyllic setting, to discover 360° content and then, in the very short term, to be able to invite their close friends and share these moments with them."

In B2B, the challenge is how the metaverse can solve the problems of the operator's customers: immersive meetings, augmented involvement in factories, remote assistance, training. Orange is also thinking about the representation of its own stores in the metaverse;

stores that would faithfully replicate the existing ones to offer a customer experience close to reality or, on the contrary, that would propose architectures and experiences that would provide real benefits in terms of use and product discovery, particularly through new interactions with people and objects.

People dancing in the metaverse

The organization of remote events, such as Travis Scott's Fortnite Concert in 2020 (or Ariana Grande's in 2021, etc.), have provided a first glimpse of the benefits of the metaverse in its current state. The multiple instances of this concert gathered 12 million "spect-actors" on the first night. Singer Travis Scott is said to have gained considerable time with zero air travel (the concert was captured in a 3D capture studio), drastically reduced production/rehearsal time, increased visibility and earned much higher revenue from virtual purchases.

Metaverses open up other opportunities related to leisure and culture, such as the immersive discovery of heritage, museums and cities, remotely and with friends. Video games, fashion, music and tourism are just a few of the sectors likely to participate in the rise of these new living and economic spaces.

Journey Through the Metaverse: Technology is Ready, But Stakeholders Need to Link Up

Digital culture | Article

Journey Through the Metaverse: Technology is Ready, But Stakeholders Need to Link Up

Friday 5th of November 2021 - Updated on Wednesday 22nd of June 2022

As our physical and virtual worlds merge with one another, we are moving toward an augmented world. However, there are still hurdles to overcome on the path to turning the era of the metaverse from fiction into reality. We need to harmonize different technological building blocks at different stages of development and ensure the interoperability of the various services.

"The VR headsets of tomorrow will have evolved into connected glasses, offering users greater comfort and a growing number of sensory and cognitive experiences."

The digital sector's major stakeholders agree that it is not a question of if the metaverse will become a reality, but when. From user experience and telecoms infrastructure to human-machine interfaces, the entire metaverse value chain relies on several technological building blocks. Some of these components are well advanced already, while others still need to mature.

A Gateway: AR/VR Technologies

VR (virtual reality) and AR (augmented reality) glasses and headsets have made strong and swift progress in recent years. These connected accessories are a gateway to the immersive world of the metaverse. It's this vision that led Facebook to purchase the Oculus VR brand of headsets in 2014 — the social media company firmly believed that the headset would "change the way we work, play and communicate." In 2016, Snapchat announced the launch of its connected glasses, Spectacles, and in August 2021, TikTok acquired Pico, a Chinese VR headset manufacturer. Orange Innovation is experimenting with Chinese start-up Nreal the use of AR glasses that are less bulky than VR headsets.

Although still in their infancy, these AR/VR technologies have already been deployed in fields such as entertainment, consumption and work; and that's only the beginning! "AR/VR equipment is the best way to enter the metaverse and provide a more human-centered experience," says James Li, Principal, Technology Group at Orange Silicon Valley. "Indeed, the pandemic has bolstered the desire for immersive virtual experiences in the real world. The VR headsets of tomorrow will have evolved into connected glasses, offering users greater comfort and a growing number of sensory and cognitive experiences."

Decentralizing for Latency and Trust

Edge computing technology is another essential building block in the metaverse. In a future world where millions of people will be having continuous virtual experiences in real time, the cloud will not be able to centralize and store all the resources involved. Due to latency, this data will need to be distributed across the country. Edge computing will bring the cloud closer to our homes, allowing us to enjoy low-latency applications.

Another key technological building block, blockchain, is the foundation of NFTs (non-fungible tokens), which give the metaverse a market value. For example, NFTs can be used when purchasing digital artwork, acting as a certificate of identity and guaranteeing the art's value as an original piece, allowing any copies to be identified.

Interoperability: A Must

Thanks to 5G's increased technological maturity and power, which will improve bandwidth while reducing network saturation and latency, the metaverse could be right around the corner. Once all the technological challenges have been overcome, the migration of Internet users to this metaverse will be reliant on interoperability. Indeed, having a virtual experience or digital asset becomes more appealing when it's possible to move into another universe or onto another platform. "All the technologies in the metaverse value chain must work together to provide an excellent user experience," explains James Li. "Interoperability between technologies and stakeholders is essential for making the metaverse a reality and for creating an open and seamless space." That is to say, an alternate universe in the true sense of the word, not just a collection of discrete 3D communities that are open only to the customers of the companies that own them.

1. Hello Future
2. Data

Data sharing increases data value for businesses

Data | Article

Data sharing increases data value for businesses

Friday 19th of November 2021 - Updated on Wednesday 15th of June 2022

Most data has limited value in and of itself, but this increases when combined with other data. The ideas and applications arising from this concept are likely to transform businesses and help solve some of our social problems. Many companies are deterred from taking up the opportunities that sharing data has to offer because of the inherent risks associated with it. "Data sharing" is the art of organizing exchange ecosystems that can protect the data of various stakeholders.

"Data sharing uses a give-and-take logic: it unites companies around common interests and use cases."

Fifteen years ago, an Open Data movement was launched, particularly by governments, to allow as many people as possible to access to public data. Everything changed with the early stages of Big Data. Previously viewed as waste left over from information systems, data became a valuable asset. Companies wanted to use data to create value, increase it by combining it with other data and share it in a more organized and secure way. They worked on the terms for data sharing, data usage and creating contracts to ensure they complied with the restrictions pertaining to their businesses. These restrictions included regulatory requirements and issues surrounding patents, intellectual property, governance and controlling third-party use of data, to name a few.

Give and take

With Big Data, many companies are already on their way to creating value with their own data. So why not share it? But with who, and for what purpose? Roxane Adle Aiguier, Head of Digital Society Research Domain at Orange, explains that "data sharing has become a business in itself, but it cannot necessarily be monetized. It can often be understood using the logic of give and take. A mutual sharing agreement unites companies around common interests and use cases." Roxane Adle Aiguier uses an example of an aviation subcontractor factory for whom Orange is helping to create a "digital twin" of the factory and the parts produced there. Tracking these parts, their location and evolution precisely is a critical issue

for the aircraft manufacturer, which is made possible by sharing data between the aircraft manufacturer and its subcontractors.

Among willing stakeholders

Let's get back onto terra farma. Does the data produced by a milking machine belong to the farmer? Or does it belong to the machine manufacturer? They both have a particular interest in using this data securely. The farmer wants to monitor and improve milk quality and production, and the manufacturer wants to enhance the performance of the machine and carry out predictive maintenance. "This type of questioning often falls into a gray area and setting up a 'data sharing' system creates a framework of trust with the consent of each stakeholder. Consent and security are essential concepts here. At Orange, we act as a trusted third party by creating technological building blocks to manage consent and security. For example, we carry out this role in the Agdatahub project, which is a platform designed to protect and enhance the use of French agricultural data."

From Data Lakes to super platforms

The challenges and risks of data aggregation have led to the emergence of platforms and ecosystems that make it easier to share data. Data Lakes are the first place where unordered and unprocessed raw data is stored. When the level of specialization is increased and data begins to be categorized by type or by speaker, then vertical platforms dedicated to specific use cases are created. At the most complex level are super platforms which are capable of linking different industries. For example, a logistics ecosystem could bring together a road and supply chain platform, etc.

Data sharing strengthens sectors

A major European data-space project called Gaia-X is in the process of being developed with the goal of promoting data exchange between different sectors within EU countries under a GDPR-compliant regulatory framework. Orange is a Gaia-X partner supporting the design of the technical infrastructure. "The popularity of data sharing is undeniable and the benefits for society evident. Although large groups currently are predominant in this ecosystem, small businesses are hungry for data too. This popularity reveals the benefits of having an organization with a clear trade, in which cooperatives and trade unions will play a decisive role."

Journey through the Metaverse: Is the Future of Retail Virtual?

Digital culture | Article

Journey through the Metaverse: Is the Future of Retail Virtual?

Monday 29th of November 2021 - Updated on Wednesday 22nd of June 2022

Browse stores in a virtual world, buy something and have it delivered to your physical mailbox. This is v-commerce, or virtual commerce, and it goes beyond virtual worlds and games to redefine how we buy and consume, in this and all other realities.

"The purpose of a metaverse is not to function in isolation, but to build bridges between the virtual and real worlds."

The digital media market is doing well thanks to video games. Many developers depend on it and are abandoning the hitherto dominant model of games being purchased as a finished product and giving each customer access to the same content. These developers now offer multiplayer applications and games, such as World of Warcraft, Fortnite or Pokémon Go, which are partially free to play. The time that non-paying players spend on a game and its multiplayer interactions provides a more enjoyable experience for customers who pay, whether via subscription or micropayment. There are all sorts of add-ons, including improved player avatars, shortcuts to an enriched experience, and even pay-to-win content that gives you an advantage over other players. The model is becoming more and more successful, a sign that consumers are increasingly keen on sharing virtual experiences with others. This trend may give rise to a future in which virtual emulation extends to other areas of daily life. Shopping, in particular, could be revolutionized by the possibility of shopping in virtual stores as a sharply dressed, customized avatar. Nike has recently announced NIKELAND, its own metaverse on the Roblox gaming platform. Players can kit out their avatar in Nike products and journey through a virtual world dominated by sports.

My Metaverse Sneakers

Other trends have recently emerged, even in physical stores. "The purpose of a metaverse is not to function in isolation, but to build bridges between the virtual and real worlds," says Mathieu Ducrot, Director of XR Products and Services at Orange Innovation. "Originating

from industry, the digital-twin concept is starting to penetrate the world of e-commerce. When a customer purchases a real-life pair of shoes, they can pay a bit extra for a similar virtual pair for their avatar. Gucci, for example, recently marketed a pair of exclusively virtual sneakers called Gucci Virtual 25. In the future, before purchasing a vehicle, consumers will be able to customize it by applying the color and features they want to its digital twin, wow their friends and family by taking it for a virtual test drive while waiting for delivery of the real thing, and keep an eye on it remotely once it has arrived. Porsche is already testing the use of digital twins to monitor the condition of the car and anticipate servicing requirements."

When Virtual and Real Worlds Collide

Augmented reality (AR) is already improving traditional omni-channel retail journeys by enabling the crucial customer benefit of being able to "try before you buy." For example, by pointing their smartphone's camera toward their feet, customers can see on their screen how the new pair of sneakers they so desperately want might look — before heading to the checkout. Furniture and interior design stores are leading the way in augmented retail. By simply downloading a mobile app, customers can already use AR to try a paint color on their walls or to see how a piece of furniture fits and looks in their living room. "This type of functionality will minimize returns, which are the biggest problem for online retail brands today: according to the French Federation of E-Commerce and Distance Selling (FEVAD), they result in the loss of 2–3% of revenues each year. The ready-to-wear, eyewear and cosmetics industries have already embraced AR technology. At Orange, our Innovation teams are focused on using AR to enhance customers' instore experience." Smartphones' growing ability to map their 3D environment and to track body movements accurately is fueling growth in these new services.

Get Your Glasses, We're Almost There

Establishing the metaverse and immersing it into the real world requires technology that is both affordable and acceptable to the general public, based on devices that offer total freedom of movement and near-real rendering of virtual objects. Detailed textures that are faithful to the original object are a sure sign of advanced, detail-rich 3D models which are, by their nature, difficult to recreate. Fiber and 5G, together with edge and cloud computing solutions, will be able to support the most demanding extended reality (XR) graphics calculations, thereby enabling miniaturization of devices such as augmented reality glasses, which will eventually take the form of a regular pair of spectacles. Orange is leading the way by dedicating a significant portion of its research to very high broadband networks (5G and Fiber) and XR cloud platforms, which are key vehicles for these new services.

1. <u>Hello Future</u>
2. <u>Digital culture</u>

Vendée Globe 2020: innovation at the service of speed

<u>Digital culture</u> | <u>Article</u>

Vendée Globe 2020: innovation at the service of speed

Monday 18th of January 2021

To sail round the world, solo, non-stop and without assistance: an outstanding human challenge, the Vendée Globe is also a great technological adventure. Each edition of this unparalleled race pushes back the boundaries.
"Boat design now favours closed cockpits from the inside of which skippers watch the sea and sails on a screen then make adjustments."

On November 8th, 2020, 33 skippers set sail to tackle the "Everest of the seas". This year again, the aim is clear: to break speed records. Armel Le Cléac'h, winner of the previous edition, made his round-the-world trip in 74 days. In 2020, the competitors hope to make it in less than 70 days. To achieve this the IMOCA 60s – 60-foot-long monohull sailing yachts – are brimming with technology. The 9th edition of the Vendée Globe marks the advent of instrumentation and artificial intelligence (AI).

Sensors and "smart" pilots to enhance performance

Collection and processing of the data generated onboard the IMOCAs have taken a giant leap forward in the Vendée Globe 2020.

Dozens of sensors are installed in strategic places such as the rudder, the hull, the sails, or the foils (see insert). They collect data relating to the boat's movement, to strains exerted on various elements, to the wind, etc. and feed the onboard computer enabling the skipper to make the right adjustments so as to reach impressive speeds.

On board Hugo Boss, skippered by Alex Thomson, 350 sensors, supported by around ten thermal and video cameras, collect a variety of data that is processed by data analysis and machine learning algorithms. The skipper himself wears a whole set of sensors to monitor his physical and mental state. Unfortunately, Alex Thomson was forced to abandon the race on 28th November following a collision with a floating object.

The sensors also feed the autopilot, the sophistication of which has contributed to one of the greatest performance gains ever in the offshore racing world.

Autopilots are based on the servomechanism principle: they receive a set value that they must maintain. Let's take course for example, the system will calculate the difference between actual course and desired course then take action on the rudder in order to stay on course.

To do this, the pilot measures the course with a compass and, for the most advanced systems, with the help of sensors. The data is processed by the control unit, the system's brain, which performs the calculations and sends the results to the actuator, which is responsible for activating the drive unit. The pilot is also equipped with a human-machine interface.

Integrating more and more technology bricks, autopilots have become "smarter". Not content with simply staying on course, today's more responsive and precise pilots adapt to the boat's movements better than a human can.

An anti-collision system based on AI to reinforce safety

Difficult to detect, unidentified floating objects (UFOs) are a great danger to the Vendée Globe yachts. For the skippers, collision with a UFO often means quitting the race. This year, 18 of them are equipped with a new anti-collision system based on computer vision.

Developed by BSB Marine with the support of big names in offshore racing, such as Jean Le Cam and Armel Le Cleac'h, OSCAR is made up of a vision unit comprising two thermal cameras and a colour camera that scan the water's surface by day and by night. Software analyses the video streams in real time.

Trained – thanks to a deep learning process – from a huge database of floating objects, OSCAR is capable of recognising the specific visual signature of floating object categories in a given situation. It displays the position of the floating objects detected on a map and immediately alerts the skipper of a potential danger.

What is the impact of these technologies on the competition?

An [article published on the Vendée Globe website](#), backed up with quotes from skippers, describes how the new generation of autopilots has changed the way in which IMOCA's are designed and managed.

The introduction of foils and the autopilots' sophistication have led to a great increase in boat speeds (and in speed differences) and therefore in apparent wind, to the point that the sailors, by their own admission, are sometimes no longer fast enough at trimming the sails.

It has therefore been necessary to modify sail design for them to accommodate speed variations without constantly needing to be adjusted. Other elements, such as the hull or the appendages (underwater elements that control or stabilise the boat) have also been affected.

The boats may have become more difficult to manoeuvre but they have also become more dangerous. On the one hand they are subjected to ever more violent impacts, which makes for more perilous and trying living conditions, and on the other, sailors can no longer spend too much time outside where they run the risk of being hit by huge cascades of solid water.

The result: boat design now favours closed cockpits from the inside of which skippers watch the sea and sails on a screen then make adjustments safely.

These evolutions have increased the trend which has been ongoing for several years: sailors spend less and less time at the helm.

Their typical profile has also evolved as the instrumentation requires greater knowledge of electronics and computing. For example, François Gabart and Armel Le Cléac'h, the last two winners of the Vendée Globe, both have an engineering background.

Skipper experience, a cardinal virtue

This does not mean that the skippers can rely completely on technology. Firstly, because the Vendée Globe rules limit what it can and cannot do (sail trim, weather routing, etc.), and also because they are not immune to technical failure.

Damien Seguin (Groupe Apicil) and Louis Burton (Bureau Vallée II) were both forced to set the race aside and "get their hands dirty" because of an autopilot problem.

Alex Thomson's IMOCA was one of the most "well-tooled" and was in fact equipped with the OSCAR system. A few days before quitting the race, the British skipper explained how during the Vendée Globe 2016 he lost use of his satellite antennas (enabling him to receive his weather files), which forced him to "navigate the old way".

Ultimately, today's skipper must have technical knowledge, but experience and intuition remain cardinal values.

The flying boats of the Vendée Globe

Foils first appeared at the Vendée Globe during the 2016 edition. A true breakthrough innovation, these "moustaches", placed both port and starboard, generate hydrodynamic bearing capacity that can lift the yachts out of the water, making them "fly" and thus gain speed. In 2020, foils have been definitively taken on board by the skippers – with 19 boats out of 33 being fitted – and their size has been multiplied threefold.

When the Vendée Globe innovations are exported

When the Vendée Globe innovations are exported

Friday 22nd of January 2021 - Updated on Wednesday 22nd of June 2022

The Imoca monohull sailing yachts of the Vendée Globe have become true technology platforms: the know-how and innovations developed for competitive sailing are being transferred ever more to maritime transport, and more generally, to industry.

"The issue for the ecosystem is to adapt these technology bricks to merchant ships so as to launch future sailing ships."

On November 8th, 2020, the 33 competitors of the Vendée Globe set sail from the Sables d'Olonne once again to sail round the world, solo, non-stop and without assistance. This unparalleled competition may be boosted by technological innovation, but another phenomenon has also been at work over the past few years: the increasingly sophisticated technology bricks developed within the frame of the Vendée Globe are being transferred to other areas.

Logically, the first to benefit from this is maritime transport, as shipowners seek on board the Vendée Globe sailing yachts solutions for reducing their own environmental footprint. However, they are not alone. Industry is also looking closely at the onboard systems.

Maritime transport sets sail once again

In 2018, the International Maritime Organisation (IMO) adopted measures to reduce the total annual greenhouse gas emissions from international shipping by at least 50 % by 2050 compared to 2008, forcing market players to explore new avenues to reduce their fossil fuel consumption.

Among these, sailpower (using the wind's kinetic energy to propel boats forward) seems to be a promising solution for decarbonising maritime transport. Sailpower cargo or cruise ship projects are on the increase (in reality they are often equipped with hybrid propulsion).

In their quest for performance, the offshore racing community members have developed a unique know-how in this area. Numerous innovations have emerged from within the race teams, naval architecture firms, ship builders, and equipment manufacturers, and proved their potential on the racing yachts. The key issue for the ecosystem (read "The Bretagne Sailing Valley" below), is to adapt these technology bricks to merchant ships so as to launch future sailing ships that can compete with today's cruise ships, bulk carriers, and container ships.

Cargo ships with sails and ferries with foils

Searching for a clean mode of transportation to convey the parts of the Ariane 6 launcher from Europe to its Kourou launch base, Ariane Group turned to French naval architecture firm VPLP, whose boats won the last two Vendée Globes.

VPLP imagined a modern sail cargo ship, which takes its shape and components from both the aeronautics industry and competitive sailing. Named "Canopée", this 121-metre-long and 23-metre-wide roro vessel with hybrid propulsion is equipped with 4,375 m^2 articulated wing-sails, thanks to which it should use 30 % less fuel and save 7,200 tons of CO_2 per year compared to a conventional ship of the same size.

Also interested in passenger transport, the architects are currently working on a passenger ferry with foils.

For their part, Chantiers de l'Atlantique have called upon Multiplast, an SME specialised in the manufacturing of racing yachts in composite materials, to work on a rigid sail named "Solid Sail".

Tested on Jean Le Cam's Imoca on his return from the 2016 Vendée Globe, this technology was designed to propel Silenseas, the future hybrid cruise ship of the Saint-Nazaire (Loire-Atlantique, France) shipyard, a nearly 200-metre-long vessel equipped with three sails whose surface totals 4,350 m^2.

A fantastic test bed for industry

The technologies developed for the Vendée Globe Imocas, monohull yachts designed for competing and facing up to the sea's worst conditions, may seem very specific. However, it is in fact because these yachts are confronted with extreme conditions that they constitute a fantastic "test bed" for industry, making it possible to test concepts and validate technologies.

Thus, the solutions aimed at helping skippers to win the Everest of the seas can help to address a number of technological challenges and lead to applications that go beyond the world of competition or even that of shipping.

This is particularly the case of onboard systems, with the Vendée Globe yachts' onboard instruments having seen significant developments over the past few years. All that has been

developed around data acquisition, transmission and processing, progress made in terms of energy efficiency, etc., are of valuable interest to industrial automation.

This is what is highlighted by Nokia Bell Labs, who have developed several technologies for Alex Thomson's Imoca, "The automation and AI systems we have created for Alex and Hugo Boss have clear applications for business and industrial automation, and they could potentially be used in future Nokia products and services. The systems on board the boat must be reliable in the most extreme weather conditions. It is the same for the industrial automation systems that we develop for mining operations, for offshore oil platforms, and even space exploration."

According to Nokia's industrial research institute, the Vendée Globe "presents an intriguing opportunity to solve one of the most vexing problems facing widespread deployment of AI and industrial automation systems: how to augment and automate mission critical remote systems."

e-Telltale, from sails to wind turbine blades

The wind power industry is also opening up to the competitive sailing community, as is shown by the example of Trimcontrol, developed by Michel Desjoyeaux' team, Mer Agitée. This electronic telltale (e-telltale) makes it possible to monitor air flow on the sails in real time, which helps the skipper make fine tune adjustments to optimise the yacht's speed.

This innovation, tried and tested on the Vendée Globe boats, turns out to be very useful in the wind power sector. It is quite possible to install an e-telltale on a wind turbine's blades to get precise information on the air flow along them. This enables the operator to ensure that the angle of incidence of the blades is well-adjusted and, if necessary, to correct it so as to obtain a better aerodynamic performance (the amount of wind energy transferred to the rotor). A version of Mer Agitée's e-telltale is being tested within the scope of a programme supported by the French Agency for ecological transition (Ademe).

The Bretagne Sailing Valley

VPLP Design, Multiplast, and Mer Agitée are all part of the "Sailing Valley", the competitive sailing technological ecosystem based in Brittany, where some of the world's most high-performing and most innovative boats are born. Made up of over 200 companies, mainly SMEs, this Breton pole concentrates most of the offshore racing skills: architecture, shipbuilding, manufacturing of rigging and appendages, onboard electronic equipment, etc.

Source: https://www.bdi.fr/wp-content/uploads/2020/09/DP-BRETAGNE-SAILING-VALLEY-ET-VENDEE-GLOBE-v6_complet.pdf

1. Hello Future
2. Digital culture

When teleworking, the IoT, and AI reduce our carbon emissions

Digital culture | Article

When teleworking, the IoT, and AI reduce our carbon emissions

Friday 12th of March 2021 - Updated on Wednesday 15th of June 2022

More widespread use of teleworking, smoother traffic flow in the smart city, energy management optimisation with the smart grid, etc.: the digital transformation is aiming to be synonymous with ecological transition.
"Vehicle-flow analysis helps to reduce city-centre traffic by redeveloping urban space and fostering soft mobility."

Can ecological transition and digital transformation go hand in hand? The carbon footprint of the digital sector is far from insignificant: 4 % of greenhouses gases at the beginning of 2021 and twice that by 2025 according to the ADEME, the French agency for ecological transition.

However, although digital may be a burden on the habitability of our planet, it could also be part of the solution to preserve it. This is where the French government has placed its bets in aiming to ensure the convergence of both the digital and the environmental transitions. The aim: to speed up the decarbonation of our economy, meaning to reduce our reliance on fossil fuels.

Its roadmap, published in February 2021, plans to create a fund of 300 million euros dedicated to GreenTech startups as well as to finance projects that will mobilise 5G to serve the environment within the frame of the 4th "Investing for the future" (PIA) programme.

Indeed, digital can replace traditional carbon-generating activities by limiting business travel, among other things. The following four use cases provide examples.

Less CO$_2$ thanks to teleworking

The current health crisis has validated the feasibility of large-scale teleworking. In France, according to the latest Malakoff Humanis yearly barometer, up to 41 % of employees teleworked during the first lockdown, thus equally reducing home-work commutes, of which

a large portion relies on personal vehicle and as such is a high carbon emitter. Although this rate of teleworking dropped by ten points in December 2020, the tendency remains.

The massification of teleworking has been made possible thanks to the maturing of digital workplace solutions that bring together all remote collaboration tools into a single interface: videoconferencing, chat, shared calendars, file-sharing, etc. This new work organisation implies prior dematerialisation of company processes; a zero-paper policy constitutes another environmental advantage.

The smart data-driven city

Reducing travel is also an important issue for the "smart city". Vehicle-flow analysis enables local decision-makers to optimise their mobility plans and reduce city-centre traffic by redeveloping urban space and fostering soft mobility.

This is, for example, the path chosen by the Toulouse metropolis with its VILAGIL plan. A MaaS (Mobility as a Service) platform enables citizens to have real-time knowledge of all available means of transport, from public transport to vehicle-sharing or electric bike and scooter sharing services… pending the arrival of the autonomous car.

This is not the only benefit of the smart city. By combining the Internet of Things (IoT) and artificial intelligence (AI), it analyses a large amount of data coming from connected infrastructures – street furniture, public lighting, waste bins, public buildings, etc. – to improve energy efficiency.

Committed to a "smart territory" project, the Angers Loire metropolis is banking on savings of 101 million euros over twenty-five years, in particular with energy-savings of 66 % for public lighting and 25 % for public building consumption compared to the current situation.

A more energy-sober building

After the smart city, the smart building. A multitude of sensors placed on various installations (heating, pipes, electricity network, air-conditioning, etc.) of the building that has become smart, enable it to gain in operational efficiency.

This reduces its carbon footprint – according to a 2017 study by Citepa (the French Technical reference centre for air pollution and climate change), residential and office buildings account for 20 % of greenhouse gas emissions and are the second most important source of environmental nuisance after transport.

Presence indicators enable a smart building to lower room temperature and turn off lights in unoccupied offices. The building can even produce energy by hosting an urban farm or digitally driven photovoltaic panels on its roof.

The smart grid to increase energy efficiency

The final smart concept, the smart grid, also calls upon the IoT and AI. Driven by data, this smart energy distribution network uses models to anticipate the evolution of electricity and gas production and consumption.

Such real-time management makes it possible to avoid blackouts – winter power cuts – and to increase energy efficiency. The visible face of this concept, Linky and Gazpar smart meters enable access to energy consumption measurements via the grid.

Everyday decarbonating

Just as we have learnt to switch out lights and turn off taps, it is possible, on an individual basis, to adopt more reasonable digital usages. Connecting to Wi-Fi rather than 3G/4G when it is possible, not leaving an "empty" charger plugged in, regularly cleaning out mailboxes, extending product lifetimes, etc. The ADEME suggests a certain number of eco-gestures in its guide "La face cachée du numérique" (The hidden side of digital).

The ADEME guide "La face cachée du numérique" (The hidden face of digital)

The French government's roadmap to bring together the digital and ecological transitions

The Orange group's Corporate Social Responsibility (CSR) policy

The Malakoff Humanis yearly teleworking barometer 2021

The Toulouse metropolis VILAGIL project's call for expression of interest

Le Journal du Net article on the Angers Loire metropolis smart city project

Hub Institute article on the Angers Loire metropolis smart city project

"Les émissions des gaz à effet de serre du secteur résidentiel" (Greenhouse gas emissions of the residential sector) factsheet from the French Ministry of Ecological Transition website

1. Hello Future
2. Data

Data and AI: How carriers can compete with GAFA

Data | Article

Data and AI: How carriers can compete with GAFA

Tuesday 28th of September 2021 - Updated on Wednesday 22nd of June 2022

Tech giants do not have a monopoly over data and artificial intelligence. A white paper published by Sofrecom highlights the benefits that carriers can reap from this sector of the future: an exceptional penetration rate and a high standing in B2B. "The GAFA monopoly is increasingly challenged by the stance taken and numerous fines imposed by regulatory authorities, suggesting a re-balancing to the benefit of carriers."

"When it comes to the economy, data is the new oil," said entrepreneur Clive Humby in 2006. History has proven him right beyond all expectations. Empires have been built on bigger and bigger mountains of data. Over the course of a decade, GAFA (Google, Amazon, Facebook, Apple) increased their sales from $78 billion in 2008 to $773 billion in 2019. From the outset, GAFA put everything into this new oil, developing data-driven services such as a search engine (Google), online sales (Amazon) and social networking (Facebook). This gave rise to a virtuous circle, as these services became more and more popular. "The more data obtained by GAFA, the more they can hone their machine learning models. The more accurate the data, the better the conversion rate and therefore the revenue," said Clotilde Marielle, Business Director of Market Intelligence Consulting at Sofrecom.

102% penetration rate

In the face of this competition, carriers have many advantages they can draw on, demanding a place at the data giants' table. First, they benefit from an unmatched penetration rate: 102% and 5.124 billion unique mobile customers worldwide in 2020 (source: GSMA). As a result, epidemiologists who wanted to study population mobility during the COVID-19 pandemic turned to mobile carrier data, which was deemed to be more reliable than the mobility data disclosed by Google and Apple. The reason? In both cases, the sample was deemed not representative of the population because it was based purely on route searches in the Maps and Plans apps.

Dare to venture into new areas

Carriers can also rely on their privileged relationships with large and small companies, enabling them to develop the B2B market and work on production processes, whereas GAFA mainly hold open data that can be searched online and that is provided by users. The GAFA monopoly is also increasingly challenged by the stance taken and numerous fines imposed by regulatory authorities, suggesting a re-balancing to the benefit of carriers. According to Marielle, carriers should grab this opportunity with both hands and "dare to venture into new areas by making the most of AI."

Diversify to gather new data

Why not follow in GAFA's footsteps and hire new budding talent working in AI to diversify? "Carriers won't make the most money by following the traditional path," writes Marielle in Sofrecom's white paper. "Because, generally speaking, there is no real gap in today's telecoms market. However, by branching into new areas (Internet of Things, banking, etc.) or B2B verticals, carriers have the chance to gather new and more data that will enable them to hold a sustainable place in the market." Since 2009, Google has invested $4 billion in acquiring AI startups, while carriers have put their money into networks and services.

1. Hello Future
2. Digital culture

Digital learning: the health crisis imposes the virtual classroom

Digital culture | Article

Digital learning: the health crisis imposes the virtual classroom

Monday 11th of October 2021 - Updated on Wednesday 20th of October 2021

With the COVID-19 pandemic having greatly reduced in-person training, businesses have largely turned to the virtual classroom. Reproducing the workings of a classroom, this new learning format fosters peer interaction and discussion.

"A virtual classroom must not identically reproduce the sequence of an in-person course. Interactivity must be omnipresent."

Training has most certainly been the HR process most impacted by the COVID-19 crisis. Businesses had to abandon in-person training overnight and massively switch to online training. This paradigm shift took place precisely at a time when they had a considerable need for training. Indeed, with the generalization of teleworking, there was a need to train staff in collaborative working tools, and their supervisors in distance management.

Organizations therefore turned massively to digital learning in order to sustain their training efforts. According to the 2020 edition of the Cegos European barometer, 86 % of human resources directors used distance training more last year than they did before the crisis. New modes of learning, from using a smartphone to learning in augmented reality, through MOOCs (Massive Open Online Courses) or video tutorials, have thus come out of the crisis stronger. There is however one that stands apart, and that is the virtual classroom. According to a joint study by consulting firm Féfaur and editor Talentsoft, conducted among over 600 European training managers, 77.4 % of French companies have used virtual classrooms since the beginning of the crisis.

Staying in touch

It is true that the virtual classroom is the format that comes closest to in-person training. As its name implies, it reproduces the workings of a classroom virtually. Using a single interface, both trainees and trainers can converse in synchronous mode both by videoconference and by chat, as well as share online content. Coached by the trainer and able to have conversations with their peers, learners are no longer left to their own devices, which is one of the most frequently encountered pitfalls of online learning.

Associate director of Féfaur, <u>Michel Diaz says this success</u> is a result of learners wishing to stay in "live" touch with their company and with their peers. He thinks that even a well-written, well-filmed MOOC cannot replace what takes place in a virtual classroom. "Contrary to what we believed, it is possible, to some extent, to distance learn live the specifics, the ways of working, and even the soft skills of trades, without however reaching the richness and depth of certain courses delivered in person", he believes.

Furthermore, Michel Diaz notes that the skepticism of trainers regarding this live learning has diminished greatly. Faced with the disappearance of in-person learning, they took courses on designing and delivering virtual classes. Equipped with new skills, they have come out of the ordeal stronger, the expert believes.

No copy-and-paste

As Learn Assembly explains in <u>a white paper</u>, copy-and-paste is to be proscribed. A virtual classroom must not identically reproduce the sequence of an in-person course. Following a recipe of "30 % top-down and 70 % interaction", it is about writing a lesson that will not exceed two hours. A healthy dose of quizzes, fun activities, tests, and open questions helps to keep learners engaged. They can also work in sub-groups and converse with each other, thus creating a feeling of community, with informal discussion being an integral part of professional training. The coffee break is often the key time for clearing up any queries raised during the lesson.

What's more, the virtual classroom must fit into a hybrid training path that combines both in-person and distance modules. For example, a learner may start the learning process at home using online content (videos, podcasts, etc.) then, having acquired this initial knowledge, join the trainer and other learners in a virtual classroom. They will then work in sub-groups on a project that they will present during an in-person half-day session.

A booming ecosystem

The spectacular rise of the virtual classroom has revitalized a whole sector of activity, in which we are seeing the historical players of digital learning and in particular LMS ("Learning Management System") and LXP ("Learning Experience Platform") editors, such as Docebo, 360Learning, or Cornerstone OnDemand.

More opportunistically, videoconference specialists such as Zoom, WebEx, or Microsoft, and their partners, have added virtual classroom modules to their platforms. Since December, Microsoft Teams has offered working rooms called "Breakout Rooms". As for ClassEDU, it distributes a virtual class layer for the Zoom platform. Facing these heavyweights are some startups trying hard to be heard, such as Classilio, Glowbl, Bizness.

In the world of EdTech, more and more startups are attempting to make technology and pedagogy go hand in hand. It is worth mentioning Ubicast and Wooclap. These fresh startups intend to break from the traditional lecture-style approach where teaching is only top-down, and the student is passive. They are a breath of fresh innovation within the French national education, whose resources reached their limits during the second lockdown. The national digital working environment and the distance education website were both paralyzed in early April 2021, either unable to support the increase in traffic, or the victims of cyber-attacks. An upgrade in capacity will make it possible to accompany and amplify the digital learning dynamic.

– The Cegos group's 2020 European barometer – Transformation, Skills, and Learning

– Joint study by consulting firm Féfaur and editor Talentsoft

– E-learning Letter website article

– Learn Assembly white paper

1. Hello Future
2. Research

Open science: the principles and tools of more accessible and efficient science

Research | Article

Open science: the principles and tools of more accessible and efficient science

Friday 3rd of December 2021 - Updated on Wednesday 15th of June 2022

Open science is the largest possible dissemination of the publications and data from both public and private research. This approach aims to democratize access to knowledge and accelerate scientific discoveries, it relies on the alliance between open access and "FAIR data" (that is findable, accessible, interoperable, and reusable) on the one hand, and the use of machine learning techniques on the other.

"The FAIR principles describe the way in which data must be stored and presented to be more easily findable, accessible, interoperable, and reusable."

Open science is based on the idea that research results must leave the universities and laboratories to be disseminated across the whole of society. To achieve this, it is necessary to make scientific publications and data freely accessible to all (to researchers but also to individuals and businesses).

Yet today, access to scientific knowledge – despite it often stemming from publicly-funded research – is generally subject to expensive subscriptions imposed by specialist journals that are held by a small number of editors.

More efficient and transparent science

For its supporters, open science leads to democratization of access to knowledge. Above all, it increases the efficiency of research and fosters scientific breakthroughs and innovation. In effect, it enables researchers to pool their efforts and coordinate their work within an ecosystem that is more favorable to collaboration and the accumulation of knowledge in one or more fields of study.

With its increased transparency, open science is also a lever for scientific integrity and reinforces public confidence.

France has adopted an ambitious policy in this area: after an initial plan launched in 2018, the Ministry of Higher Education, Research and Innovation announced a Second National Plan for Open Science in July 2021. This second plan, via which the government confirms its commitments to the opening up of scientific publications and data, extends its scope to include the source codes produced by research.

Open access routes

The first prerequisite of open science, open access, refers to the free availability of academic articles in digital format. This notion covers both open access, meaning the content freely available to internet users, and free access: content that is both freely available and provided under a free license, which means it can be reused – under the terms specified in the license.

Open access has several economic models, or "routes", for covering publishing costs. The "green route" refers to the depositing, by the authors themselves, of their work in an open archive such as HAL, the French national archive created in 2001. It is also worth mentioning the European initiative OpenAIRE, or the American archive arXiv in the fields of biology, physics, mathematics, computing, etc.

The "golden route" concerns natively open access journals. Several models enable financing of the editorial work. In the author-payer model, the author of an article (or the institution that employs them) pays the editor to compensate for the loss of funding that is usually received via subscriptions. For example, the American Public Library of Science (PLOS) project has taken up this route. OpenEdition has also chosen the "golden route" but with a "freemium" model: subscription is free but there is a fee to access extra services.

France is championing yet a third route: the "diamond" model whereby publishing fees are not charged to readers or to authors but are paid for by the state, a university, or a not-for-profit organization, etc.

Open (scientific) data and FAIR principles

The topic of opening up scientific data is more complex as it can be limited by legal restrictions (industrial or trade secret, personal data, etc.) or by best safety practices.

In some fields researchers are used to sharing data, such as in particle physics where the CERN, the European Organization for Nuclear Research, makes the data produced available to the scientific community as well as to the general public, and in others, such as sociology or biology, the trend is more towards "data hoarding" (in particular due to their acquisition cost).

Because of this, it is difficult for researchers to analyze or reproduce the results of their peers' work or use it to make new discoveries.

To address this situation, based on the model of what has been achieved in the area of public data, the French government has decided to create a national platform bringing together all of the cross-disciplinary research data under the "Recherche Data Gouv" heading.

As for the European Commission, it has launched the European Open Science Cloud (EOSC). Researchers working in European institutions have access to all available data and to services enabling the processing and analysis of this data.

The way in which the data is organized is also important. Thus, the FAIR (Findable, Accessible, Interoperable, Reusable) principles describe the way in which data must be stored and presented to be more easily findable, accessible, interoperable (meaning exchangeable), and reusable. This implies that this data – and the metadata describing it – conforms with a certain number of protocols and standards.

NLP and text mining supporting open science

Finally, open science goes hand in hand with the development of tools based on artificial intelligence (AI) and machine learning (ML) to help researchers analyze and exploit the scientific production in a particular field – a task humanly impossible given the huge amount of data available!

Natural Language Processing (NLP) and Text and Data Mining (TDM) prove particularly useful for sorting through all the publications and scientific data, and for discovering relevant information (information retrieval).

TDM refers to the methods and algorithms that make it possible to analyze, with the help of linguistic technologies, large heterogeneous sets of data or non-structured text and to automatically extract knowledge from these.

Funded by the French government, the ISTEX platform (Information Scientifique et Technique d'Excellence) provides teachers and researchers with online access to over 20 million documents from around thirty corpora of scientific literature in all fields.

To enable even finer and relevant research, it also provides them with TDM services. Several data-semantics and visualization tools developed for the purposes of this project are now available to all, such as the LODEX software.

In the field of biomedical research for example, pioneer PubGene offers tools that enable users to explore huge data repositories using advanced text mining algorithms and specialized NLP algorithms. The objective of the Norwegian company founded in 2001 is to make personalized medicine more accessible. Its Coremine Vitae thus promises to help clinicians to identify the best treatment options and to define health protocols according to the patient's individual medical profile.

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