

EMERGING TECHNOLOGIES TREND REPORT



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FOREWORD

Thank you for your interest in Conclusion's first Emerging Technologies Trend Report. Conclusion is a dynamic ecosystem of more than 25 expert companies focused on business transformations and IT services. By bringing together our expertise around customer issues, we can offer truly distinctive services – from strategy and design to implementation, management, and further development.

Conclusion companies continuously monitor emerging IT trends and discover and explore new technologies that may be of interest to our customers. In order to provide all Conclusion ecosystem partners with an insight into these trends, concepts, and technologies, we have developed the Emerging Technologies Radar. This is a practical tool for both ourselves and the market, and it helps to spark a conversation about where an organization wants to go in terms of innovation.

My role as CTO at Conclusion is to stay on top of developments and to bring together the various Conclusion companies. We have grouped all the technologies into three categories, and also indicated the level of expertise that Conclusion has in these technologies. Each chapter of this report corresponds to a category.



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In this biannual Trend Report, we always present two technologies per category that we feel deserve a closer look. That may be because we're already seeing that a particular technology is delivering great value to our customers, and we have noticed that other companies are not yet embracing it in the same way. Or because we have our eye on an emerging technology that we're excited about and feel has great potential, and we're looking for customers who want to explore this technology with us.

The aim of this Trend Report is to inspire you and invite you to explore with us. I hope you enjoy reading it.

Lucas Jellema CTO Conclusion





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EXPLANATION

The biannual Emerging Technologies Trend Report presents six trends that we feel have potential, that we are currently exploring, that are in the early stages of practical application, or that are already part of our standard portfolio. The technologies are grouped into the following three categories:

- as the development of new products and services.
- technology in the digital world.
- analyse, and solve problems faster.

As you read this Trend Report, you will at times notice the struggle we faced, as many of the technologies we describe have aspects that fall into all three categories. The Emerging Technologies Radar is therefore not black and white but has many shades of colour. This is what makes our field so interesting.

Scroll through the report or use the interactive links. The buttons in the top right-hand corner will take you back to the table of contents and this explanation.

Business Enablers: technologies and technology trends that have an impact on processes, methods, or functions in an organization, as well

Interfaces & Experiences: technologies and technology trends that are transforming the way we interact with each other and engage with

Productivity Revolution: technologies that enable organizations to process larger volumes faster and more accurately, and to identify,









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BUSINESS ENABLERS



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IT FOR OT By CTO Jochem van Lierop of Conclusion Mission Critical

IT for OT is a technology that we deploy at several companies, which then automatically initiates a new action: scheduling particularly for remote monitoring and updating assets in maintenance, stopping a conveyor belt, or venting a vessel. remote locations.

What is IT for OT?

Controlling your OT through IT allows you to automate manual tasks, which means you can do more with fewer people. In addition, it often opens up opportunities to make your processes smarter. For instance, you might be able to deploy machine learning to analyse sensor patterns. Take a camera on a conveyor belt, for example, that monitors whether all the bottles are still positioned correctly on the belt. The images captured by this camera are analysed in real time using computer vision. As soon as this image recognition algorithm detects a process error - such as a bottle that has fallen over - the IT solution communicates this directly to the OT environment, which stops the belt. Previously, an operator would have to monitor this process and stop the conveyor manually, often after dozens of other bottles had fallen over as a result of the disruption.

Wouldn't it be great if a train was capable of indicating that a particular component needed to be serviced? Or if a conveyor belt could stop without operator intervention the moment a camera detects that something is going wrong somewhere in the process? In an increasing number of places, this is already happening - by using IT to control operational technology (OT). This data-driven control of industrial assets is also known as the Industrial Internet of Things (IIoT), or Industry 4.0. Assets can be anything from machines, conveyors, and forklifts to wind and solar farms, bridges and locks, locomotives and train sets, and so on. These assets are equipped with sensors that measure vibrations, noise, pressure, or air quality, or with cameras that monitor processes. This data is processed by a predictive algorithm,

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What are the benefits?



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What makes IT for OT so complex?

- There are many differences between the OT world and the IT world. OT systems are controlled by measurement and control technology such as PLC and SCADA – systems that are designed to last for decades. They are incredibly robust and not easily modified. This makes innovation a challenge.
- **2** On top of that, OT almost always involves stand-alone systems that were not designed to connect to the outside world. So they are not made for sharing data, and certainly not for twoway communication. Now that IT for OT is here, OT needs to be secured. And preferably in a way that can be integrated with the rest of the security landscape, otherwise all you are doing is creating tomorrow's legacy. A final point to bear in mind is lifecycle management. While this is often neglected in IT environments, it is even lower down the list of priorities in OT environments. In addition, no budget is set aside for maintenance and management.

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3 This all adds to the complexity of creating a stable OT environment that is also future-proof. An environment where you can innovate without costs spiralling out of control – and which is extremely secure, because it involves business-critical processes.







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Case study: Controlling wind

and solar farms remotely

One of the biggest challenges we face in the energy transition is balancing the energy grid. At times when the sun is shining and the wind is blowing, there is often an oversupply of energy. As the grid itself has little capacity to store energy, production needs to be adjusted at these times. This means that wind turbines may have to be shut down or solar farms switched off. This also has to be done in near real time. myBrand Conclusion has developed an application for controlling and monitoring this in a standardized way. Based on the agreements made (energy to be supplied) and the current level of energy demand and supply in the grid, all sites producing renewable energy receive a notification: you must now generate x number of megawatt *hours*. The wind turbines and solar farms switch on and off automatically, without the need for an operator to go to the site and flick a switch. The application runs on a hybrid cloud developed by Conclusion Mission Critical. The IoT platform was also provided by Conclusion Mission Critical in partnership with AMIS Conclusion.

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"Organizations often see the opportunities of accessing their industrial assets via IoT, but they tend to overlook what such an IT for OT environment requires in terms of security and management. This is extremely dangerous, especially in a missioncritical environment."

Jochem van Lierop, CTO at **Conclusion Mission Critical**



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MEDICAL INTELLIGENCE By data scientist Roel van Reij from Mediaan Conclusion

Hospitals are now well aware that data can provide a wealth of networks (known as black boxes) cannot be applied in healthcare. They may prove useful in discovering completely new relationships information. Almost every hospital uses AI. The big challenge in in very large data sets. But then the next step is always to find an this sector no longer lies in finding interesting cases, but in scaling up – putting this technology at the heart of the Radar. explanation for those relationships through research, so that a white box can be used when applying new insights in clinical practice.

What is medical intelligence?

By medical intelligence, we mean supporting healthcare providers with smart, Al-driven solutions. The word 'support' is key here. Medical intelligence is being used to address the three major problems in healthcare: staff shortages, growing demand for care, Because unlike in other domains where AI sometimes makes decisions independently, medical intelligence always requires a and rising costs. By providing AI systems to support decisionhuman to monitor what's going on. Decisions are made by a nurse making, doctors and nurses can make better decisions faster. One or doctor. A good example is an algorithm that predicts the example of this are the computer vision algorithms mentioned above, likelihood of complications after surgery based on risk profiles. which are widely used in radiology and pathology departments.

Additionally, medical intelligence must always be transparent. This is sometimes referred to as explainable AI. There has to be complete transparency as to how the algorithm arrives at a particular recommendation. However, this does not mean that deep neural

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What are the benefits?



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AI can also help reduce the administrative burden; think of the use of speech-to-text technology that allows a nurse to record a reading by speaking rather than typing it in. Or conversational AI that summarizes action points for a doctor based on a conversation and creates a lay description for the patient, with links to web pages with more explanations about the disease and treatment. Or, taking it a step further, a chatbot that patients can use to ask questions they would otherwise have to ask the doctor or nurse. Of course, as mentioned earlier, a human is always involved.

What makes medical intelligence so complex?

First of all, the many different systems and a lack of standards create a multitude of data islands: patient data is scattered across many different systems. It is therefore extremely difficult for a hospital to piece back together patient data in the data warehouse, let alone be able to centrally access and analyse information from different partners in the healthcare chain. Furthermore, domain knowledge is crucial. You need to know exactly what data are relevant to a diagnosis or decision. And you need to know how that data relate to each other. For example, is a particular blood value the cause

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of a disease or the result of a particular medication? And finally, the context also determines the relevance of the developed AI solution. For example, a predictive algorithm that works very well in a teaching hospital in the Randstad may not be of any use for the patient population of a regional hospital in Limburg or Drenthe.





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Medical intelligence in practice

A good example of AI in practice is a dashboard that Conclusion Mediaan developed for a hospital in the south-east of the Netherlands. It predicts patient movements within the hospital based on statistical simulations. The need for such a solution arose during the Covid-19 pandemic, when it was critical for hospitals to be able to correctly predict bed capacity. Even now, at a time when hospitals are trying to work through a backlog of patients, bed capacity is a crucial factor in planning operations. To gain an insight into the inflow, throughput, and outflow of patients, Conclusion Mediaan developed a dashboard that uses large amounts of internal and external data (including CBS data on the patient population and weather data) to predict bed occupancy in different departments. The model not only predicts the number of patients admitted per department and specialization but also provides upper and lower limits with a certain degree of reliability. This allows the hospital to strategically plan for worst-case scenarios.

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"To develop a sustainable" solution, it is essential that data scientists work closely with future users of the AI solution. This is how you develop medical intelligence that adds real value and reduces the burden on doctors and/or nurses."

Roel van Reij, Data Scientist at Conclusion Mediaan



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Lucas Jellema on Business Enablers: **TECHNOLOGY THAT ENABLES YOU TO DEVELOP COMPLETELY NEW BUSINESS MODELS**

At Conclusion, we define Business Enablers as technologies and We now know that blockchain comes with its fair share of challenges, technology trends that have an impact on processes, methods, and that many of the use cases we envisioned at the time don't require or functions in an organization, or even open up avenues for new blockchain. Does this mean that the technology has disappeared processes, products, and services. Basically anything you can think altogether? Well, no, because it is still proving its worth in certain of that might fall under the umbrella of 'digital transformation', applications. But those applications are too few and far between for blockchain to make it onto our Emerging Technologies Radar at the although this has become a bit of a catch-all term that not everyone interprets in the same way. The bottom line is that you moment. However, the topic of smart contracts, a specific application can use these technologies to develop entirely new business of blockchain, has made it onto the Radar. models or to organize existing processes in a completely IoT at the heart of the Radar different way, making them much more efficient.

Blockchain bumped down

One technology that certainly deserves a spot on the Radar is the Internet of Things (IoT). This is an umbrella term for the interaction If we had had an Emerging Technology Radar five years ago, between enterprise IT and the real world, using devices such as sensors. blockchain would undoubtedly have been on it. Back then, we saw all We use these devices to collect data – often in real time – that describe sorts of opportunities for what was then a relatively new technology. reality, such as the location, temperature, vibration, and/or sound of

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relevant objects or processes. We then use this data to monitor skilled IT professionals. As a result, the software development and make adjustments where necessary. Five years ago, IoT would process is undergoing a radical transformation, as is the role of IT. have been on the fringes of our Emerging Technologies Radar; now it Instead of doing the actual development, IT is taking on more of a is at the very heart. We are now deploying this technology for a wide governance role; IT supports and oversees issues such as security, range of customers in a wide range of situations. A good example lifecycle management, and the prevention of (the negative aspects is Eneco. In 2019, we started implementing the first applications of) shadow IT. In fact, low-code is on its way out of the Emerging and building the IoT platform there; IoT now plays a vital role in Technology Radar: the technology is so well established that it is no longer really *emerging*. We are now also seeing other low-code dozens of chains and processes within the organization. Eneco is and self-service applications that perhaps deserve their own using devices that measure and transmit values for a wide range of applications - from real-time monitoring of the yield of solar or wind mention, such as integration, data exploration, RPA (robotic farms and stopping wind turbines when a flock of birds approaches process automation), data science, and machine learning. to controlling central heating boilers. And that sometimes also And finally... convert control signals into actions 'in the field'.

Low-code is changing the software development process

Although the Radar mainly focuses on technologies that benefit the business, we occasionally feature a technology that affects the way ICT departments work. Low-code is one such technology. It allows developers to increase productivity, but also allows people with fewer advanced programming skills to contribute to application development - which is sorely needed given the shortages of

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As we have seen above, Business Enablers represent a broad field in which developments are coming thick and fast. In this Trend Report, we focus on two of them: IoT in the IT for OT domain and medical intelligence, both of which are already widely used in practice. Currently, technologies like AI-powered fintech are still on the periphery of our Radar, in the 'potential' and 'exploring' segments. Keep an eye on this biannual Trend Report or the Emerging Technologies Radar to see how guickly these new technologies are becoming commonplace.





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PRODUCTIVITY REVOLUTION



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METAVERSE

The metaverse is a concept that we have recently added to the **Emerging Technologies Radar as we are seeing more and more** companies thinking about how they might use it in their day-to-day operations. At the same time, we are already implementing some forms of the metaverse quite often; just think of a digital twin, for example. Because the metaverse is not so much an end point as it is a movement.

What is the metaverse?

The thing that sets the metaverse apart from other forms of digital information transfer is experience and perception. Whereas in a normal video call you can never look the person you are talking The metaverse is a virtual world, either in 3D or as an extension of to straight in the eye (either you look into the camera and they our real world, where people interact through a virtual or augmented experience. The concept has been around for a long time, but its experience it as you looking straight into their eyes, or you look form is now changing rapidly - and so are the potential applications. into their eyes and they experience it as you looking at something The metaverse is a kind of digital city that you can access in a variety next to them), in the metaverse you get a 'real-life experience'. Depending on the device you are using, this experience will be more of ways. Instead of a car, plane, or train, you use Apple, Google, Meta, or Microsoft transportation to get around in the metaverse. Once or less immersive. For example, you can view a newly built factory you are in the city, you can do all sorts of things: work, study, go to in 3D on a computer screen, or you can wear VR glasses that make it seem like you are actually walking through the factory. Because a sporting event or concert, and shop. To interact during such an experience, you use a digital device such as a smartphone, of the intensity of the experience, you retain the information more computer, or VR glasses. effectively and notice links and connections more quickly.

More and more digital worlds will emerge in the future, which you will be able to access separately but which will sometimes be connected. You probably already use some of these worlds without even realizing it - just think of the head-up display in your car or an app that lets you admire your new kitchen or bathroom in 3D.

What are the benefits?



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These features make the metaverse ideal for training people in an environment in which it is not easy to gain experience, such as training a surgeon or an engineer to maintain wind turbines. The technology is also ideal for marketing applications. For example, you could project your new car onto your own driveway and into your own garage to give you a better idea of how much space is left for your bike. The big game-changer in B2C will be AR or VR glasses that look like regular glasses and are just as comfortable to wear.

What makes the metaverse so complex?

Although the technology is relatively complex, it already exists for most applications. It is often still possible to find use cases. So, the biggest challenge is to ask the right questions. Before you know it, you have invested a fortune in creating a digital world where people leave after a few seconds because although the world looks amazing, it does not meet their needs. Our advice is to involve future users right from the start, and to start small. For example, start by developing a virtual environment for training purposes, a virtual environment for onboarding new employees, or a virtual office where people scattered around the world can meet and collaborate.





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Case study: Supporting working from home

As office workers wanted to retain the benefits of working from home after the Covid-19 pandemic, but also wanted to interact with their colleagues, a large Dutch company asked us to design a 3D environment for meetings and events as a first step towards creating a complete metaverse of their office. Employees can access this environment via their computer, smartphone, or a VR headset. By gaining experience with the metaverse in a cost-effective way, this company will have a clearer perspective on future use cases.

"The thing that sets the metaverse apart from other digital worlds is the 'real-life experience', which helps you, the user, to remember the information you are being told and gives you greater insights into the situation. It feels like you are really there."

Sebastian Winkler, Managing Director at Conclusion Mediaan





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PRODUCTIVITY REVOLUTION

DATA MESH

Data mesh is a concept that is currently straddling the line between exploration and practical application. We have already applied aspects of it for several customers. For a large telecommunications provider, we developed the concept in its entirety and implemented the technical infrastructure underpinning it.

What is data mesh?

Strictly speaking, data mesh does not belong on the Emerging Technologies Radar because it is not a technology, but rather an organizational concept; it is a way of organizing how you deal with data in your organization. The basic idea is to think of data as a product that can be created and used by anyone in the organization. Data is captured once and can then be reused in different ways, for example in a dashboard, an AI model, and shareable data sets, and so on. These data products are created by autonomous business/ domain teams that also include data experts. Rather than a central data and analytics team creating the data products, data mesh adopts a decentralized approach. This includes a decentralized data architecture.

What are the benefits?

The main benefit of the data mesh concept is speed. By distributing responsibility for data products throughout the organization and democratizing data, teams can develop their own data products more quickly. This means they are no longer dependent on a central data team. If your goal is to make data-driven working the norm in your organization, data mesh is a powerful concept that can help you achieve it. It works particularly well in larger organizations where there is a high demand for data products and a wide variety of data sources. Because in practice, we see that adopting an approach in which a central team is responsible for the delivery of data products can lead to bottlenecks and delays in the delivery of data products in such organizations.

Another advantage of this concept is that data teams can use their own tools if necessary, as long as they comply with architecture and



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data management agreements. This gives the data specialists at your organization a relatively high degree of freedom.

What makes data mesh so complex?

The most challenging aspect of such a decentralized approach is that you have to keep your eye on the big picture. You need to think about common data definitions, governance, data management, and other such tricky but vital issues for the consistent use of data. Technology is rarely the problem; convincing everyone to stick to the agreed governance principles often is. You need to create, share, and manage common definitions. For example, how do you define a customer, and which (source) system is used to determine this? After all, a sales process may define a customer differently from a finance process. You will also need to agree which team owns which data and what that ownership entails. How do you ensure the quality of the data? How do you make sure that everyone sticks to the delivery agreements regarding data? How do you maintain the integrity of the data chain in your organization?

It goes without saying that implementing such a new way of working is not something that happens overnight. It is a change process that takes time and needs to be continuously nurtured. Otherwise, there is a good chance that, although you may quickly and very successfully deliver a few data products that are hugely popular in the first month, the change will not be sustainable and the quality and reuse of data in your organization will not improve.





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Case study: Data mesh at a telecommunications provider

In almost every organization, the demand for quickly available and actionable insights is on the rise. In order to meet this demand, a telecommunications provider implemented a fundamental change in its data architecture and data management. Hot ITem Conclusion helped this company to make the transition from a centralized data department to distributed data domains at an architectural, organizational, and technological level.

"When it comes to implementing data mesh, the old and new worlds - centralized and the decentralized approaches – collide. How you manage this transition is the single most important factor in the success of a data mesh project."

Ernout Douqué, CTO at Hot ITem-Conclusion



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Lucas Jellema on Productivity Revolution:

FASTER, MORE ACCURATE, AND MORE

And all of this is done from code (Infrastructure as Code is therefore an Productivity Revolution is the term we use for any technology that enables organizations and individuals to process larger volumes inherent part of this process) and with a high degree of automation, using cloud facilities and usually based on containers and serverless faster and more accurately. This often includes being able to mechanisms. Cloud-native DevOps eliminates the need for separate identify, analyse, and solve problems more quickly. This category teams for development, testing, and management; all of these tasks comprises a relatively large number of technologies in the inner circle of the Emerging Technologies Radar. These are technologies are performed by a single team that designs, builds, tests, deploys, manages, and further develops. This approach cultivates product that we have already deployed for many of our customers and that are about to drop out of the Radar as they transition from ownership and drives strong team commitment to the business emerging to established. outcome. It also results in a short time-to-market, and teams have a vested interest in active lifecycle management.

The importance of lifecycle management

The latter is therefore a key piece of advice for organizations: review A good example of this is cloud-native DevOps. This is a topic that your applications regularly. Doing so will make moving components almost all of our customers are thinking about. As organizations of your landscape to the cloud a much more manageable project began to realize that applications and the underlying platform and because then you will know which applications can be migrated to infrastructure components go hand in hand, it suddenly made sense the cloud easily, which need to be redeveloped for the cloud, and which to develop, deploy, and manage them as a single entity. are better left on-premises or are even no longer needed at all.

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Beyond migration to the cloud, lifecycle management is a critical, building feedback functionality into new applications, regularly asking users for their opinions and suggestions on a particular feature. We also make sure that it is easy to monitor which features in applications are used a lot and which are used only occasionally or not at all. And we also report on unusual user behaviour, such as clicking around in an application or frequent input that leads to errors; in such cases, the user interface is clearly not very intuitive. This helps us to obtain feedback on how we can further improve the applications we develop, or the way they are explained, to further increase user productivity.

but often overlooked, process. Issues such as security, cost, support, knowledge, manageability, and adaptability are factors that often receive insufficient attention. In practice, we see that too many organizations are still approaching migration to the cloud as though they were moving house: waiting until the moving van arrives before going through the attic. Only then do you start throwing things away that you haven't used for years. In our world, that is not a wise approach, because applications you don't use much, if at all, cost money. Which is why we insist on And finally... regular and active application lifecycle management – even if you have no plans to migrate to the cloud.

Gathering feedback on application usage

Another thing we often see with cloud-native DevOps is that customers ask us to individually redevelop applications that need to be moved to the cloud. There is simply no time to properly investigate whether all the functionalities are being used because moving day is fast approaching. Then we hear from users: 'Why did you redevelop that feature? We never used it or haven't used it for a long time.' This is one of the reasons why we are increasingly

Increasing productivity through IT is sorely needed. The issue is at the forefront of many organizations' minds. After all, shortages on the labour market are forcing them to work more efficiently and also to make work more enjoyable for their employees. Developments in the Productivity Revolution segment are therefore coming thick and fast. Keep an eye on this biannual Trend Report or the Emerging Technologies Radar to see how quickly these new technologies are becoming commonplace and how AI and technology like ChatGPT will find their way into concrete applications.

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INTERFACES & EXPERIENCES

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INTERFACES & EXPERIENCES

DIGITAL TWIN

We are already using digital-twin technology on a regular basis for customers in a variety of sectors. It plays a crucial role in real-time decision-making in operational processes, for which there is a growing need.

What is a digital twin?

A digital twin is a digital copy of reality: a model of the current, actual situation with a real-time data link between the actual situation and the digital copy. This situation could be anything from an engine, a factory, or traffic flows in a city district to a logistics process or even the human body. The data used can originate from all kinds of machines and applications, such as cameras, meters that take electricity or heat readings, sensors that record vibration, temperature, or sound, and so on.

is What are the benefits of a digital twin?

A digital twin maps the real situation onto a computer model, allowing the user to get a comprehensive picture of the situation at a given time. It is also possible to simulate the effect of changes in the digital copy. For example, you can test whether a particular modification to a machine will actually deliver the results you expect. Lastly, the digital model can help you predict what will happen in certain situations, based on past patterns, so that you can intervene in time. You can add logic to a digital twin so that the model can respond directly to its physical state. Furthermore, as a digital model, it can quickly perform complex calculations and optimize the outcome. For instance, it can be used to automatically adjust logistics flows based on the supply of goods, congestion in the logistics network, the price of transport, and available manpower.

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Why is building a digital twin so complex?

When building a digital twin, you ideally want to use data sets that are as complete as possible. This means that data can come from hundreds of different sources, often reporting a status every few seconds. This can quickly add up to millions of messages per day. On top of that, you are also using historical data, which can sometimes amount to billions of data points to be analysed. The data you use all have a different structure, which means they first have to be translated into a standard. Then you have to check the quality of the data, which is not always up to scratch. You also often have to interpret all this data in order to understand the context in which they were collected and whether or not they should be included in your model.

To keep things manageable, it is often easier to work with multiple models side by side. Instead of a single digital twin of, say, a railway station, you might use a model for passenger flows, a model for the indoor climate, a model for energy consumption, and so on. Each model has its own purpose: to optimize comfort, safety, sustainability, profit, etc.

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Case study: Digital twin of Utrecht Central Station

AMIS Conclusion contributed its expertise to an NS Stations project to develop a digital twin of Utrecht Central Station. The aim of this digital twin is to increase safety, prevent the breakdown of assets such as lifts and escalators, and improve passenger comfort. To build the digital twin, AMIS Conclusion partnered with the NS Stations team to tap into IT data streams that provide real-time information on the status of a large number of objects at the stations. The status of lifts, escalators, passenger flows, and energy consumption are therefore all incorporated into this 3D model. In total, the model consists of up to 20 billion fine-scale LIDAR data points and 540 high-resolution drone images. This data, combined with real-time data, has been processed into multiple models that are used to display real-time station conditions and simulate scenarios. This helps station managers to schedule lift and escalator maintenance in a way that minimizes disruption to passenger flows, or to more quickly detect undesirable passenger behaviour and intervene in panic situations. The aim is also to gain a better understanding of energy consumption, waste, and peak loads in order to reduce CO₂ emissions.

"Many people think that a digital twin is a 3D model. And yes, it can be – but it doesn't have to be. The real power of a digital twin lies in the real-time notifications that the model provides."

Robbrecht van Amerongen, Head of Strategy at AMIS Conclusion

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INTERFACES & EXPERIENCES

CONVERSATIONAL AI

Conversational AI is still on the periphery of the Radar. We see a lot of potential for applying this technology to your business data. But no such product is currently available on the Dutch market.

What is conversational AI?

Most people probably have two associations with the term conversational AI: chatbots, which are widely used in customer contact, and ChatGPT developed by OpenAI (and also used by Microsoft). While many chatbots rely on a back-end decision tree, ChatGPT uses a generative language model to produce answers. As a result, conversations feel much more natural than discussions with chatbots like those found on many websites.

Conversational AI has four components. The first is NLU: Natural Language Understanding. This is based on a neural network that is trained on lots of texts, so that it understands them better and better. The second step is to extract intent: what exactly do you

mean by a particular question? Chatbots based on decision trees are not very good at this, and it was also a challenge for firstgeneration conversational AI. But this is where ChatGPT has made a huge leap forward.

The third component is adding context to the conversation, in other words, the chatbot should be able to infer context from previous questions. For example, if you start by saying 'l'm cold' and then ask 'What temperature is the thermostat set at?', a contextually trained algorithm can infer from the context that the thermostat probably needs to be turned up a notch (interpreting intent). The final component is NLG: Natural Language Generation - generating answers in a language that is so well articulated that it is as though they were given by a human being.

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What are the benefits?

The main difference between conversational AI and algorithms that Where ChatGPT uses the Internet as its source, leaving you uncertain rely on a decision tree in the background is that conversational AI as to how it generates its answers – and it sometimes even uses the wrong data to generate an answer –, Microsoft has developed will interpret a question and then provide an answer accordingly. a service that runs OpenAI's algorithm on your own company data. After all, AI is simply the application of pattern recognition – in You can decide which sources you want to make accessible to the this case, patterns in language. That is where the interpretation program, for example the ERP system, the knowledge database, the aspect comes in, and then the systems get creative: they start to 'hallucinate' when giving an answer. They look for patterns of words product database, and the CRM software. By having access to these four sources, ChatGPT would be able to answer almost all customer that 'logically' belong together, which can lead to hilarious slip-ups. For some applications, this is not too much of a problem – and can queries. In the rare case that it cannot, the bot can forward the question to a specialist in the company, who can provide the correct even be a good thing. For example, if you ask: 'Write a poem for this answer immediately in the chat or later by e-mail. The beta version of person, based on these hobbies, to go with this present.' But for this service has been released in the USA. At the time of writing, it is other applications it can be disastrous; for example, when making a not yet available on the Dutch market, so we have only been able to medical diagnosis. So, it depends on the application as to whether you use conversational AI or whether you prefer to rely on a decision see an American demo here in the Netherlands. tree that leaves no room for interpretation. One thing that you often see is that the answers generated by conversational AI are checked by a human. This is widely used in the healthcare sector.

What makes it so complex?

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The decision on which type to use largely depends on advances in technology; developments are occurring at a breathtaking speed. As mentioned before, Microsoft will soon be releasing a version of OpenAI that can be deployed on any data source you choose. The system will then no longer have the freedom to invent its own answers, significantly increasing their reliability. A key factor here is that this also places high demands on the quality of the data. Because after all, garbage in is garbage out.

"Conversational AI interprets a question and then 'hallucinates' when giving an answer. You have to be acutely aware of the situations in which this shouldn't happen."

René Altena, Director of Strategy & Innovation at Conclusion MBS

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Lucas Jellema on Interfaces & Experiences: **FUNDAMENTALLY CHANGING THE WAY WE COMMUNICATE AND INTERACT**

Our Interfaces & Experiences segment covers all technologies technology trends that are fundamentally changing the way w interact with each other and engage with digital systems in th digital world.

Digital data exchange in the chain

I recently read in the newspaper that the healthcare sector is finally One of the prerequisites for automatic data exchange is the use of saying goodbye to the fax machine. It was then that I realized that standards. To ensure that the producer of the data continues to be not all sectors and information chains have made the same level the owner of the data, whilst also allowing the data to be shared with of progress in the digitalization and automation of the exchange third parties under the aegis of the owner, Europe has set the pace of data. Take the healthcare sector and the energy industry, for with the European Data Act. This is a law that requires organizations example. If TenneT detects that the production of energy from wind in nine different sectors to work with standards and to make certain and solar sources is higher than demand, within seconds electricity data available across chains. Many parties will be required to provide generators such as Eneco automatically receive a notification to data to a common 'data space', and there will also be opportunities limit production. Human intervention is no longer necessary. The for many organizations to make use of the data that become available. The European Data Act is intended to prevent monopolies travel information chain is another example, where the information

| and | presented in the OV9292 app is supplied in near real time by |
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| ve | the administrative planning and coordination systems of ProRail, |
| ne | NS, and other public transport companies. |

European Data Act stimulates standardization

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being created or unfair competitive advantages being given to companies whose devices happens to have generated the data or who happen to be at the beginning of the information chain. Data, like street lights or a beautiful view, will become a common good that can be used by many organizations at the same time. This will create fairer opportunities for all kinds of parties – from start-ups to multinationals – leading to better healthcare, safer and cleaner transport, more efficient energy supplies, and/or lower costs for products and services.

Conversational AI is more than ChatGPT

Interfaces & Experiences is about improving data exchange, but it is also about new technologies such as conversational AI. ChatGPT's results may come as a surprise to many, but certain segments of the market have been aware of how good chatbots can be for a long time. The reason we don't always experience this first-hand – as a consumer, you have no doubt been driven to despair by the surprisingly misguided follow-up questions asked by a chatbot – is that not every organization takes the time to train a bot properly. That is because when it comes to machine learning, the quality of a product hinges much more on the training than on the technology itself. And that is actually quite easy to do: you configure a model, train it, and validate it – preferably with a lot of data. You do this in several iterations with better and better configurations. Then you use it to interpret new data faster and translate it into action, after which you use the model's results to develop an even better version. In the case of <u>conversational AI</u> the action is a chat conversation that allows users to obtain information – without human intervention – in a very natural and intuitive way.

And finally...

In short, Interfaces & Experiences is a broad field in which exciting developments are taking place – such as the <u>metaverse</u> and the Digital Identity Wallet – but in which there are still many benefits to be gleaned from tried-and-tested technologies that have been around for years. Do you want to stay up to date with how technology is evolving and how it can benefit your organization? Then keep an eye on this biannual Trend Report or the Emerging Technologies Radar.

