JOURNEY TO CLOUD PLANET

amadeus Microsoft

ITINERARY

FOREWORD

“ The hope is that, in not too many years, human brains and computing machines will be coupled together very tightly, and that the resulting partnership will think as no human brain has ever thought and process data in a way not approached by the information-handling machines we know today. ”

- J. C. R. Licklider, 1960

In a lot of ways, our cloud journey with **Microsoft** will bring us closer to the vision articulated by the first proponent of an ‘intergalactic computer network’ in J.C.R. Licklider more than 60 years ago. We are bringing the minds of **Amadeus** closer to the technology they work with, while enabling exciting new possibilities to create better travel experiences with **Microsoft**.

The move to **Microsoft** Azure is the greatest technology transformation in the history of **Amadeus**. We are entering a new dimension and the partnership will unlock exciting opportunities that translate into value for the travel industry. We call this new dimension ‘Cloud Planet’ to do justice to its magnitude. It will bring our technology and capabilities closer to our customers to unlock a whole new universe of possibilities.

Azure cloud technology revolutionizes our software development cycles, data capabilities, and brings us closer to our customers. It ensures a future proof infrastructure and prioritizes collaboration with one of the world's most trusted technology companies.

Our partnership with **Microsoft** is not just about accelerating our journey to the cloud. It's also about unleashing the next wave of innovation in the travel industry. The goal is to take advantage of the possibilities that cloud technology offers, and work together with **Microsoft** and the entire travel industry to transform travel. We want our customers to be able to develop truly engaging solutions on top of our technology.

Together with **Microsoft**, we've already set up an innovation program through which we are exploring and developing new travel solutions that offer a smoother and more personalized user experience.

This journey is no small undertaking. **Amadeus** solutions demand extremely high-performance transaction processing power under stringent system availability, security, and performance requirements. In light of these requirements, **Microsoft** is the right partner to accompany us on this journey.

We are drawing on expertise and insights from across our talented and forward-looking teams as well as working with some of **Microsoft**'s greatest minds.

In this report we look in depth at the transition to **Microsoft** Azure, how we are working together as true partners to define and implement next-generation services, and what this means for the future of travel.

I hope you enjoy reading this story of how we got here and where we're going – so buckle up and prepare for lift-off to Cloud Planet.

- Christophe Bousquet
Chief Technology Officer, Amadeus

CREATIVE SYNERGY

When the convergence of ideas and people from Microsoft and Amadeus work in synergy – a radiant blue light of creativity is released, propelling us to Cloud Planet.

A JOURNEY THREE DECADES IN THE MAKING

Amadeus was born from airlines. It was conceived by Air France, Iberia, Lufthansa and SAS to be a Global Distribution System (GDS). The company grew quickly and partnered across the travel industry in the early 2000's to develop a new generation IT platform for airlines. Fast forward 20 years to the present, and over 400 airlines, hundreds of airports, some of the world's largest hospitality groups and many thousands of travel sellers use **Amadeus** technology to power better journeys.

Amadeus has always taken advantage of new technologies even before the tumult of the last few years. In fact, it was the first travel technology provider to run exclusively on open systems and has managed its own data center for many years.

In 2006, **Amadeus** made a bold move in decommissioning its use of mainframes and moving to open systems. The decommissioning of the Transaction Processing Facility (TPF) was completed at a scale not seen before.

Sylvain Roy, SVP, Technology, Platforms Engineering, **Amadeus** said, "It was really an incredible undertaking. Over 400 engineers worked full-time at the peak with over 1,500 engineers contributing to the project. Most importantly, the transition was achieved with minimum disruption to our customers and throughout the undertaking we continued to process over two million Passenger Name Records (PNRs) per day."

The decommissioning was completed in 2017 and Amadeus became the first technology provider to run a Global Distribution System and Passenger Service System exclusively on open systems.

Denis Lacroix, SVP, Cloud Transformation Program, **Amadeus** further elaborated, "Mainframes are used by organizations around the world, and they've been a backbone of computing since the 1960s. But they come with some downsides. Over time, we found that the mainframe became slow and rigid to take on the challenges of the digital age. It can take engineers three to four months just to train on them, and new graduates have rarely been motivated to learn such outdated technology."

Lacroix continued, "Open systems on the other hand, are much faster to learn, and are designed to be easily inspected, modified and enhanced. For new grads, they are also much more appealing and inspiring to work on. That's why open systems have reshaped the IT and business landscape, fostering a collaborative spirit across the global developer community. This has resulted in software, systems and technologies that are not only more innovative, but also secure and cost-effective."

Concurrently, with the move to open source, **Amadeus** was building cloud environments, and in 2014 launched **Amadeus** Cloud Services (ACS), an internal application platform developed in collaboration with Red Hat and OpenShift Enterprise. This earned **Amadeus** the 2015 Red Hat Cloud Innovator of the Year award.

In 2015, the company piloted **Amadeus** Airline Cloud Availability with Lufthansa on the public cloud.

This cloud-based dynamic availability solution helped airlines cope with the rapidly rising volume of search 'look-to-book' ratios and shopping traffic, which placed significant strain on previous generations of technology. The exponential growth of the capabilities of cloud-based infrastructure in the last few years has exceeded even the most optimistic of assessments. "Public cloud technology has evolved in such a way that it can now deliver an improved level of service than was previously possible through our private infrastructure," said Lacroix.

When it came to looking for a partner to co-develop solutions, share ideas, and to scope out a roadmap for the future, Roy said, "We found that partner in **Microsoft** from not just a technology standpoint but also from a cultural one and we announced our strategic collaboration in February 2021."

METAMORPHOSIS

Anchored by a central compass representing travel – the journey to Cloud Planet will see Amadeus reborn with the latest software development capabilities.

COMPUTING ON THE EDGE WITH MICROSOFT AZURE

Edge computing, loosely defined as computing that's near or at the source of data to reduce response time, has largely been pioneered by **Microsoft** and is a significant benefit of cloud-based systems.

Sebastien Pellise, Deputy Program Director, Cloud Transformation Program, **Amadeus**, noted, "Engineers are naturally curious and early on in our cloud journey they were strong catalysts for more experimentation with cloud capabilities. We quickly saw the benefits for latency and response times in other regions of the world. The results were incredible and opened a world of possibilities in terms of providing our customers with ultra-fast response times for things like travel search and other business critical areas."

Indeed, Azure's global infrastructure is perfectly suited for the travel industry. Each Azure region is defined by a set of datacenters that are deployed within a latency-defined perimeter and connected through a dedicated regional low-latency network.

Azure has more global regions than any other cloud provider, giving Amadeus the flexibility to deploy applications wherever they are needed.

Azure CTO Mark Russinovich commented, "**Microsoft** is investing in fast, distributed infrastructure to virtually eliminate latency concerns. The system is designed for ultra-low-latency access for large data and connectivity requirements. Azure Edge Zones, for example, provide compute, storage, and services such as containers at the edge. All of these elements will be extremely beneficial for customers of a globally distributed company like **Amadeus**."

Russinovich continued, "We're building fifty to one hundred datacenters a year and that's not slowing down. For low latency, it's about having data and the compute power close to where your customers are. In **Amadeus**' case, customers are all around the world and so they will have Azure access all over the world as well. But you also need great networking. **Microsoft** has one of the largest private global networks on the planet and hundreds of peering relationships with ISPs. So, when you talk to the Azure cloud you get routed into one of our edge sites very close to where the customer lives and then routed to the closest **Microsoft** region."

AVIATION GRADE SYSTEM RESILIENCY

Cloud-based architecture encompasses a set of design practices and concrete technical implementations all aiming to provide the highest levels of flexibility, reliability, resilience, scalability and performance for very large systems. They promote an explicit separation and abstraction of the application, platform and infrastructure layers.

"When we talk about the cloud, I think it's not only infrastructure as a service. It's also the architecture of your applications and building in resilience to any type of failure," Gaëlle Bristiel, SVP, Airport IT and Airline Operations Engineering, **Amadeus** said. "The core concepts are based on redundancy, isolation, and operational monitoring of components in a distributed architecture, providing built-in scalability and intrinsic tolerance to system failure. Applications are containerized and can easily be deployed over any compliant infrastructure," Bristiel noted.

Through Azure, Amadeus will have the ability to seamlessly distribute an application over several infrastructures. This provides a full solution to resilience and capacity management.

Applications will always be up and running on one of the infrastructures, and there's no limitation to adding or reducing the number of machines in each infrastructure where applications are executed.

Russinovich elaborated, "We've got services that make it easy to route traffic. Traffic Manager lets you distribute traffic to your public facing applications across the global Azure regions. It provides your public endpoints with high availability and quick responsiveness. Most importantly, it ensures continuity if there's a disaster in a region and traffic needs to be rerouted."

Azure Availability Zones protect applications and data from datacenter failures. Russinovich said, "These Availability Zones are made up of a minimum of three zones. This allows **Amadeus** to spread their infrastructure and applications across discrete and dispersed datacenters for added resiliency, high availability, and the confidence that data traversing between Availability Zones is always encrypted."

Azure uses thirty viability and risk-based criteria to evaluate the placement of each of the three Availability Zones to identify both significant individual risk as well as collective and shared risk between Availability Zones—without compromising the latency perimeter of less than two milliseconds.

"Let's say **Amadeus** wants to build an application that spans four regions for very high availability and disaster recovery capabilities. Tools like Cosmos DB makes that as easy as configuring replication across those four regions just as part of calling an API. This allows for a globally distributed database that supports applications operating from any or all regions at high scale and can survive if a certain regions experience disruption like natural disasters for example.

And to understand if a system is truly resilient, it is best to measure and understand the resilience of the entire system in the environment where it will run. We have new tools like Chaos Studio where we can inject faults into a system and run various advanced scenarios. For example, we can look at what would happen if there was a large-scale natural disaster in a region that impacted numerous datacenters and plan for the appropriate response to ensure resiliency," Russinovich added.

ELASTICITY AS THE NEW NORMAL

One of the great advantages the cloud offers is known as ‘elastic computing’. It’s the ability to quickly increase or decrease computer processing, memory, and storage resources in line with demand. This approach alleviates the worry of planning for additional capacity and engineering for usage peaks.

Roy said, “In times past, developers would need to plan out computing needs and an actual physical server would need to be installed to meet those needs. This process is very time consuming and can delay development cycles. With cloud elasticity, our dev teams can call up the processing power they need instantly. This opens a whole new world in terms of what we can accomplish with a ‘fail fast’ experimental mindset.”

Corey Sanders, **Microsoft**’s CVP of Customer Solution Areas, said, “You can spin up solutions our engineers have worked on for years and can at the click of a button try things out. You can run at massive scale for a couple of hours and determine what you’ve learned and decide whether to keep running or shut down. This is a powerful capability that is hard to replicate in private data centers or with in-house applications.”

SCALED EXPERIMENTATION

Science is everything on Cloud Planet and experimentation is key. Some ideas flourish and others are merely steppingstones to bigger and better things.

SECURITY AND DATA PROTECTION ON ANOTHER LEVEL

Years ago, security was the primary concern of public cloud computing. Now it's a strength. **Microsoft** has invested significantly in securing Azure and new approaches like post-quantum encryption are game changers.

Russinovich detailed the benefits of this technology and said, "Our research and engineering work focuses on how private information and communications will be protected when more powerful computers, such as quantum computers, which can break that cryptography, are available. For example, Shor's Algorithm, discovered by Dr. Peter Shor of AT&T Bell Laboratories, could defeat the RSA public-key cryptosystem, but requires the help of quantum computers in order to do so. While this possibility is still far out, it is on the horizon and **Microsoft** is at the forefront of threat preparation in this field."

When it comes to data that **Amadeus** processes for the travel industry, the company complies with data protection legislation as it applies to **Amadeus**. The organization has taken the necessary steps to comply with the General Data Protection Regulation (GDPR) introduced in May 2018 by the European Union and is continually assessing systems and processes to identify areas for improvement, and to ensure compliance with applicable data protection legislation.

Russinovich said **Microsoft**'s confidential computing technology could be a gamechanger for the aviation industry to further ensure data protection. "We've been pushing the state-of-the-art with confidential computing which is computing that is effectively encryption in use. With this technology data can be encrypted while in use and can be protected from anything around the computation ensuring complete security. We're working with Intel and AMD to push this forward and Azure will be the first public cloud to have SGX servers, Intel's technology for this, available to our customers. And we're working with AMD to launch confidential virtual machines. This opens a whole world for the airline industry because you can protect sensitive data from application operators and the data holder. It also allows for multi-party analytics to share data between suppliers in a protected way."

Amadeus is implementing a new cloud-based cybersecurity defense system together with Microsoft and other leading technology providers. The system is based on a vision and strategy to 'trust no one and verify everything, continuously' according to 'defense in-depth' technology principles.

Virginie Amar, PhD., Program Lead, Cloud Cyber Security, **Amadeus** said, "Our strategy is built on the three core pillars of technology, continuous compliance, and a global Security Operations Center. We are combining the very best, cutting-edge technology with zero trust principles and robust defensive layers."

The first pillar, technology, features several layers including identity, perimeter, network, compute, application, and data. It provides important protection to counter or at least slow the advance of any attack. This is further heighted by a strong focus on protecting sensitive and personal data with enforced encryption.

The second pillar of 'continuous compliance' is related to proactively complying with evolving industry compliance standards and conducting recurring audits. Amar elaborated, "We've implemented a number of continuous compliance initiatives through security as code, policies as code, regular penetration testing, automated processes and combining our expertise with that of market leaders in the cybersecurity industry."

The third pillar anchored by the globally distributed Security Operations Center (SOC) provides **Amadeus** with an offensive team performing penetration testing and security attack simulations. "The **Amadeus** SOC includes a functional fraud detection engine, a threat intelligence team, and an Incidence Response Team following the sun with twenty-four hours, seven days a week monitoring," Amar said.

While securing its infrastructure together with **Microsoft**, **Amadeus** is also further integrating security into every aspect of the software delivery lifecycle and its teams will benefit from Azure DevSecOps to develop applications that can face any security challenge, particularly as cyber criminals advance with more sophisticated tactics.

SUSTAINABLE CLOUD INFRASTRUCTURE AT A GLOBAL SCALE

Amadeus and **Microsoft** view sustainability and humanity's response to climate change as one of the greatest challenges of our lifetimes. Both organizations are committed to reducing environmental and social impacts and the move to Azure is one that comes with a myriad of benefits in this respect.

INTERGALACTIC ASPIRATIONS

Microsoft and Amadeus aspire to unleash creativity in the travel industry. It is a technological journey to a new dimension where intergalactic computing has no limitations.

"**Microsoft** has the most ambitious clean energy program of any company on the planet and Azure is the most sustainable public cloud. By 2050 we will be carbon zero for **Microsoft**'s entire history and all the carbon we've put into the atmosphere, directly or indirectly. This includes the construction of all our facilities, employees' travel and operations from our founding in 1975 onwards. And when it comes to our Azure datacenters, the power usage effectiveness or PUE has been consistently trending downwards to around 1.12 and we are continuing to drive it down. Our datacenters are eighty to one hundred percent more efficient than your typical datacenter," Russinovich said.

Azure is driven by four principles when it comes to reducing its energy and carbon footprint.

Russinovich expanded on the principles, "The first three—IT operational efficiency, IT equipment efficiency, and datacenter infrastructure efficiency—reduce the energy required to deliver these services. The fourth is the purchase of renewable electricity, which will power 100 percent of electricity consumed in **Microsoft** datacenters, buildings, and campuses by 2025. This means that **Amadeus**' partners, like airlines, will know that core components of their IT operations are completely sustainable and carbon neutral. In fact, we want Azure to be carbon negative and **Microsoft** is leading the way in researching carbon capture technology to do this."

Microsoft has committed to also focus on the environmental impact on local communities where Azure datacenters operate with a goal of replenishing more water than they consume and being zero-waste by 2030 as well as adhering to a practice of net-zero deforestation from new construction.

Sabine Hansen Peck, SVP, People, Culture, Communication & Brand, **Amadeus** commented, "As we work to rebuild travel, a sustainable recovery that safeguards our planet and our future prosperity needs to be central to the decisions we make. Therefore, **Microsoft** is the ideal partner for us as a recognized leader in sustainability, and we share a commitment to putting people and the environment at the heart of our business decisions."

Applying the latest technology and practices has helped **Microsoft** become 98% more carbon efficient. But as technology advances, so does the demand for processing power.

Russinovich described how Azure can help in this area, "Organizations need increasingly sophisticated AI and machine learning functionality to stay competitive, but they don't want to increase their environmental impact. Moving workloads to Azure can help with this. The most advanced microchips today have six times more processing power than standard chips.

Within two years, most cloud AI compute will need to process on advanced chips that run too hot to be cooled by conventional air circulation techniques. Immersing the AI chips on server blades in low-boil dielectric fluid improves latencies and throughput while providing better overall performance."

Elaborating further Russinovich said that, "low-boil dielectric fluid converts the thermal energy released from the AI chips into vapor that is then recaptured in a closed-loop system for reuse in other applications. Liquid immersion cooling is predicted to lower server energy consumption in the future by five to fifteen percent at a minimum while greatly minimizing overall water use in datacenters."

Taking this liquid immersion concept even further, **Microsoft** has pioneered breakthroughs in subsea datacenters. As the name suggests, **Microsoft**'s Project Natick team deployed the Northern Isles datacenter 117 feet deep to the seafloor in spring 2018. The 40-foot long datacenter was loaded with 12 racks containing a total of 864 servers and associated cooling system infrastructure. The concept is considered a potential way to provide ultra-fast cloud services to coastal populations and save energy.

"More than half the world's population lives within 120 miles of the coast. By putting datacenters underwater near coastal cities, data would have a short distance to travel, leading to lightning quick response times. Plus, the consistently cool subsurface seas are ideal for energy-efficient datacenter designs. For example, they can leverage heat-exchange plumbing such as that found on submarines," Russinovich said.

The results are encouraging, and **Microsoft** says that the servers submerged off the coast of Scotland's Northern Isles showed a failure rate of just one eighth of that of its land-based control group.

REIMAGINING AMADEUS WITH THE POWER OF AZURE

Early in 2014 **Amadeus** started introducing Agile methodologies into its software development activities. In many cases, **Amadeus** also involved its customers in the Agile cycle. Therefore, as of 2018, **Amadeus** embraced the industry standard SAFe® methodology (Scaled Agile Framework). SAFe promotes collaboration and alignment for a very large number of Agile teams along the whole production cycle, from the requirements stage to delivery.

SAFe has been adopted as the global methodology for the whole **Amadeus** organization, including its commercial activities. Organizations that use SAFe methodology apply a DevOps approach to implement Continuous Integration/Continuous Delivery (CI/CD), which are a set of best practices and tools used to automate and monitor the software production cycle.

IMAGINATION

Each newly conceived application starts as an idea in the mind of an engineer and is limited only by imagination on Cloud Planet.

Simply put, DevOps is the combination of software development and IT operations. CloudOps is the extension of this in the cloud. The essence of the concepts are deliberate ways of developing and putting software into production.

"Our partnership with **Microsoft** is also about evolving the ways we work. I think working in a DevOps setup has really brought our operations teams closer to the development teams. And with Azure toolkits, the changes are a lot easier for teams that need to learn new processes," Bristiel commented.

A DevOps approach to software development is the natural partner to cloud. It allows the development of software and its maintenance through its lifecycle to be owned by the same technical team.

Bristiel continued, "By unifying our development toolkits, taking a DevOps approach, and embracing Azure's cutting-edge environments, we will be able to reach new heights in terms of the innovations. And we can put these innovations into production faster than ever at scale. It is really exciting when you think about the possibilities our developers are exploring."

By incorporating agile working methods and processes this approach sustains a focus not just on developers who create the code but also on project managers who guide a project through, and customers who will, in the end, be the ones to use what's been created.

Taking a DevOps approach results in faster innovation and delivery cycles, quicker response to customers both in terms of issue report and fix and in terms of responding to requests for new features, the creation of stronger bonds with customers and a greater sense of ownership across all the collaborating partners.

Crucially, taking a DevOps approach ensures product development is always grounded in the vision of Amadeus and its customers.

"Moving to Azure and taking a DevOps approach is allowing us to pursue ideas we've had in the plan but not been able to realize because of factors like scalability, platform readiness, and data siloes. We can now bring ideas to life without spending most of our time building full-stack environments with continuously evolving technologies that we need to permanently maintain and operate ourselves. We can work much faster and lower the time-to-market for our products and solutions. In turn this means we can have more ideas, and explore more use cases, than in the past," said Abdelaali Sadki, Manager, Architecture & DevOps at **Amadeus**.

Building on the DevOps role, the cloud introduces the possibility of FinOps which aims to maximize eco-system value. "Further incorporating a FinOps approach will unlock new efficiencies for **Amadeus**. Better understanding of our infrastructure usage will allow us to adjust our application design to better meet our targets. We have the opportunity for more control by running the infrastructure only when needed and according to the demand. All of this translates into efficiencies that enable more focus on our products. In addition, by pushing the responsibility of spawning the infrastructure to the edge and DevOps teams, we are unlocking new heights of delivery speed and innovation capabilities," Nicolas Hourdou, Head of Commercial Finance, Technologies, **Amadeus** remarked.

THE AMADEUS DATA MESH - TRAVEL'S BRAIN

With a unique position at the heart of the travel industry, **Amadeus** processes the most complete travel data cohorts in the world. Data sets from airlines, travel agencies, hotels, car rentals, cruise and more, are the key business lines feeding **Amadeus** systems. The company has already pioneered work on various data platforms, including the Dynamic Intelligence Hub for airlines.

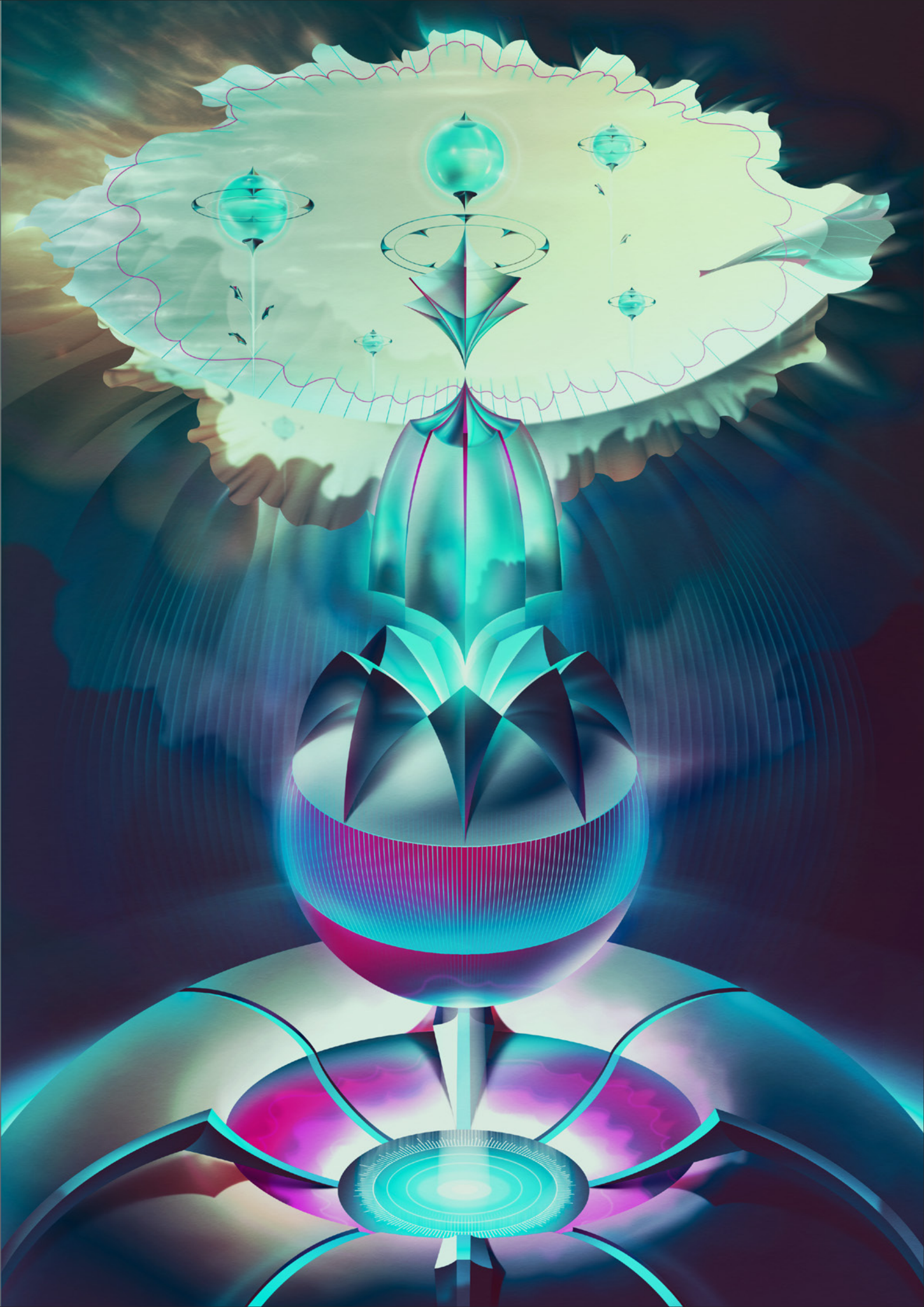
Amadeus is perfecting a 'data mesh' with Microsoft, which simply put is the next evolution of a data lake and the only one of its kind in the travel industry, to enable data to be processed in a secure and compliant way to understand the travel industry better.

Microsoft's Sanders explained, "It starts with the data and how it can be used to drive better insights and outcomes. The partnership combines the technical abilities of **Amadeus** with the fantastic data services **Microsoft** offers to enable fast, agile delivery of AI-driven outcomes that allow for an amazing understanding of the travel industry."

The possibilities for the travel industry of a data mesh are cause for excitement. The data mesh is effectively 'a network of data', with a central node to enable a governance framework to be used to ensure that any data is processed in a secure, compliant and accountable manner that can be trusted. Different data sets are sub-nodes on the network and powered by Azure data technology.

DATA MESH

On Cloud Planet the data mesh spawns new ideas and smarter solutions in an open and collaborative space.



"With Azure AI capabilities, we will be able to extract more value from data than ever thought imaginable. This means continuing our work perfecting a data mesh where different business lines can access each other's data to maximize value. Any access to data will be lawful with the relevant rights and authorizations in place to process the data. For example, airlines could create offers with hospitality insights on a specific travel cohort like business travelers," said Joel Singer, Director, Data Mesh, **Amadeus**.

The over-arching vision is to enable Amadeus customers to benefit from this complete view of travel to create new opportunities.

Travel players will be able to develop highly personalized, highly bespoke offers to individual travelers. They will be able to better understand and segment their markets, which in turn will allow them to offer appropriate products and services to travelers.

Singer continued, "Much of the data in our sector exists in legacy formats such as EDIFACT. This will be transformed into ready-to-use open data in order to make it usable by data scientists for machine learning and artificial intelligence (AI).This is a critical enabler for customers like airlines to maximize the potential of sophisticated retailing made possible by IATA's One Order and NDC standards for example."

The data mesh enables open data. Certain data sets will be openly documented so that developers from **Amadeus**, its customers and third parties can all access the data to innovate more quickly, via APIs and open interfaces in Azure. As providers realize the benefits, innovate and add more data, the ecosystem will grow and flourish.

"Everyone wants advanced data capabilities, but few have that full data perspective, so it's very hard for others in the travel industry to do what **Amadeus** is enabling," Sanders said. "It's quite exceptional and exciting to see **Amadeus** push the travel industry forward in this way. One of the areas I'm excited about is how to enable **Amadeus** customers to build their own apps and experiences. There's an expectation across industries that every app is a collaborative one – that every solution can be brought together and exercised by a multitude of individuals."

Regulation and control of data sharing are absolutely central to the aspirations for the data mesh. To this end, **Amadeus** is one of the 22 founding members of Gaia-X, a European initiative to provide a mechanism that enables all industries to share data through an open, transparent and secure digital ecosystem.

"We are involved in determining several policies from its IP Rights Policy to its Software Policy and its Corporate documents in the formation of an independent, incorporated association. **Amadeus** is also the leader of the working group that is tasked with defining the data space for Travel & Mobility. We are gathering other travel players to understand what sort of use cases could be used to define the technical workings of this data space," commented Lacroix.

ARTIFICIAL INTELLIGENCE AND DATA SCIENCE SET FREE

Large quantities of real time and historical data are required to train the next generation of AI and machine learning (ML) algorithms. This data will also be used to develop advanced techniques like Deep Learning and Reinforcement Learning and bring them into production. **Microsoft** Azure offers several key benefits in this area that **Amadeus** is already taking advantage of.

Head of AI Research at **Amadeus**, Rodrigo Acuña said, "The Azure platform is a great enabler for faster, powerful and scalable AI development. As an example, just the fact of being able to access tools and data faster than today will open new opportunities and foster great collaboration not only between different **Amadeus** units but also with customers and partners."

Azure features several services ideally suited to enable **Amadeus**' AI R&D teams to realize the potential of this powerful technology.

Acuña elaborated further, “We benefit from access to state-of-the art deep learning frameworks and powerful hardware like FPGA, GPUs, and new innovations that are coming in this area such as quantum computing. We are really excited about collaborating with our counterparts on the **Microsoft** side. We will also leverage the more and more Azure managed services with pretrained cognitive models like speech, vision, and language; enabling a new generation of IT solutions for the travel industry.”

Amadeus’ data science capabilities will be supercharged thanks to the on-demand processing power and testing environments of Azure.

Igor Arambasic, Head of Data Science, **Amadeus**, commented, “In addition to elasticity, we have all the computing power we could possibly need with Azure. Some of our advanced data science processes that require days of number crunching could be cut down to just hours. But it’s not just power itself. There are special GPUs we can have access to that will be gamechangers for deep learning and image processing. The prospects for data science in travel are limitless with the power of Azure.”

SPECIES

Ideas come to life and become part of the local ecosystem. They are the species of Cloud Planet.

"For example, our team worked on an ambitious and fun data project back in 2019 where we analyzed 3.4 billion data points. We used Generative Adversarial Networks (GANs) to create an image of the average traveler out of the data points based on an open database of 10,000 adult face images. We named the creation 'Shin Walker', Shin in Japanese means 'truth' and Walker because of the travel aspect. It was a fascinating project and we learned a lot from it. Partnering with **Microsoft** means that our data science teams will have even more capabilities and tools to pursue advanced data projects like Shin Walker," said Arambasic.

Machine learning is a focus for **Amadeus** and Azure ML will empower data scientists and developers with a wide range of tools to build, train, and deploy ML models and foster team collaboration.

"We are working to inject ML into existing and new solutions and training the models is crucial. **Microsoft** has all the toolkits necessary for training ML models. Beyond that, **Microsoft** provides the entire pipeline management system for experimentation and collaboration. This will decrease the amount of manual work we have to do to run data science experiments and keep an historical record of all our experiments. We can then compare all of our past ideas and really embrace the scientific process of learning to improve our ML models," remarked Michael Defoin-Platel, Head of Machine Learning Services, **Amadeus**.

CLOUD MAGIC UNLEASHED IN TRAVEL

Amadeus' journey with **Microsoft** may have only just begun, but there are already a number of projects on track, and many more at the scoping phase.

Jorge Elliott, VP, Strategic Partnerships, **Amadeus** elaborated, "Our partnership with **Microsoft** is not just about accelerating our journey to the cloud, it's also about unleashing the next wave of innovation in the travel industry. The goal is to take advantage of the possibilities that cloud technology offers, and work together with **Microsoft** and the entire travel industry to transform travel IT."

Amadeus and **Microsoft** have set up an innovation program, through which the organizations are exploring and developing new travel solutions. The innovation program covers initiatives from all **Amadeus** business lines and the aspiration is to co-innovate the future of frictionless travel together.

"We are looking both at creating immediate benefits for customers by integrating ready-to-use services from **Microsoft** like AI and machine learning, trained on **Amadeus**' travel data and at longer term more disruptive opportunities. To complement this, we're also looking at integrating some **Amadeus** services into **Microsoft**'s offerings and using each other's ecosystems to go to market. Part of this is exploring new, innovative ways to help our customers implement solutions and get the most value out of them," commented Fredrik Odéen, Program Director, Corporate Strategy, **Amadeus**.

The potential of the partnership is limited only by imagination. With Amadeus' position at the heart of travel and Microsoft's at the heart of technology – the two companies will be able to unlock great innovations and value at scale.

Microsoft's Sanders said, "Being able to create a traveler experience that is much more hassle free is exciting, particularly when it comes to helping airlines create a smoother journey for travelers. I think **Amadeus** and **Microsoft** can create solutions that will add more value services, reduce cost, and support the needs of travelers. Bringing data together and driving an AI solution on top of it will help not only **Amadeus** but also its airlines partners to leverage better data-driven outcomes."

There's excitement around the world for the potential of the partnership. "We are leveraging the power of proximity and already looking at areas where we can accelerate innovation. India is where **Microsoft** and **Amadeus** have large engineering centers and can take collaboration to a whole new level. The engineering community has reason to be excited about the possibilities this partnership enables to really make an impact on the travel industry at scale. Working with Azure's cutting-edge toolkits and software development pipelines coupled with access to the most complete view of the travel industry is a powerful combination," commented Mani Ganeshan, Head of **Amadeus** Labs and APAC R&D, **Amadeus**.

PUTTING THE PUZZLE TOGETHER WITH A TRAVELER CENTRIC PLATFORM

It is a time of huge opportunity for travel providers to refocus their offer and improve their services to meet and exceed new, more demanding traveler expectations. Travelers are looking for a smoother trip experience with genuine pro-active personalization and trips oriented towards their particular needs, preferences and circumstances, at every step of the journey.

In the past, providers have been limited in their ability to deliver this due to the fragmentation of traveler information across multiple and unconnected providers.

Tarek Zaigouche, CTO and Head of R&D for the **Amadeus** Traveler Centric Platform remarked, "**Amadeus**' Traveler Centric Platform has been developed to offer a new, collaborative way for travel providers across the industry to share customer insights, create brand new revenue streams, and at the same time, humanize the traveler experience with a more personalized and joined-up service."

The Traveler Centric Platform (TCP) allows travel providers serving the same traveler to share data and insights related to the journey, so they can better serve the traveler at a given time.

"Imagine a scenario where a hotel knows which flight the traveler is taking, and from which airport, not only it could propose proactively a transfer to the hotel, but also depending on the time of arrival, an early check-in or a direct transfer of the luggage to the hotel. This will truly contribute to customer satisfaction," Zaigouche said.

Multi-party data collaboration is made possible through the open data capabilities of Azure.

The flexibility of the public cloud is allowing vertically integrated teams of **Amadeus** developers to derive value from TCP already, building machine learning models to spot servicing opportunities across the entire traveler journey and to make them available to customers in real-time.

This co-development with **Microsoft** demonstrates how synergies can result in a better time to market and in a new way of sharing data securely across the different verticals of the travel industry to reshape the whole travel experience.

"With Microsoft, we will be able to create a truly collaborative platform for TCP users to develop exciting new customer experiences based on the complete view of their journey," Zaigouche added.

A MORE PERSONALIZED WAY TO SEARCH FOR TRAVEL

Today searching for travel is laborious. It requires the traveler to specify an origin and a destination, and results returned are typically structured by price.

By combining **Amadeus**' travel data and experience with **Microsoft**'s tools for Natural Language Processing (NLP) the companies are exploring the potential for intuitive search which will allow much greater flexibility in terms of how the traveler searches, what is included within their search parameters, and what is delivered to them.

Pierre-Yves Rault, Program Manager for Data Platform & Partners, **Amadeus** explained, "Using NLP, travelers can describe their trip verbally or through written text, and search capabilities that harness public cloud infrastructure will compute billions of possible itineraries before returning a small number of highly relevant options. This has the potential to drastically simplify the experience of searching for travel, reducing the number of websites a traveler visits and delivering tailored results that dramatically improve conversion."

SOLVING TRAVEL DISRUPTIONS BEFORE THEY HAPPEN

As airports continue to automate the standard passenger experience it's equally important the industry has the capability to automatically handle exceptions like disruption. The combination of public cloud computing and machine learning will help **Amadeus** move to the era of predictive disruption management, where passengers receive alerts before disruption even happens.

Predictive disruption management should mean travelers can be presented with re-accommodation options perhaps as much as 48 hours before departure based on a high probability of expected disruption. Predictive disruption management should also mean that travelers can be told well in advance of issues, and can delay their arrival at terminals, or be moved to an alternative flight or route.

Airlines managing disruption today can have little notice of issues, and too often find themselves firefighting, with one airport handling knock-on effects from disruption to another, managing bottlenecks and delivering information to travelers later than the traveler, airport or airline would like.

"Our move to **Microsoft** Azure means we can tackle this problem at a global level, combining data from different airlines and airports along with external data like weather and historical trends to make highly accurate predictions of when disruptions will occur. The goal is to provide the traveler with a seamless, stress free experience, and allow airports and airlines to plan and be proactive," said **Amadeus**' Joel Singer.

This 'global optimizer' is made possible by the ability to combine data from any airline, airport and third-party providers more easily through the **Amadeus** Data Mesh so that machine learning algorithms can be applied to identify disruption and automatically propose solutions.

REIMAGINING THE CORPORATE TRAVEL EXPERIENCE

Amadeus' move to Azure enables business travel and expense to be connected into the day-to-day digital workplace. This could not be timelier, as it allows physical meetings and digital collaboration to be planned in a way that better supports new ways of working, like the emerging hybrid digital and physical world.

Being able to plan and book travel within the productivity and collaboration tools we all rely on for communicating with colleagues or managing our working day unlocks an immersive travel experience.

Rudy Daniello, Head of Corporate IT, **Amadeus** commented on the vision, "We are working in collaboration with **Microsoft** to provide a native experience for business travelers, drastically reducing the complexity of travel planning and increasing productivity. We will also support personalization with more scope for tailored notifications for destination services or transfers. Reducing the friction involved in business travel in this way makes it easier for workers to find and book their own travel, and for groups to organize trips together, in one place, at the same time, as part of a meeting."

But it also has wider implications for businesses, opening the door to simplification of the decades old processes that impact departments like finance, procurement and travel.

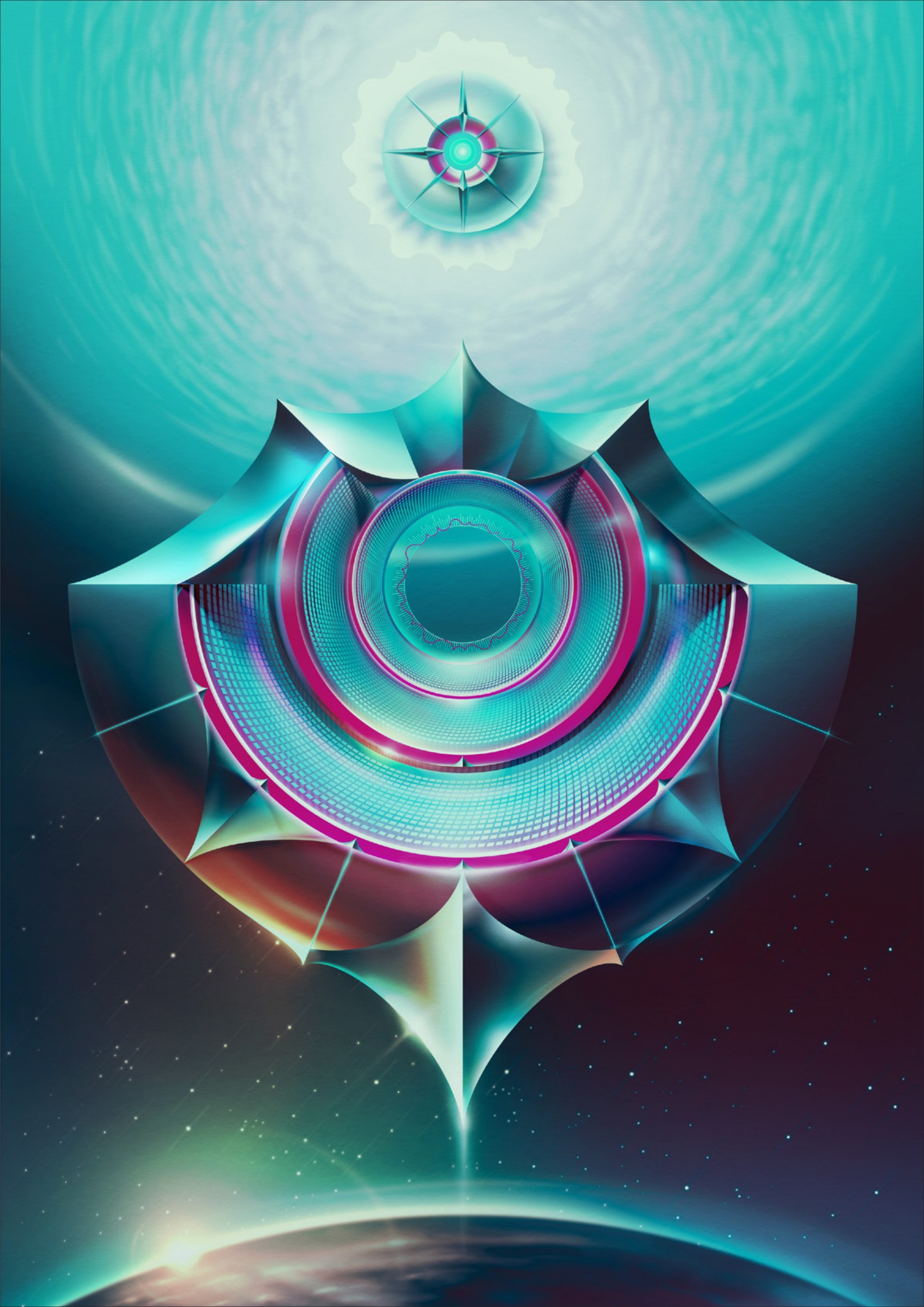
Amadeus and Microsoft are actively working on opportunities to help many different job roles reduce administration so they can focus on their core day-to-day business.

The public cloud makes it possible to combine **Amadeus** and **Microsoft**'s respective assets to harness data in new ways that can drastically improve the value businesses realize from a trip. With more complete data relating to an employee's location and the location of colleagues and contacts, a single business trip could deliver on several different objectives.

AN EXCITING JOURNEY FOR THE TRAVEL INDUSTRY

UPWARDS

As we journey towards Cloud Planet together, Microsoft and Amadeus can build better travel experiences that enrich, excite, and delight. Upwards we go.



Amadeus and **Microsoft** can build better traveler experiences that enrich, excite and delight. Together, the companies will unlock new ways to see travel. Learning how to embrace emerging trends; exploring other sectors such as entertainment, retail and healthcare; unleashing the potential of data to shape the future of travel.

The best metaphor for this journey is travel to another dimension, where intergalactic computing is the standard and technology has no limitations. It's a fanciful dimension we call Cloud Planet for the sake of visually describing the journey in this report.

But it is indeed a very real sentiment where the boundaries are constantly expanding thanks to collaboration between two innovative companies like **Amadeus** and **Microsoft**. Stay tuned because the journey is just getting started.

*“ Amadeus’ strength is built on **our people** and our history of **pushing the boundaries of travel technology**, providing our customers with better and ever more **innovative** ways to achieve their goals. From our long experience with **cloud technology**, we are convinced it is the **right systems** architecture to deliver on this continued commitment, and that **Microsoft is the right partner** to help us achieve our goals together. This includes the opportunity to explore, design and develop **new solutions** that take full advantage of cloud technology. ”*

- Luis Maroto, CEO of Amadeus

> *Advances in **digital technology** are rapidly redefining every aspect of work and life, including **how we travel**. Together with Amadeus, we will apply the **power of Azure and its AI capabilities** to create new **frictionless experiences** for travelers worldwide and **reimagine the travel industry** going forward.*

- Satya Nadella, CEO, Microsoft