WHITE PAPER

The Industrial Metaverse Needs a Strong Data Fabric.

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The metaverse is data rich, which introduces a lot of problems for companies to be successful in this space if they do not have a strong data fabric to manage the data produced and consumed by the AR and VR applications that make up the metaverse.

The Industrial Metaverse is Game Changing

The industrial metaverse is truly a game changer for equipment intensive operations organizations, where digital twins and AI driven analytics provide real-time immersive experience to operations personnel to optimize the work environment to save costs, provide more instruction to new, less experienced workers and drive sustainability and net zero initiatives.

For example, digital replicas of wind power turbine assets can be designed and placed at precise locations where weather conditions will provide the most optimal power production while reducing wind and water pressure on the structure. Inspection processes for power poles and bridges can be automated with drones and computer vision to prioritize work activities and keep people out of harm's way, reducing insurance premiums and improving reliability in critical infrastructure. Also, the entire act of collaboration can be digitized, where people avatars or digital phenotypes, are interacting in virtual design, maintenance, and production facilities to speed up group decisions and better harness creativity across previously siloed teams and processes.
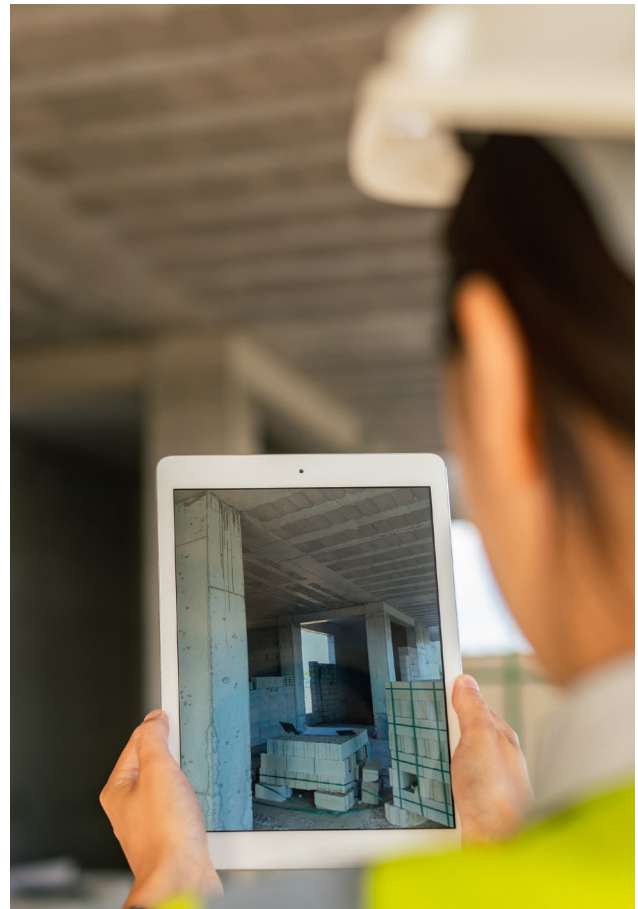
Hitachi is Active in the Industrial Metaverse

Hitachi has been active in the metaverse for many years. For example, we have applied visualization techniques to understanding complex subjects like data patterns and support for regenerative medicine applications. We have helped to develop wearable sensor arrays that provide an ability to improve workplace safety with continuous monitoring of vital statistics for the employee, to understand the strain that the human body undergoes and to provide immediate feedback to managers and supervisors to enable the human in the loop. We have also created virtual plant tours to help people understand the business we are in and create transparency around what we do as a company.

Hitachi Examples of Metaverse Solutions

Here is one more specific example. GE Hitachi, a joint venture, has created virtual reality training simulators that are used in nuclear power generation plants to train operations personnel, in a cost effective and safe manner, of changing fuel rods.

Using exact replicas of the operator console overlaid with virtual reality training simulation to provide a realistic immersive training experience for operators. Virtual training schools are created, like on the Star Ship Enterprise Holodeck, where instructors and students interact. Realistic problems are presented to the operator who must act, preparing them for doing the job and feeling more confident as part of the process.

In another example, Hitachi is also designed augmented reality headgear to aid the assembly worker and technician in doing their job in the most effective manner. Ergonomically designed with user comfort and portability considered, these AR glasses can easily integrate stored data, for example work instructions, design documents, and provide them at the point of work to get the job done. With the addition of telecommunications equipment, a remote expert can also be brought in to help with any task and provide an additional level of confidence that the job was done right and in the most effective manner.

Industrial Metaverse Use Cases Are All Focused on Augmented and Virtual Reality

For example, product design and engineering uses augmented reality to accelerate the design and prototyping of new products. It is an increasingly attractive option for companies keen to reduce product development costs and improve time to market.

Also, hands-on training is one of the clearest and most widely applicable uses for metaverse technologies. Virtual reality can bring people together without the expense and downtime associated with traveling to a central training location. And training in this learning space is not just a matter of virtualizing activities that previously took place with physical objects in a physical space. VR and AR training can go one step further and make the invisible visible for training purposes, illustrating what a problem may look like providing guidance on what to do in case of a fire, spill or break in a machine.

Virtual services for hands-on work is also a very a powerful use case for AR for virtual guidance for people faced with unfamiliar and technically challenging hands-on work. Virtual overlays can provide them with vital information on what to look for, where to focus, and how to complete the task successfully.

Networking, socializing, and creating is also an opportunity. As we discovered during the pandemic, work means more to us than simply getting on with the task at hand. Many of us found we missed the social side of the workplace - from serendipitous encounters at the coffee machine to the chance to just hang out with work friends. Could the metaverse make work-based socializing more meaningful?

AR is the Application, But Data Can Come and Go Anywhere

AR may be the application, but content is needed to really make to useful. This includes vast amounts of data and information from sensors, documents, and user guides. Work instructions are provided at the point of work for a technician or operator to use with the actual equipment. Not all this information can come from the cloud and edge processing and storage requirements need to be considered.

This technician is also a generator of added information, such as notes on what was fixed, checklists that were signed off on and other data collected by walking through the operation and doing their work. All this forms a record that is uploaded to the system and can help to make operations more effective in the future, as well as providing the needed documentation for compliance purposes.

Virtual reality can bring people together without the expense and downtime associated with traveling to a central training location.

"...hands-on training is one of the clearest and most widely applicable uses for metaverse technologies."

Established Industrial Metaverse Collaboration Tools are Used Today

But let us not kid ourselves. There have been established metaverse collaboration tools in use for many years. These include picking up the cell phone or radio to talk with somebody about a problem that you have. Instant messaging and collaboration tools have also been there. Conferencing technologies allow us to share audio, video, and chat in real time. Also, documentation systems and workflow applications help to keep things moving along when it comes to solving a problem. All these technologies come forward into the metaverse and the new immersive environment.

All Leading to Data Problems for the Metaverse

The metaverse as a whole. Is set to push data usage up by twenty times in the next 10 years, testing 5G and ushering in the need for 6G networking. This all leads to data problems with the metaverse that need to be overcome.

Data privacy is seen as the number one hurdle not just in the commercial application environment but also in industrial. For example, imagine gathering bio data from line operators in a union shop. Over 77% of managers distrust the data that they must use for decision making. Also, anyone who has played video games in a virtual environment knows that when the network slows down, dizziness and vertigo can be induced which make the experience very unpleasant. The industrial metaverse experience is based upon application development of AI and analytics, of which 70% of the time needed to create applications is just in the integration and data prep for machine learning. Data management is something that everyone needs to be thinking about when it comes to enabling the industrial metaverse.

Hitachi Vantara is Fundamentally a Data Company

Data is our DNA at Hitachi. Hitachi Vantara offers a trusted and established track-record in IT and deep experience in OT that no other company can claim. Our heritage gives us access to 60 years of IT experience with the world's leading enterprises and 110 years of industry domain knowledge. Because of our long-established expertise, we have an advantage over our competitors: We know data better than anyone. Thousands of the most mission critical systems in the largest enterprises use Hitachi Vantara's data management solutions today. We are data management, analytics, and industry rolled into one solution provider.

DataOps is about delivering more agile and automated approaches to data management.

DataOps is a term that may not be that well known in Industrial today. It is a professional approach to managing your data to build a data fabric to serve your overall organization. Data

operations, or DataOps, offers a new opportunity for those who want to be industry leaders, by leveraging their existing data. DataOps applies the lessons learned from the highly successful DevOps movement. DevOps helped to institute agility, improve quality, and increase production success — simultaneously — in large-scale software development programs. DataOps is a data management practice that brings agile principles to data by improving cross-functional communication, integration, and data flow automation between the data stakeholders. It works edge-to-multi-cloud. DataOps is about having the right data at the right place and at the right time. And just like DevOps, DataOps relies on a high degree of automation and collaboration.

Hitachi's Lumada Industrial DataOps Portfolio

A data fabric approach to enable and accelerate business, IT and OT use cases

Lumada Industrial DataOps software manages data in the same way a production automation system manages material and processes. It considers all the Total Quality Management (TQM) aspects of data to ensure that it is enabled as a fundamental building block for operations and business use. This includes secure collection of operations data, management of data definitions, which may include storage, version control and exchange with other systems of master data. Management of data resources, including registration, exchange, and analysis of resource information. Scheduling data processes. Execution of analytics assembly projects using digital twins and ml services to train models. Analytics dashboards for performance analysis. Data track and trace to present a complete history of data including source, combination, transformations, and more. Lumada DataOps offers a data fabric-based approach to enable and accelerate business across both IT and OT use cases.

Digital Twin for Data Management in DataOps

Our digital twin is a data manager for the flow of data associated with a physical machine or process. These twins can be embedded one inside of another to build more complex representations, for example an entire manufacturing plant containing production lines which contain machines which contain individual components like pumps, motors, and sensors. Data is routed through these digital twins but also there is the ability to integrate in third party first principles physics-based simulators which represent the complete digital behavior of an asset. This allows us to create synthetic data that provides additional details using virtual sensor data, which is data that cannot easily be measured in the real world, such as angular acceleration. This provides additional information to train models to be more accurate when predicting outcomes.

To illustrate how data plays a primary role in the industrial metaverse, let us look at three use cases.

AR for Physical Product Design

Let us take the example of an automotive organization that leverages industrial metaverse applications for product design. In this case they are trying out different engine designs along with accessories and how they will fit into the engine bay of a car that they are designing. In building apps, all the design documentation for the engine needs to be managed and cataloged for use in the application. There are also different revisions of design files that need to be tracked, so a lineage of the information needs to be maintained across multiple databases. Here our data catalog can help to organize and keep track of this and provides the ability for others to annotate information to the data sets and documents so more people in the organization can leverage them.

When the team is working on the actual automobile chassis and they're using augmented reality to fit various engine designs into the engine bay in a virtual environment, hundreds of point cloud attributes are coming from vision systems attached to the headset that need to be interpreted using visual analytics and a local computing node to calculate the information in real time. The user may also want to look at test and maintenance history information associated with the engine or the chassis to validate any assumptions that they are making and how the final engine placement will behave in real life. All this information flows from existing systems in databases using a data flow manager and combines data from two systems together and creates a new stream of information that is leveraged within the application. All this is done behind the scenes with the design engineers experiencing a seamless environment to do their job in.

Virtual Reality Training

Let us consider another example of an automobile assembly line where a new employee has been hired, who has no manufacturing experience whatsoever, but is very eager to learn the process.

To develop such an application, an enormous amount of data needs to be gathered about the actual production facility to generate a game-like environment for training. This data was stored in a data lake and organized for use by the programming team. As part of the exercise data engineers properly tagged and documented the metadata associated with the data files so they were easily accessible and could be browsed or searched for by the programming team when they assembled the application.

Video footage of the process where animations are created and overlaid was cataloged automatically using AI in the data catalog.

Building blocks are digital twins, a fast edge processing platform, visual analytics and data centralized in a data lake.

At the same time, manuals and training documents were referenced and integrated as part of the work process. This resulted in not only the application being developed faster but also provided the local video storage and content management platform that spanned from the cloud to development sites.

Now comes the day the worker to uses the system. The movement of the data files we're automatically scheduled based upon the need for the training that day and taking into consideration cloud storage costs versus on-premises deployment needs. The data fabric made sure that the data was available at the right location in the right form to feed the system when it was needed to deliver the training. Information was integrated from the HR system, with new employees and personal information redacted so only the things that were needed in the training simulation were used. The results of the training exercise were securely stored in the training system for reporting purposes and compliance with government regulations. All this data management helped make the virtual reality experience much better for the participants and the administrators of the system.

Virtual Guidance Hands-on Work

Finally let's take the example of a technician in a chemical plant who is dispatched to fix a pump in the water treatment facility. To find the right pump, the AR glasses they are using should guide them to the pump's location, provide safety information on how to best get there, present the technician with the current state by accessing sensor values from the control system. Then maintenance records are provided to see what previous problems were fixed and how it was done. Then a YouTube video is presented on how to do a repair.

Once the work begins, the technician starts producing data that needs to be stored. Pictures or videos of the problem are uploaded so a remote engineer can help with the troubleshooting. A workorder is requested to order parts which notifies someone in the parts storage bin to dispatch a repair kit. All along telemetry data is stored, like the movements made by the technician through their bio-suite for improvements on future work instructions. Verbal and written comments are captured as part of the work record. Resulting checklists are uploaded, as they do the work, to certify what was done. The technician's supervisor inspects the work and provides an inspection signoff before the technician closes up the pump. Then a communication is established with the central control room operator to start the pump.

And the operation is back on-line.

All of this required a strong data fabric to pull off combining Instruction Videos, Geo-Location, Sensor Data & Work Manuals. Building Blocks were Sensor Integration, Data Pipeline Management, Visual Analytics, and an Integration Platform.

What makes it all possible is the merger of digital and physical worlds with interactions made in real time and accurate 3D identification of virtual and real-world objects.

Enabling the Metaverse Data Experience

In summary, the opportunity exists today to better enable the industrial metaverse data experience, to drive projects and scale solutions, so they are achievable for your organization. A strong industrial data fabric will be needed to make this successful. If you would like to learn more on how to build a strong data fabric, please contact Hitachi Vantara today.

ABOUT HITACHI VANTARA

Hitachi Vantara, a wholly-owned subsidiary of Hitachi Ltd., delivers the intelligent data platforms, infrastructure systems, and digital expertise that supports more than 80% of the fortune 100. To learn how Hitachi Vantara turns businesses from data-rich to data-driven through agile digital processes, products, and experiences, visit hitachivantara.com

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Watch our webinar on "The Industrial Metaverse is built on a Strong Data Fabric"

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