
AWS
re:Invent
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IOT310

Scaling Industrial Transformation with the AWS Digital Twin Framework

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Agenda

01 Session Alignment:
What is a digital twin

02 Trends and challenges:
Industrial customers

03 What is the AWS
digital twin framework

04 Key use cases, example customer
deployments, and demos

05 Working through the
digital twin framework

06 Breaking the twin up:
Common patterns for IoT and Spatial data, building and orchestrating simulations

07 Working through use cases

08 Q&A

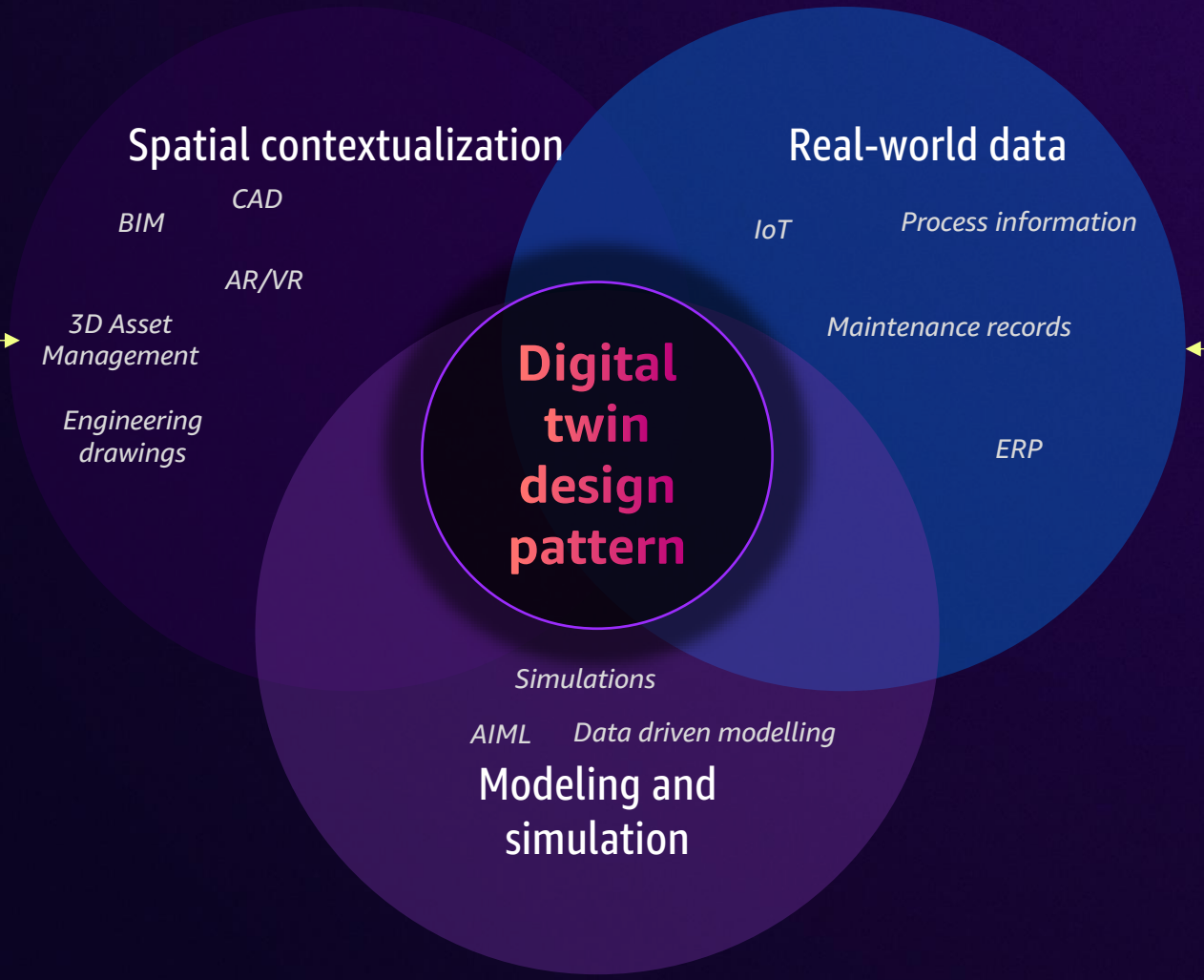
What is a digital twin

A digital twin is a
living digital representation
of a physical system that is
dynamically updated
to mimic the
structure, state, & behaviour
of the physical system to drive
business outcomes

Components of a digital twin

Spatially accurate replica: Dynamic virtual representation that precisely mirrors the physical system in the real world, enabling detailed spatial analysis & interaction

Operations optimization: Analyze continuous streams of data to deliver insights for operational improvements, efficiency gains and decision making



Predictive tool: Leverages AI/ML, simulations & IoT data to forecast future states, enable proactive interventions & innovation

A leveling guide to digital twins

L1 Descriptive

- Engineering design and visual representation.

AWS Batch, AWS ParallelCluster, Elastic Fabric Adapter (EFA), Amazon FSx For Lustre, NICE EnginFrame, NICE DCV,HPC6a,G5

L2 Informative

- Integration of IoT, asset history, and maintenance data.

AWS IoT TwinMaker, AWS IoT Core, AWS IoT Greengrass, AWS IoT SiteWise, AWS IoT Analytics, AWS IoT FleetWise, Amazon QuickSight, Amazon Textract, Amazon Rekognition

L3 Predictive

- Predictions of unmeasured quantities and future states based on continued operations.

Industrial AI portfolio, (Lookout For Equipment, Lookout for Vision, Amazon Monitron, AWS Panorama), AWS HPC, Amazon SageMaker

L4 Living

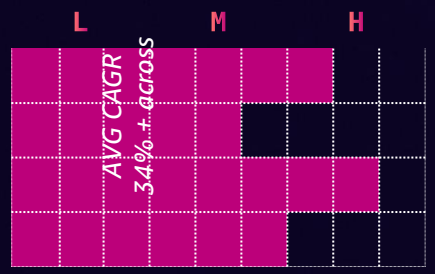
- Updatable models to drive actionable insights.

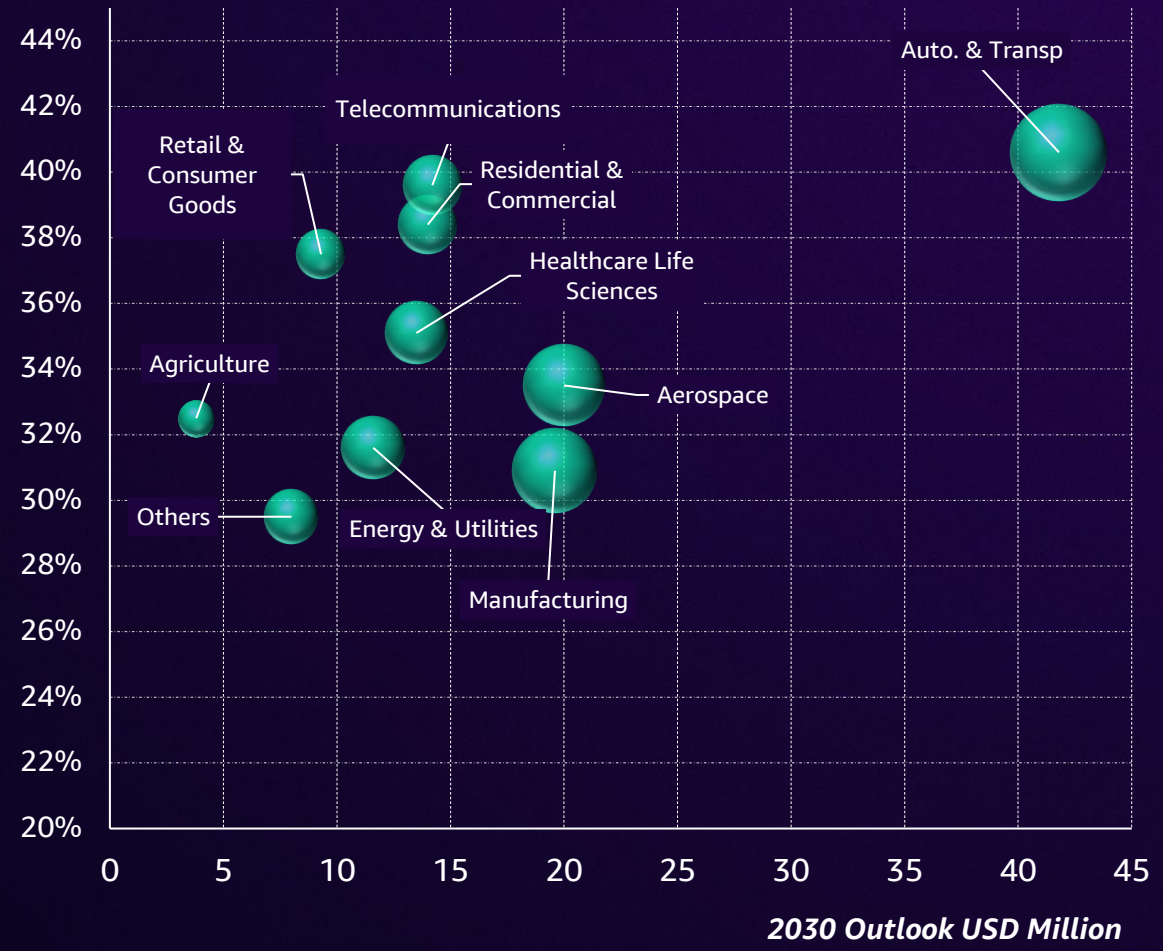
AWS HPC, Amazon SageMaker, Amazon EC2, Amazon S3, AWS Lambda, AWS Deep Learning AMIs (DLAMI), Amazon DynamoDB, aws-do-pm framework (opensource)

DT Levels framework adapted from: Verdantix, Five Digital Twin Strategies For Industrial Facilities, 2019.

Industry trends

	SHARE	GROWTH MOMENTUM
PRODUCT DESIGN & DEV.	38%	
PREDICTIVE MAINTENANCE	26%	
BUSINESS OPTIMIZATION	27%	
OTHERS	9%	





Typical deployments and use cases

Integrated asset performance management

- A systematic approach to improving the performance, reliability and availability of physical assets such as machinery, industrial plants, or fleets of assets throughout their life cycle

Process monitoring and optimization

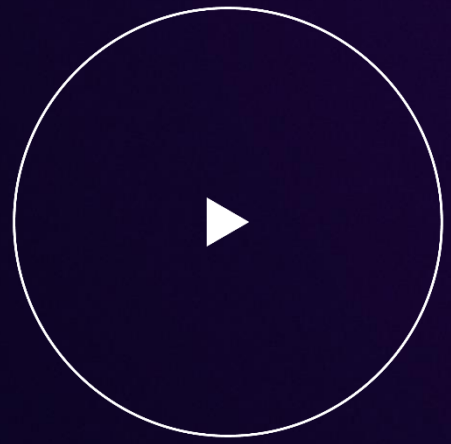
- Streamline and refine production workflows using data driven insight. Helps you fine-tune your operations to achieve maximum efficiency and quality.

Design and engineering

- De-risks product/system designs through prototyping for faster evaluation and feedback loop

Augmented worker

- Information for enhanced performance & decision-making. Leverage global experts to enhance productivity and ensure safety



Matterport + AWS

Description: This demonstration showcases the capabilities of integrating sensor telemetry, Matterport 3D visualization, and a generative AI chatbot powered by Amazon Bedrock.

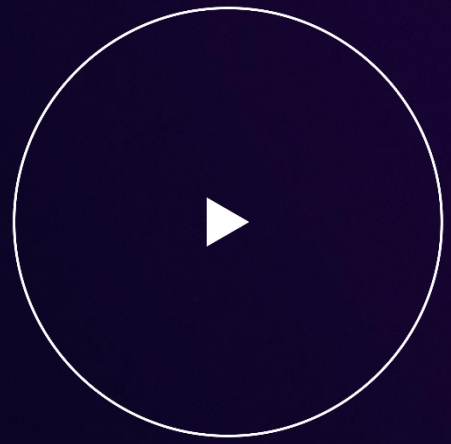
The solution provides maintenance engineers with a unified interface to access contextual sensor metrics, historical maintenance data, and real-time insights to assist with repair and troubleshooting tasks.

AWS Services: The key components of this solution include:

-  Amazon Bedrock : A generative AI service that powers the conversational chatbot, enabling natural language interactions and delivering personalized guidance.
-  AWS IoT TwinMaker : Responsible for ingesting and visualizing sensor data within the 3D Matterport environment, allowing engineers to view metrics in the proper physical context.
-  AWS Lambda : Serverless compute service used to orchestrate the integration between the various AWS services and deliver a seamless user experience.

This innovative approach empowers maintenance teams to work more efficiently by providing a comprehensive, data-driven platform to access and leverage critical information, ultimately enhancing their ability to identify and resolve issues in a timely manner.

Contact: Garry Galinsky (ggalinsk@amazon.com)



The Garnet Framework is an open-source framework for building scalable, reliable and interoperable platforms leveraging open standards, FIWARE open source technology and AWS Cloud services. Using this platform, we can visualize the entire digital twin of Singapore.

Example deployments

Why aren’t you scaling quicker?

Data integration challenges

- Harmonizing diverse data streams into one coherent model

Technological complexity

- Flexible and secure architecture that integrates with existing IT/OT systems and scales as needed to additional capabilities

Maintaining synchronization

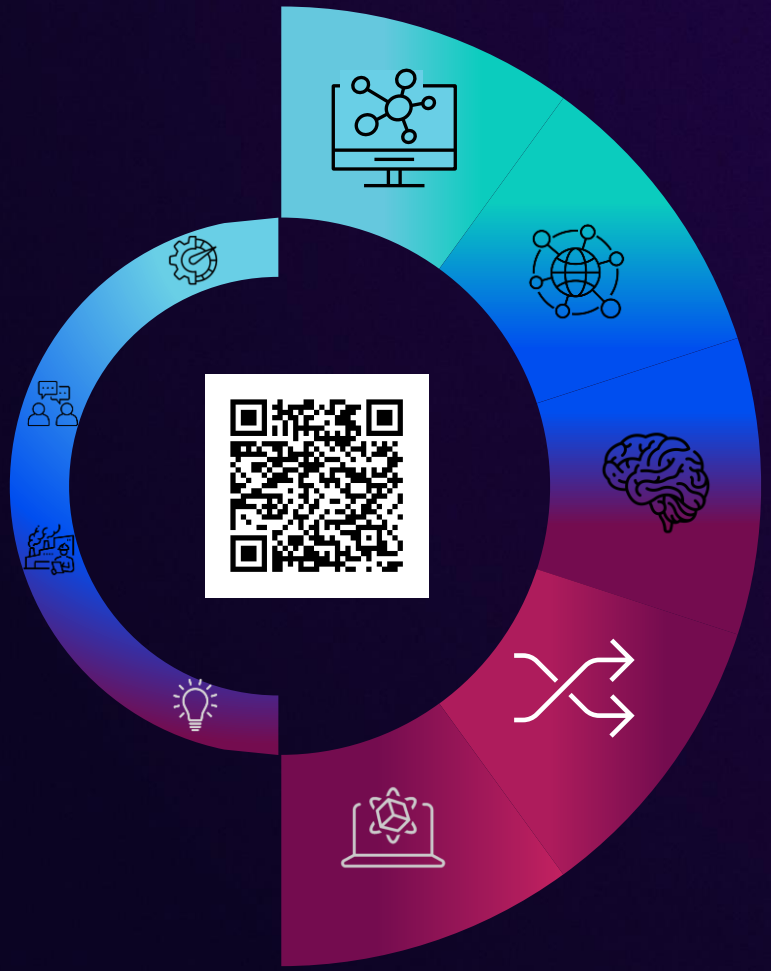
- Ensuring instantaneous data reflection and accuracy

Scalability and flexibility

- Grow and adapt with your business

The digital twin framework from AWS

A **unified architecture** which spans **data collection and contextualization, spatial data lakes**, and **predictive modeling** into a **digital twin framework** which includes the various **applications** that consume and action the data



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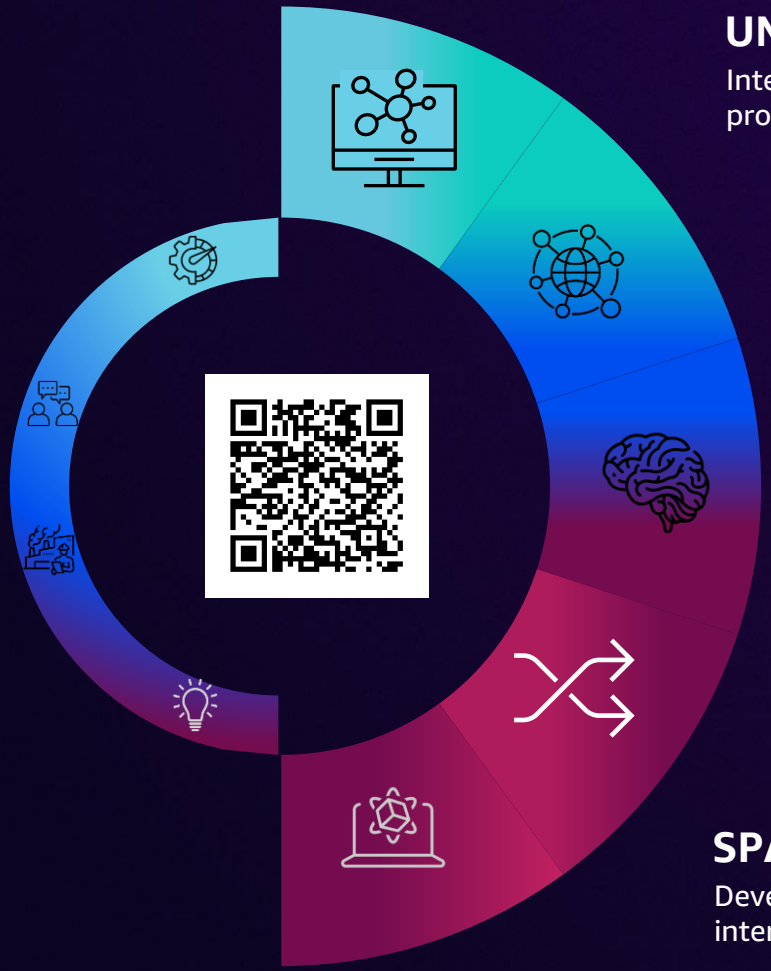


UNIFIED DATA CONNECTIVITY

Integrate physical assets, business systems and processes into a cohesive data model

DATA FOUNDATION

Establish the backbone for data management and analytics infrastructure

OPERATIONAL INTELLIGENCE

Enhance real-time decision-making through data insights

PREDICTIVE MODELING

Utilize simulation and AI to forecast outcomes, and plan scenarios

SPATIAL INTEGRATION

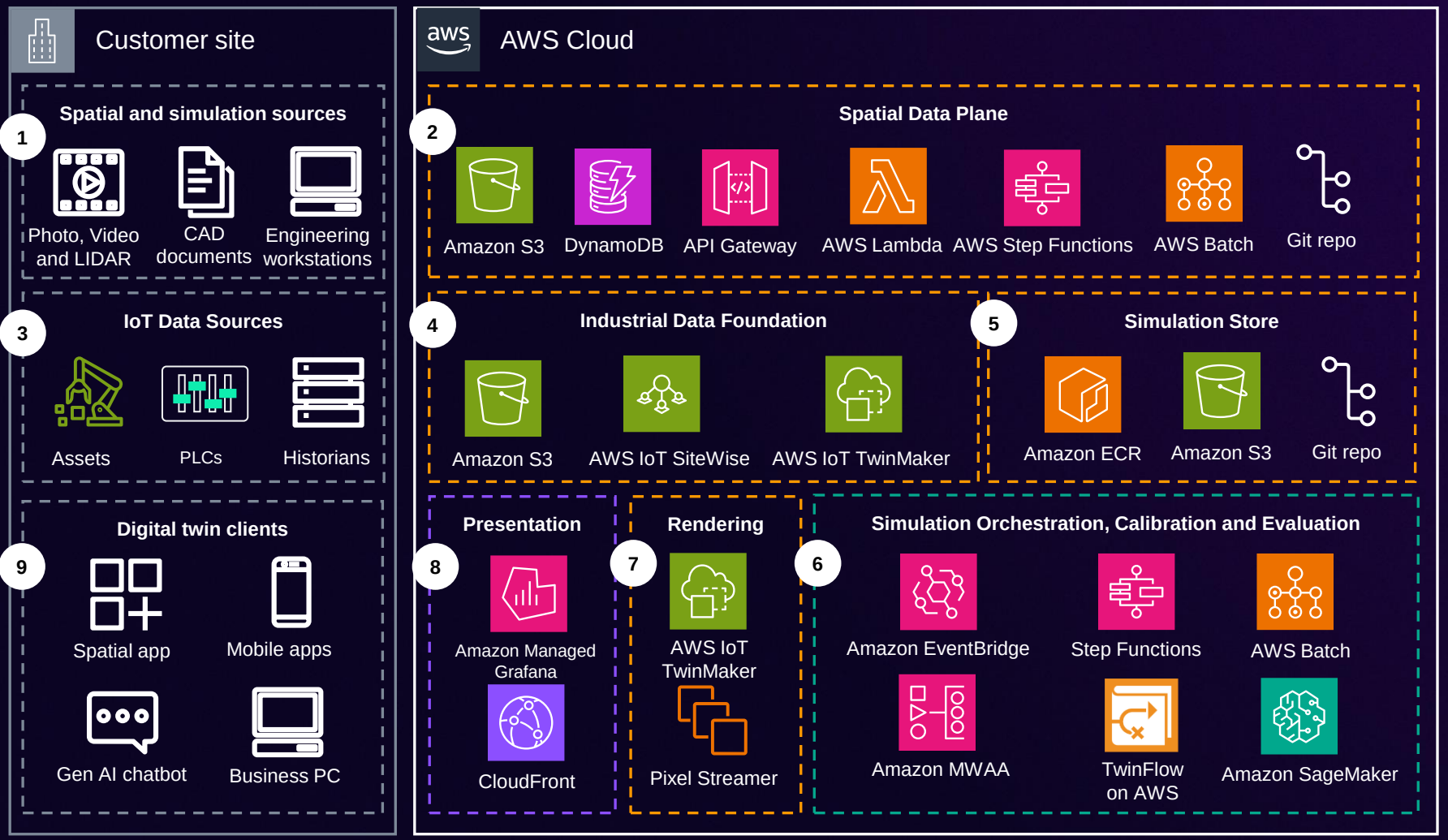
Develop Immersive spatially aware models for interaction and visualization

This is a great example of how AWS enables companies to drive combinatorial innovation to connect people, products, and processes based on the AWS Digital Twin Framework. A great example of how digital twins in industrial environments can make a real difference.

Prahallad CR

Partner: Customer Solutions, Bosch Digital Twin Industries

Digital twin framework on AWS



2 Spatial assets transformed into Realtime 3d file formats with automated workflows and pipelines using **AWS Lambda**, **AWS Step Functions**, **AWS Batch**, **AWS Deadline Cloud**, and other AWS compute services.

3 IoT data to fuel the Digital Twin is ingested using solutions like the **Industrial Data Fabric** .

4 **AWS IoT SiteWise** and **AWS IoT TwinMaker** provide structure, and semantics to the IoT data.

5 Simulation and AI/ML models created by engineers/ scientists are stored in AWS. Simulation runtime environments are containerized and stored in **Amazon Elastic Container Registry**. Configuration files and model weights are stored in **Amazon S3**, and the simulation source code is stored in git repositories.

Simulations workflows are managed with orchestrators like **TwinFlow on AWS**, **Amazon MWAA**, and **Step Functions**. Simulations and AI/ML models are evaluated in **AWS Batch** or **Amazon SageMaker** use **Amazon EventBridge** triggers.

Periodically, Amazon Eventbridge will trigger AWS Batch processes that re-calibrate the Simulation or Model with updated data stored in **Amazon S3**, **AWS SiteWise**, or other database solutions like **Amazon Timestream**.

6 Realtime 3d rendering of the Digital Twin can be done in the user's browser using **AWS IoT TwinMaker OR** rendered in the cloud and displayed in the user's browser with WebRTC video streams.

7 Users can interact with Virtual Workstations using **NICE DCV** remote desktop software or use cloud hosted applications with **Amazon AppStream 2.0**

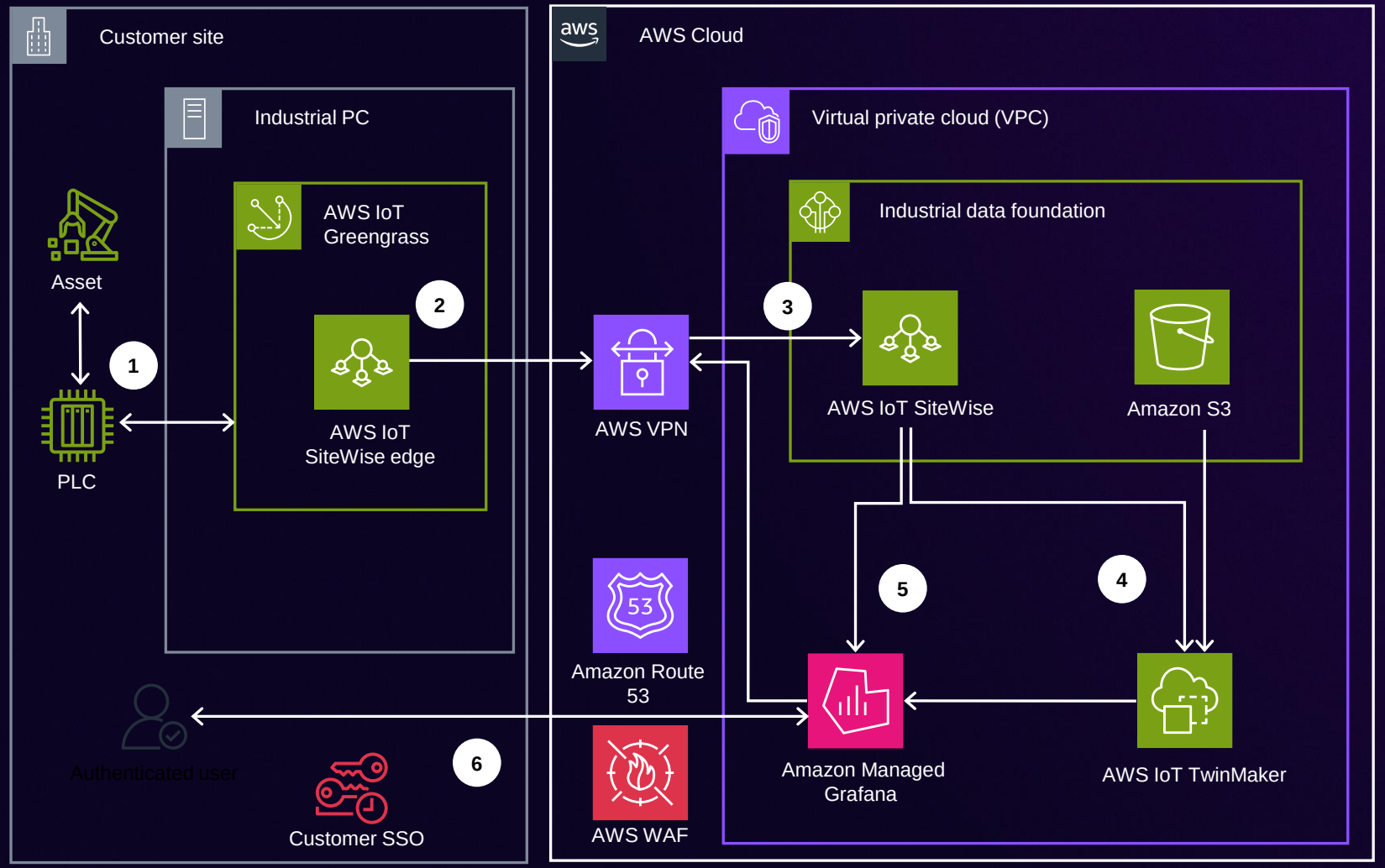
8 Users view Digital Twins with **Amazon Managed Grafana** or with custom dashboards built with IoT App Kit and hosted wtih **Amazon Cloudfront**.

9 Some users will view Digital Twins on mobile devices and AR/VR head sets. Others might integrate generative AI Chatbots into their dashboards.

See Appendix for Specific Product Design Twin architecture

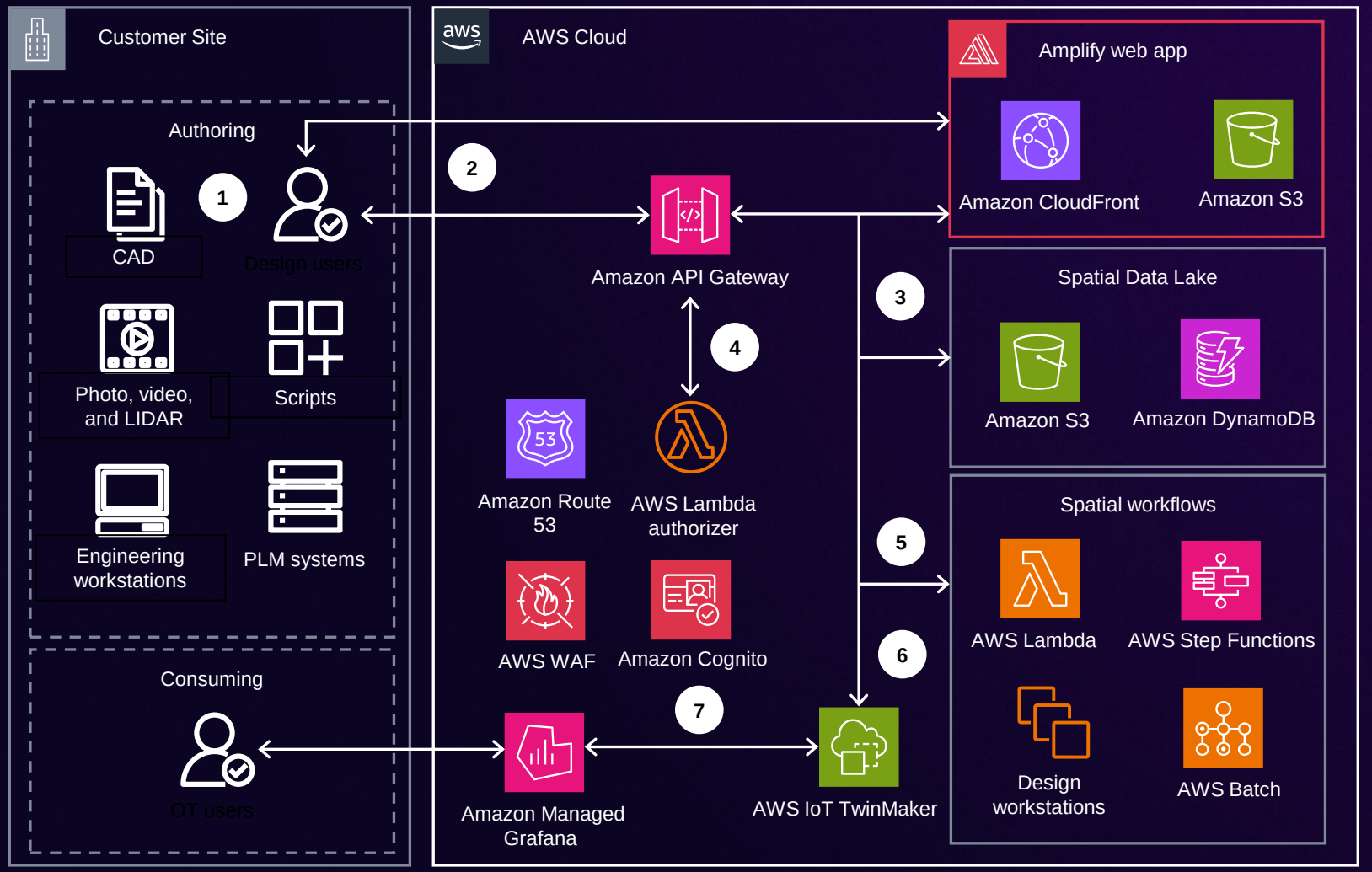
Breaking up the twin

IoT data

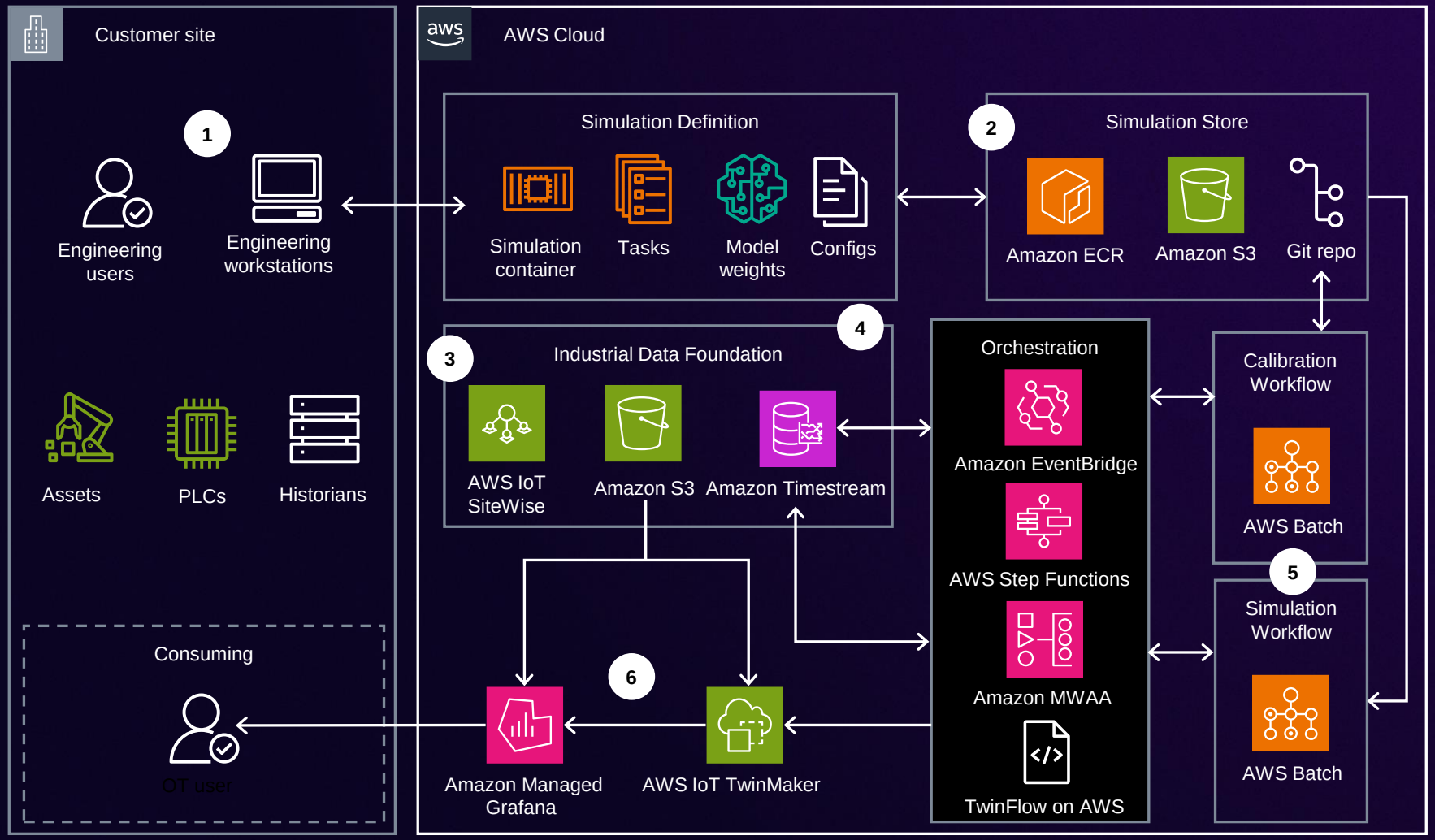


Data ingestion and visualization – how to decide what works for you (7 paths)

Spatial data plane - ingestion and processing of data into real-time 3D assets



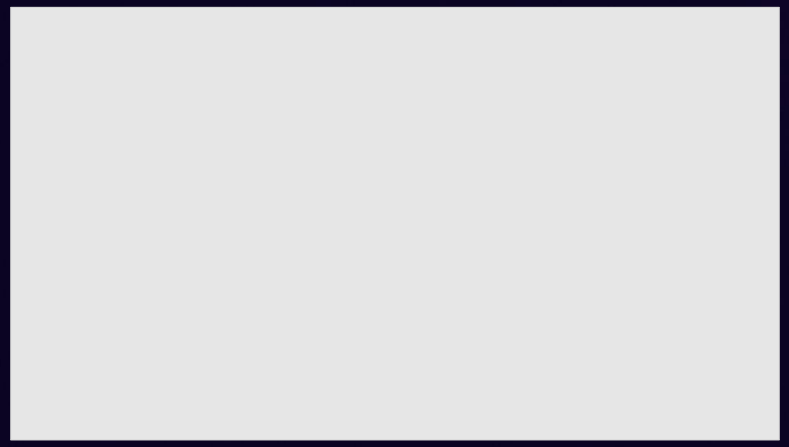
Building and orchestrating simulation twins



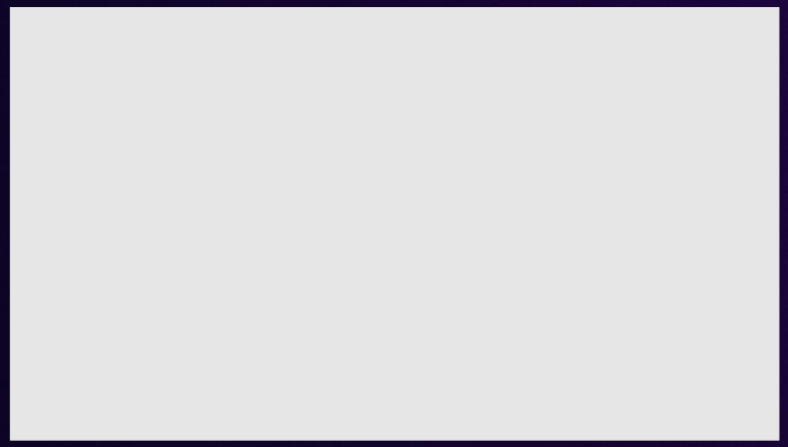
Working through use cases

Let’s pick a use case to architect

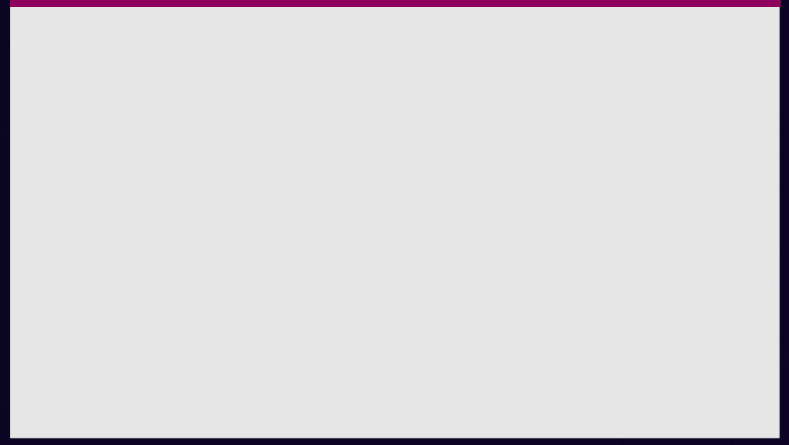
Product design optimization



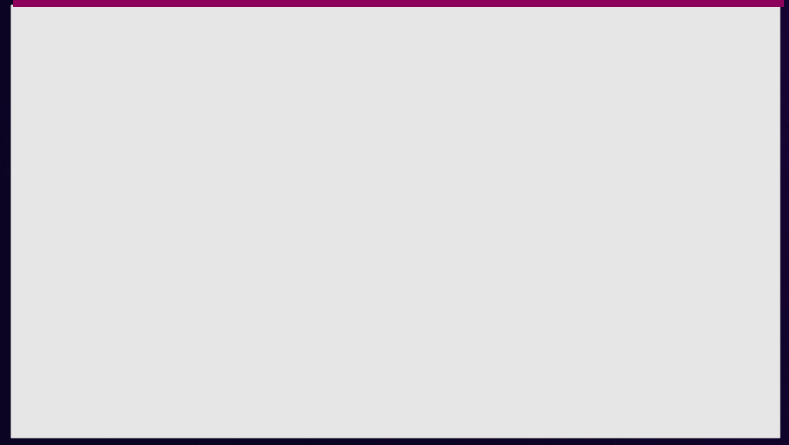
Yield optimization for BioReactor processes



Minimizing line losses (quality, energy)



Asset performance management



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Deploying the digital twin framework

Prescriptive guidance and support on how to build & scale digital twins

AWS Immersion Days, workshops, published walkthroughs and architectures support you in building your digital twin

Focused use cases and deployments

Our working backwards methodology and partnerships are built with a view on business outcomes and industry specialism

Starter Kits, full solutions and implementations

Strong partnerships which enable you to deploy and value quickly without straining IT resources *(technology accelerators, full solutions, and implementation partners)*

More Information

LINKS TO THE DIGITAL TWIN FRAMEWORK, PARTNERSHIPS AND DIGITAL TWIN LEVELLING INDEX

AWS digital twin framework

AWS Solutions Library and partnerships

Product design optimization

L1-L4 digital twins leveling index

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