Tapping Experiential Knowledge to Enhance Business Operations using Digital Twins

Nov 28th, 2023

10 AM CST (USA) / 930 PM IST (INDIA)

Energy | Manufacturing | Utilities

Consulting+ Technology solutions **team from Fortune 500 and Tier I IT/ITES Firms**

Members from consulting, technology and operations provide an **all-inclusive perspective at an engagement level**

Design thinking and Change Management at the core of any proposed solution

Leveraging **low-code/no-code platforms for MVPs** as part of our engagements

Sujatha Kumar
Panelist
Dsider, Inc. Founder & Chief Executive Officer

David Crawley
Panelist
Professor of Practice, Univ of Houston, Digital Media, Organizational Leadership and Supervision

Sabyasachee Panda
Panelist
CTO, Performatica and Co-Founder, Greenojo Consulting

Murthy Divakaruni
Panelist
Founder and CEO Performatica LLC

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Section	Topic	Speaker/s
Introduction	Performatica & Digital Twins S-O-A	Murthy Divakaruni
Industry Insights	Transformation of Business Operations using Industrial AI and Digital Twins	Sujatha Kumar
Trends	Technology Research Challenges: Examples	David Crawley
Applications	Application of Digital Twins in Energy Industry	Sabyasachee Panda
Panel Discussion (Moderator)	Discussion and Q&As	Richa Saxena & All Panelists
Key Takeaways	Summarize and Next Webinar	Murthy Divakaruni

Digital Twins: definition and examples

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Definition

Digital Twin is a replication of a physical asset or an object in a virtual world with all its characteristics.

Industry Examples

- Nuclear Plant Simulated control rooms
- Construction: Airports Design & traffic flow
- Airlines: Pilot training

Consolidation of technologies, data sets, systems engineering thinking & deploying vast human knowledge allow us to derive tremendous value from Digital Twins to solve industry problems in real-time and to improve operations and build better reliable systems.

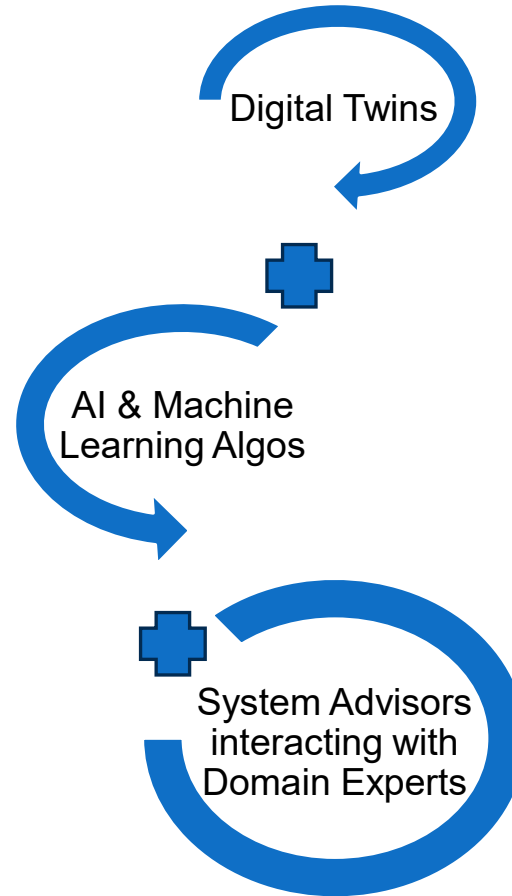# Digital Twins: Data Sources & Enhancements

DATA MANAGEMENT

- Simulations/ Experiments
- Rule Based Expert Systems
- Real-Time Control Systems
- Expert Chats/Documentation
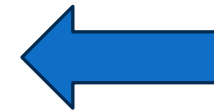- Visual & Computer Image Files

Digital Twins

AI & Machine Learning Algos

System Advisors interacting with Domain Experts

SYSTEMS ENGINEERING

- Engineering Design Codes - ET
- Operations Data & Analytics - OT
- Information Systems - IT

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Digital Twins: Progression to solve key issues

Traditional Past Industry Examples

Three Mile Accident (Nuclear)
- Offline Analysis
- Operator Training Simulators
- Probabilistic Risk Analysis (PRA)

Airline Accident (Airlines)
- Pilot Training
- Equipment Failure RCA
- Man, Machine Interface (MMI) Development

Value Enhancements

- **Tapping Retired Domain Expertise (at a global level) & training new workforce**

- **Combining Physics with Data Sources**

- **Putting Machine Learning to develop that capture possibilities**

Key Future Issues

- **Sustainability**

- **Energy Transition**

- **Remote Operations**

Next Gen Digital Twins

A 4D digital representation of physical assets, processes, or systems.

Real-world

Reference – Bentley Systems

ET Engineering Technology
- P&ID/PFD
- Drawings
- Documents
- Models
- Analyses
- Geotech
- OEM specs

OT Operations Technology
- IoT feeds
- Sensors
- Drones
- Cameras
- LiDAR
- Point clouds

IT Information Technology
- Asset tags
- Maintenance records
- Work orders
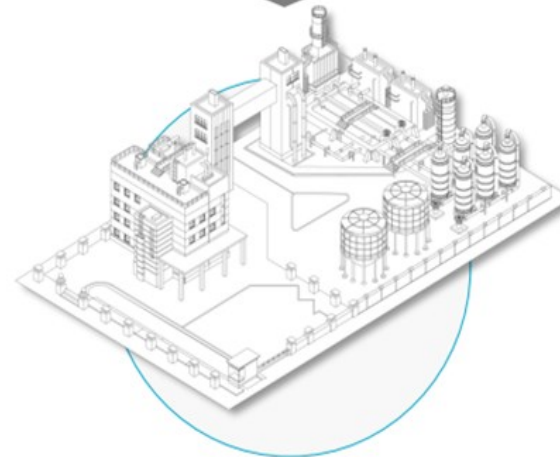- Inspection records

3D/XR — Immersive Visualization

4D — Timeline of Change

AI/ML — Analytics Visibility

Digital twin

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INDUSTRIAL COMPANIES STRUGGLE WITH DATA AND INSIGHTS TO ACHIEVE ENERGY TRANSITIONS

Enterprise NetZero Planning Solution, Delivers Analytics To Reduce Risks, Increase Decision Confidence, And Accelerate Energy Transition With Ease And Precision.

CURRENT PLANNING APPROACH IS COMPLEX AND INEFFICIENT

DSIDER'S NET ZERO PLANNER REDUCES COMPLEXITY AND STREAMLINES PROCESSES
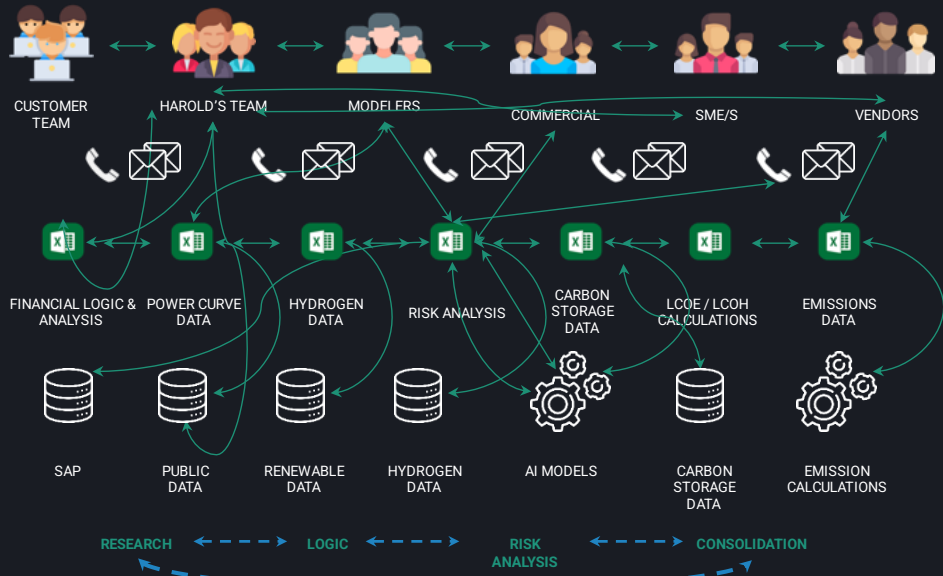
- Delayed planning timeline
- Compromised data integrity and ownership
- Sub-optimal collaboration
- Siloed Solution

SaaS platform
- Integrates data, process, and analytics
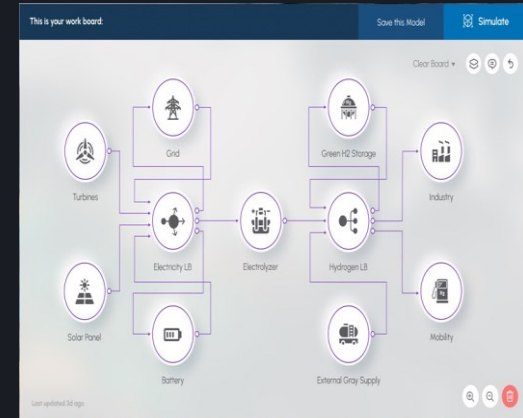- Creates single source of truth

Collaboration
- Better collaboration reduces process timelines
- Advances execution of NetZero plans

Virtual SMEs
- Models embed expertise and create virtual SME Eliminates need to build huge departments to do these analysis

ANALYSIS IN HOURS VS MONTHS

DELIVERING SAVINGS OF $100M/YR

Dsider

OUR APPROACH ENABLES DIGITAL "LEGO" STYLE PLANNING

ENERGY TRANSITION OPTIONS

DSIDER'S NET ZERO PLANNER

COHERENT NET ZERO PATHWAY

SUSTAINABLE OPERATIONS

CAPITAL EFFICIENCY

RISK MITIGATION

EMISSION REDUCTION

ENTERPRISE NET ZERO PLANNING ACROSS THE LIFECYLE

FORWARD FORECASTING

GRANULAR METRICS

SCENARIO ANALYSIS

RISKS AND TRADE -OFFS

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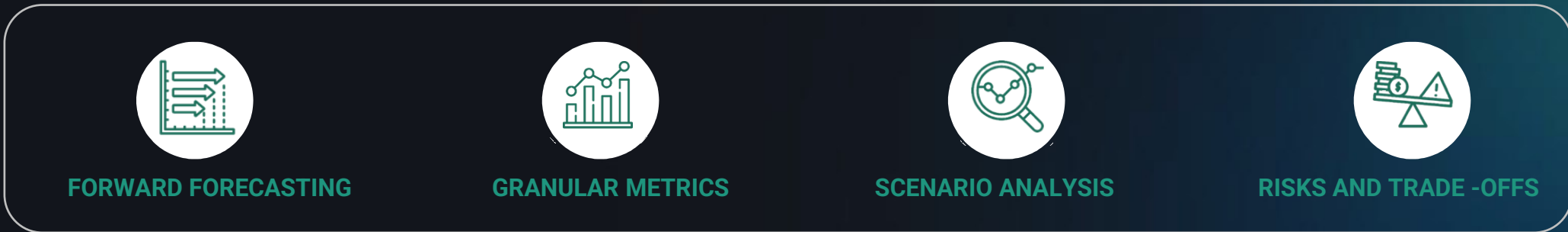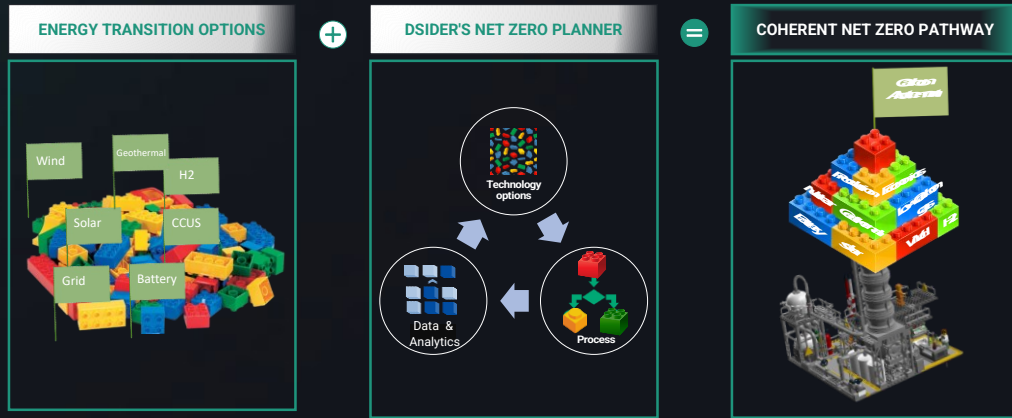
A POWERFUL INTEGRATED PLANNING PLATFORM

OPTIMIZED PLAN

SIMULATED YIELD

- Energy Balance
- Material Balance
- Resource Efficiency

SIMULATED ECONOMICS

- NPV/IRR Metrics
- Cash Flow Projection
- Impact of Tax Credits and Subsidies

SIMULATED CARBON ABATEMENT

- Carbon Intensity of Energy
- Process and Component Carbon Intensity
- Aggregate Scope 3 Emissions

ADDRESS NET ZERO PRIORITIES WITH EASE AND PRECISION

Dsider

TO SOLVE A DIVERSE SET OF TRANSITION USE CASES

COMPUTATIONS OF EMISSION AND ABATEMENT ACROSS MULTIPLE ENERGY SOURCES

ENERGY YIELD AND COST COMPARISONS ACROSS MULTIPLE LOCATIONS

CROSS ASSET ANALYSIS FOR CLEAN BASE LOAD POWER
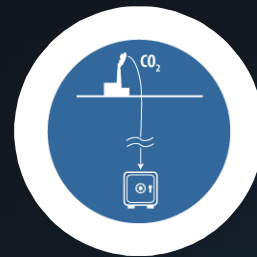
REDUCING NON-PRODUCTIVE TIME FOR LOW CARBON FOSSIL FUEL PRODUCTION

RELIABLE AND SUSTAINABLE SUPPLY OF GREEN HYDROGEN AND DERAVATIVES

INCREASING LEVEL OF COMPLEXITY

FORWARD FORECASTING

STANDARDIZED METRICS

SCENARIO ANALYSIS

RISKS AND TRADE-OFFS

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Creating Tomorrow by Building Today With Digital Twins

You can't dig a new hole by digging the same one deeper

Creating Tomorrow by Building Today With Digital Twins

Entering The Unknown and Everything Is Changing

- **The global digital twin market size was valued at around $8.6 billion**, and it is projected to grow up to US $137 billion by 2030.

- A.I. is now a downloadable consumer product and current to new generations and global to local organizations are taking note: new degrees are emerging

- Internet bandwidth speed and load has increased. *Last month China unveiled the 'world's fastest internet' network, claiming data transmission at 1.2 terabits per second*

- Digital Graphics and cloud-based virtual representations are able to mimic real world scenarios and physics in parallel with speed of reality

Creating Tomorrow by Building Today With Digital Twins

The Emerging Adventure: Bridging the gap between thinking and reality

- Organizations have proven to increase productivity at unparalleled speeds that have inspired new revenue streams, efficiencies, and innovations.

- Scenario Panning has become more acute and able to risk mitigate threats and prove-out opportunities relative to impact upon the organization.

- Along with new potential: new jobs and capabilities are emerging at unprecedented rates to integrate edge computing capabilities and enable real-time analytics that deliver better decision-making potential at the edge of networks.

- Increased rapid implementation of competitive edge tools and resources for reliable first mover advantages and response to the marketplace

Creating Tomorrow by Building Today With Digital Twins

The Emerging Challenges: The unknown

- Technology is emerging and will cause adjustments to enterprise siloes of legacy systems

- We don't know what problems the solutions will cause, what types of jobs will occur, how operations will accommodate a parallel workforce… or operational layers between digital and real.

- Training, trusting proven providers, and prudent rollouts are critical to success

- The industry workforce is unprepared and lack the skills to adjust and capitalize:
  - 28% to 36% gap of innovation skills in the global workforce: Critical Thinking, Lateral Thinking, Systems Thinking, Logic Modeling, and Communications/Leadership. Meanwhile, 28% of the workforce will retire in the next 5 years.

Creating Tomorrow by Building Today With Digital Twins

The Emerging Approach: Be Prudent and Learn

- Don't boil the ocean

- New academics, certifications, and simulation training are being created from digital to skills of innovation

- Digital Twinning technology providers must be trusted partners... not venders.
  - *There are emerging providers with experience that have proven to be trusted and skilled*

- Educate your organization and monitor evolution with a sense of expectation and engagement. If you're going to not adopt, don't be left too far behind. Draft behind leaders (or competition) and learn.

The world has changed. You're either going to be part of it... or subject to it.

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The 6 main Digital Twin applications

1 System prediction
2 System simulation
3 Asset interoperability
4 Maintenance
5 System visualization
6 Product simulation
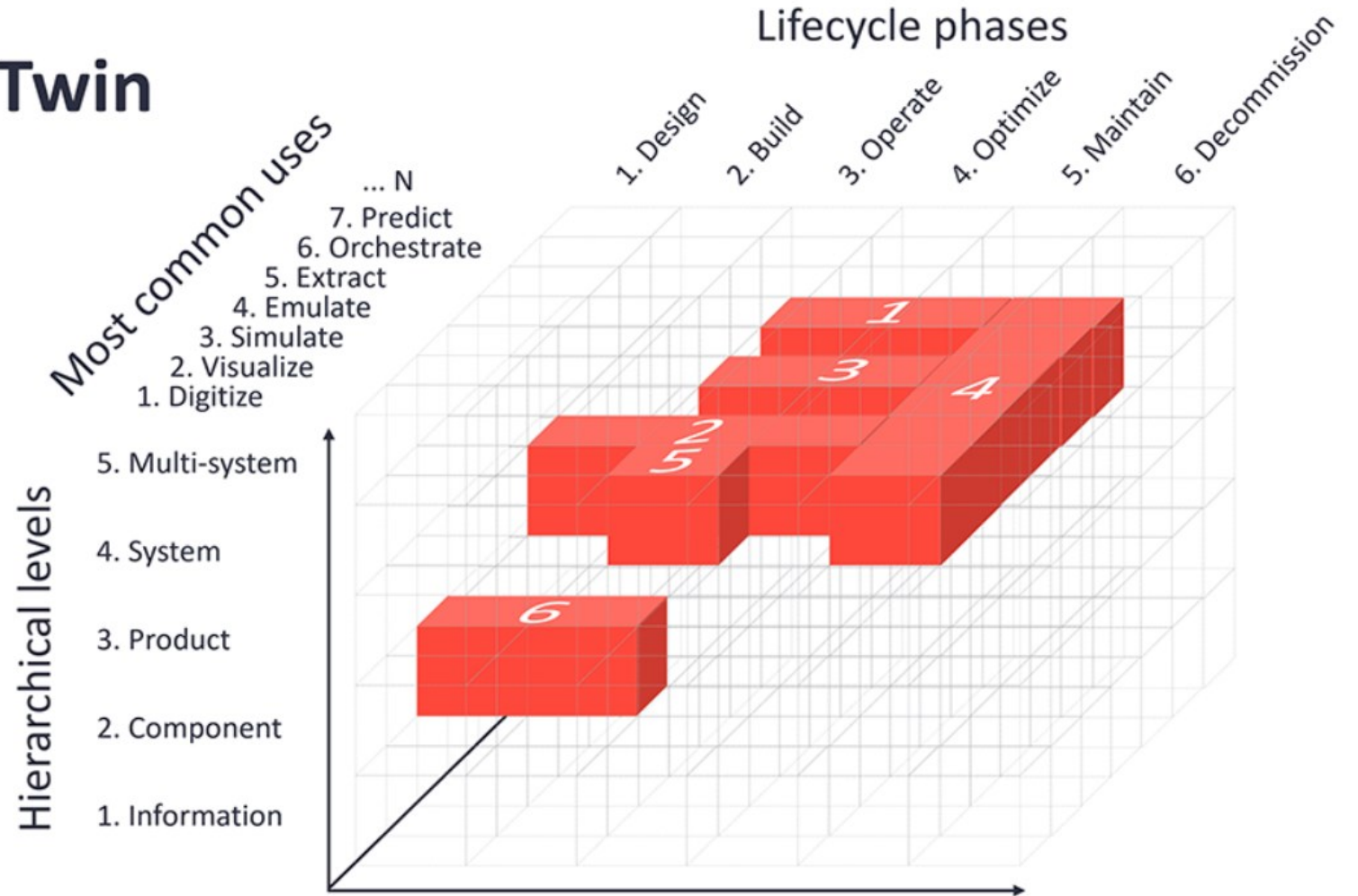
Reference – IoT Analytics Research 2023

Scalable, Modularized & Aligned to DT Consortium Model

A. Data Services

#	
1	Acquisition
2	Streaming
3	Transformation
4	Contextualization
5	Batch Processing
6	RT Processing
7	Data Publication
8	Data Aggregation
9	Data Generation
10	Manage Ontology
11	DT Model Repository
12	DT Instance Repository
13	Temporal Data storage
14	Data Archival
15	Simulation Model Store
16	AI Model Store

B. Integration

#	
1	Enterprise Systems
2	Engineering Systems
3	OT/IoT Systems
4	DT
5	Collaboration Platform
6	APIs

C. User Experience

#	
1	Basic Visualization
2	Advanced Visualization
3	Realtime Monitoring
4	ER Visualization
5	Dash Boards
6	Continuous Intelligence
7	Business Intelligence
8	BPM and Workflow
9	3D Rendering
10	Augmented Reality
11	Virtual Reality
12	Gaming Engine Visualization
13	Gamification

D. Intelligence

#	
1	Command and Control
2	Orchestration
3	Alerts and Notifications
4	Reporting
5	Data Analysis and Analytics
6	Prediction
7	Machine Learning
8	AI
9	Simulation
10	Business Rules
11	Edge AI and Intelligence
12	Federated Learning
13	Mathematical Analysis
14	Prescriptive Recommendations
15	Distributed Ledger
16	Composition

E. Trust

#	
1	Security
2	Privacy
3	Safety
4	Reliability
5	Resilience
6	Data Encryption
7	Device Security

F. Management

#	
1	Device Management
2	System Monitoring
3	Event Logging
4	Data Governance

Ref: DT Consortium

Building Custom Digital Twin Solutions for Enterprises

Your Digital Twin Application				
	YOUR APIS & SERVICES			

iTwin Platform (PaaS)

Create	**SYNCHRONIZATION** (Engineering design data)	**FEDERATION** (Business systems, IoT data, maps, asset performance, etc.)	**REALITY MODELING** (Reality mesh, point clouds, etc.)	**DATA MANAGEMENT** (iModels, file sharing, change ledger)
Interact	**VISUALIZATION** (iTwin Viewer, tile streaming, game engines)	**REPORTING** (Querying, insights, report generation, PowerBI)	**AUTHORING** (iTwin Editor, extensions)	**ADMINISTRATION** (Users, permissions, context management)
Workflows	**ADVANCED WORKFLOWS** (Issues, clash detection, version comparisons)	**AR / VR** (GLTF, Azure remote rendering)	**AI / ML** (Inspection, validation, element recognition)	**EXPORT** (IFC, LandXML, etc.)
DevOps	**MANAGE KUBERNETES** ⚙ (Handle loads and query traffic, provisioning)	**SLA** ⚙ (High availability, patches and updates, support)	**GLOBAL DEPLOYMENT** ⚙	**STORAGE AND DATA RESIDENCY** ⚙

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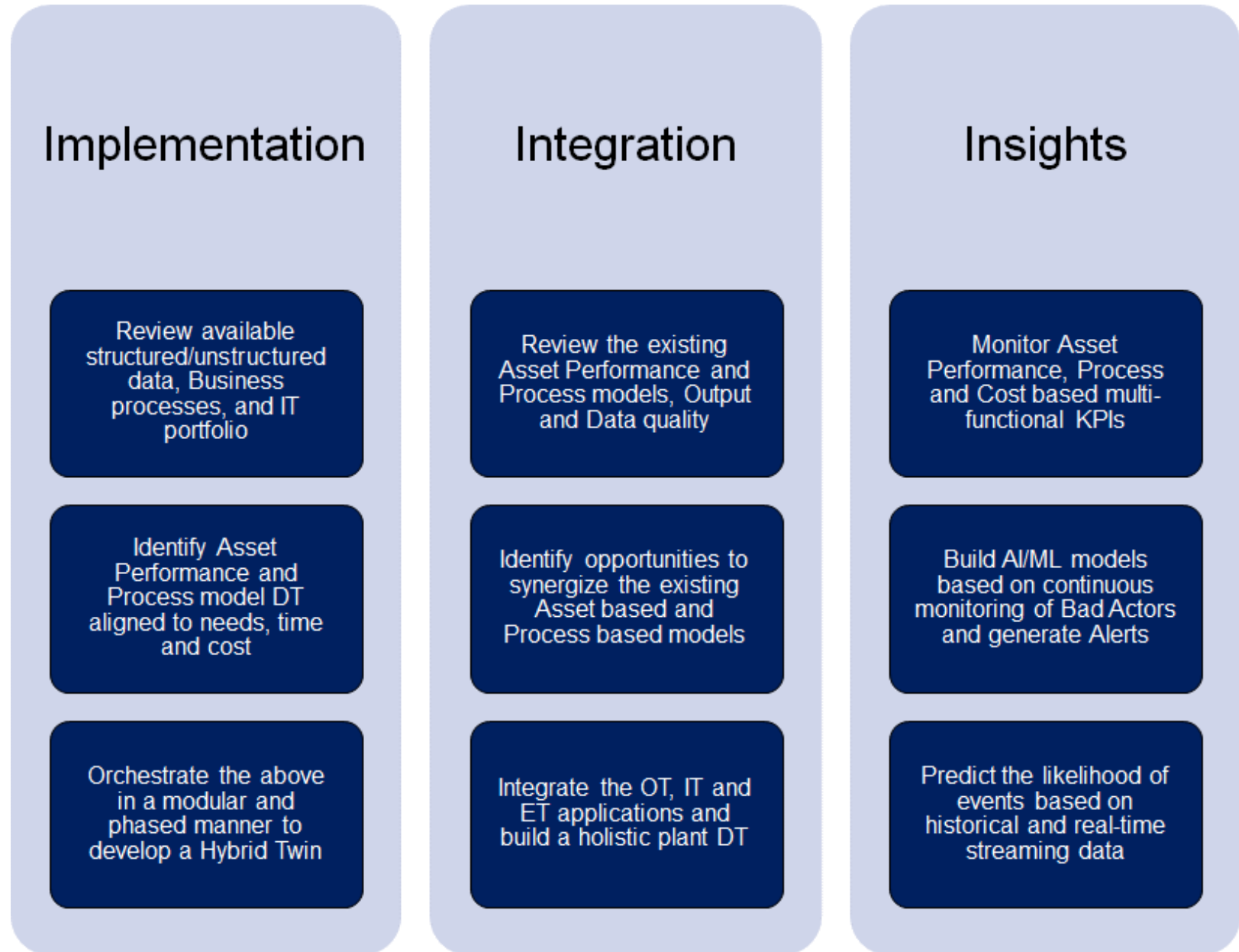
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- Hybrid Digital Twin (HDTs) Services, Solutions & Applications
  - Process
  - Assets
  - Cost

Implementation

Review available structured/unstructured data, Business processes, and IT portfolio

Identify Asset Performance and Process model DT aligned to needs, time and cost

Orchestrate the above in a modular and phased manner to develop a Hybrid Twin

Integration

Review the existing Asset Performance and Process models, Output and Data quality

Identify opportunities to synergize the existing Asset based and Process based models

Integrate the OT, IT and ET applications and build a holistic plant DT

Insights

Monitor Asset Performance, Process and Cost based multi-functional KPIs

Build AI/ML models based on continuous monitoring of Bad Actors and generate Alerts

Predict the likelihood of events based on historical and real-time streaming data

Performatica Support in Enterprise Adoption of Digital Twins

Generate the Platform **Strategy** with Product Roadmap & Milestones

Design **Platform** CoE & Run the Operations/PMO Office

Manage & Monitor **Technology** Licenses and the Cloud Partners

Develop & Monetize from the **Alliance/Partner** Ecosystem

Thank You

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