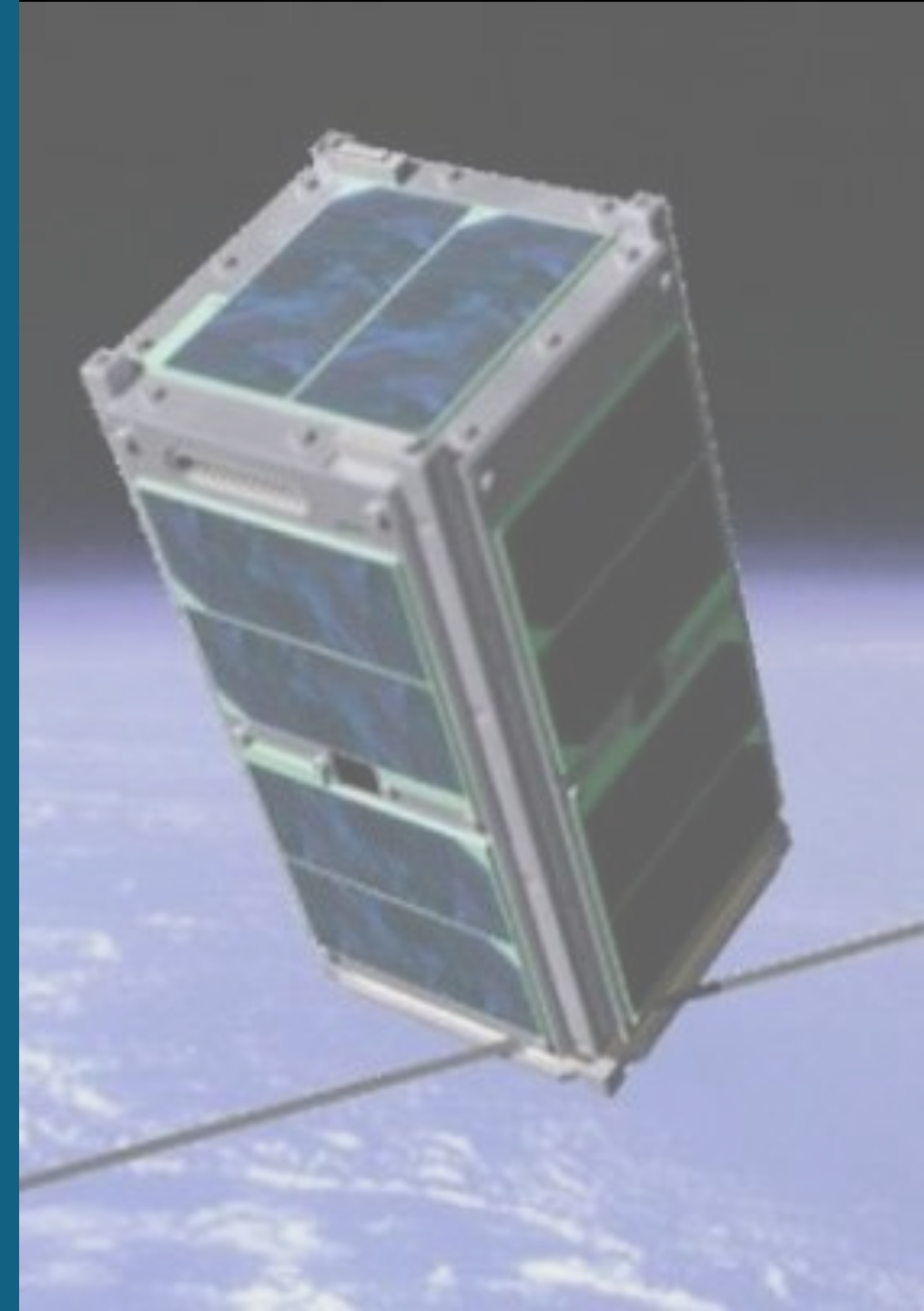
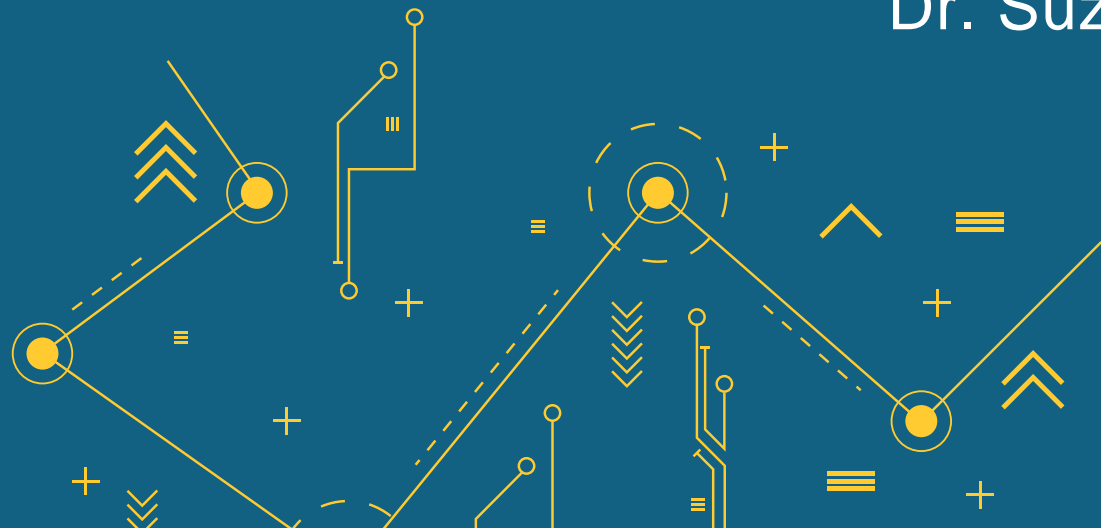


build better systems faster

INDUSTRIAL DEVOPS

Leveraging the power of digital twins
and Industrial DevOps

Dr. Suzette Johnson



Introduction



Dr. Suzette Johnson

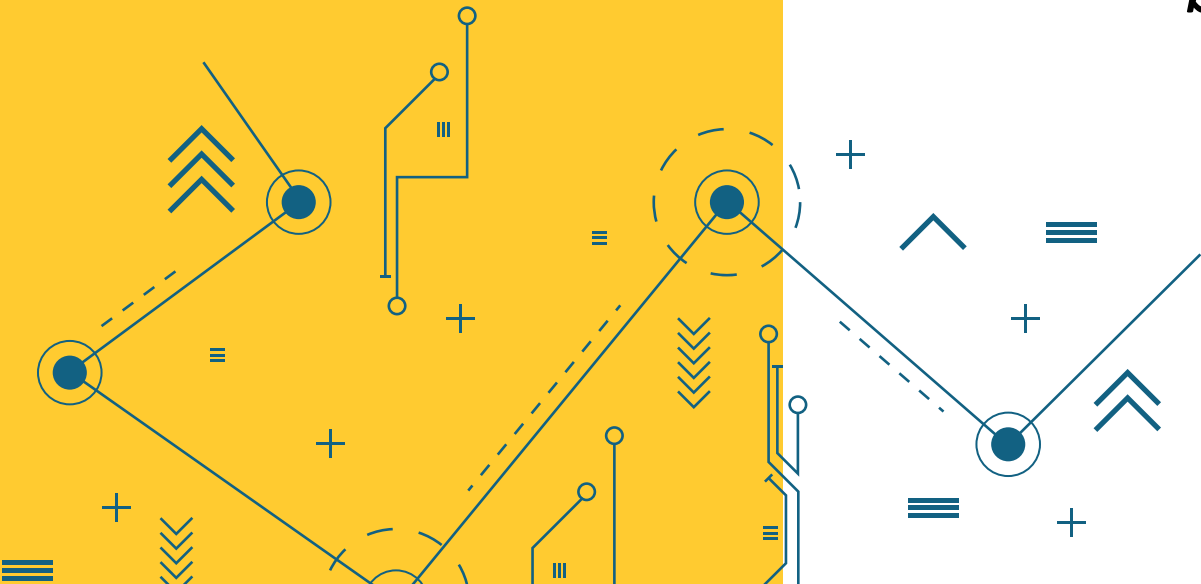
On a journey to improve the state of the practice in building large-scale safety-critical cyber-physical systems using Industrial DevOps principles

Topics

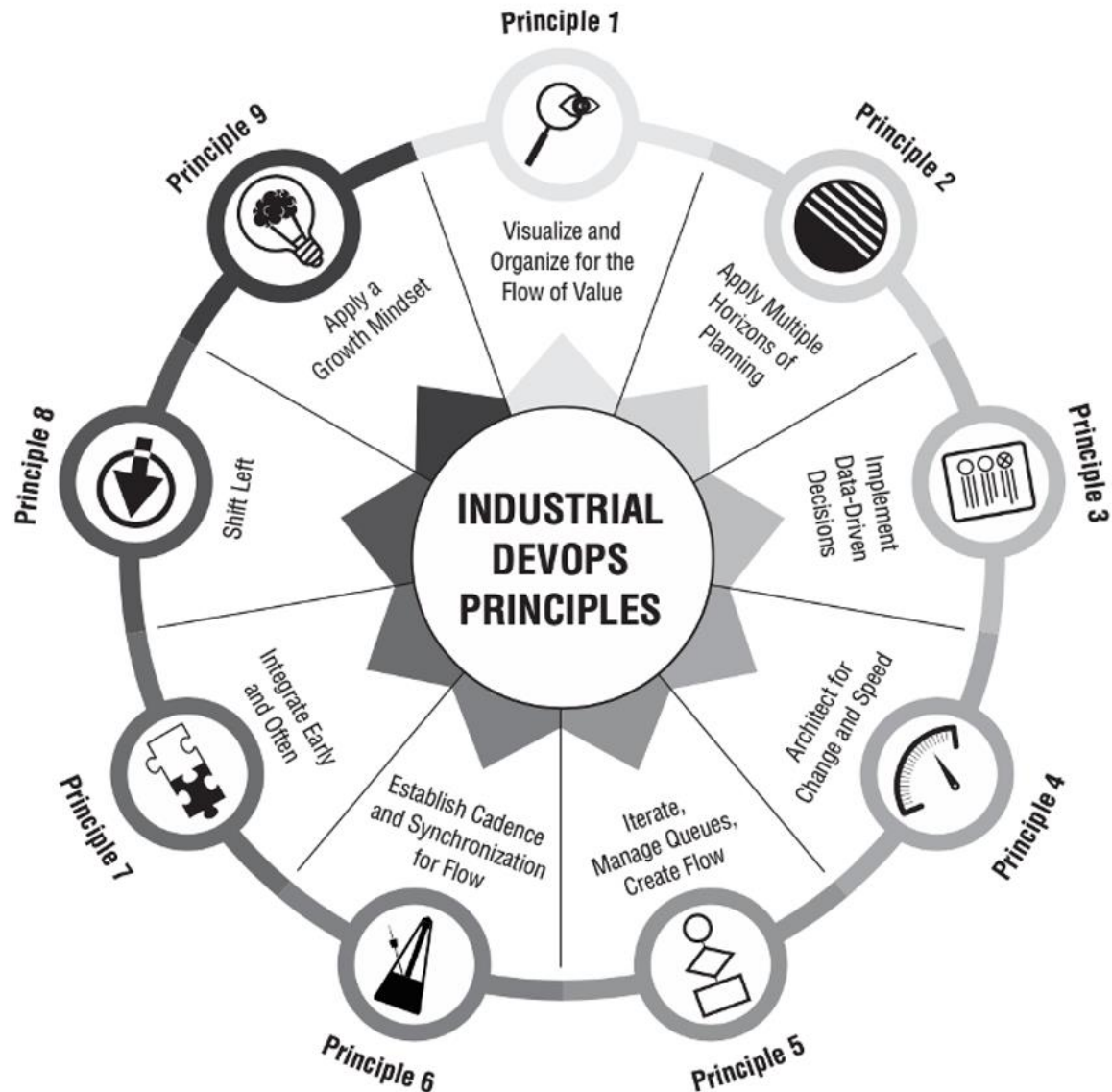
- The Why
- The Objective
- Concepts: Industrial DevOps and Digital Twins
- Application
- Getting Started
- Resources

Objective

To explore the synergy of a seamless, real-time development environment and feedback loop for cyber-physical systems to build better systems faster



What is Industrial DevOps?



The application of Lean, Agile, and DevSecOps principles to the planning, development, manufacturing, deployment, and serviceability of significant cyber-physical systems.



A digital representation of a physical object, person, or process, contextualized in a digital version of its environment.

What is a digital twin?

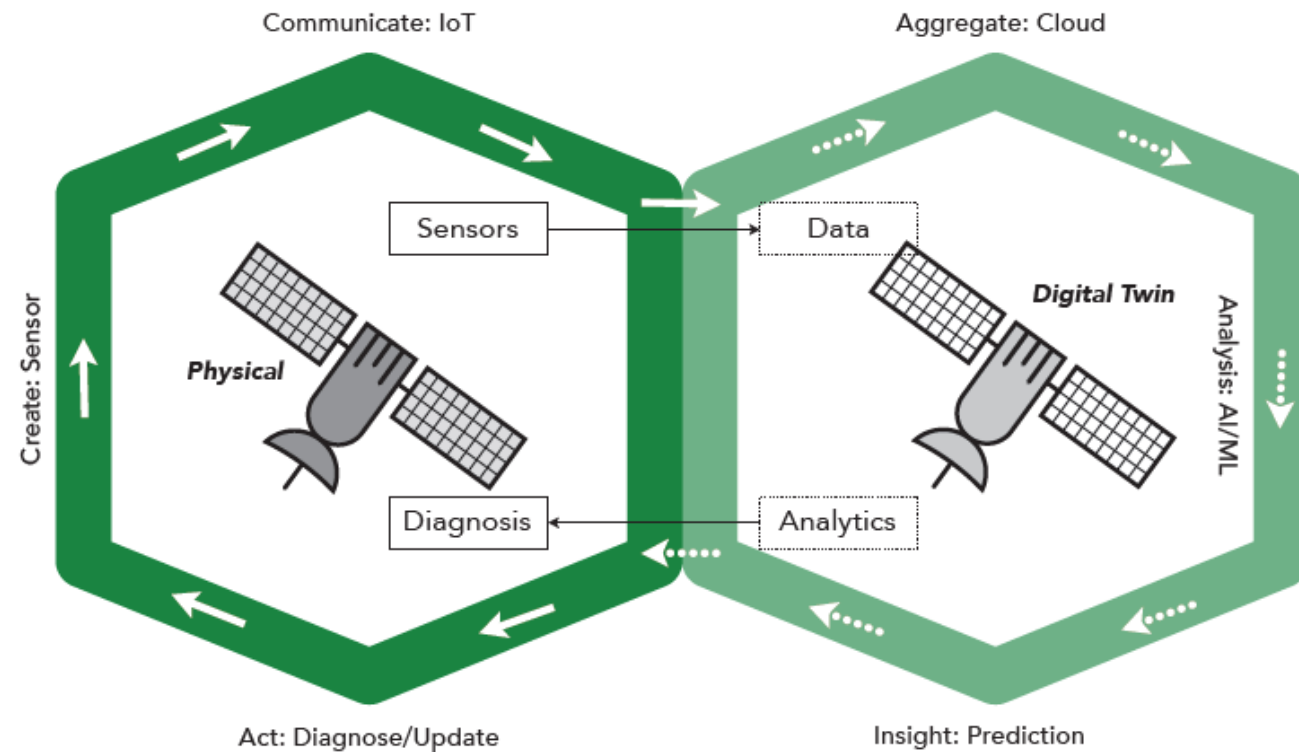
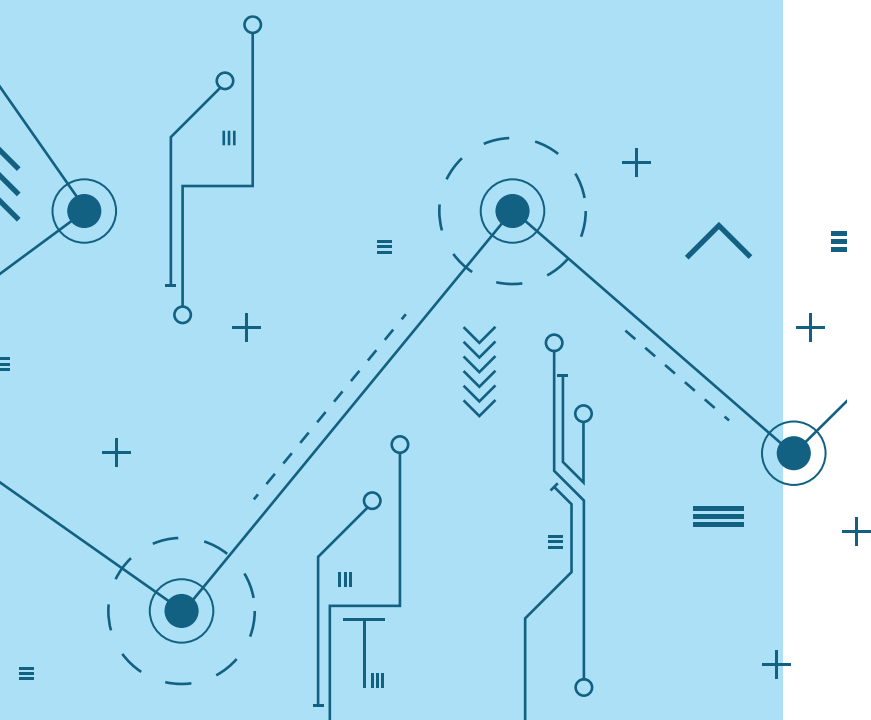


Figure 2: Digital Twin Example

“Digital Twins leverage real-time data, simulation, machine learning, and reasoning to create living digital simulation models that update and change as their physical counterparts change.”



Digital Entities

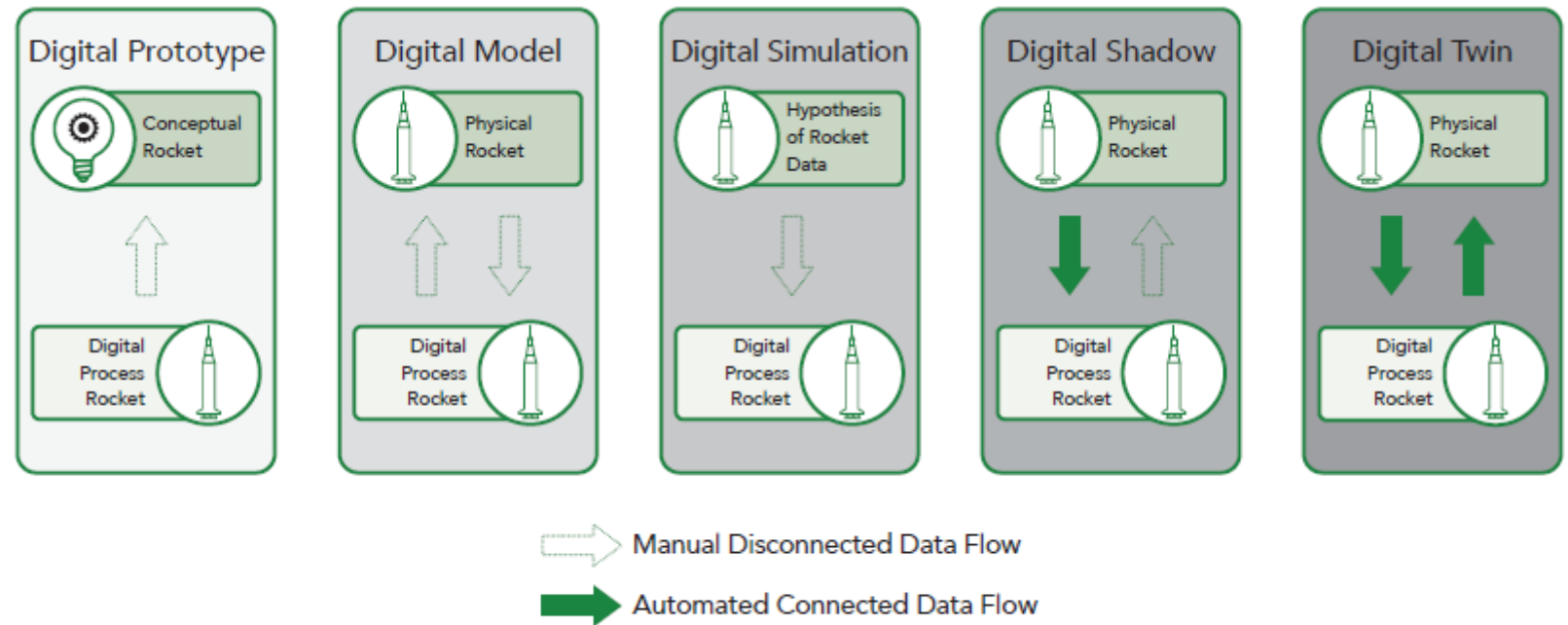


Figure 4: Evolution From Modeling and Simulation to Digital Twins

Digital Twin Applications



Manufacturing

- Virtual replicas of production lines, Predictive maintenance
- Reduce downtime, Increase efficiencies



Urban Planning

- Simulate urban environments, buildings, transportation systems, utilities
- Enhances sustainability, quality of life, efficient resource management



Automotive

- Design and test vehicles virtually, simulate traffic systems
- Improves vehicle efficiency, safety, reduce TTM



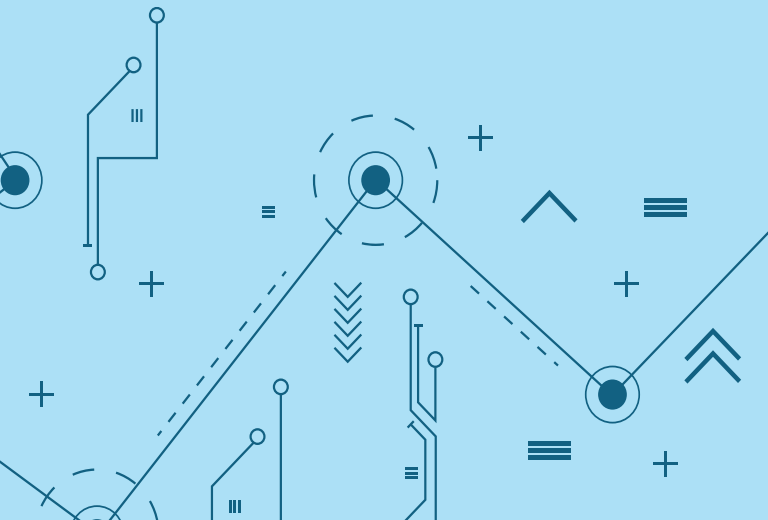
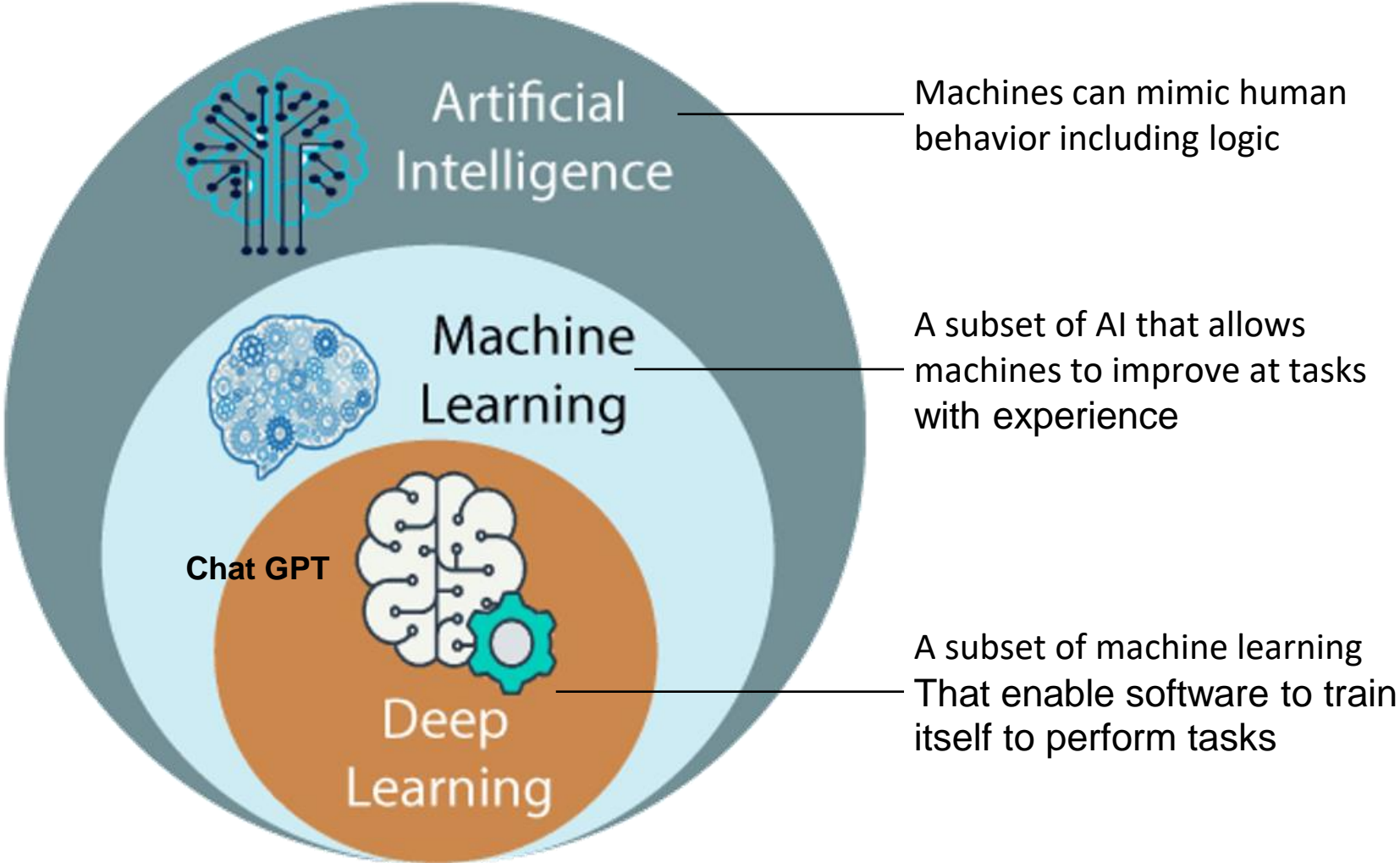
Aerospace

- Desing, test, maintain aircraft/spacecraft, simulate performance under different conditions
- Improves safety, extends lifespan of assets

“Digital twins can simulate real-world conditions, predict outcomes, and recommend actions to improve performance, prevent failures, and support decision-making processes.”

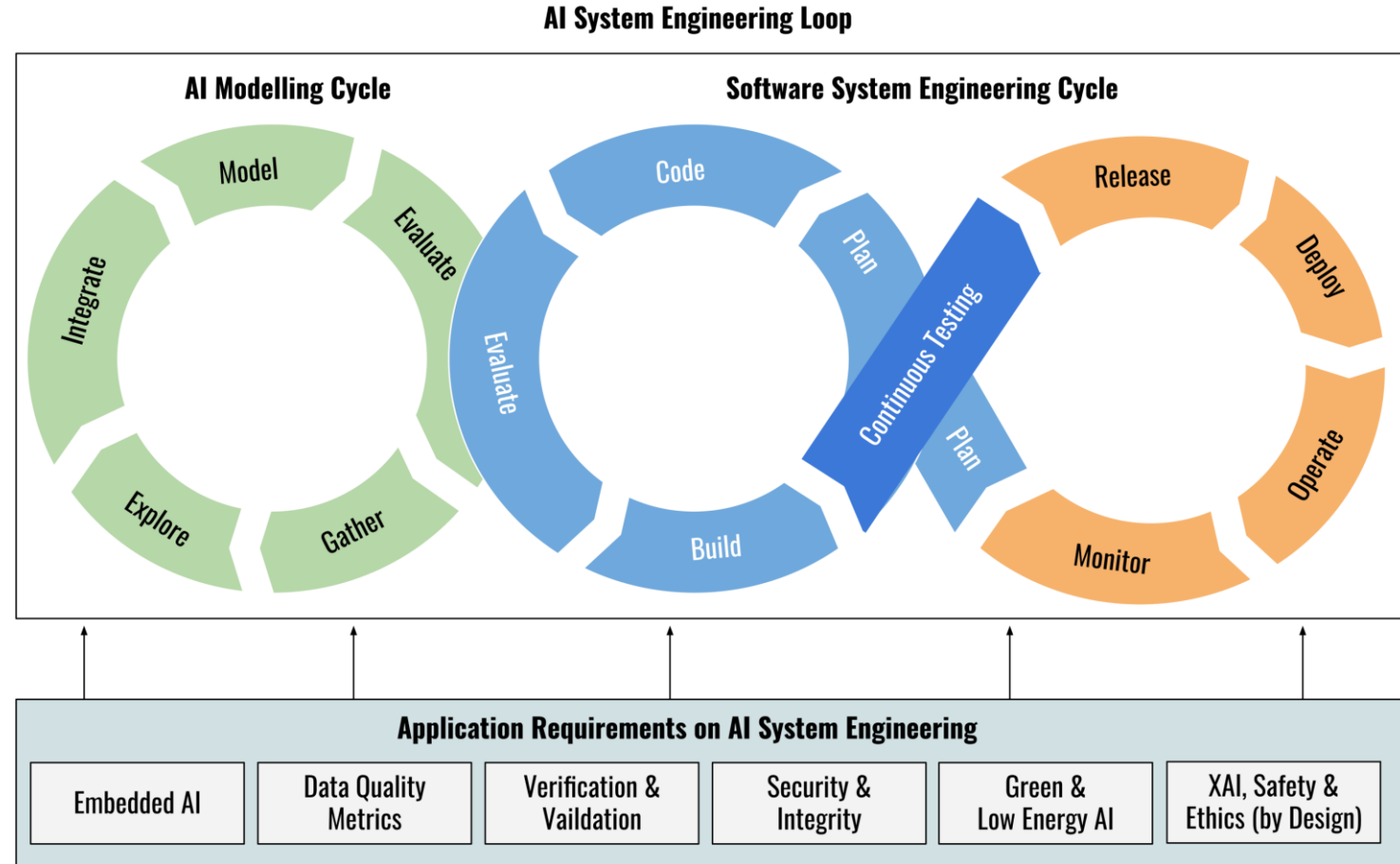
Artificial Intelligence

“AI isn’t going to replace you but those who know how to use AI will.”



Intersection of Systems Engineering for AI

We need to bring it all together to build Cyber-Physical Systems, which is why Digital Twins can help.



Fischer, Lukas & Ehrlinger, Lisa & Geist, Verena & Ramler, Rudolf & Sobieczky, Florian & Zellinger, Werner & Brunner, David & Kumar, Mohit & Moser, Bernhard. (2020). AI System Engineering—Key Challenges and Lessons Learned. Machine Learning and Knowledge Extraction. 3. 56-83. 10.3390/make3010004.

Benefits AI for CPS

*As Sam Altman said
"Iterate Faster"*

Reduced Error

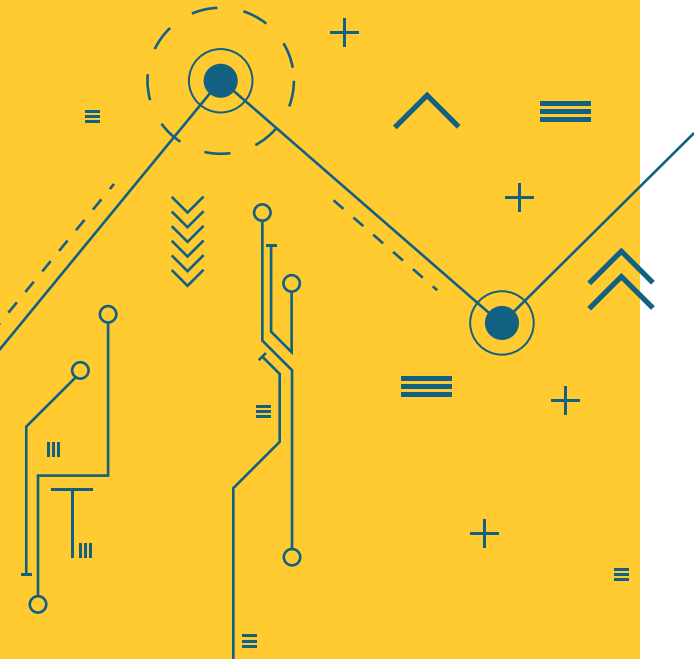
Learn Faster

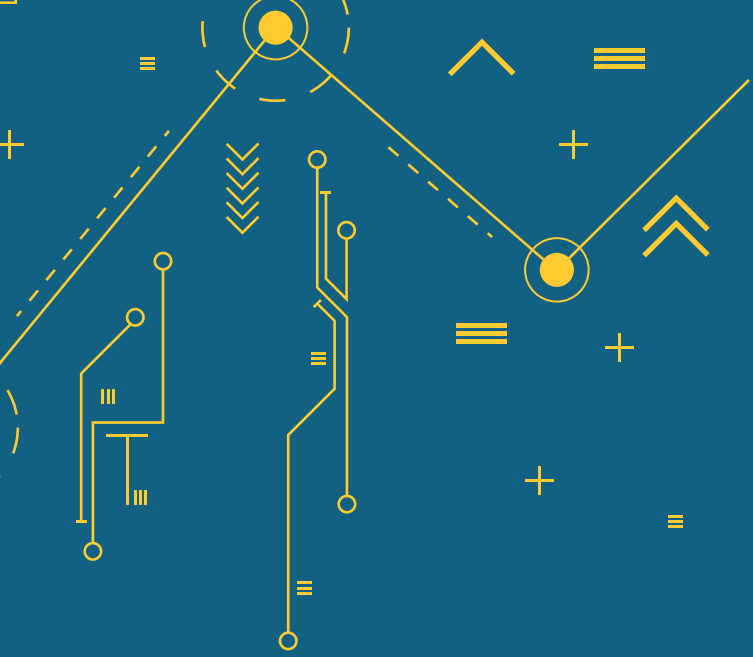
Faster Decisions



Increased Efficiency

Unbiased Decisions





Use Case: Space Twin from Slingshot Aerospace Stratfi

- In partnership with the US Space Force
- Slingshot Laboratory: a digital space twin and a space training product
- Simulate various scenarios for mission planning, wargaming, and spacecraft and constellation design.
- Combines real-time mapping of objects in orbit and space weather data with physics-based simulations
- Provides a real-world, hands-on environment to simulate mission execution.

“...simulate and analyze the complex dynamics of space, improve the design and operation of satellite constellations, reduce costs and risks, and enhance the training and preparedness of its personnel.”

Bringing it together (Examples)

Integrating Industrial DevOps with digital twins revolutionizes delivery processes

- **Organize for the Flow of Value:** Siemens leverages digital twins to manage supply chains by creating a virtual representation of physical supply chains and productivity networks. This approach enables Siemens to mimic supply chains in real-time, test various scenarios, and provide insights to optimize supply chains for maximum flow of value.
- **Apply Multiple Horizons of Planning:** Digital twins enable us to get empirical data to further inform our planning horizons. In wind farms for example the twins allow for short term adjustments based on real data as well as enable long-term planning for predictive maintenance. Key benefits include predictive maintenance schedules and increased efficiency in energy production.

Bringing it together (Examples)

Integrating Industrial DevOps with digital twins revolutionizes delivery processes

- **Implement Data-Driven Decisions:** Hospitals can monitor patient flow and resource allocation with data which improves patient care and reduces wait times.
- **Architect for Change and Speed:** The automotive industry leverages modular design in electronic vehicle development to increase the speed of innovation and adoption of new technology. Tesla is an extreme example where they go to the extent of having modular reconfigurable manufacturing allowing A/B testing on new ideas all the time. Key benefits are the speed of innovation delivered to the market.

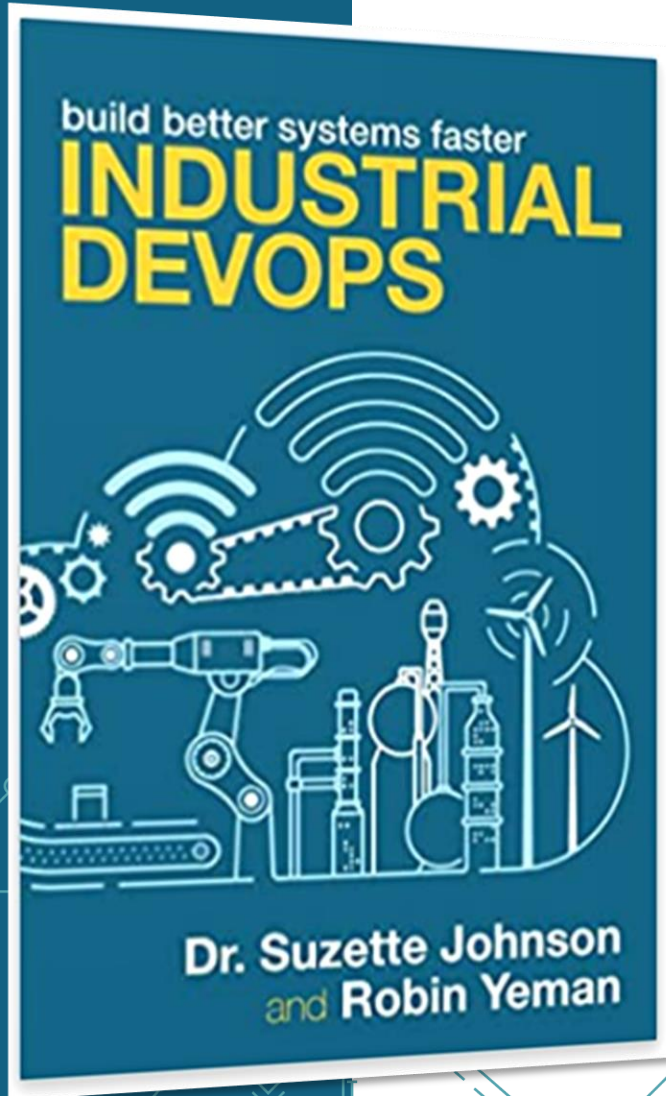
Getting Started

- Define the need
- Determine Threats and Challenges
- Identify Goals
- Assess Current State: Infrastructure, Simulation/Modeling Tools, Visualization Tools, Data Sources/Tools, Platforms, Domain Specific (Space) Situational Awareness tools, Human Capital
- Define Road Map and MVP/NVP
- Build: Infrastructure, Data Sources, Models, Simulation environments
- Integrate with Operations
- Scale and Adjust your operating model for greater ROI
- Embrace a continuous learning and improvement mindset

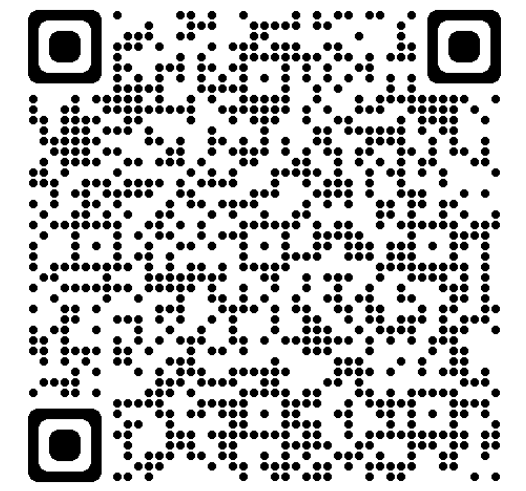
Recommendations for getting started as you continue to shape your technology roadmap.

Industrial DevOps Articles





Free chapters



Amazon

Next Up! (TBD)

Industrial DevOps
AI as a Team Member

Summary

“The integration of digital twins with Industrial DevOps offers exciting opportunities to revolutionize industrial operations.

By addressing the challenges related to IT infrastructure, data management, privacy and security, trust, and user expectations, organizations can unlock the full potential of this emerging technology.

Overcoming these challenges requires a collaborative effort between IT, operations, and other stakeholders, along with a commitment to continuous improvement and innovation.”



Q & A

ASK AWAY!