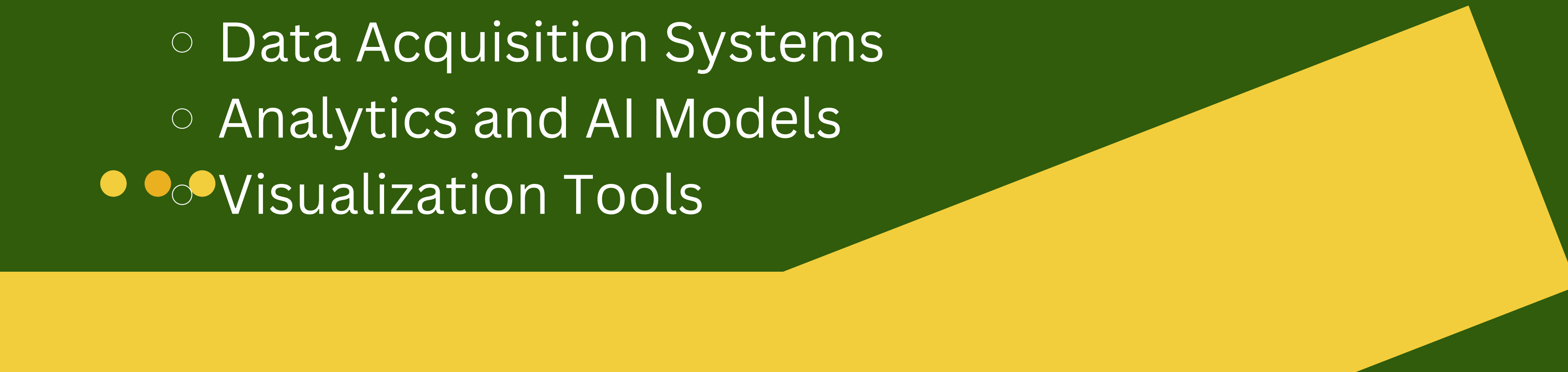# Task 05 :-Inference Mapping

TOPIC :-Digital twin application for monitoring rotating machines in process plant / power plant

TEAM :- Cyber Tribe

Inference Mapping for Digital Twin Applications:-

1. Digital Twin Concept:-

- **Definition**: A digital twin is a virtual representation of a physical asset that simulates its behavior and performance in real time.
- **Components**:
  - Physical Machine
  - Data Acquisition Systems
  - Analytics and AI Models
  - Visualization Tools

2. Data Acquisition:-

- **Sensors:** Vibration, temperature, pressure, and acoustic sensors collect real-time data.
- **Data Types:**
  - Operational Data
  - Maintenance Records
  - Environmental Conditions.

- **Integration:** IoT platforms for real-time data streaming to the digital twin.

3. *Real-Time Monitoring:-*

Performance Metrics:
- RPM (Rotations Per Minute)
- Efficiency Levels
- Wear and Tear Indicators

Alert System:
- Anomaly Detection Algorithms
- Predictive Maintenance Alerts

4. *Analysis and Diagnostics:-*

Predictive Analytics:
- Failure Prediction Models (using historical data)
- Root Cause Analysis for performance issues

Simulation:
- Scenario Testing for different operational conditions
- Stress Testing under extreme conditions

5. Visualization:-

- **Dashboards:** Real-time visualization of machine health and performance metrics.
- **3D Models:** Interactive 3D representations of machines for detailed inspections.
- **User Interface**: Customizable for different user roles (operators, maintenance teams, management).

6. Decision Support:-

- **Operational Decisions:** Insights for optimizing machine performance and scheduling.
- **Maintenance Decisions:** Data-driven maintenance planning to minimize downtime.
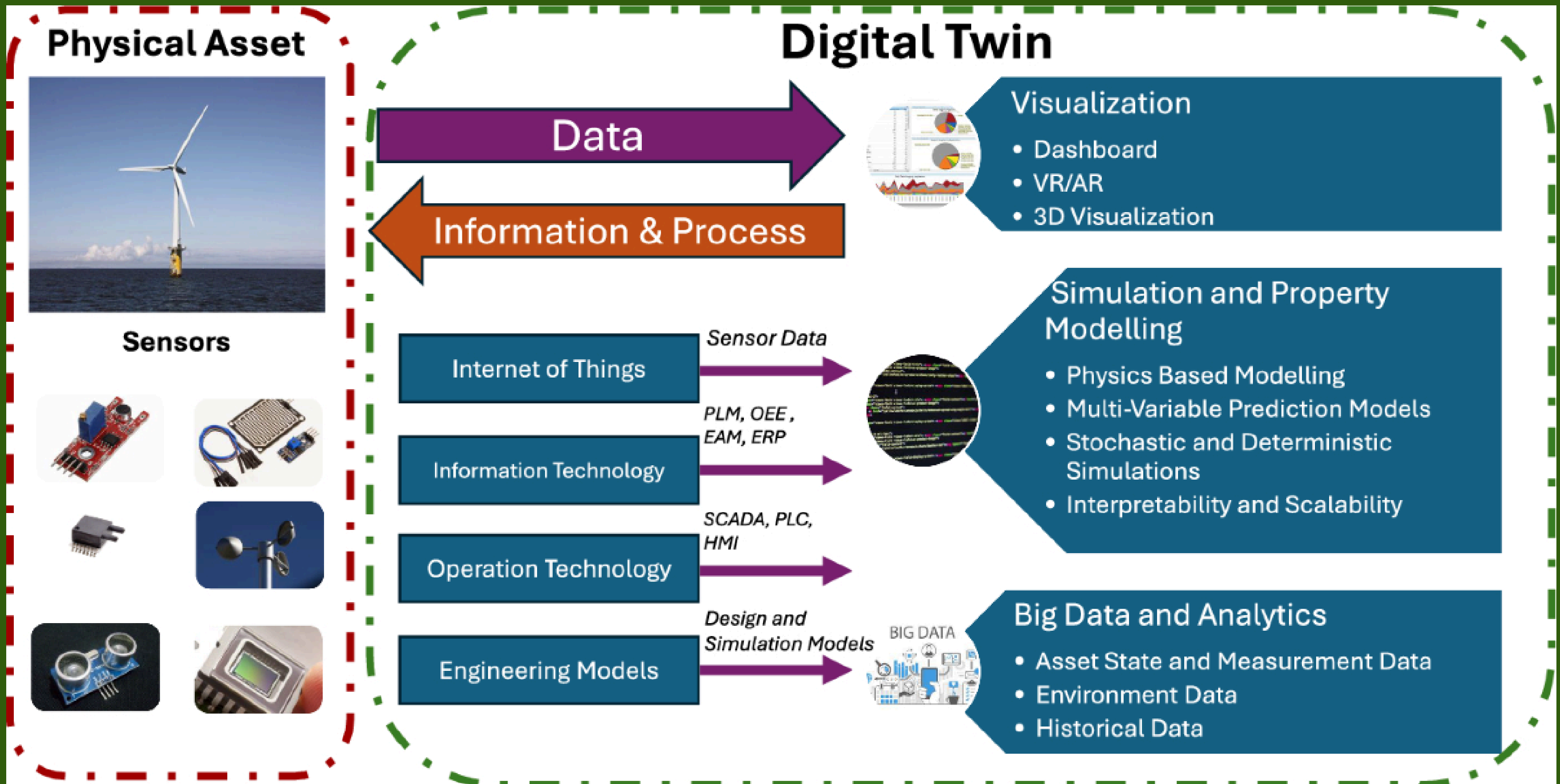- **Resource Allocation:** Efficient use of resources based on performance insights.

7. Continuous Improvement:-

- **Feedback Loop:**
- Continuous data collection informs updates to the digital twin model.
- Lessons learned applied to future design and operational strategies.
- **Machine Learning:** Models improve over time with more data.

8. Impact on Efficiency and Reliability:-

- **Reduced Downtime:** Early detection of issues leads to timely interventions.
- **Increased Lifespan:** Proactive maintenance extends equipment life.
- **Operational Efficiency:** Optimized performance based on real-time insights.

Inference Map :-

THANK YOU

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