Digital Twin & Data Collection

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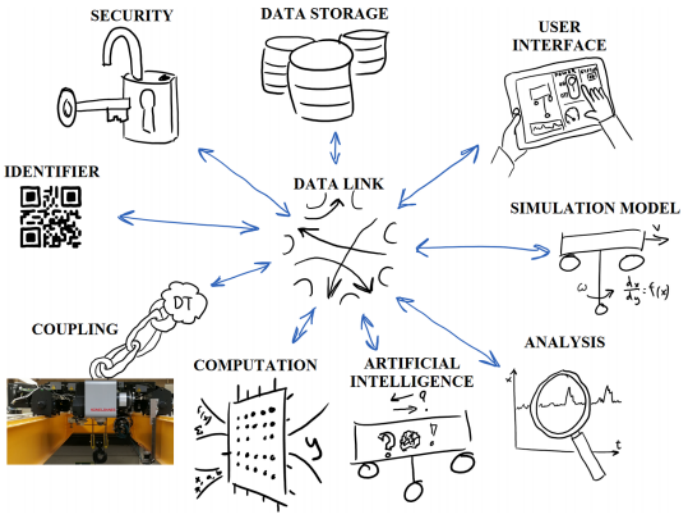
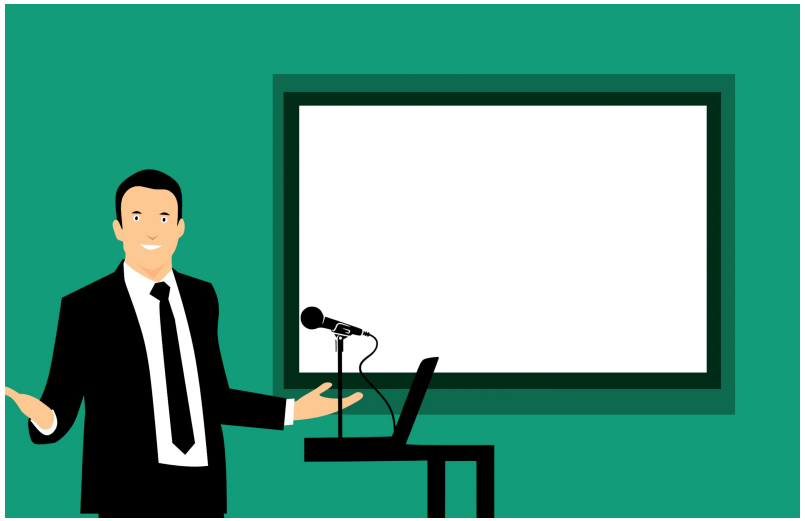
Data collection is an essential part of DT

- Digital twin needs real data from its counterpart to reach its full potential
- Most of the DT features are based on *accurate* *information* about the counterpart
  - No output without input



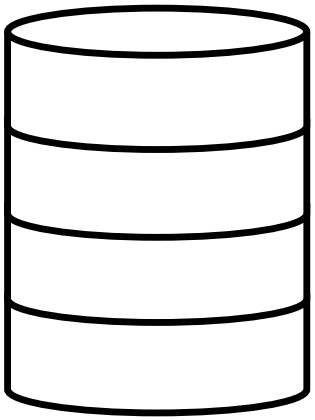
Structure of the presentation

- What can a DT do with data and what kind of data is needed for that?
- Requirements for data collection
- Solution for data collection



What does data collection enable?

- **Confirming the simulation results or assumptions made in the development phase of the product**
- **Analyzing the use of the product, improving the design**
- **Optimization of operation**
- **Couples physical product and DT**
  - Running (forward) simulation
- **Predictive maintenance**



What kind of data is needed by DT?

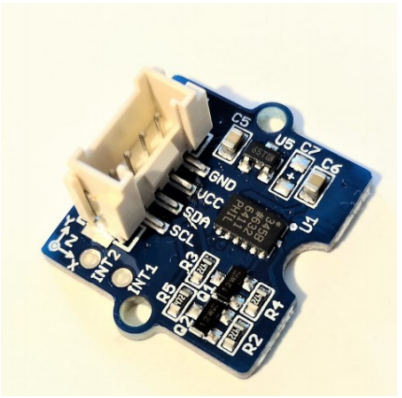
- **Boring, yet truthful answer: depends on the use case & product**
- **In scientific literature, sometimes it is stated that DT *completely* mirrors its physical counterpart [1]. However, this is not feasible.**
- **What should be then monitored?**
  - Weak parts
  - Performance
  - Adding sensors based on need
  - Oversensoring
  - Virtual sensors

[1] M. Shafto, M. Conroy, R. Doyle, and E. Glaessgen, “DRAFT Modeling, Simulation, information Technology & Processing Roadmap,” Technology Area 11, 2010.

Requirements for data collection

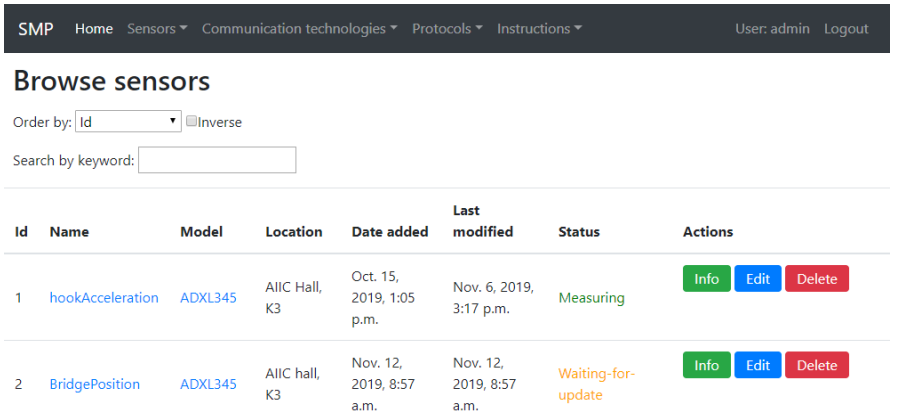
- **High quality data**
  - Sufficient sample rate and sensitivity
- **Addition of new sensors, removing unnecessary**
- **Changing measurement settings**
- **Changing the network parameters**
- **Software updating**
  - Bug fixes
  - New features

Source: https://www.baaahq.org/news/dont-wait-until-its-too-late-update-your-software-now



Solution: Sensor Management System

- Easy addition of new sensor nodes
- Easy addition of new sensor types
- Software updates & remote management of sensors over Internet
- Support for multiple data formats and both HTTP and MQTT
- Web User Interface & REST API



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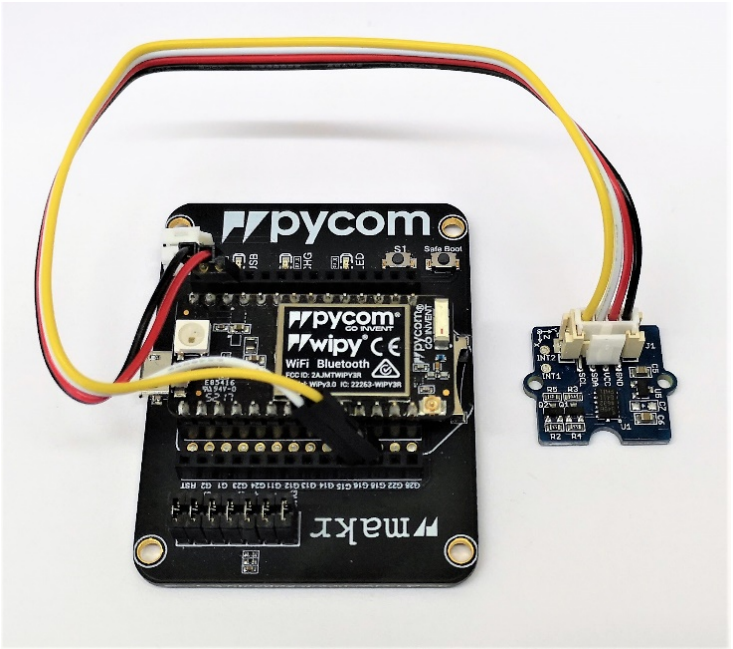
Hardware & software

- Pycom WiPy ESP32-based microcontroller, micropython
- 3-axis accelerometer ADXL345, Garmin LIDAR-Lite v3HP…
- Django, Django REST framework, jQuery, Bootstrap…



Source: https://buy.garmin.com/en-US/US/p/578152

Source: https://www.djangoproject.com/start/overview/

Source: https://www.cablefree.net/wireless-technology/history-of-wifi-technology/

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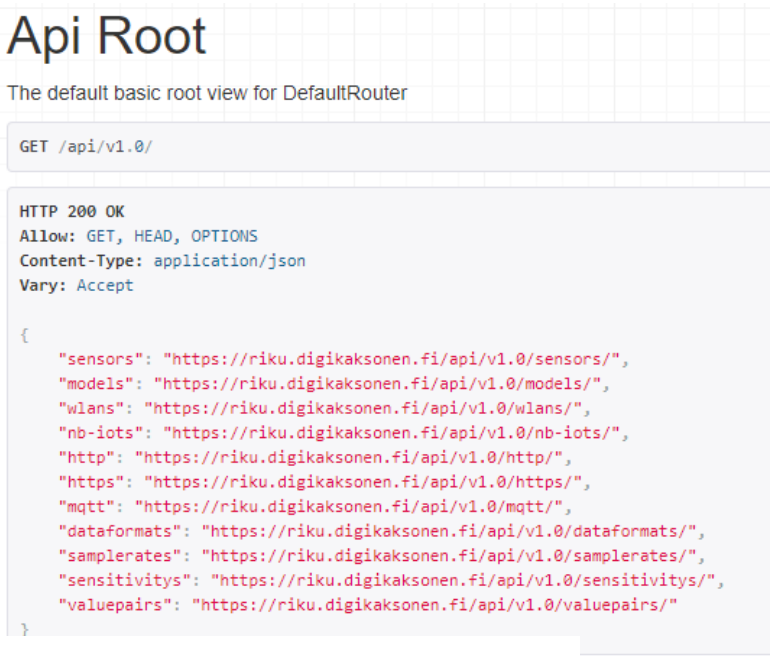
User Interface & API

- Sensor nodes can be added, modified and removed from Web user interface or REST API
- Web user interface provides ease of use



Browse sensors

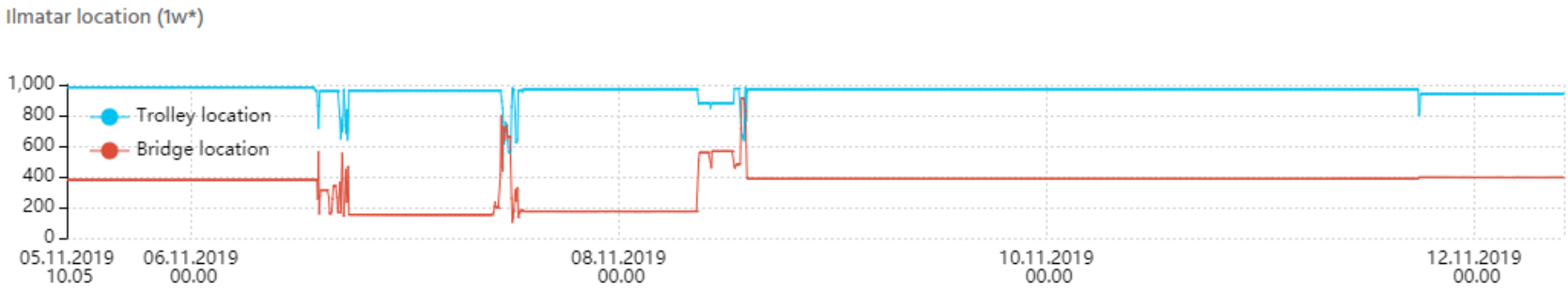
Order by: Id ▾ Inverse

Search by keyword:

Id	Name	Model	Location	Date added	Last modified	Status	Actions
1	hookAcceleration	ADXL345	AIIC Hall, K3	Oct. 15, 2019, 1:05 p.m.	Nov. 6, 2019, 3:17 p.m.	Measuring	Info Edit Delete
2	BridgePosition	ADXL345	AIIC hall, K3	Nov. 12, 2019, 8:57 a.m.	Nov. 12, 2019, 8:57 a.m.	Waiting-for-update	Info Edit Delete

Data?

- **Managament system has ”nothing to do with the collected data” i. e. it does not have access to it**
- **External IoT platforms can ne used to store and visualize data**
  - Good option: Remion Regatta platform
- **External systems can change the measurement setting via REST API**



Conclusion

- **Data collection is an essential part of DT**
- **Large amount of sensors necessitates management system**
- **Solution: Sensor Management Platform**
  - Code open-sourced in GitHub, please collaborate

Source: https://bics.com/news/bics-enables-worlds-first-intercontinental-5g-roaming-service/