How to Create AI in Decentralized Systems

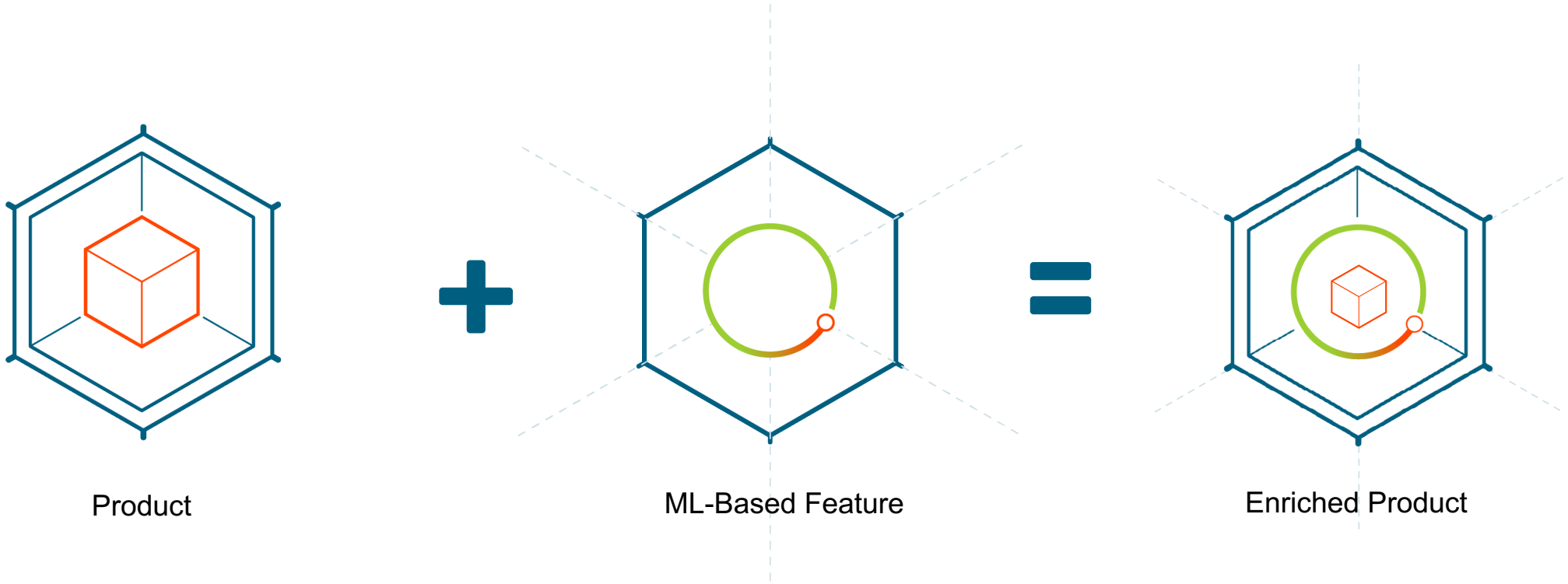
ARIC Brown Bag Session

Dr.-Ing. Robin Hirt, 21.07.2020

prenode

Companies have a great interest in the enrichment of their products with AI…

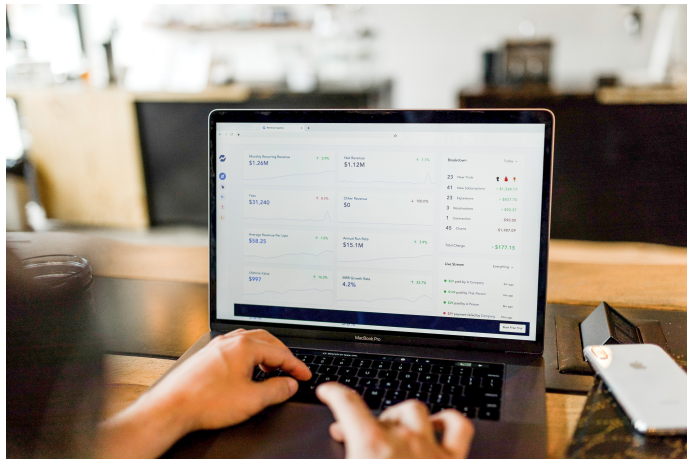
prenode



Companies that employ AI/ML features achieve up to 61% ROI on their projects. [1]

…to improve their products and services…

prenode



Spotify®

Tesla Autopilot

...and therefore require a large amount of (training) data.

1

2

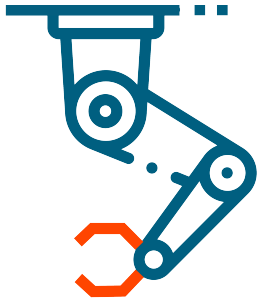
3

Many entities face similar problems that could be solved by exchanging knowledge but..

prenode

…some prefer to protect their data for legal, ethical or strategic reasons.

…some are not capable of cooperating in a knowledge exchanging system due to lack of expertise and coordination effort



Industry 4.0

Insurance and Finance

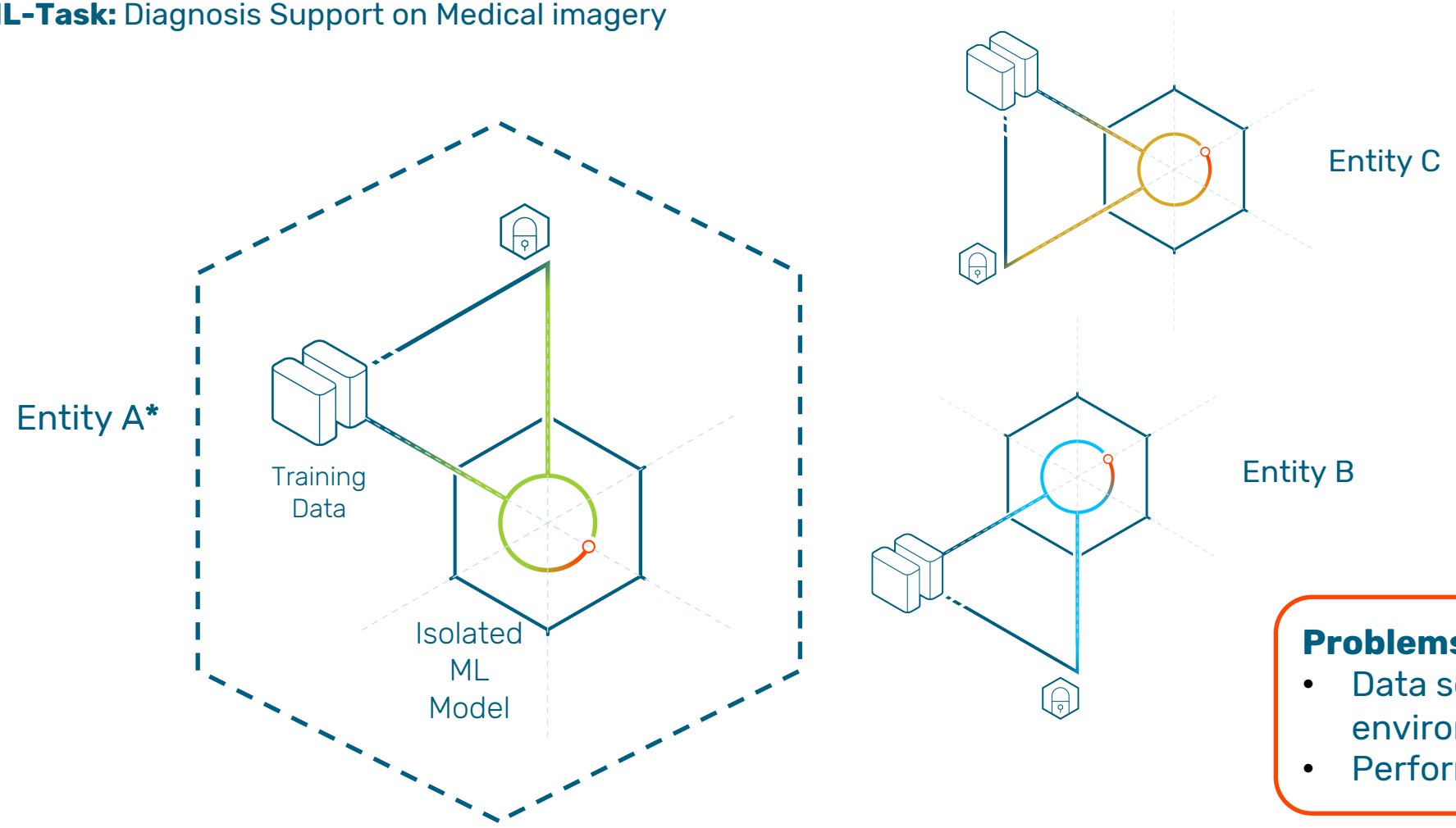
Healthcare

How can you built AI features when data is distributed?

Option A: Train isolated models for each customer

prenode

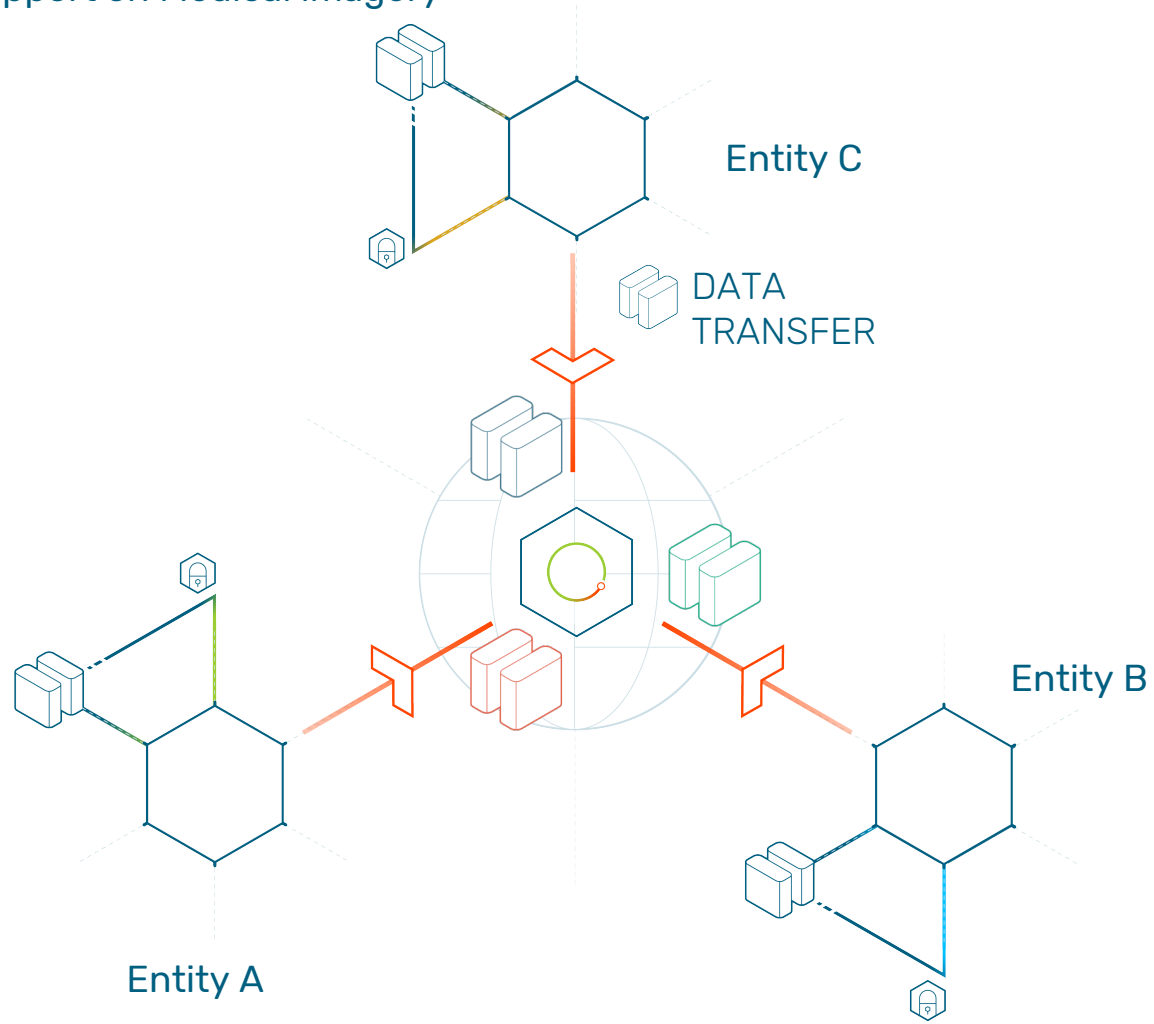
Ex.: System landscape of hospitals and (research) institutions with distributed data[1]
Joint ML-Task: Diagnosis Support on Medical imagery



Problems
- Data scarcity in local environment
- Performance of models

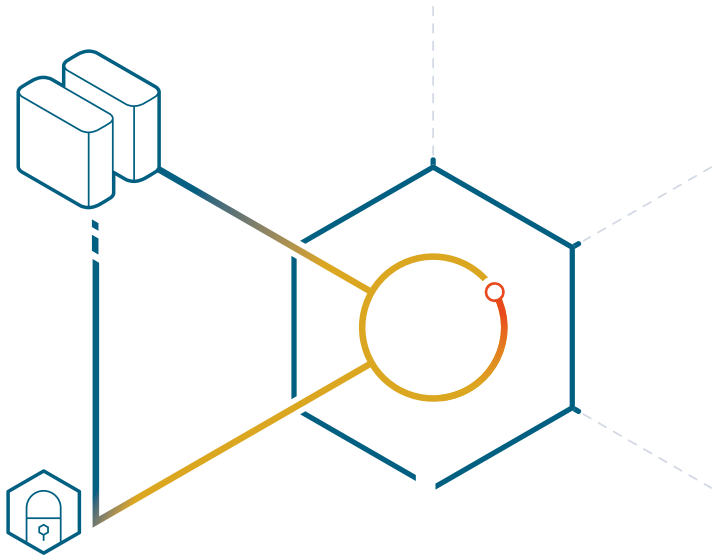
Option B: Centralize all data to train a general ML model

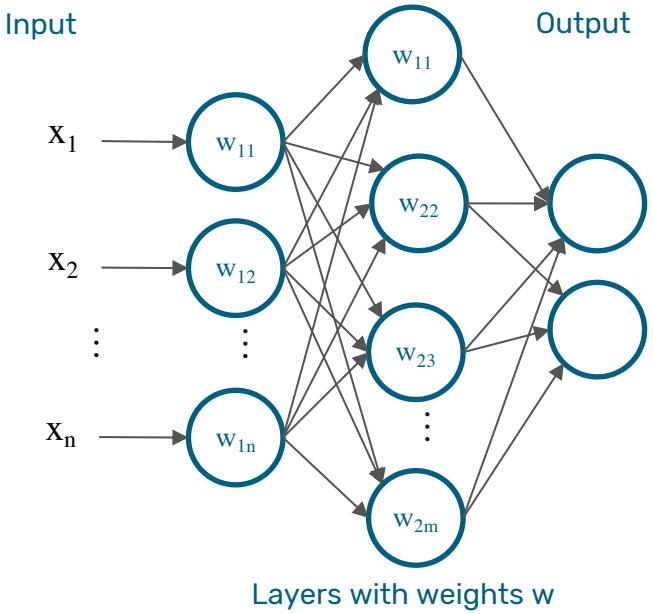
Ex.: System landscape of hospitals and (research) institutions with distributed data[1]
Joint ML-Task: Diagnosis Support on Medical imagery



Problems
- Data sensitivity/criticality
- Data volume & cost of transmission

Option C: Change the paradigm – instead of data, send the model



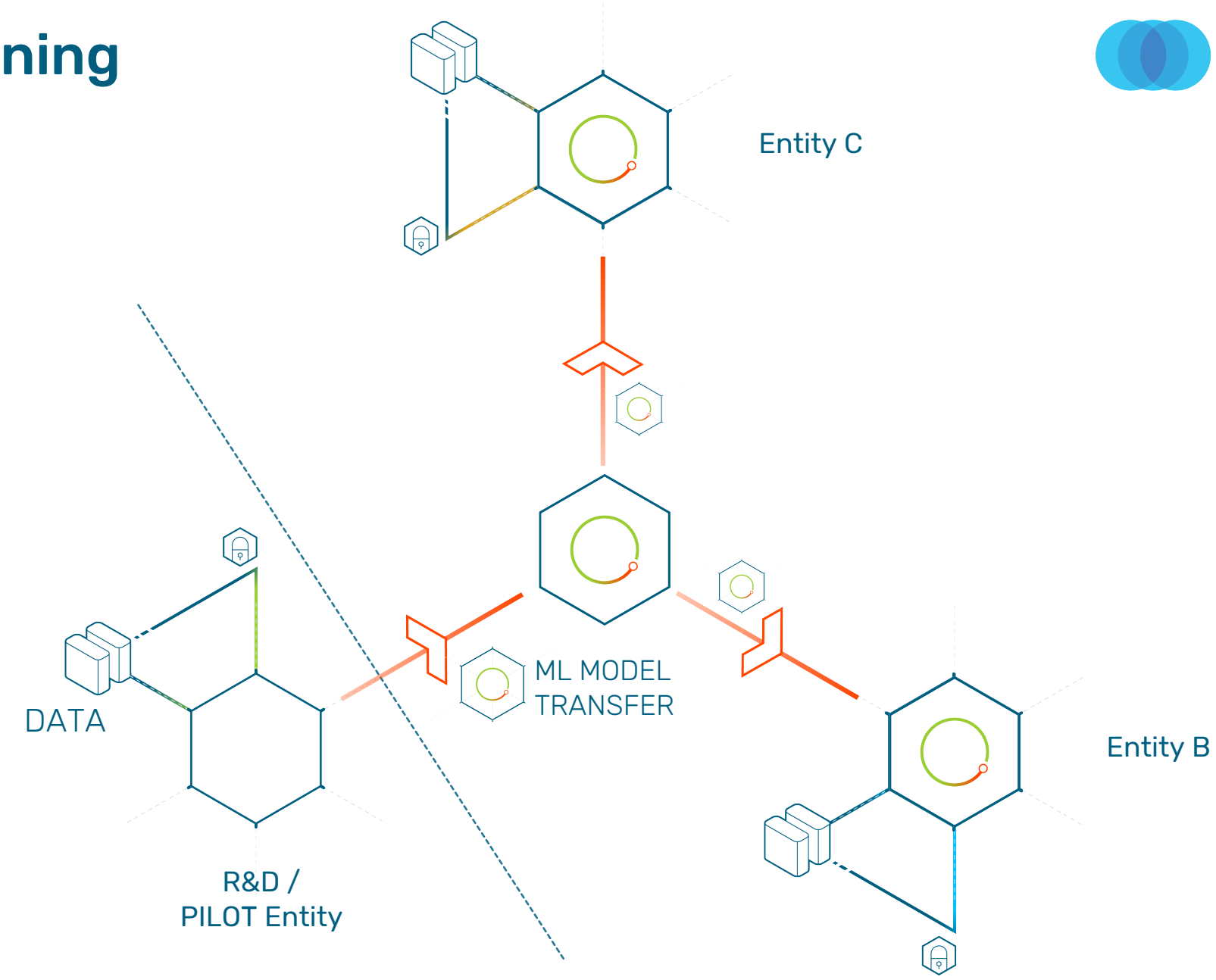


- Neural network models are trained on data to predict/classify outputs on a given input.
- These models are considered to be **"black boxes"** that make it very hard to extract raw data.

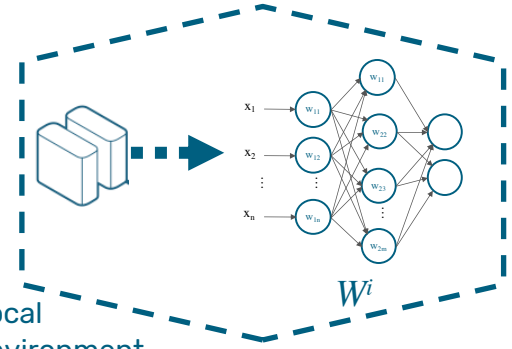
- Neural network models contain information of the underlying training data (represented by *weights*).
- These weights W^i can now be exchanged instead of raw data.

Transfer Learning

prenode

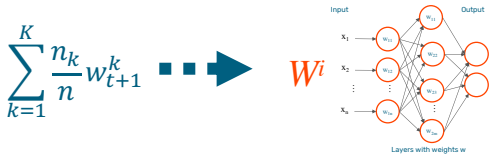


Federated Machine Learning



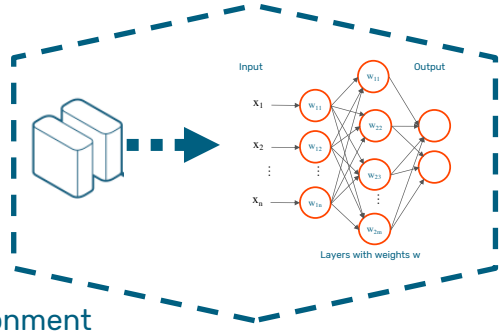
Local environment

1 Local model training



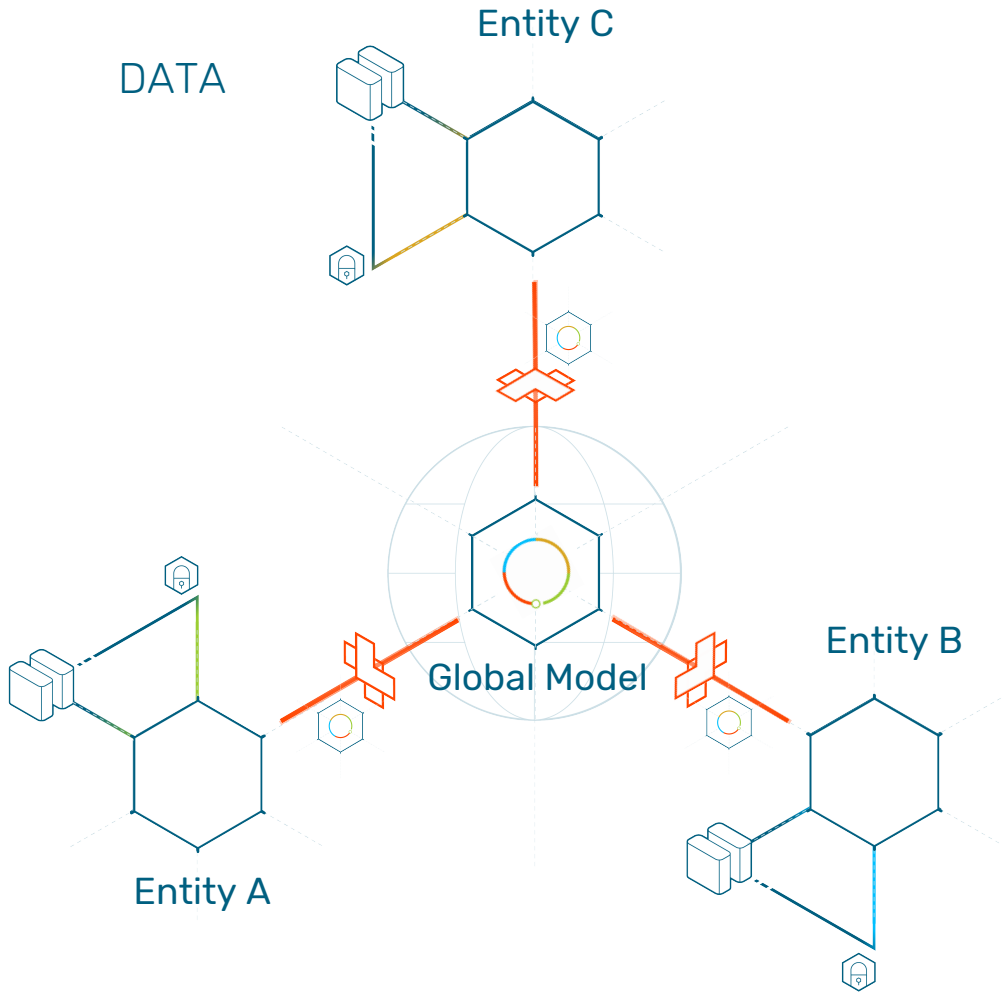
2 Model centralization & fusion

x times per training

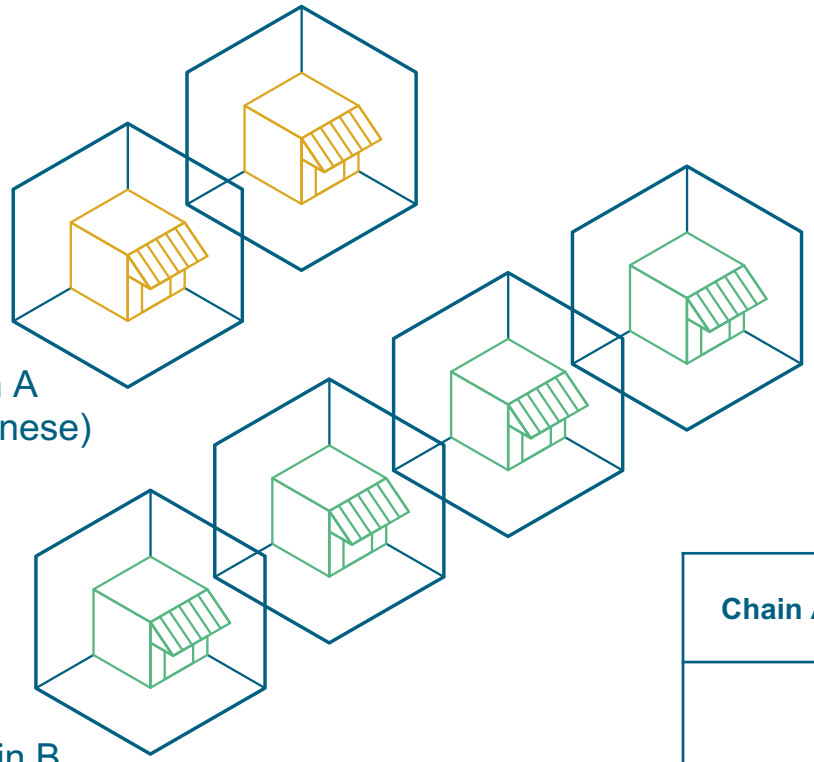


Local environment

3 Model redistribution



FedML for Restaurant Sales Forecasting across Branches & Chains

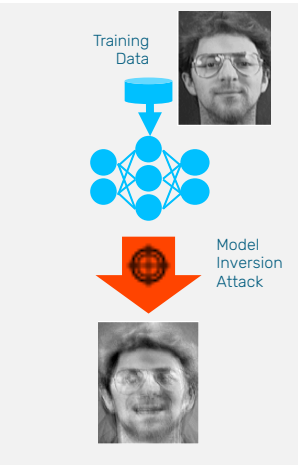


- Two restaurant chains with independently run branches.
- Branches need to plan staff and supplies ahead based on future sales to reduce costs and improve service.
- **Goal:**
  Enable the ERP provider to offer sales forecast without centralizing and mixing sales data

		Baseline (Isolated ML)
Chain A	Branch 1	17,29
	Branch 2	16,44
Chain B	Branch 3	14,28
	Branch 4	23,89
	Branch 5	17,04
	Branch 6	12,44
	Branch 7	22,30

Results of study [1] (in mean absolute percentage error)

FedML faces many challenges in the real-world.



1. Communication between Systems

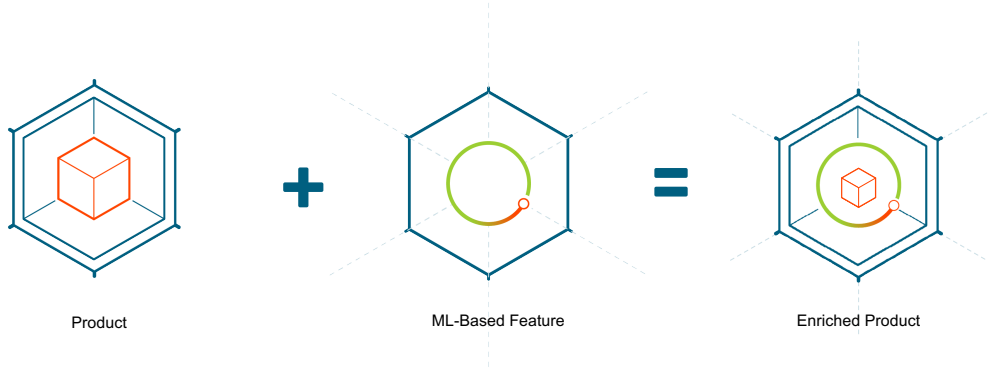
2. Information Systems Heterogeneity

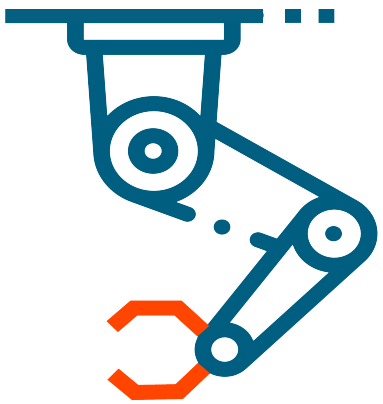
3. Statistical Heterogeneity

4. Privacy

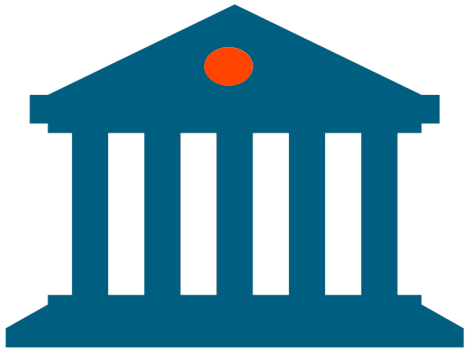
Federated Learning enables many industries to utilize the potential of their data.

prenode





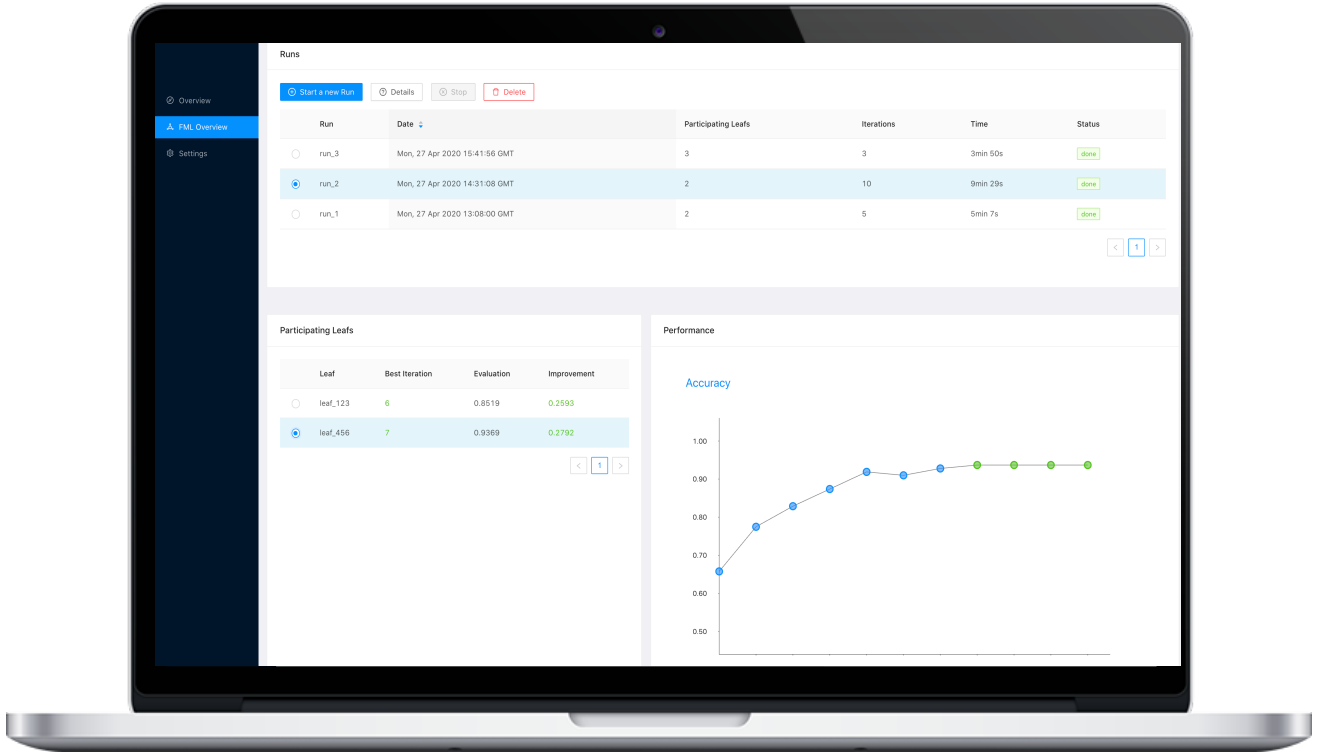
Industry 4.0



Insurance and Finance

Healthcare

prenode



mlX
Managed Federated Learning

> *"Organizations that want to share data, but are concerned about privacy, should explore a* ***federated learning*** *approach. […] There is a small yet growing list of vendors using various approaches in that space, including […]* ***prenode.***"
>
> Gartner®

In collaboration with

Karlsruher Institut für Technologie

Sponsored by

Bundesministerium für Bildung und Forschung

CyberForum
HIGHTECH. UNTERNEHMER. NETZWERK.

Thank you for your attention.

Sparked your interest? Let’s connect.

Dr.-Ing. Robin Hirt

linkedin.com/in/robinhirt/

robin@prenode.de

@robin_hirt

www.prenode.de

prenode