



# Crypto Mountain Davos 2023

Blockchain based Federated  
Learning in Life Sciences and  
Electricity Transmission

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# Overview

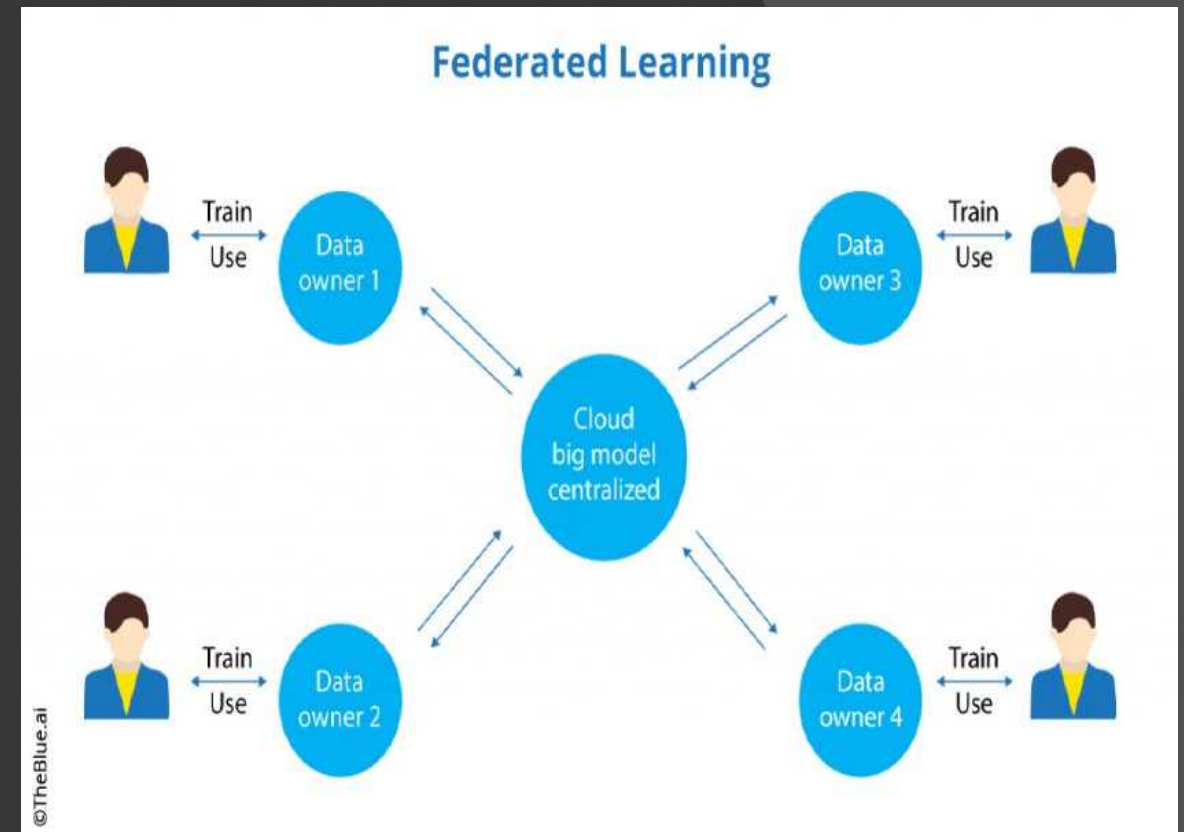
- The Data Availability Problem
- Federated Learning
- Blockchain based Federated Learning (BCFL)
- Real World Applications: Energy Transmission and Drug Development
  - BCFL for High Voltage Lines Predictive Maintenance
  - BCFL to improve Clinical Trials in Oncology
- Conclusion

# The Data Availability Problem

- Regulations
- User preferences and restrictions
- Data volumes
- Examples:
  - Health/patient records
  - Financial information
  - Sensitive competitive information

Federated Learning (FL) learns from decentralized Data – the model comes to the data not the other way around

ML is a machine learning environment in which many participants train a model collectively, whilst the training data stay decentralized. In most cases the learning process is orchestrated by a central server.

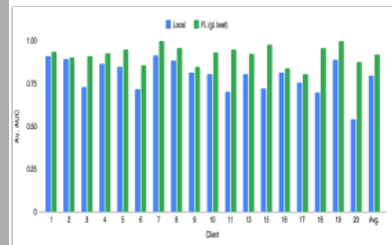


## How Apple personalizes Siri without hoovering up your data

The tech giant is using privacy-preserving machine learning to improve its voice assistant while keeping your data on your phone.

by Karim Hoo

December 11, 2019



## Swiss Re partners with Tencent's WeBank to research AI use in reinsurance

⚡ 24th May 2019 - Author: Matt Sheehan



**Major pharma companies, including Novartis and Merck, build federated learning platform for drug discovery**

Kyle Wiggers September 17, 2020 1:00 AM

SCIENCE NEWS MAY 26, 2021 / 4:49 PM

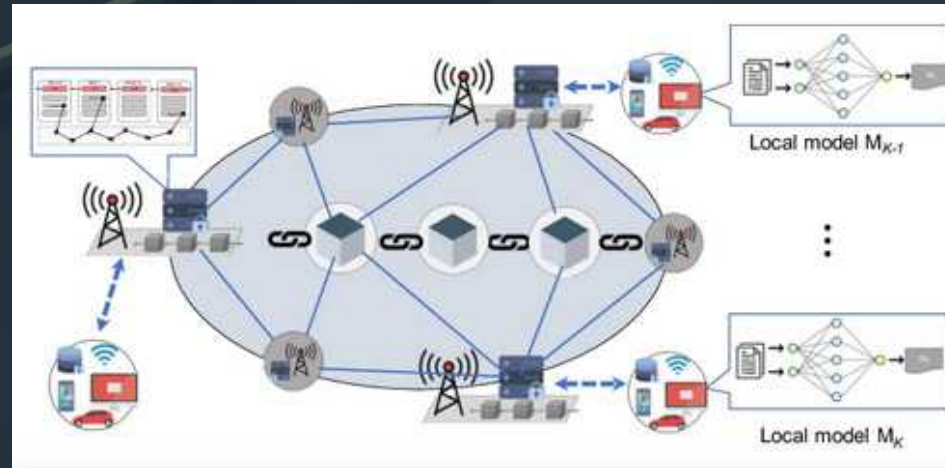
**Researchers train medical diagnostics algorithm without sharing patient data**

- A lot of scientific papers are published – just a few real world applications
- A few projects are underway in medicine (dental network,...), agriculture...



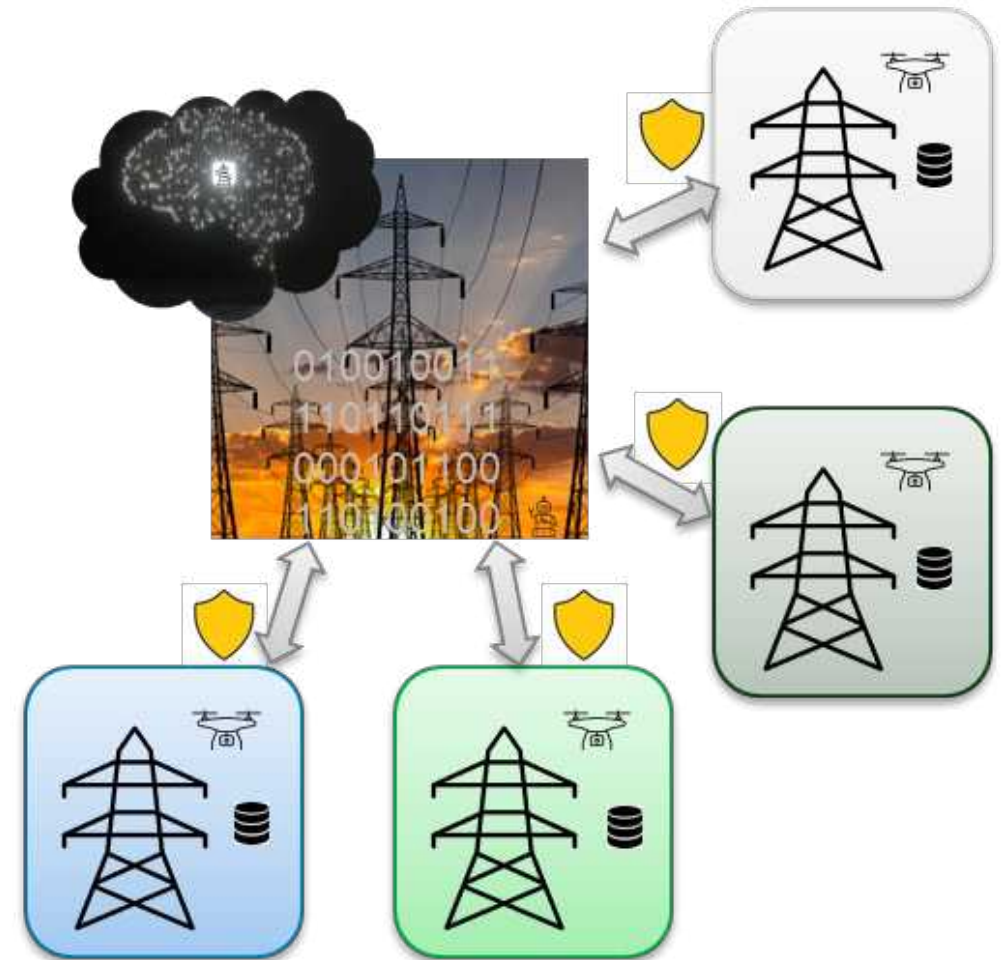
BCFL

- **But why Blockchain?**
- Each of the various local data siloes become a node in a private chain (could be extended any time)
- The chain holds just metadata that help control the network (data inputs, deletions, changes etc.) – main problem is to delete and/or improve quality of data to stabilize the models predictive quality
- The solution will be some sort of central/decentral architecture



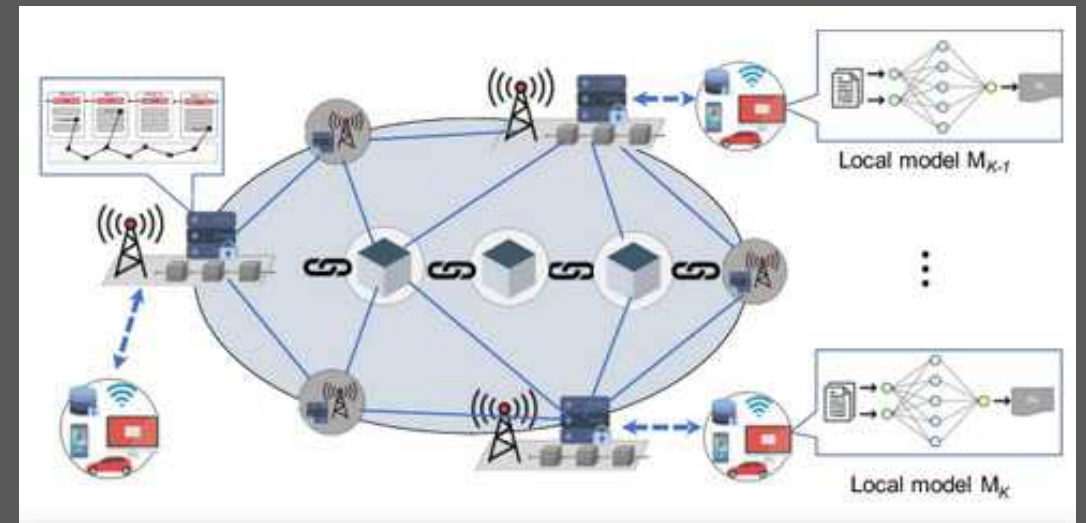
# BCFL for Condition Evaluation in Electricity Transmission

- High voltage transmission (>110KV) in DACH is fulfilled by 4 TSO's in Germany , 1 in Switzerland and 1 in Austria
- In Germany the 4 TSOs operate 37.000 km of lines with about 100.000 high voltage poles
- TSO's have big problems to control their poles and lines for damages
- Most TSO's started to do drone based photographing thus producing millions of photos altogether
- To analyze all this materials manually is almost impossible
- AI/ML needs many, many data (images and data from operations) to get trained for damage detection
- Still, a single TSO doesn't have enough data on the various components (isolators, pole construction, lines...)
- Bringing all data in one single data base for training is not wanted for various reasons



# Federated Learning for Condition Evaluation of physical assets in decentralized environments can be made transparent and traceable using blockchain technology

- Blockchain Technology is seen as a secure and efficient solution for implementing FL
- BCFL provides maximum protection of operational data; common learning model, avoiding a central database
- BCFL allows the traceability of the value of included data sources
- Building an "audit trail" (secure, time-stamped recording of data events on the (private) blockchain > transparency
- Blockchain technology provides the basis for a later settlement scheme in the ongoing use of the condition assessment model ("smart contracts").





# BCFL to improve Clinical Trials in Oncology

- Regulators are asking for complete, transparent and immutable audit trails in clinical trials
- FDA specifically wants to make clinical trials more cost effective – too many trials fail because of lacking financing. Too many middlemen make trials very expensive
- In many countries in Europe patient data have to stay with the clinics because of data privacy regulations, thus most data today are used only once.
- No access to meta data from trials – new trials can't make use of already existing data.
- → Siloed data from previous clinical trials can be used multiple times
- → BCFL can help in auditing trials, make them more cost effective and make much better use of patient data

MELLODDY  
project

 **MACHINE LEARNING LEDGER**  
**ORCHESTRATION FOR DRUG DISCOVERY**  
JUNE 2019 - MAY 2022



**PHARMA PARTNERS**

**PUBLIC PARTNERS**

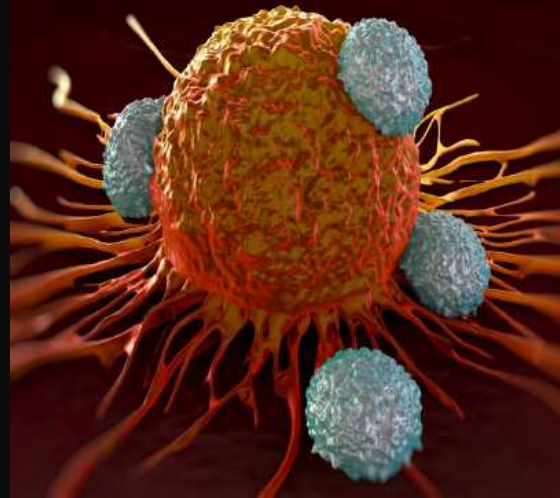


This project has received funding from the Innovative Medicines Initiative 2 Joint Undertaking under grant agreement N° 833472. This Joint Undertaking receives support from the European Union's Horizon 2020 research and innovation programme and EFPIA.

# Our Real World Clinical Trial

Blockchain and Decentralized AI in humanized Girentuximab (huGmab) development



- Basket trial in (say) 3 different clinical sites
- Each site contributes patients in the 4 different indications (ccRCC, NSCLC, colon, head&neck cancer) selected
- Altogether  $3 * 4 = 12$  data servers included
- Each data server has patient privacy preserving software installed
- Each server is connected to a permissioned blockchain to control the anonymous use of data
- An AI/Machine Learning model will go from server to server analysing data enhancing predictive quality without centralising the data (Blockchain based Federated Learning – BCFL)
- Blockchain enables a complete audit trail and trial adaptations based on ongoing model predictions
- Trail Management (payments etc.) supported by Blockchain

# Conclusion

- The world is full of useful but scattered data
- Data siloes are produced in any industry
- BCFL is a disruptive method that can help to make much better use of data in a controlled, decentralized and responsible way





# The Technologies

## A New Approach to Clinical Data

