Real-world Federated Learning in Medical Image Computing

DSI Students Colloquium
by Marius Kempf

KARLSRUHE SERVICE RESEARCH INSTITUTE (KSRI)
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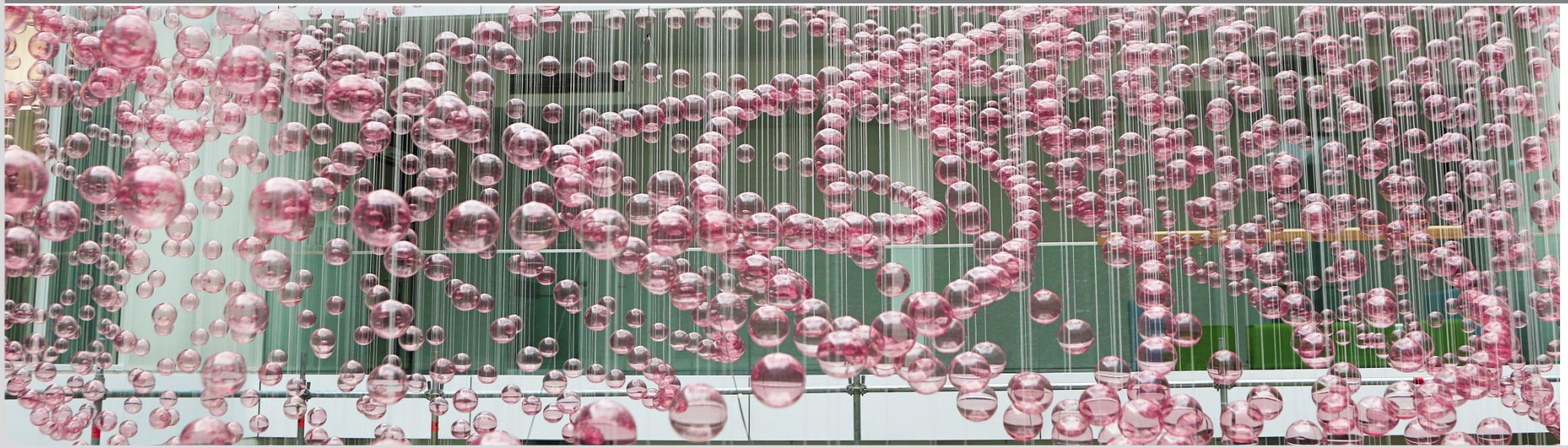
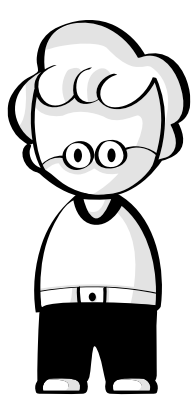
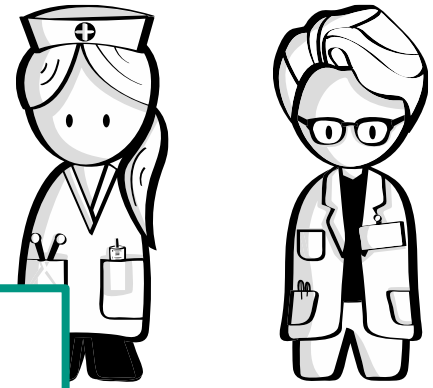
Research Group: MEDICAL IMAGE COMPUTING (MIC)



In medical imaging big and labelled data sets are rare and expensive – especially for semantic segmentation!

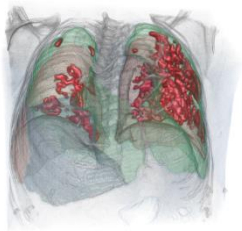


Data Scientist



Radiologists

- **Huge amount of samples needed**
- **CT scans need to be labelled by costly experts**



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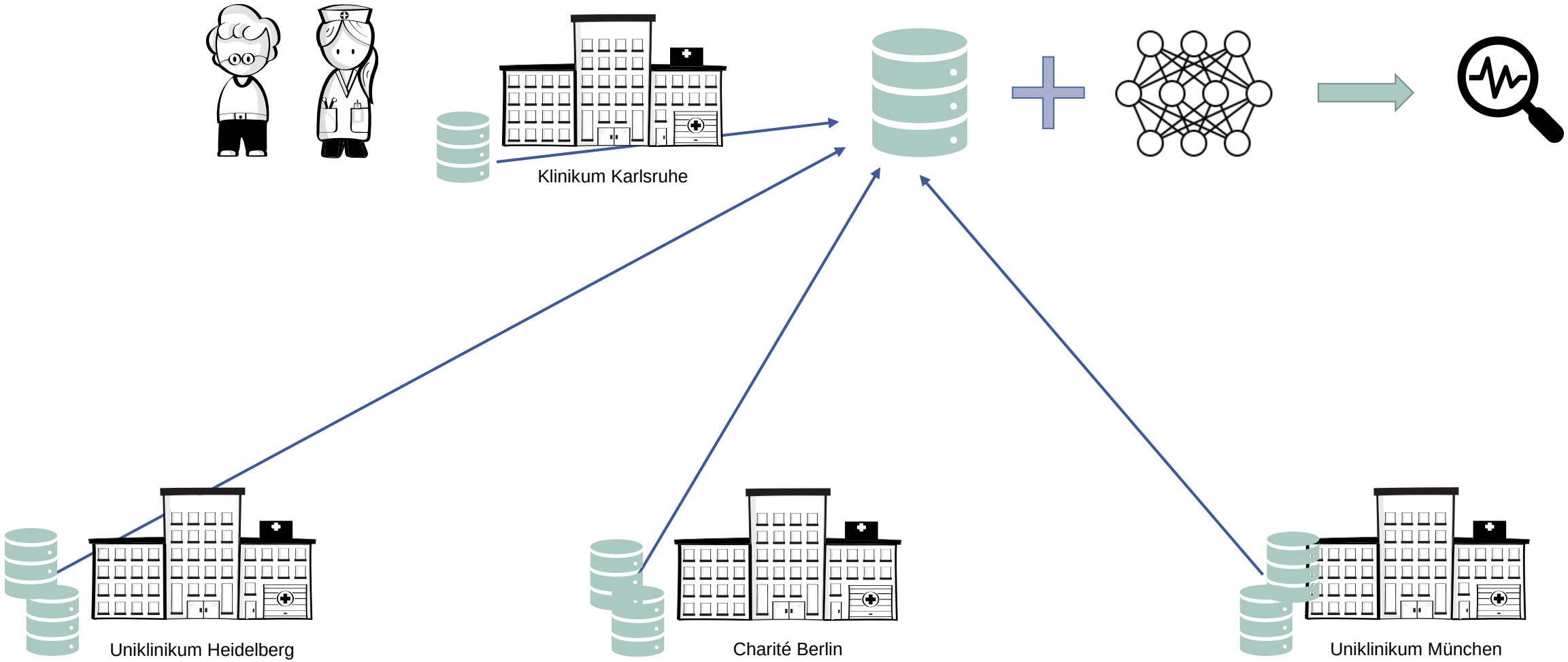
Why not just ask some colleagues for some of their data?



Rieke, N., Hancox, J., Li, W. et al. «The future of digital health wit federated learning» 2020

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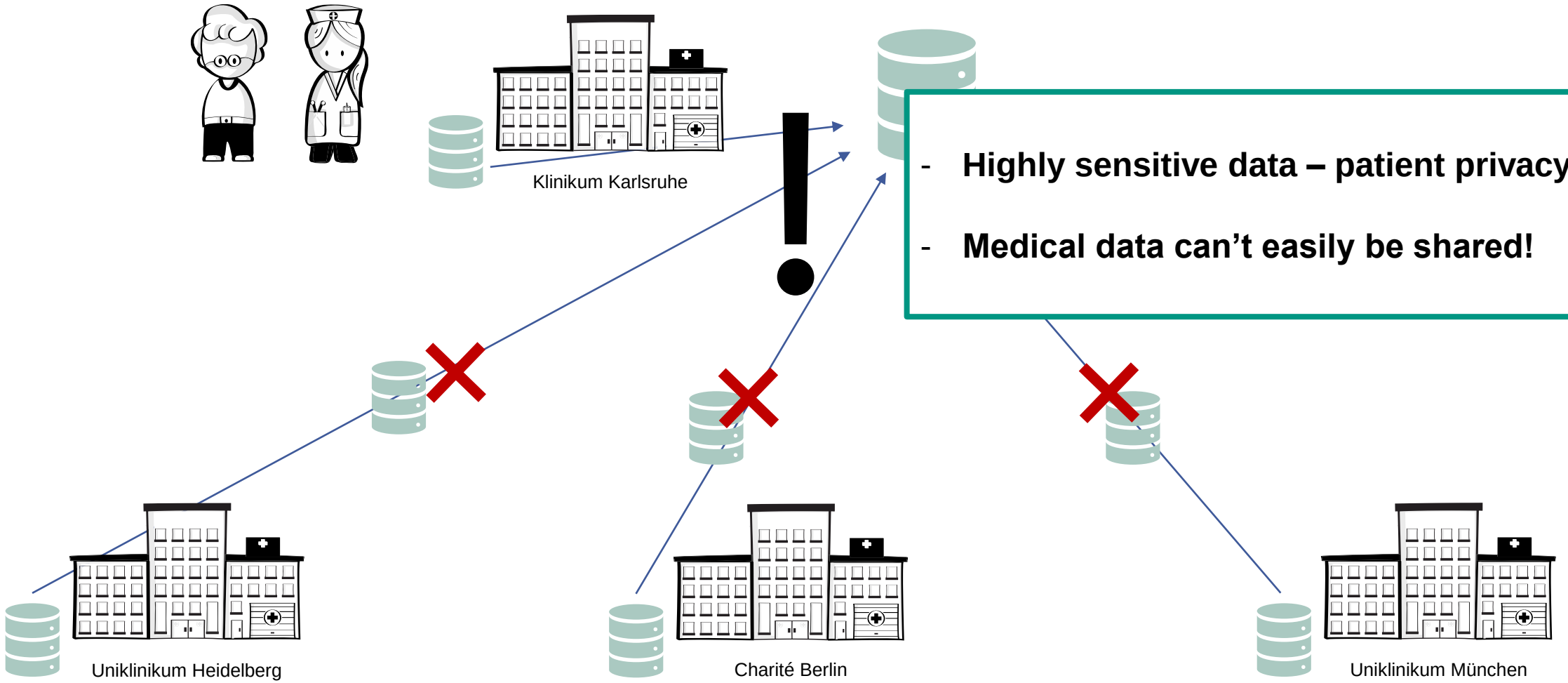
Medical data is highly sensitive – most of the time it can't be shared!



- **Highly sensitive data – patient privacy!**
- **Medical data can't easily be shared!**

Rieke, N., Hancox, J., Li, W. et al. «The future of digital health wit federated learning» 2020

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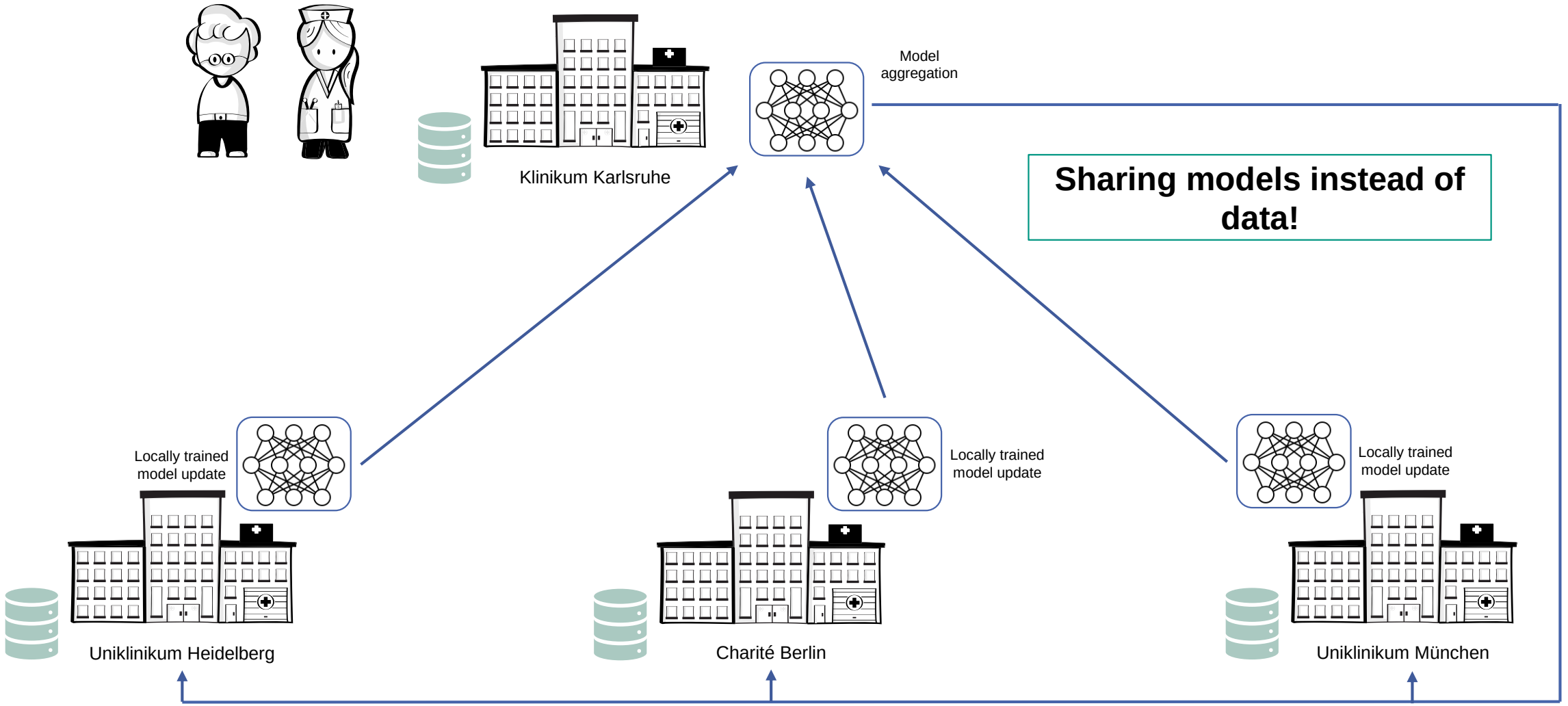
There is a solution: “The future of digital health wit federated learning”…



Rieke, N., Hancox, J., Li, W. et al. «The future of digital health wit federated learning» 2020

McMahan, HB.,Moore, E. et al. «Communication-efficient learning of deep networks from decentralized data» 2017

… but, academia mainly focusses on methodological questions, rather than making it real-world.

#	Paper*	…	FL Framework	Setting
1	Sarma et al. (2021)		NVIDIA Clara	**Real-world**
2	Flores et al. (2021)**		NVIDIA Clara	**Real-world**
3	Wang et al. (2020)		NVIDIA Clara	**Real-world**
4	Roth et al. (2020)		NVIDIA Clara	**Real-world**
5	Xu et al. (2020)**		Custom solution	**Real-world**
6	Remedios et al. (2020)		Custom solution	**Real-world**
7	Remedios et al. (2019)		Custom solution	**Real-world**
8	…		-	Simulated real-world
…	…		…	…
27	…		-	Simulated

*Applying Federated Deep Learning on Medical Image Data

** Preprint

7 publications trained on a real-world setting across institutions

How to enable researches to apply FL in medical imaging in (more) real-world settings?

Can the existing Kaapana platform be extended for real-world Federate Learning?

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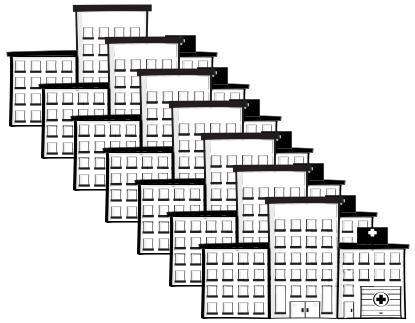
So, we use an existing and running platform to make federated learning applicable in real-world scenarios.



… 36 university clinics in Germany

KAAPANA

- Up and running in many clinics
- Open-source project on GitHub
- Highly flexible, scalable and extendable
- Offline mode supported
- …

Next Steps

- Finalize training workflows for test experiments
- Time / Performance measurements
- From basic classification to segmentation (nnU-net)
- Work out the differences to other frameworks / tools (i.e. NVIDIA Clara Federated)

Challenges

- Appropriate data set
- Define suitable experiment for publication
- Leave DKFZ environment – making it real-world!

BACKUP

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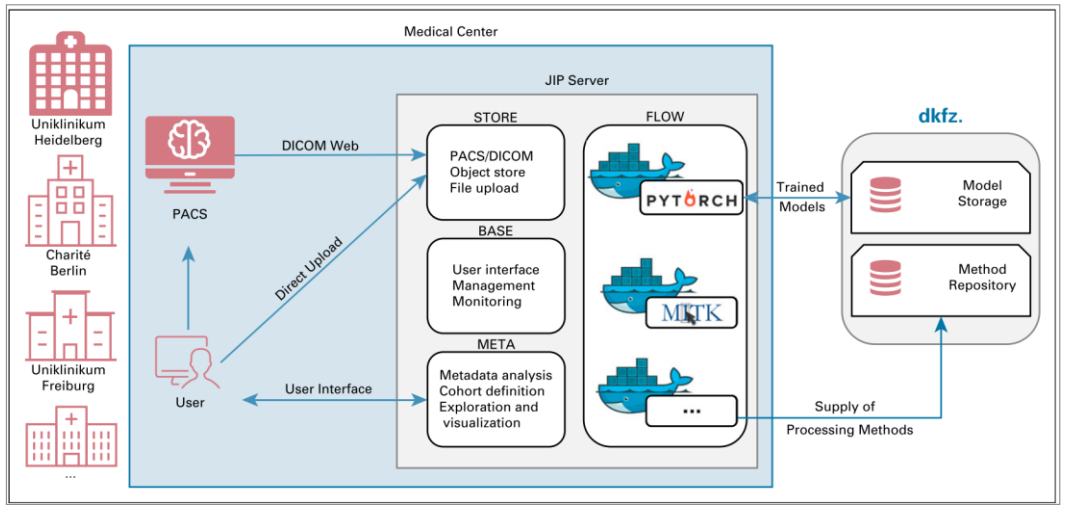
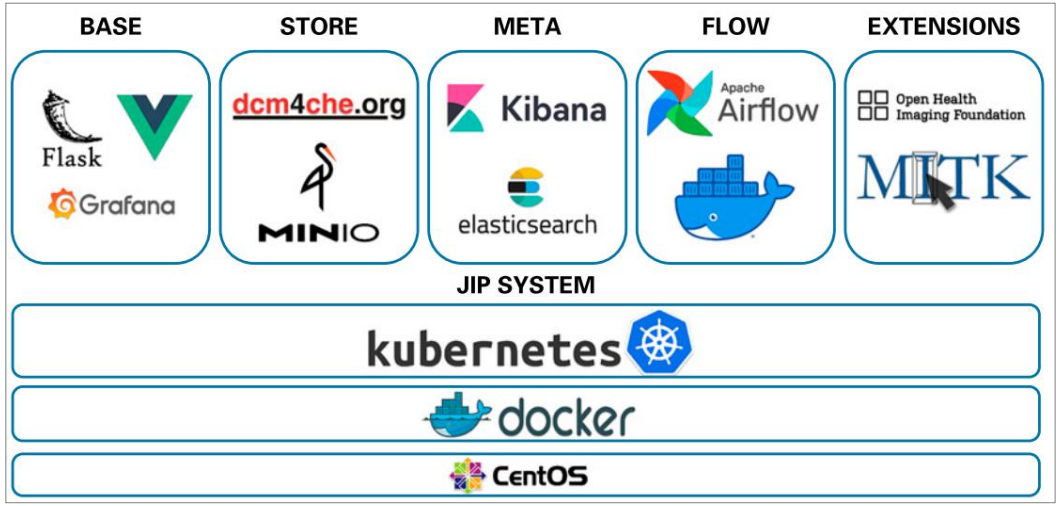
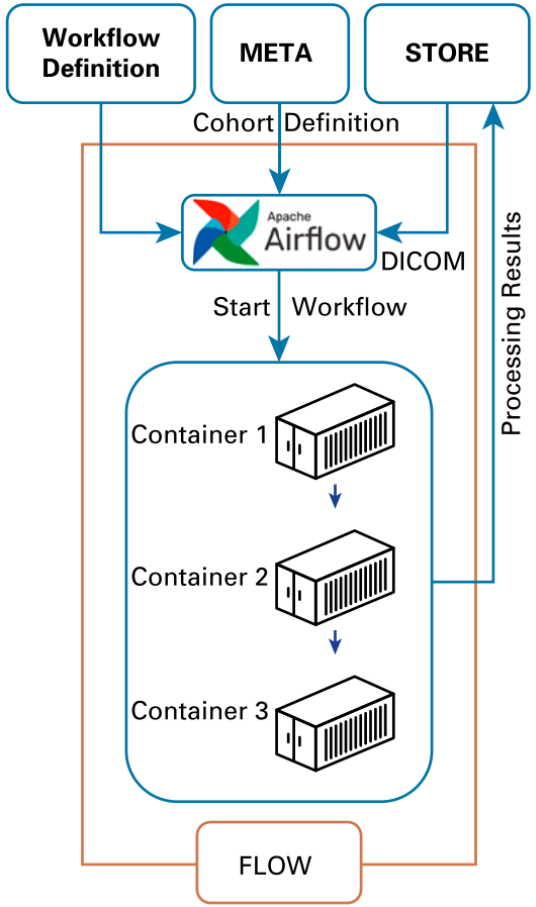
Kaapana – Deep Dive







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