

Towards Collaborative Business Models for Interorganizational Federated Machine Learning

Milena Zahn, 30.05.2022, Kick-Off Guided Research

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Motivation

- Background
- Problem Statement

Research Approach

- Research Questions
- Research Design

Initial Results

- Systematic Literature Review
- Design Concept
- Semi-Structured Interviews

Time Schedule

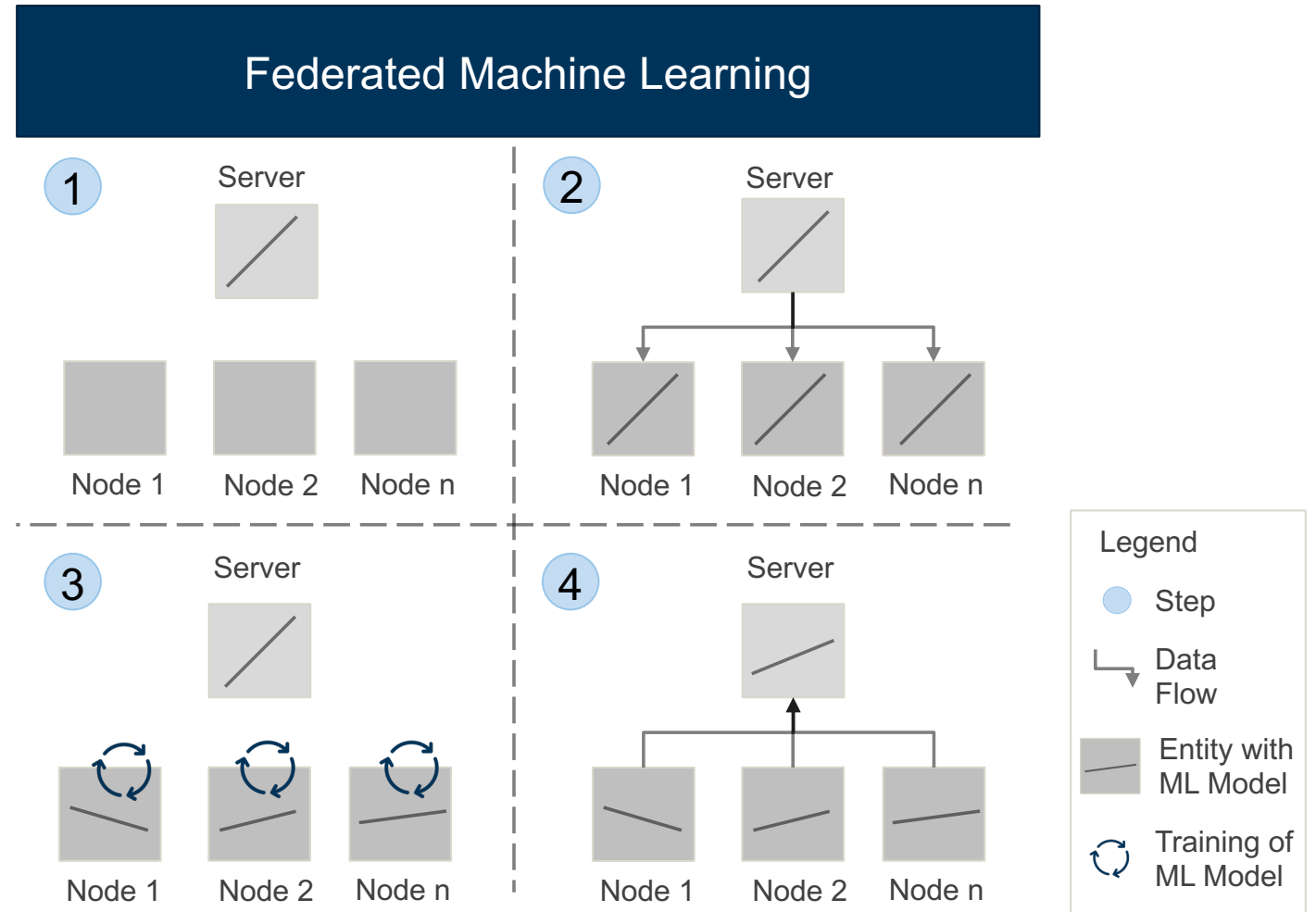
- Challenge

Machine Learning (ML) projects are limited due to insufficient data and data silos, i.a.

- Data Privacy
- Industry Competition
- Regulations on Data Protection
- Efficiency

- Federated Machine Learning enables collaborative development of a global model while keeping data decentralized

- Use Cases in Different Industries, e.g. Medicine



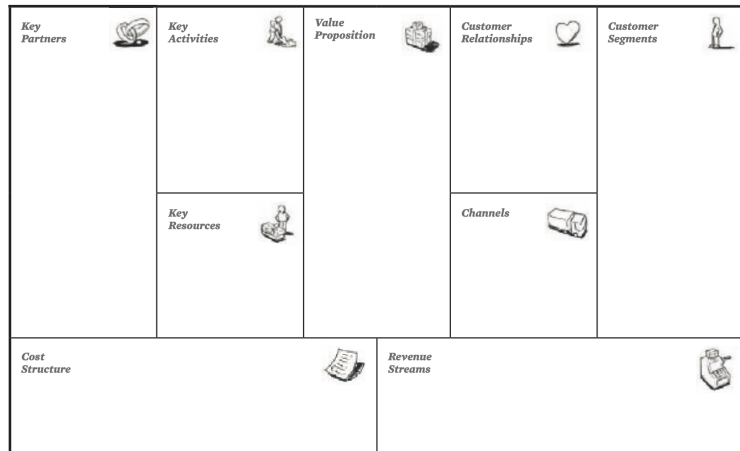
[Ya19] Yang, Q., et al.: Federated Machine Learning: Concept and Applications

[Lo21] Lo, S., et. al.: A Systematic Literature Review on Federated Machine Learning: From a Software Engineering Perspective

[Ka21] Kaissis, G., et al.: End-to-end privacy preserving deep learning on multi-institutional medical imaging

Collaborative Business Models

Business Model Canvas¹



→ Several approaches for Collaborative and Interorganizational Business Models in specific areas

Observation

- Challenging especially when multiple companies are involved²
- Alliance failure rates are high, leaving much revenue at risk and value unrealized³
- Complex to operationalize³



Conclusion

- Align with operational governance
- Suggest attributes that support successful implementation⁴

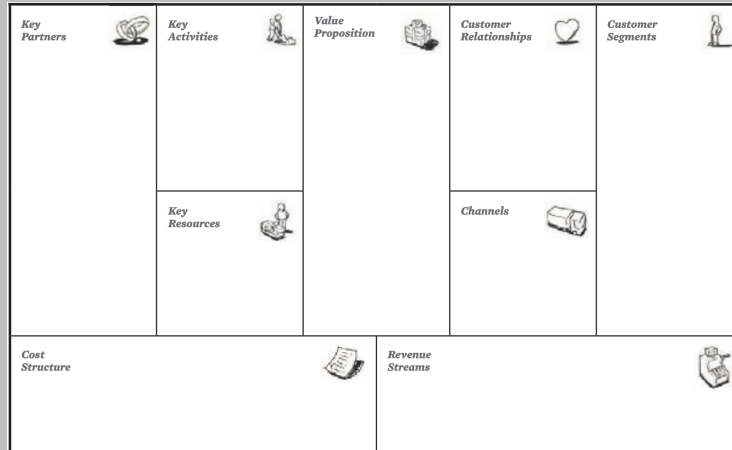
¹ [Os10] Osterwalder, A., Pigneur, Y.: *Business Model Generation: A Handbook For Visionaries, Game Changers, and Challengers*

² [Pa21] Pauna, T., et al.: *Challenges for implementing collaborative practices in industrial engineering projects*

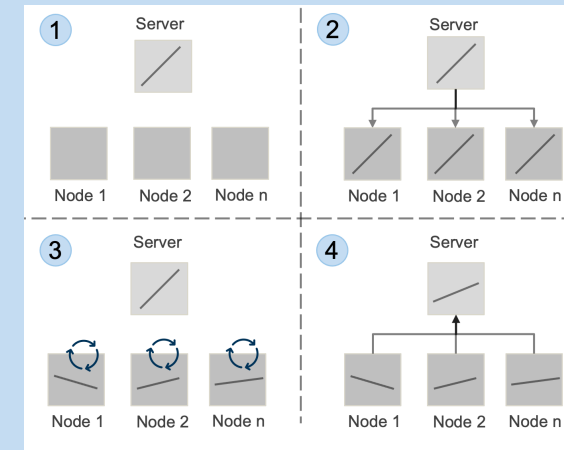
³ [Ma19] de Man, A., Luvison, D.: *Collaborative business models: Aligning and operationalizing alliances*

⁴ [Cu21] Curtis, S.: *Business model patterns in the sharing economy*

Collaborative Business Models



Federated Machine Learning



Main Challenges

- What are foundational elements of Collaborative Business Models determined by Interorganizational Federated Machine Learning?
- How can they be operationalized?

Research Title

Towards Collaborative Business Models for Interorganizational Federated Machine Learning

RQ1

What are governance-related challenges of interorganizational Federated Machine Learning in distinction to prevailing collaborative Business Models?

RQ2

What are the foundations of governing Machine Learning processes, and how can they be derived to interorganizational Federated Machine Learning?

RQ3

Which benefits does a Governance Concept provide for interorganizational Federated Machine Learning, and what limitations can be identified?

Research Questions

- RQ1** What are governance-related challenges of interorganizational Federated Machine Learning in distinction to prevailing Collaborative Business Models?
- RQ2** What are the foundations of governing Machine Learning processes, and how can they be derived to interorganizational Federated Machine Learning?
- RQ3** Which benefits does a Governance Concept provide for interorganizational Federated Machine Learning, and what limitations can be identified?



RQ1

Literature Review

- Status-Quo Collaborative Business Models
- Identify Challenges for Federated Machine Learning



RQ2

Concept

- Identify Roles and Life Cycle Processes
- Derive Concept



RQ1-3

Interviews

- Determine Challenges and Requirements for Concept
- Validate Concept

RQ1

What are governance-related challenges of interorganizational Federated Machine Learning in distinction to prevailing Collaborative Business Models?

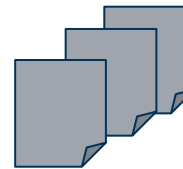
1 Preliminary Search

Base literature

- Theory Business Models (5)
- Collaborative Projects (8)

2 Search String: S1 AND S2

- **S1: Collaborative**
interorganization* OR collaborati* OR intercompany
OR cross-company OR [...]
- **S2: Business Model**
"business model*" OR "model canvas" OR "business value model*"



262 unfiltered



3 Electronic Data Sources²

- IEEE Xplore
- ACM Digital Library
- ScienceDirect
- Wiley InterScience
- SCOPUS

In Progress

4 Quality Check

- Inclusion and Exclusion Criteria

5 Backward Search

- Inclusion and Exclusion Criteria

6 Extract Data & Synthesize

- Document Outcomes

¹ [Ki15] Kitchenham, B.: Evidence-Based Software Engineering and Systematic Reviews

² [Ch10] Chen, L., Babar, M., Zhang, H.: Towards an Evidence-Based Understanding of Electronic Data Sources

RQ2

What are the foundations of governing Machine Learning processes, and how can they be derived to interorganizational Federated Machine Learning?

Key Activities

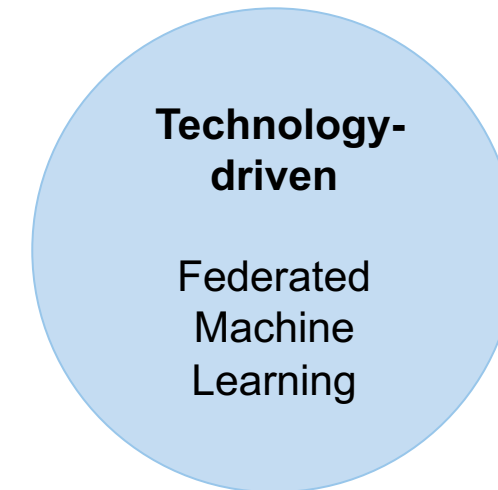
Life-Cycle-Management of Federated Machine Learning, i.a.

- Setup
- Training
- Deployment
- Maintenance
- Retirement

Key Roles

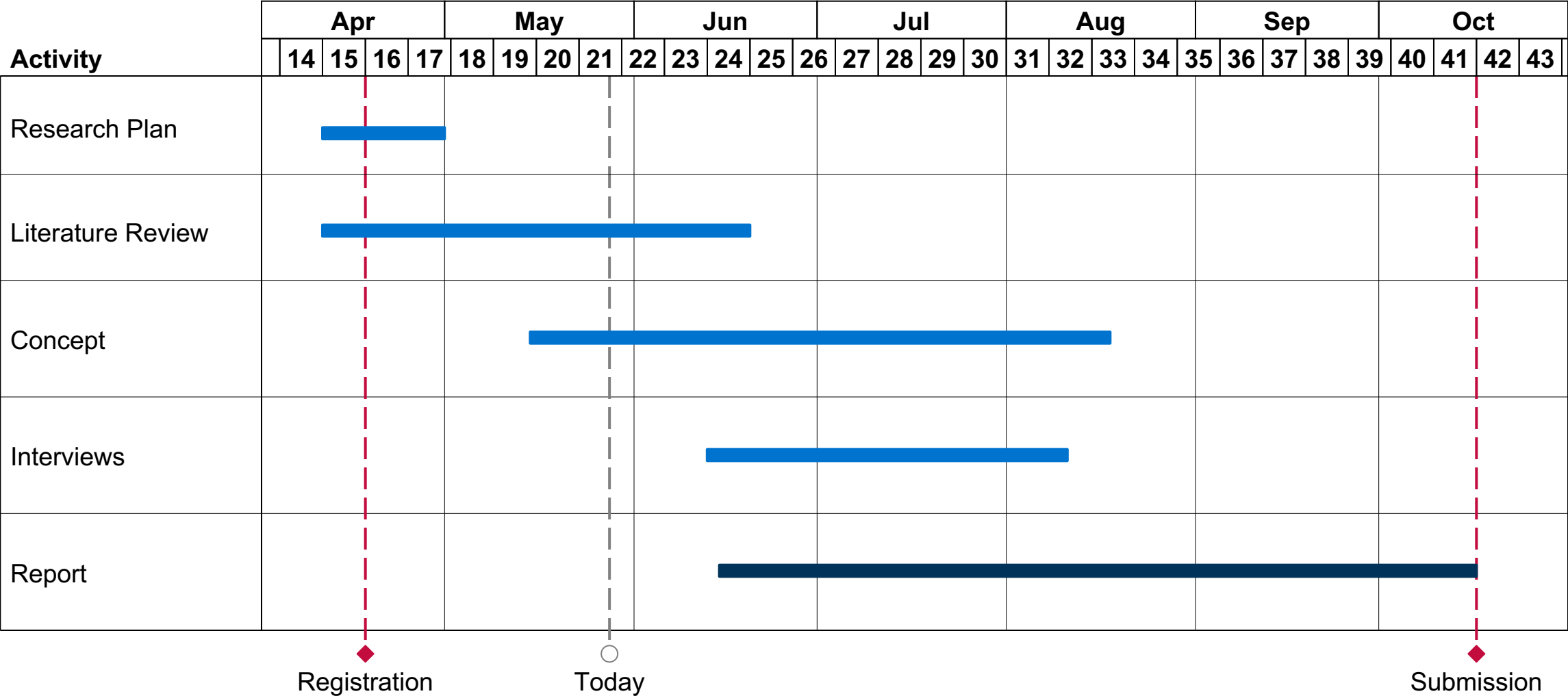
Seven Core Roles, e.g.

Model Owner and Model Builder



- Inclusion Criteria
 - Experience with Interorganizational Federated Machine Learning Projects
 - Real-World Scenario
- Current Status: 10-12 Contacts
- Format: 1 Hour
- Prepared Interview Guide
 - Category A: General Introduction
 - Category B: Motivation for Federated Machine Learning Projects
 - Category C: Challenges in Federated Machine Learning Projects
 - Category D: Implementation Collaborative Business Model
 - Category E: Outlook

Time Schedule





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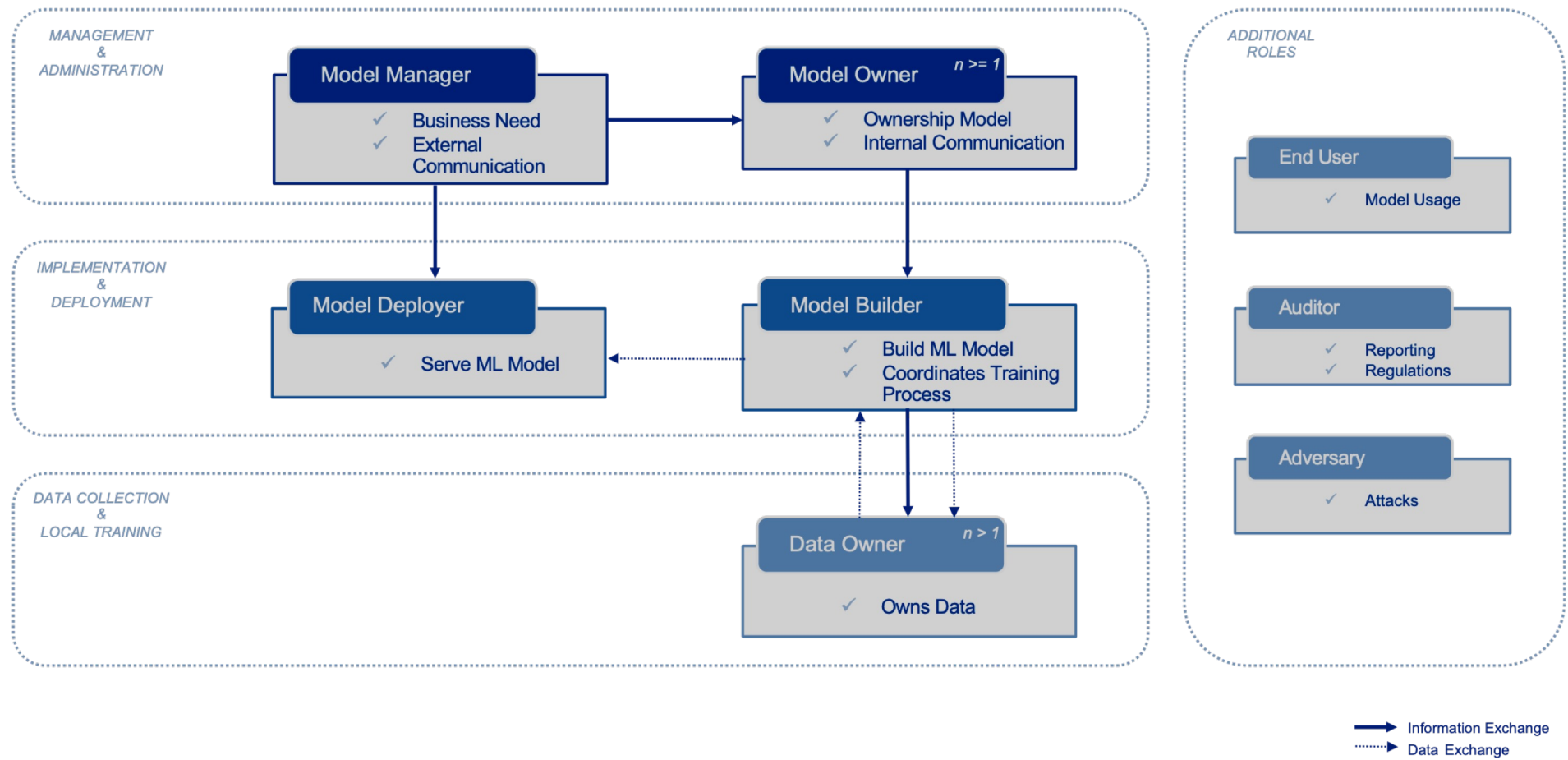
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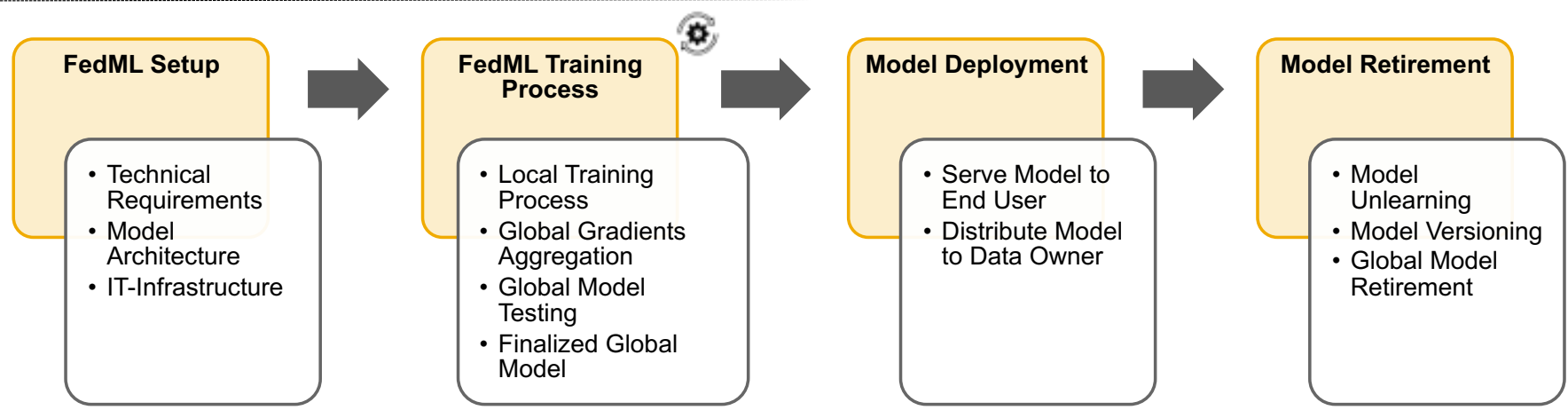
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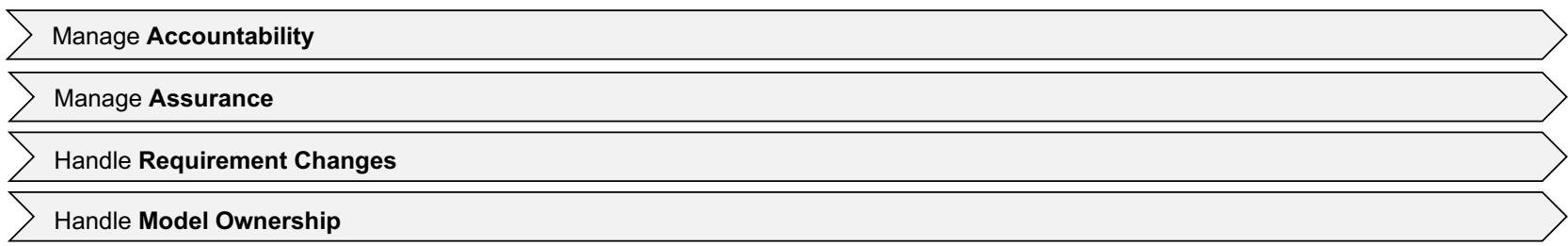
Appendix A: Preliminary Roles



Core Process



Parallel Activities



[Ch21a] Chandrasekaran, et al. "SoK: Machine Learning Governance"

Appendix C: Inclusion and Exclusion Criteria

ID	Facet	Inclusion criterion	Exclusion criterion
F1	Coarse Focus	Within the field of computer science and technology	Any other subfield
F2	Narrow Focus	Business Models and interorganizational collaborations	Any other focus
F3	Publication Channel Type	Conference, journal or workshop publication	Any other publication
F4	Language	English or German	Any other language
F5	Duplicates	Publications are new to filtering process	Has already been processed
F6	Peer-Review	Publication has been peer-reviewed	Publication is a grey publication
F7	Full-Text Access	TUM-Access granted	Access not granted