UNIKASSEL VERSITÄT

DISTRIBUTED SYSTEMS

The (C)omprehensive (A)rchitecture (P)attern (I)ntegration method: Navigating the sea of technology

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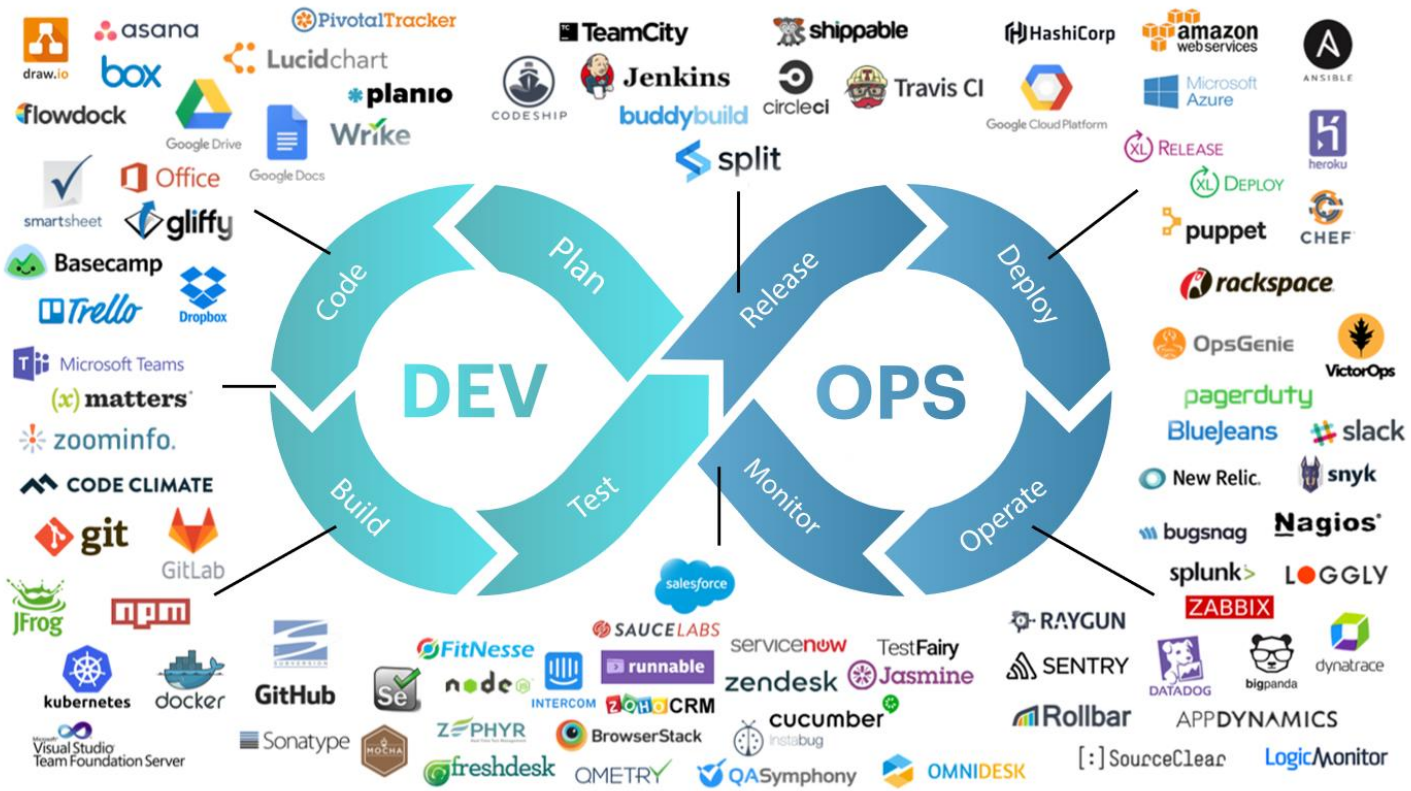
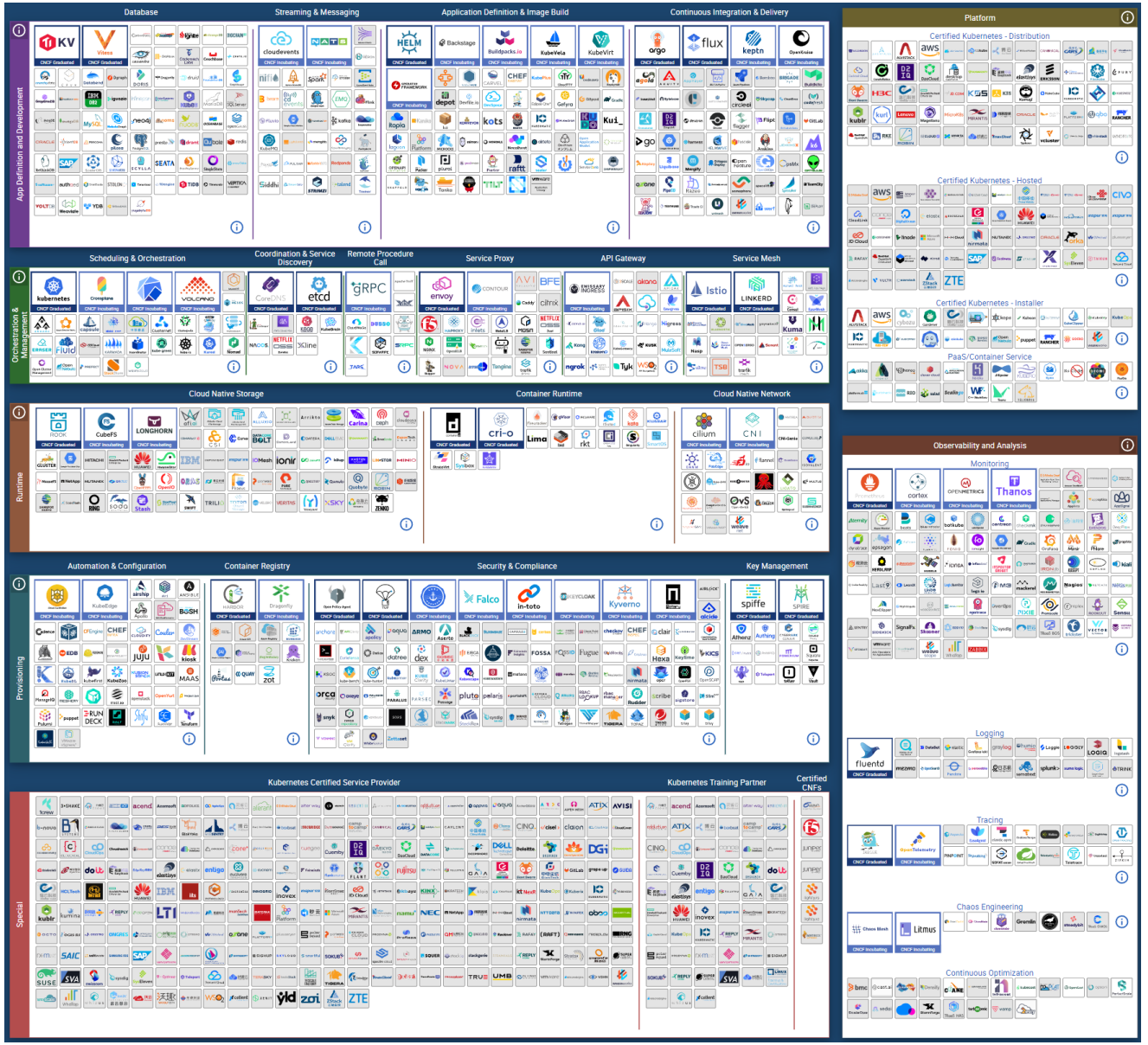
Distributed Systems / Innovationfield Digital Ecosystems

at AMP2025 on ECSA2025

Motivation – Many tools for many problems



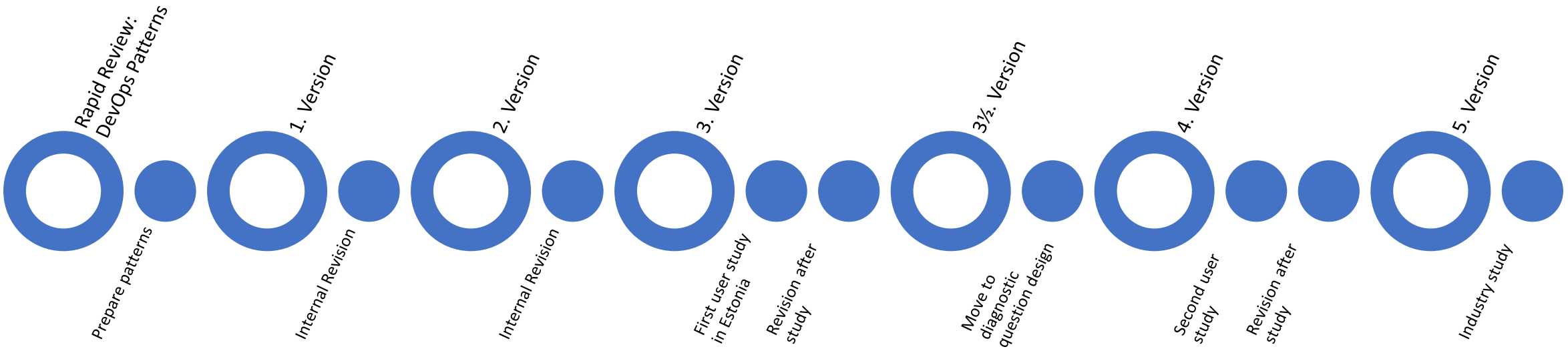
Motivation – Possible solutions also complex



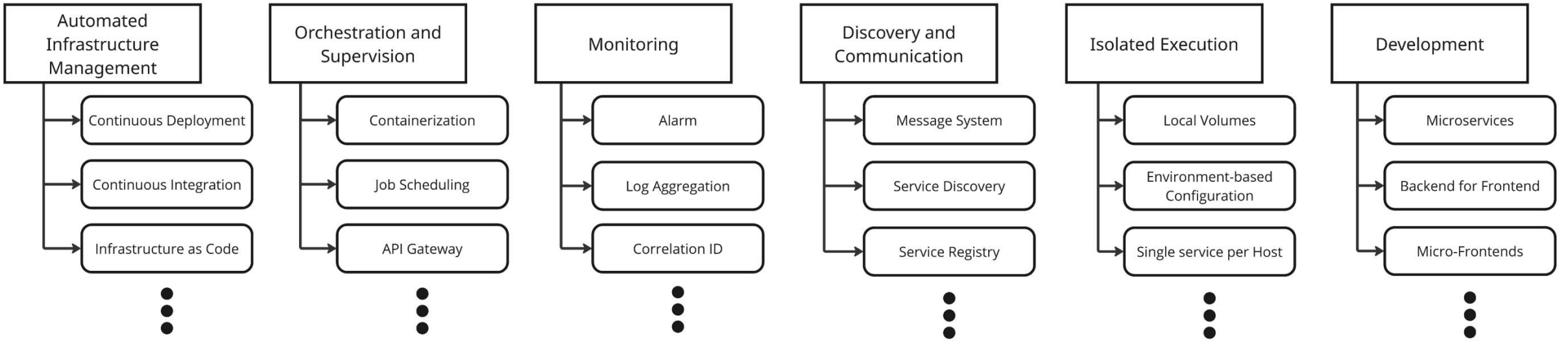
Goals

- RQ1: How do practitioners select software architectures for their project?
- RQ2: What problems do the practitioners face during this process?
- RQ3: How does the CAPI method help industry practitioners select better software architectural designs more easily?

The CAPI method – The way to CAPI

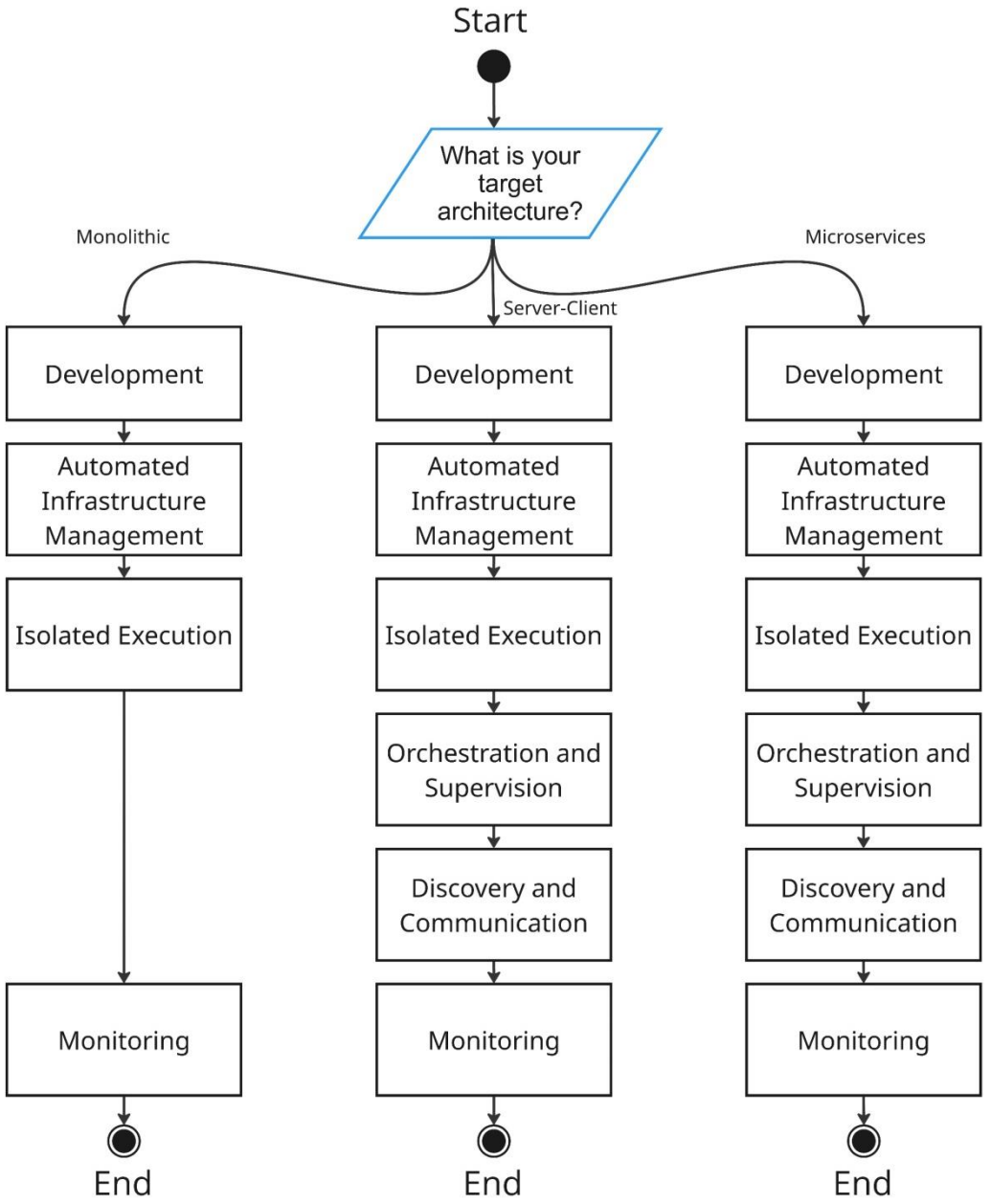


The CAPI method – The patterns

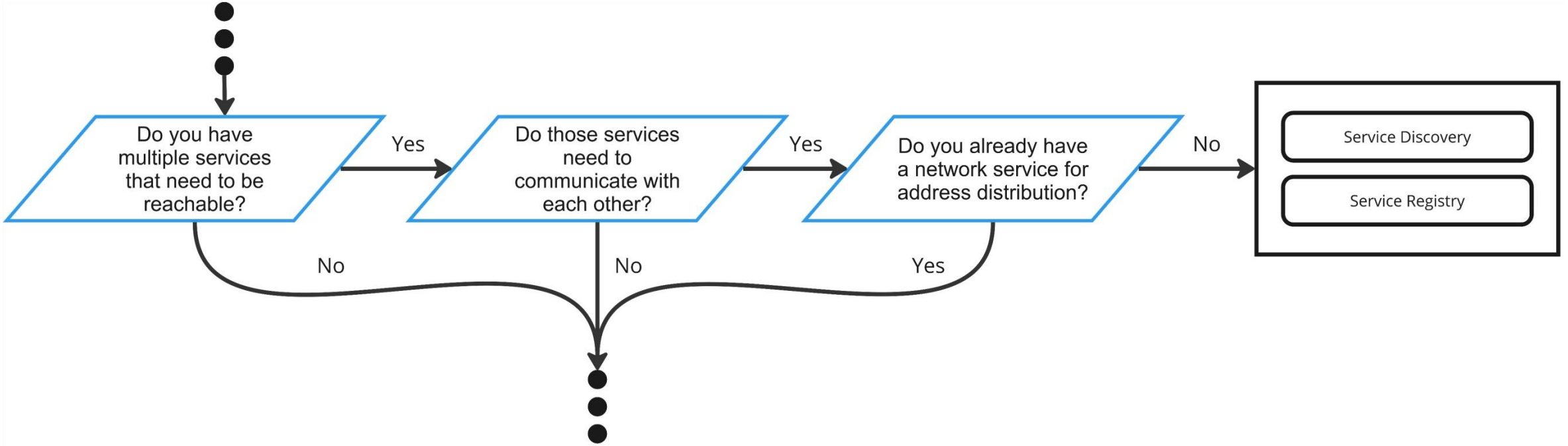


[1] Copei, S., Kosiol, J. (2024). DevOps Patterns: A Rapid Review. In: ECSA 2023 Tracks, Workshops, and Doctoral Symposium.

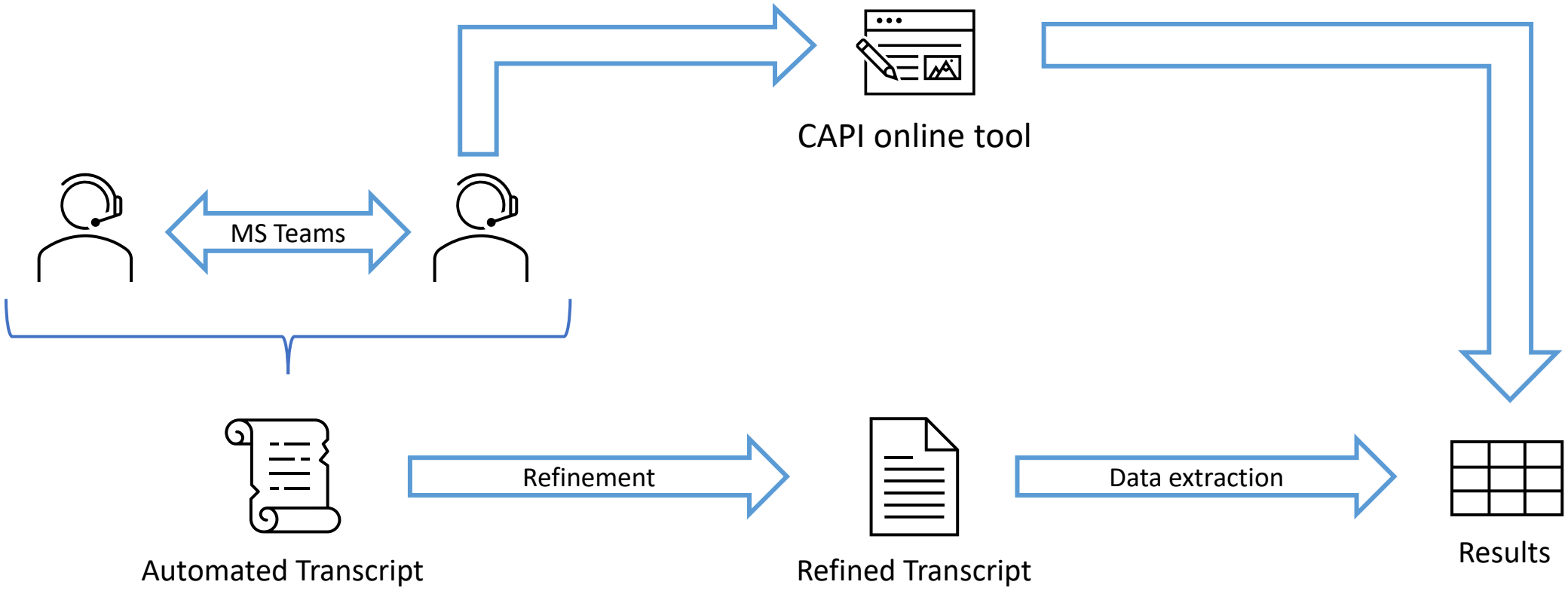
The CAPI method – The decision tree



The CAPI method – Question design

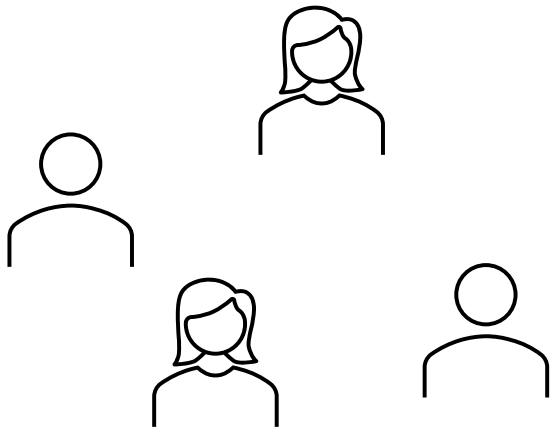


Study Design – Interviews and data extraction

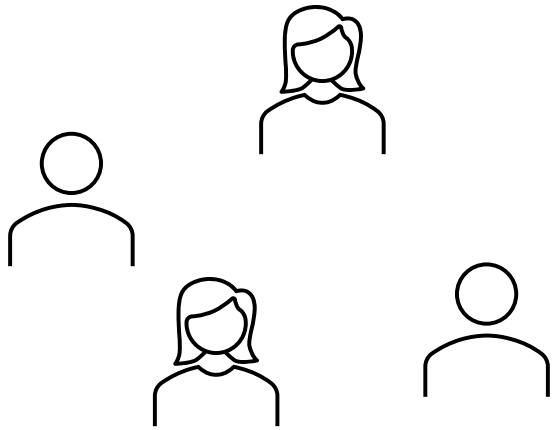


Study Design – Grouping

About to adopt DevOps (G1)



Have adopted DevOps (G2)



Study design – Questions

Question ID	Question text
Q1	Do you have a process for identifying necessary technologies?
Q2	Could there be problems with this process?
Q3	Would the tree have helped you with your problems in identifying necessary technologies?
Q4	Would the result of the tree now help you implement DevOps?

Question ID	Question text
Q5	How did you select the necessary technologies?
Q6	Have you encountered any problems with this approach?
Q7	Would the tree have helped you with your problems in identifying necessary technologies?
Q8	How much does the result of the tree differ from the stack you are actually using?

Results – Participants

Participant ID	Company ID	Industry Sector	Position	Group
P1	C1	Heat Industry	Software Engineer	2
P2	C1	Heat Industry	Software Engineer	2
P3	C2	Energy Economics	Software Engineer	2
P4	C3	Energy Economics	Software Engineer	1
P5	C4	SAP	Technical Consultant	1
P6	C4	SAP	Technical Consultant	1
P7	C5	Multiple	Cloud Solution Architect	2
P8	C6	Consultant	Lead Architect	1
P9	C5	Multiple	Cloud Engineer	2
P10	C5	Multiple	Lead DevOps Engineer	1

Results – G1

Question ID	Answers	Participant
Q1	No	**5 / 5**
	Technologies were specified by client	2 / 5
	We rely on our experience and do it iteratively	4 / 5
Q2	No problems	1 / 5
	We possibly miss new things	2 / 5
	cost-intensive knowledge collection	1 / 5
Q3	Yes	**5 / 5**
	Good start	3 / 5
	As far as results are complete	1 / 5
	But method should suggest tools	2 / 5
	But method should show reasoning	1 / 5
Q4	Yes, the method would have helped us	**4 / 5**
	Good checklist	2 / 5
	Only missing relation between patterns	2 / 5
	Method should integrate in agile process	1 / 5
	No, as we do not know all the patterns	**1 / 5**

"…if there is a new requirement, we use a well-known technology for it, or search for a new one…"

"…CAPI is helpful, especial to understand the things I maybe forgot…"

Results – G2

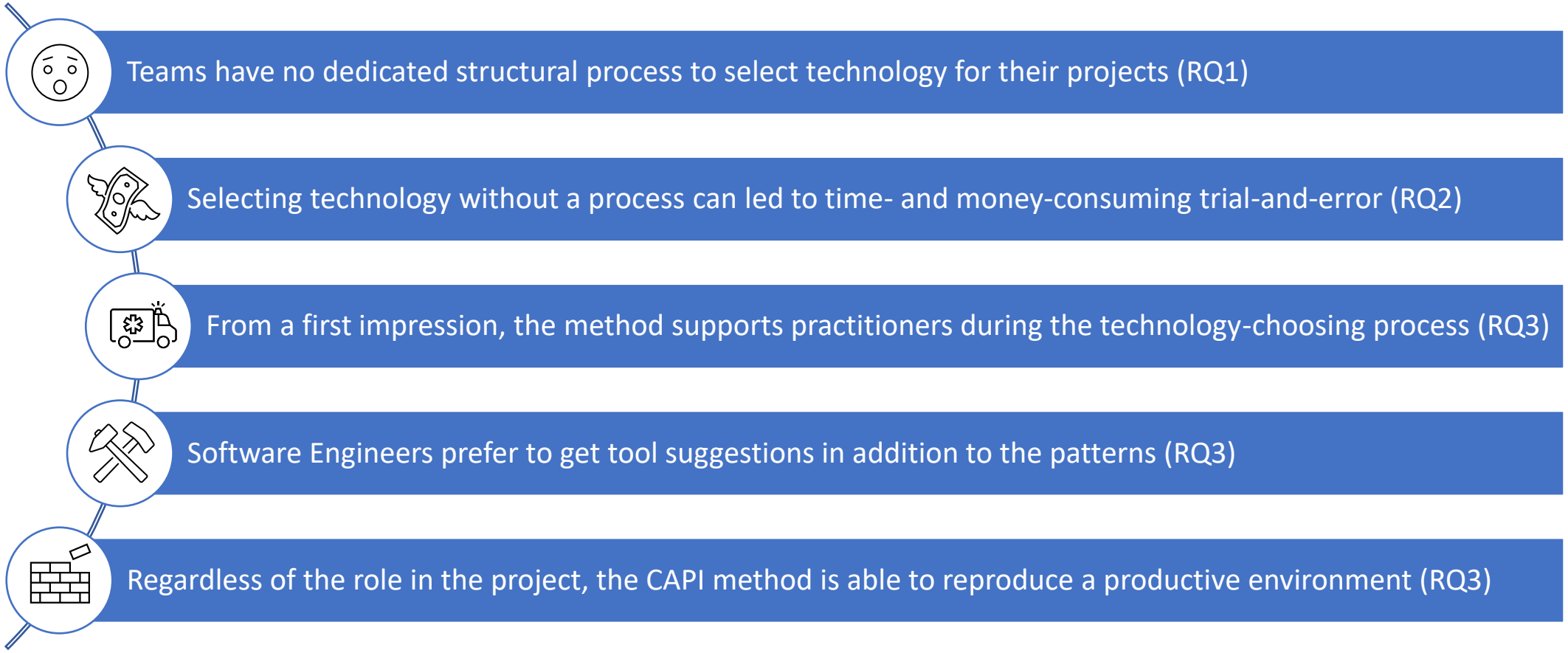
Question ID	Answers	Participant
Q5	No process, as our client specified many factors	4 / 5
	Trial-and-error if not specified	2 / 5
	From self-motivated employees	1 / 5
Q6	No, as everything was specified	2 / 5
	Trial-and-error is very cost-intensive	2 / 5
	correct timing for trying the next technology	1 / 5
Q7	Yes	**5 / 5**
	If method would suggest tools	4 / 5
	It helps focus on what is needed	2 / 5
	Only for greenfield project without client specifications	1 / 5
	Method should integrate in agile processes	1 / 5
	Only missing relation between patterns	1 / 5
Q8	On the first view, results match with our stack	5 / 5
	Some patterns we are using are not highlighted	2 / 5
	Method highlight even patterns that we plan to implement	1 / 5

"…most technology is specified due to compliance and governance rules of our client…"

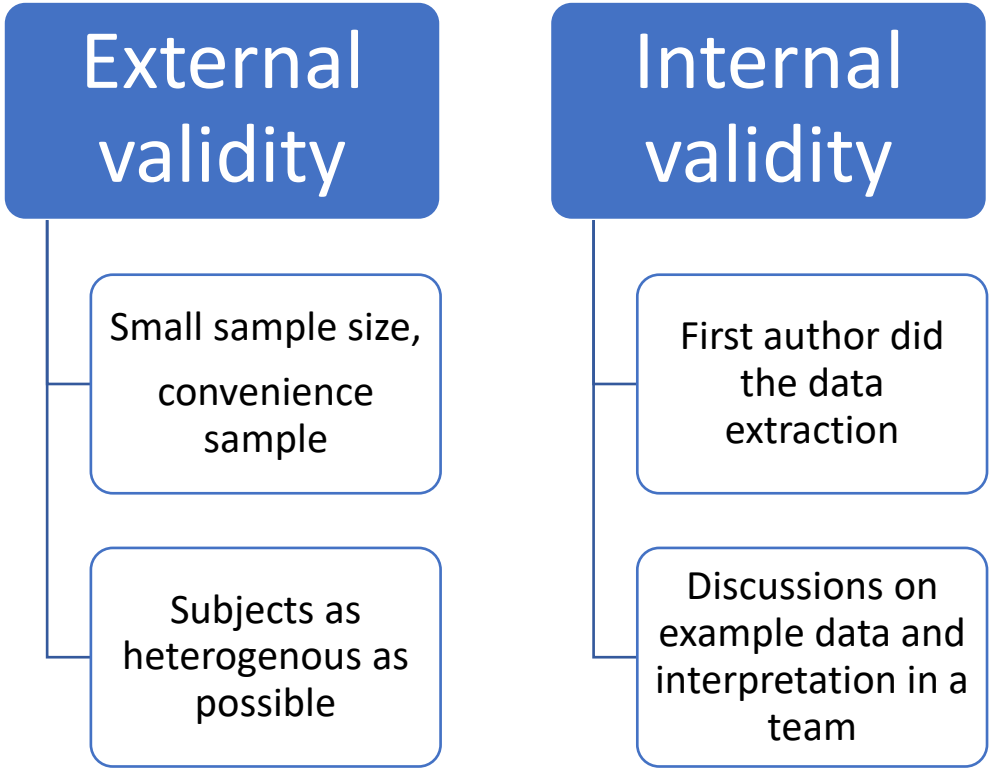
"…the focusing that CAPI enables, helps me to structure my application…"

"…actually, most of our architecture is covered by the results…"

Key findings



Threats to validity



Conclusion

Study	CAPI Method	Findings	Still open
• 10 Participants • 6 Companies • 2 Groups	• Iterative refinement process • Two user studies to develop the method • Industry study to investigate it in the real world	• Teams do not have process for technology selection • Trial-and-error is time- and money-consuming • The CAPI method may be a suitable to support practitioners during the technology selection process	• The CAPI method need to be improved due to the feedback from the interviews • How does LLM compare to the CAPI method, or do they possibly complement each other