Jun 4, 2024

STPA for Data-Driven Safety: A Google Case Study

Ruben Barroso, *Site Reliability Engineering*

Google

Big Picture

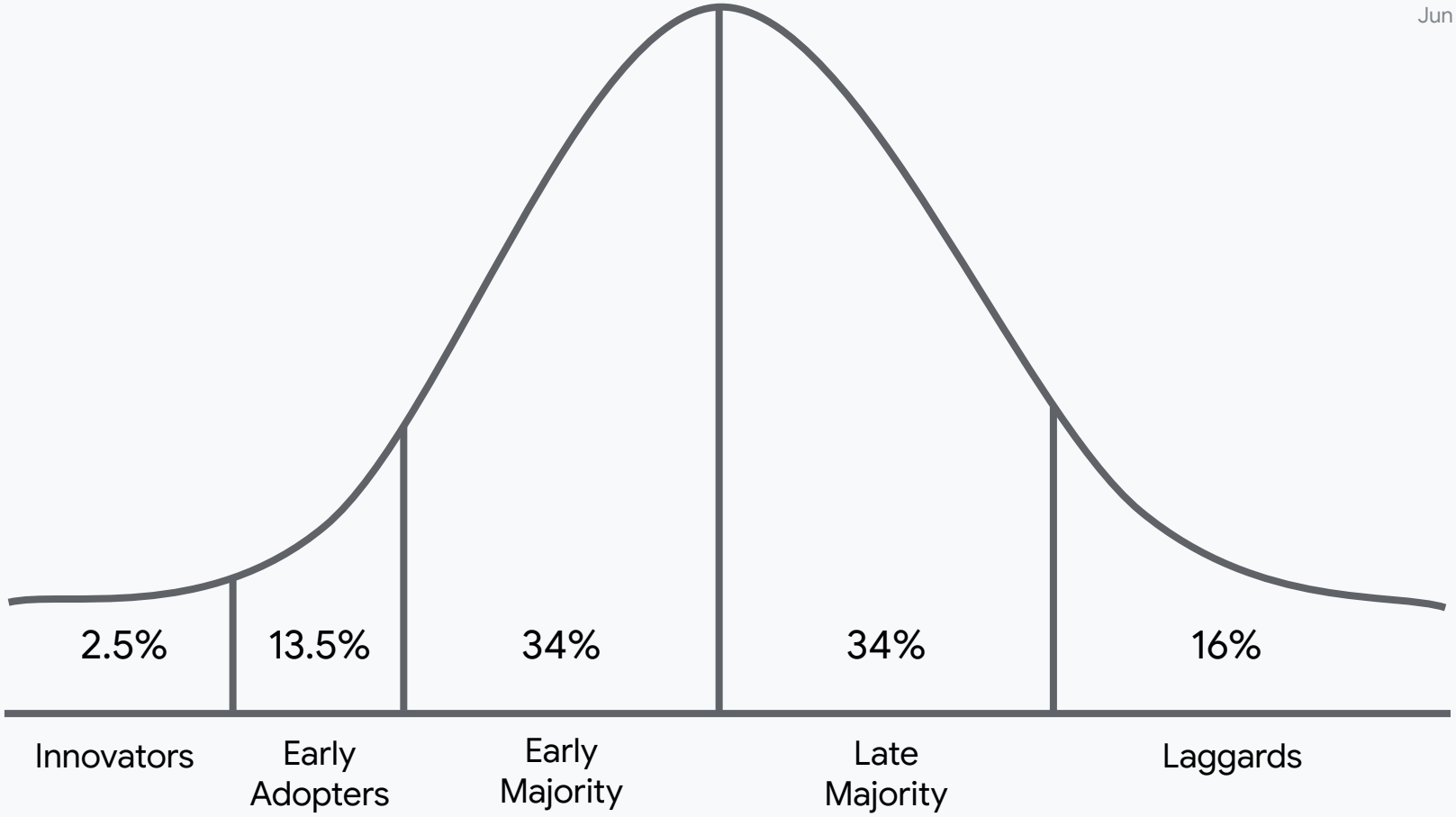
Three Challenges

Deep-Dive



STPA ADOPTION

The Big Picture



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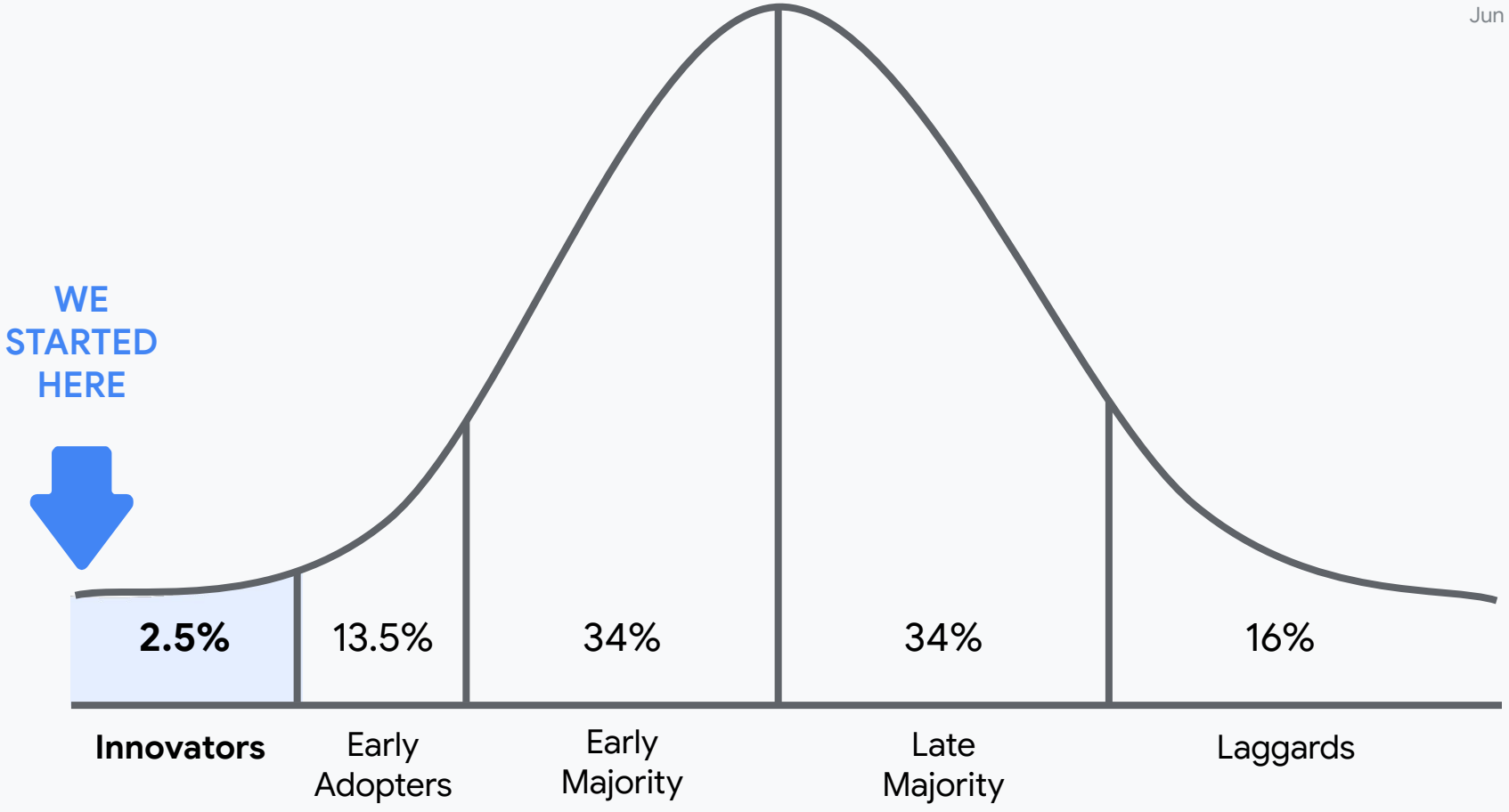

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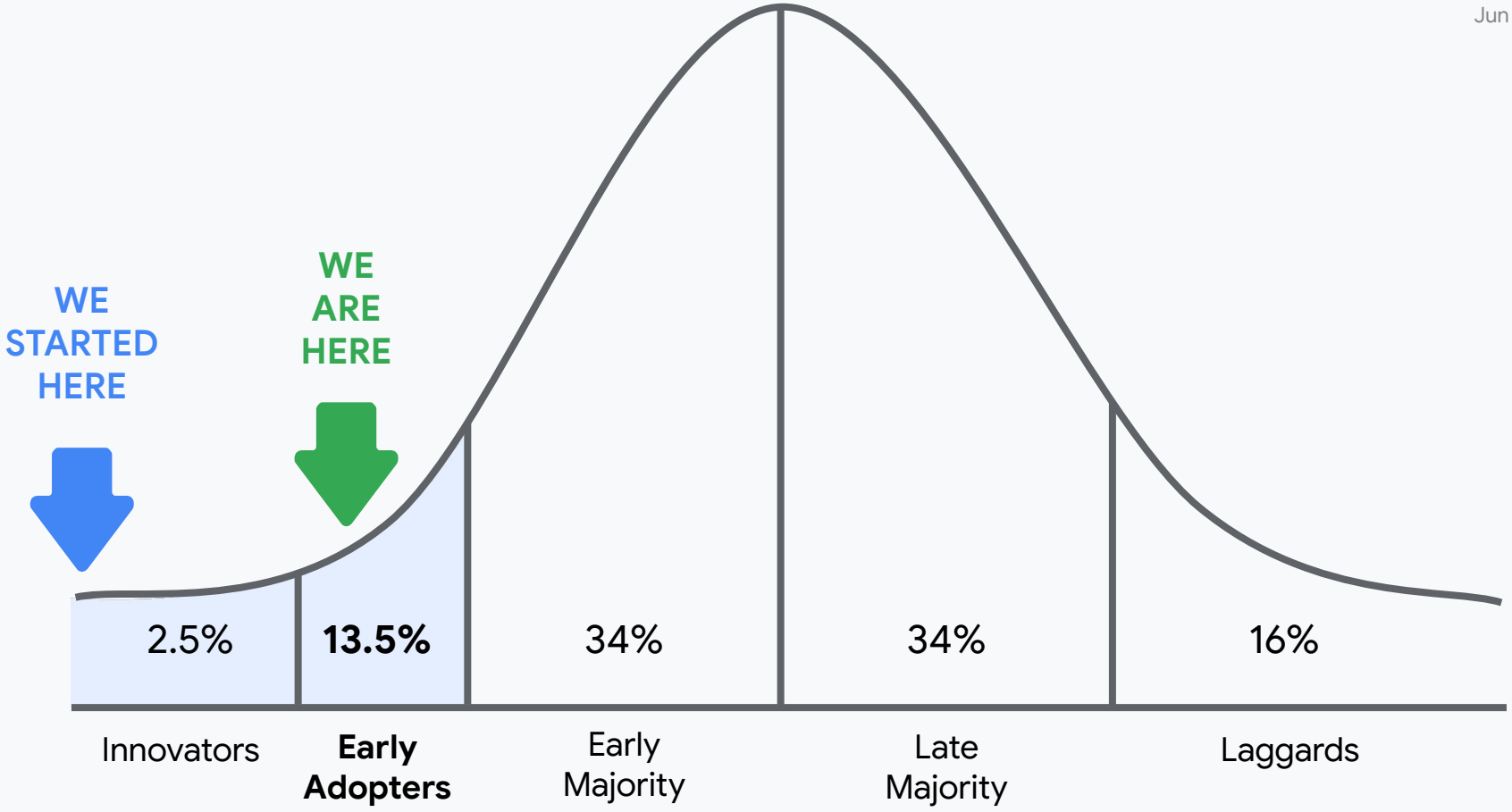

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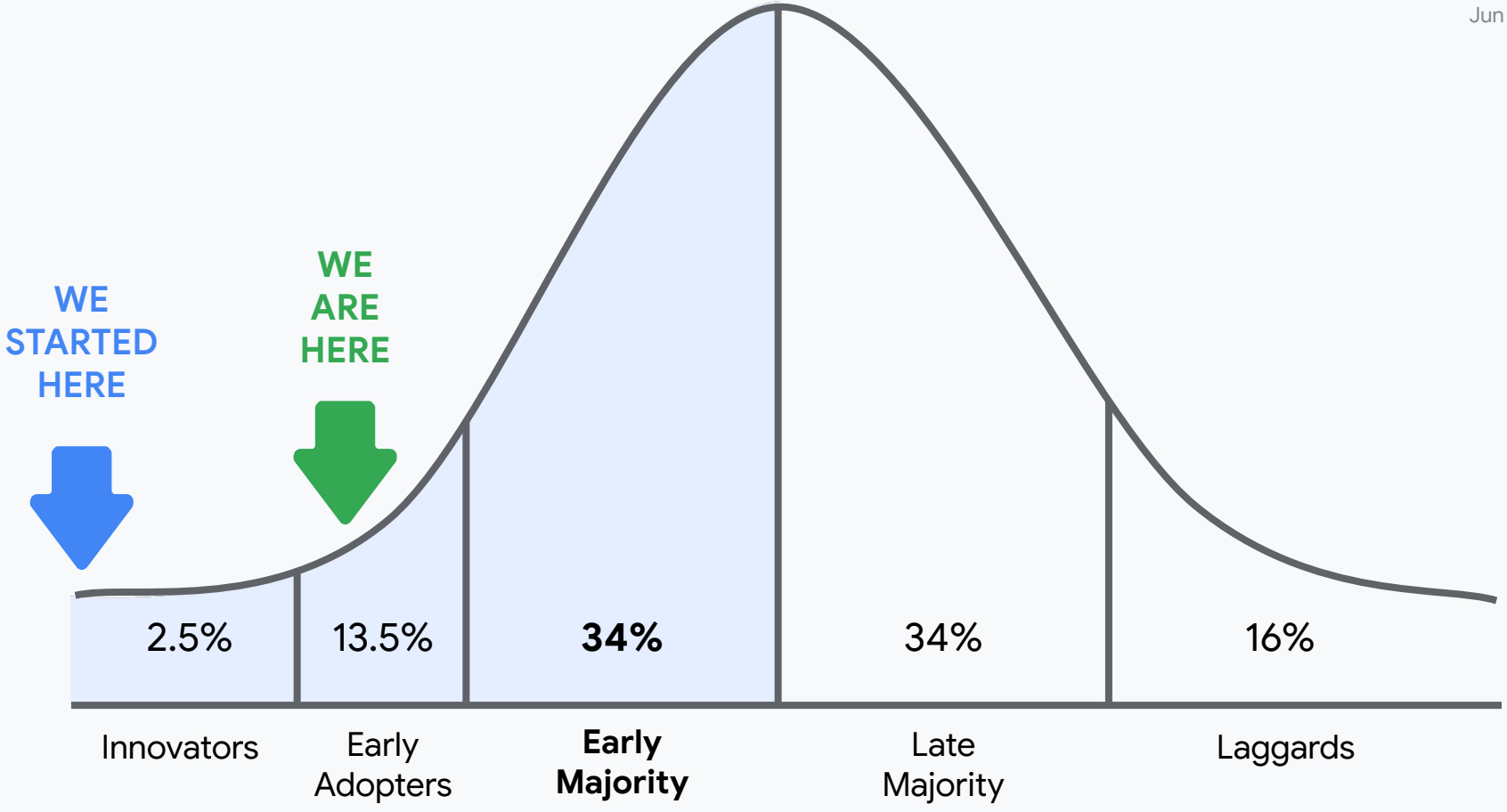

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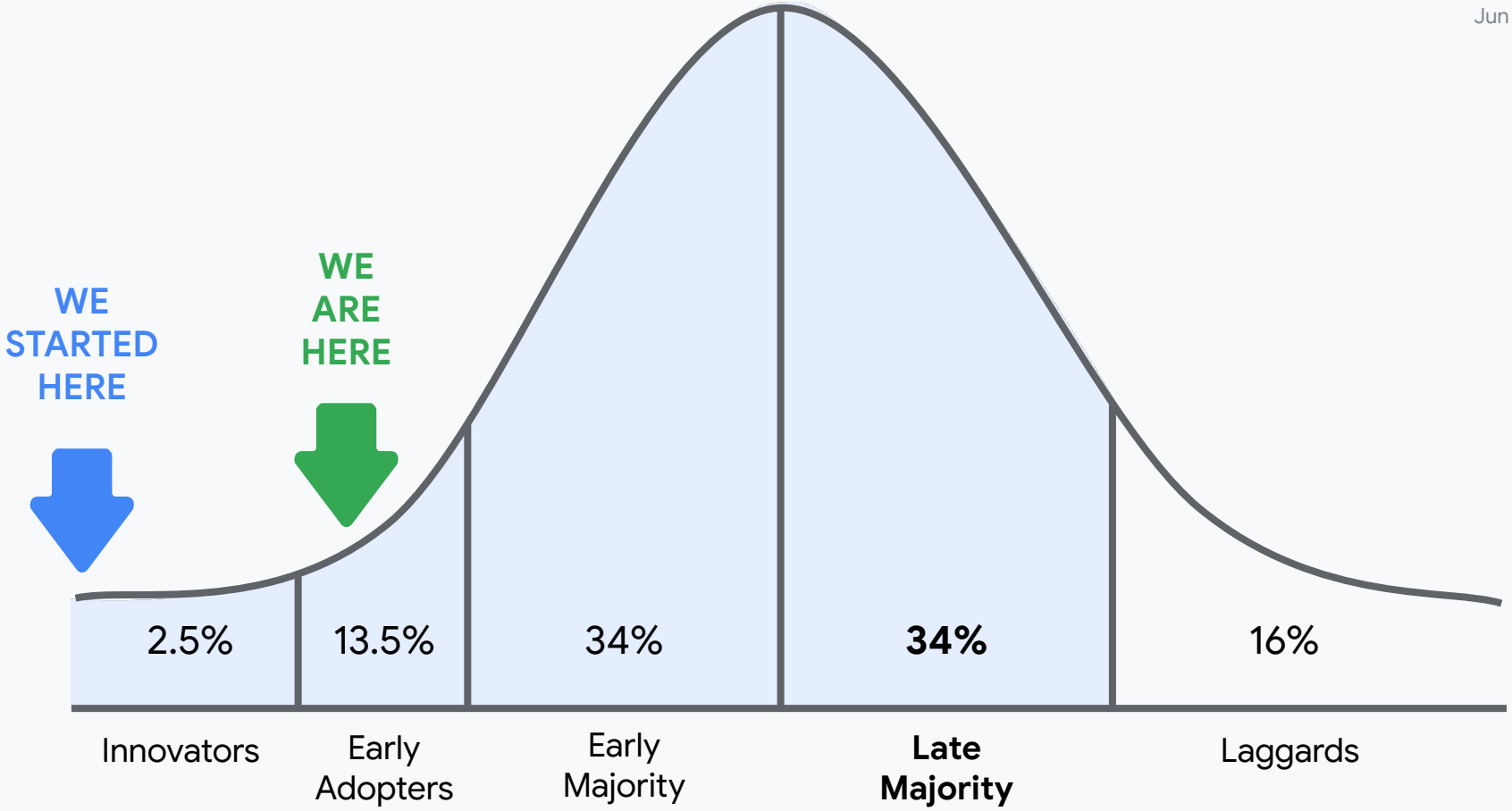

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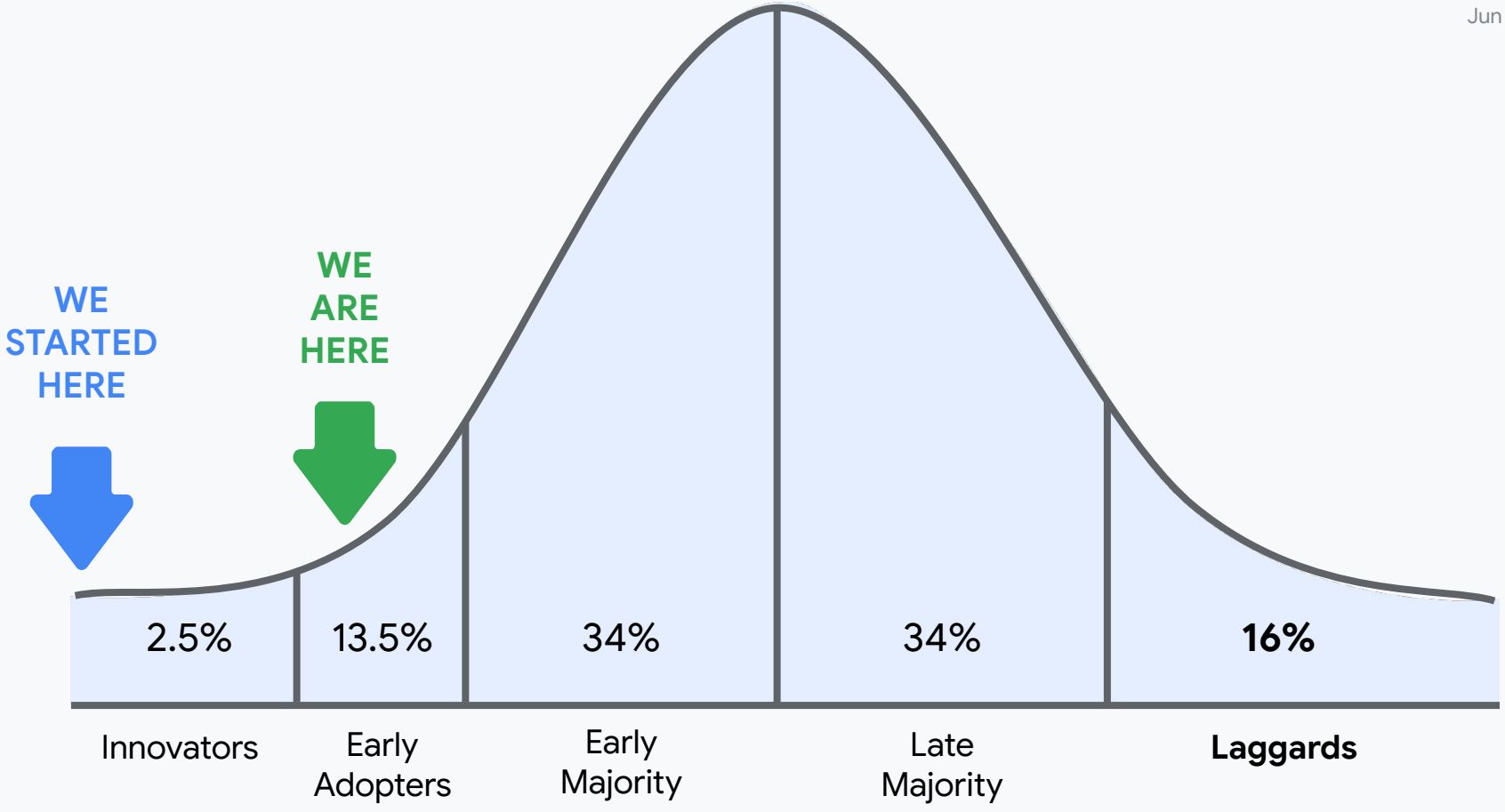

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STPA ADOPTION

Three Challenges

Buy-in

*"Does STPA produce tangible **improvements** in our systems or processes?"*

Scalability

"Is STPA scalable to handle the complexity of our systems?"

Efficiency

*"Can STPA be **executed quickly** enough?"*

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DEEP DIVE

Risk With Colored Pencils



Data Products



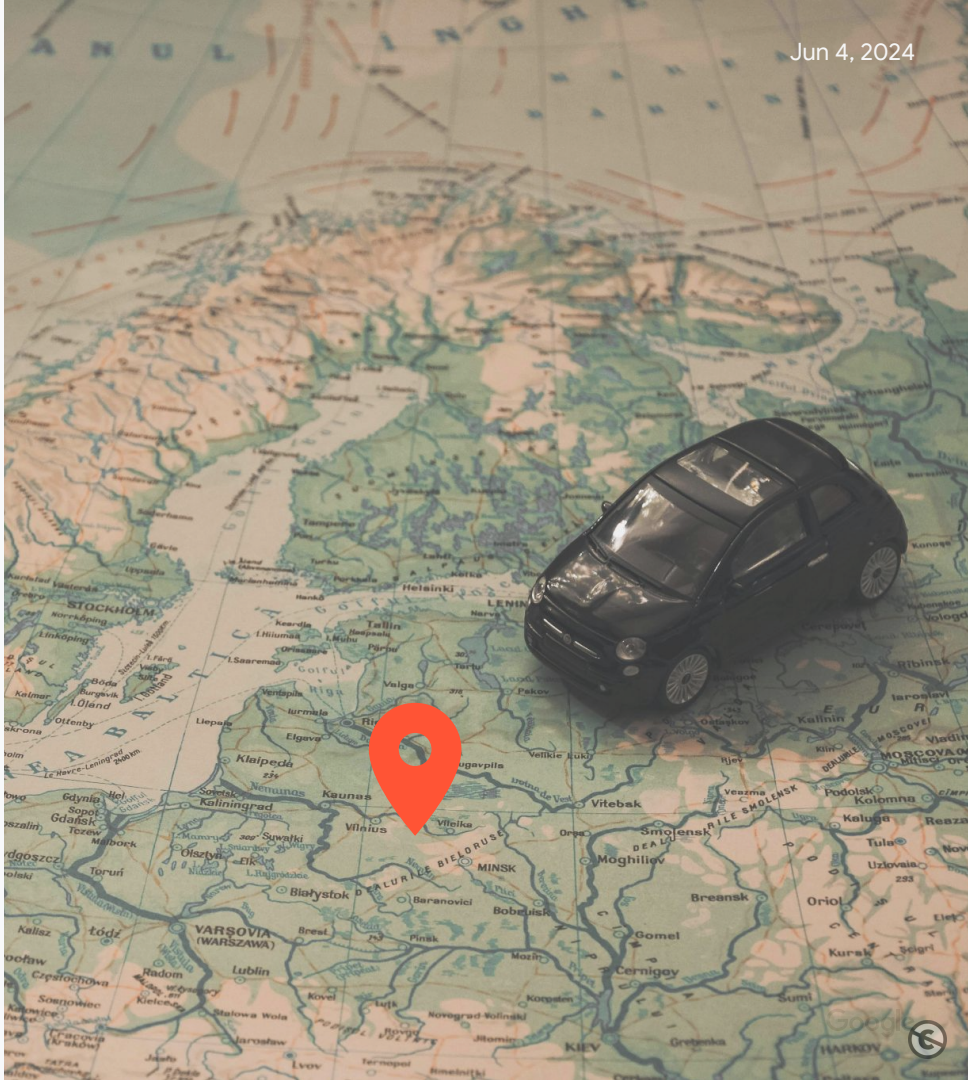






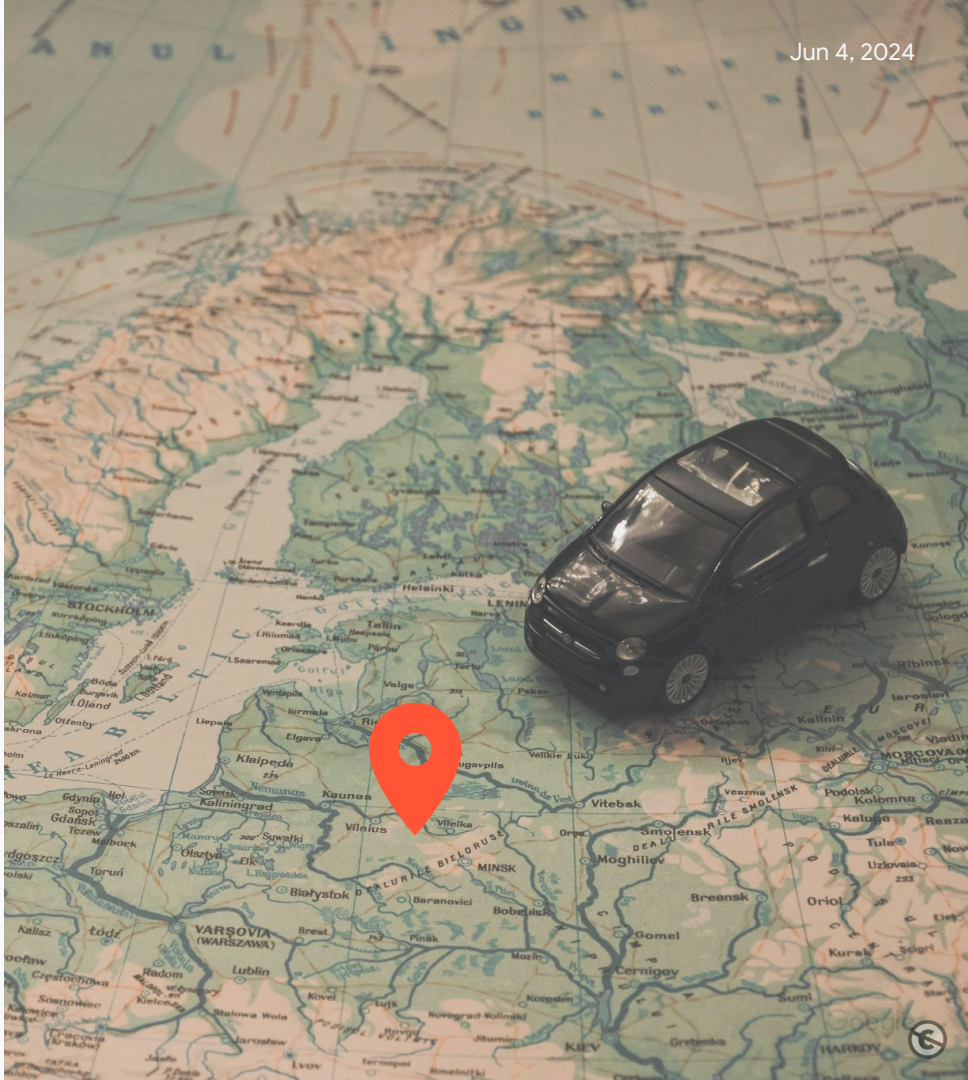






Data Products

*"What is the **risk** associated to each one of those **data products**?"*



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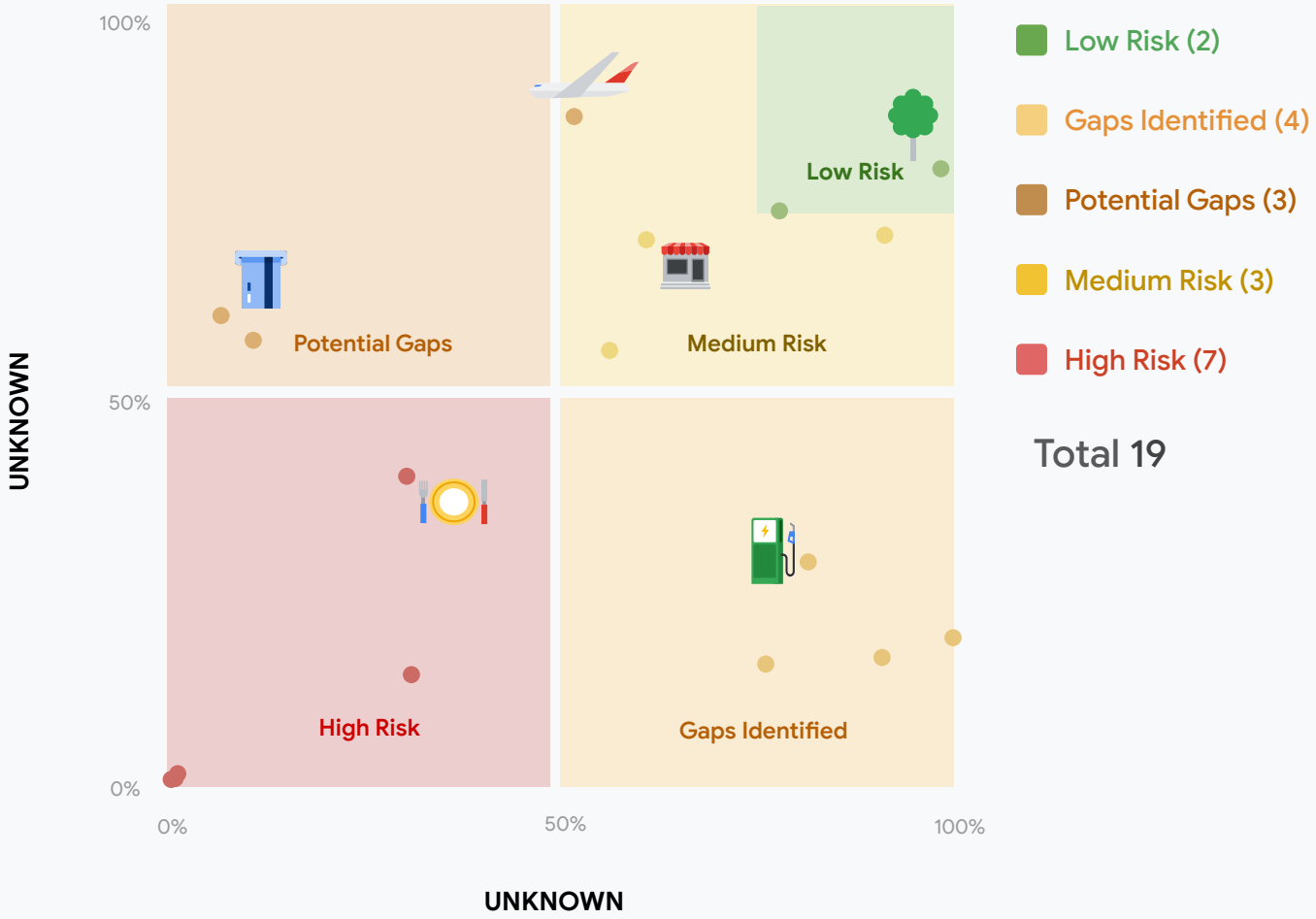
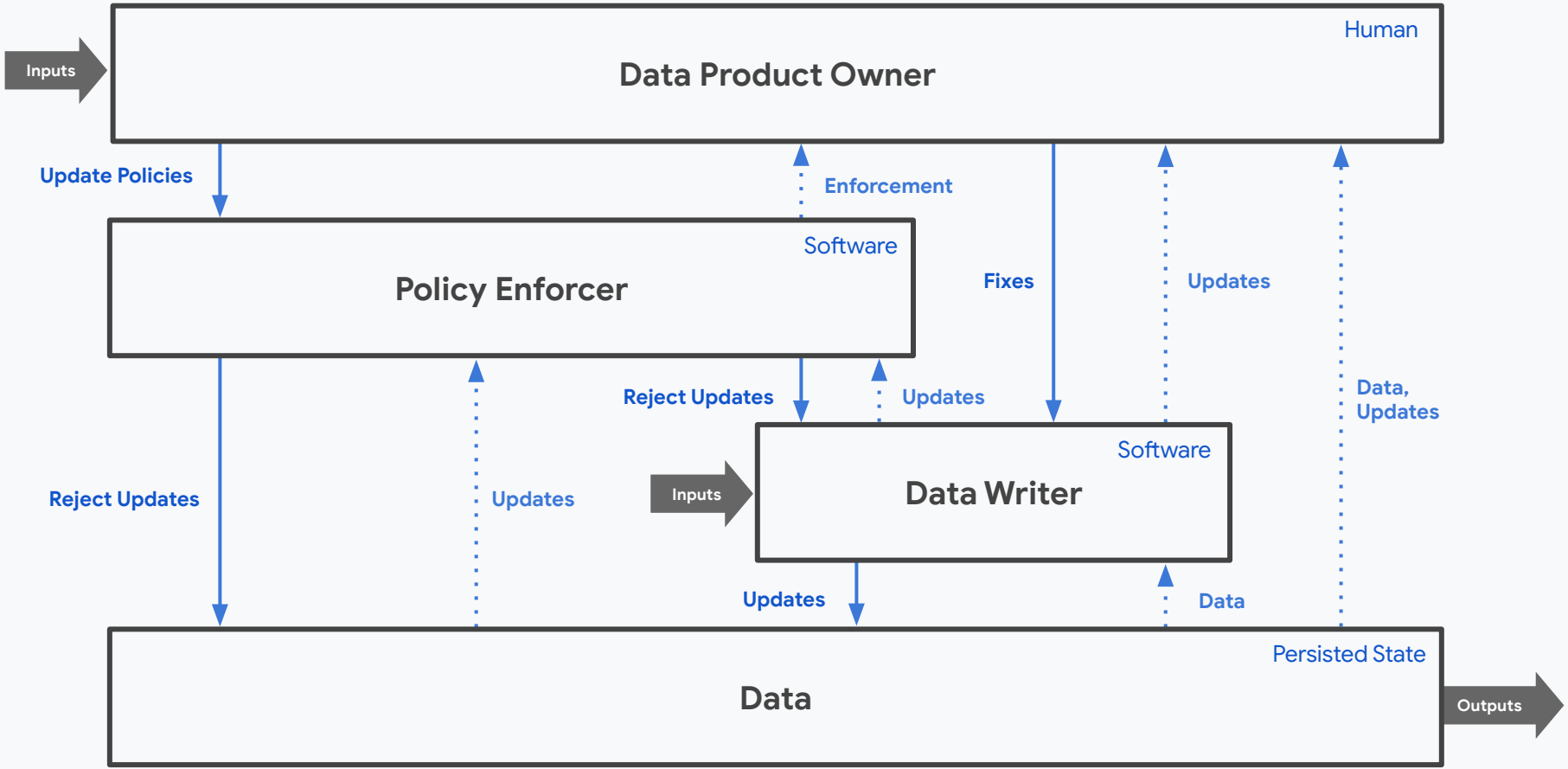


Google


Inputs
Human
Data Product Owner
Update Policies
Enforcement
Software
Policy Enforcer
Fixes
Updates
Data,
Updates
Reject Updates
Updates
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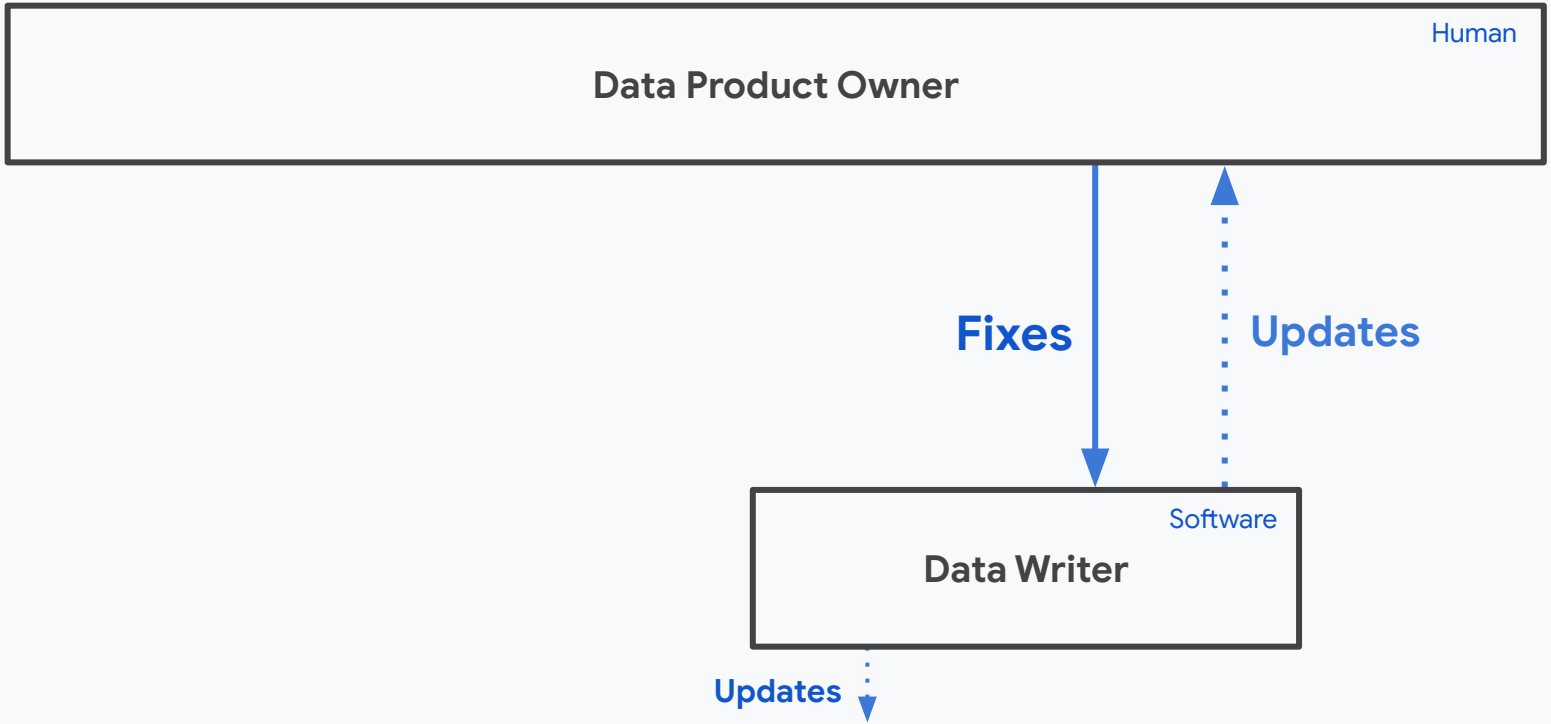
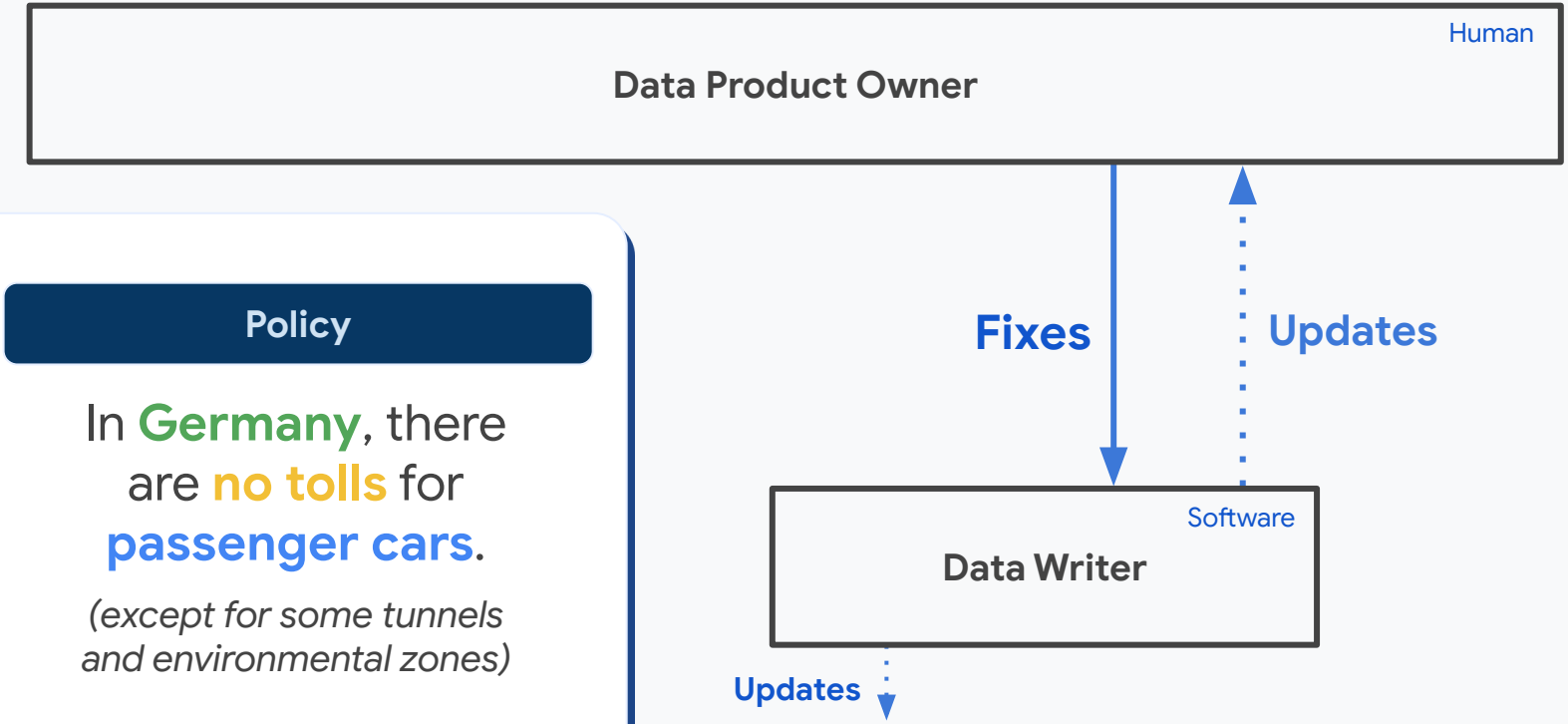
Updates
Inputs
Software
Data Writer
Updates
Data
Persisted State
Data
Outputs

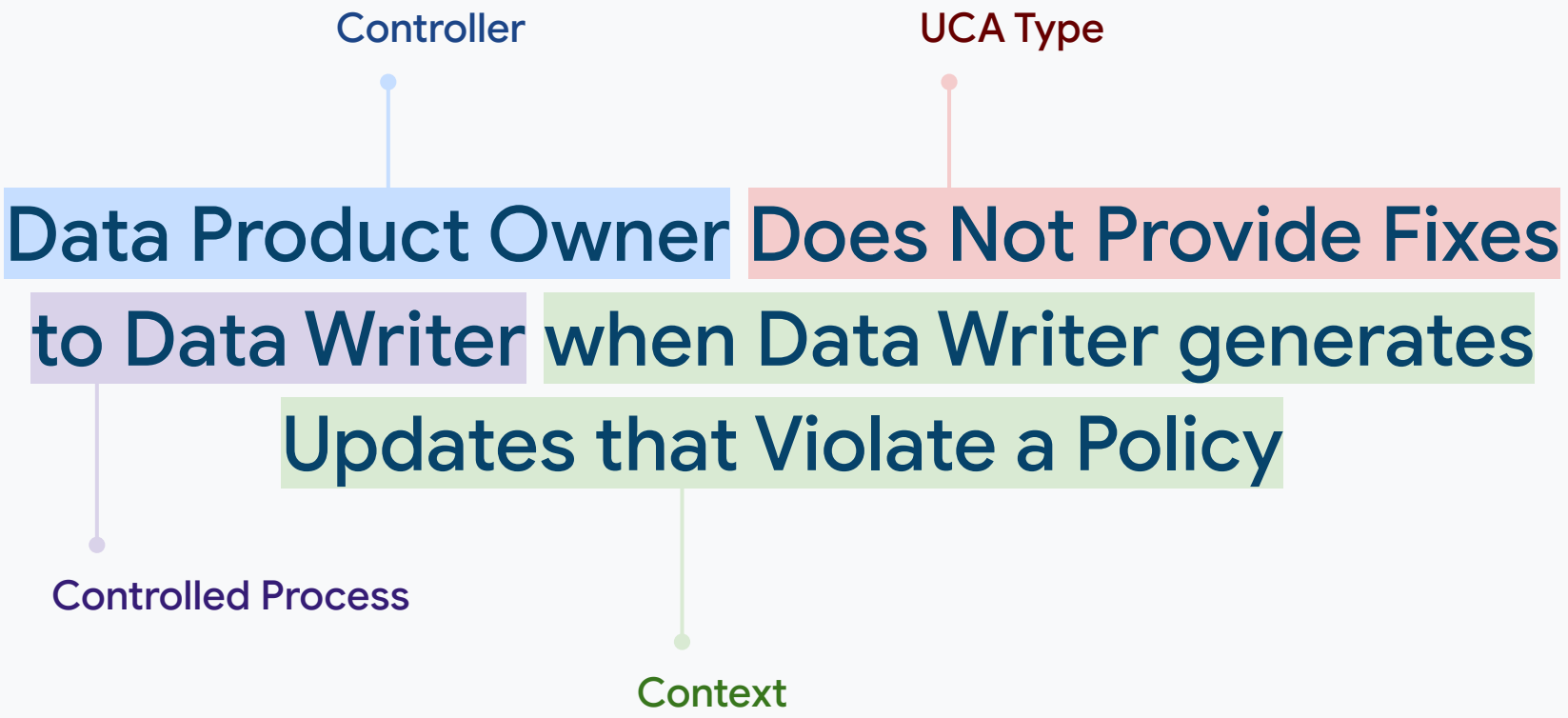

Human
Data Product Owner
Fixes
Updates
Software
Data Writer
Updates



Policy

In Germany, there are no tolls for passenger cars.

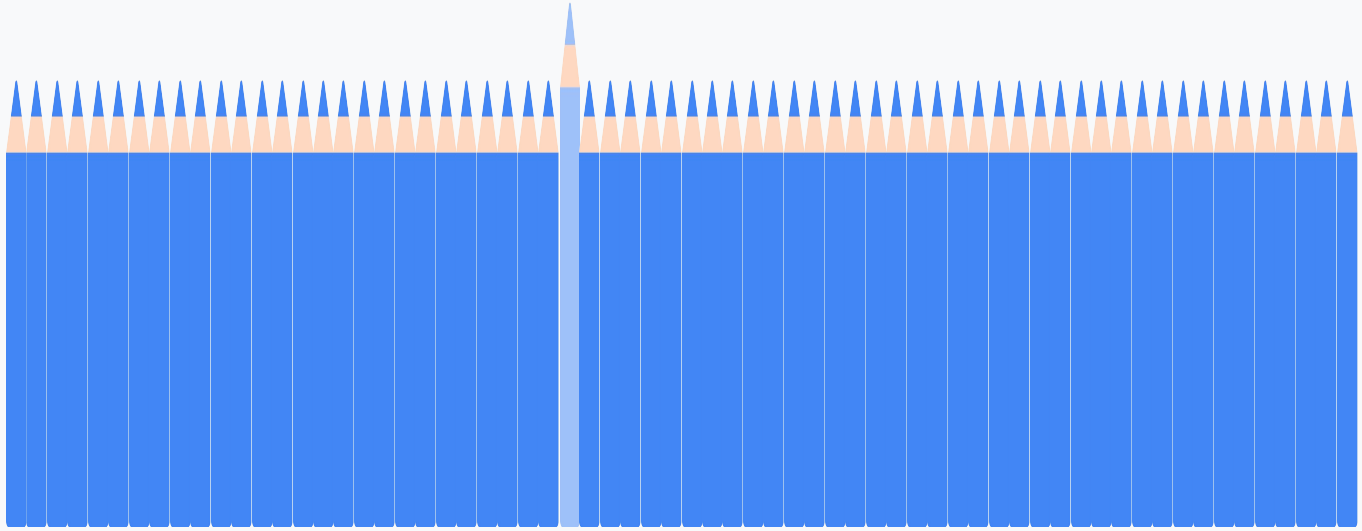
(except for some tunnels and environmental zones)


Controller
UCA Type
Data Product Owner Does Not Provide Fixes to Data Writer when Data Writer generates Updates that Violate a Policy
Controlled Process
Context

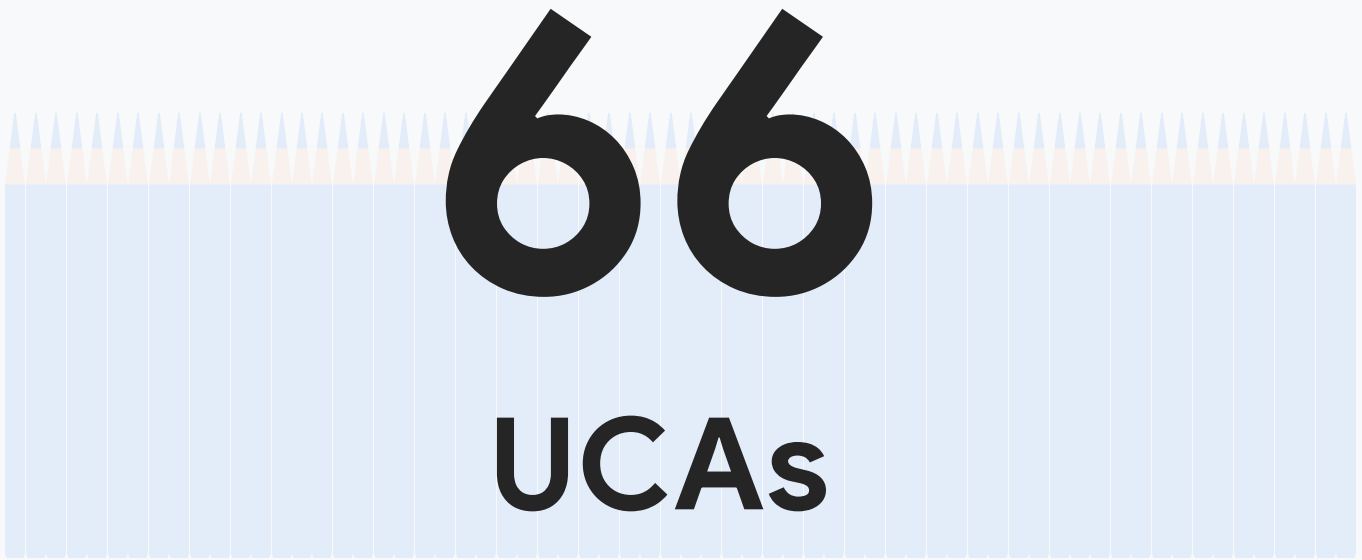
Data Product Owner Does Not Provide Fixes to Data Writer when Data Writer generates Updates that Violate a Policy



Data Product Owner Does Not Provide Fixes to Data Writer when Data Writer generates Updates that Violate a Policy



Data Product Owner Does Not Provide Fixes to Data Writer when Data Writer generates Updates that Violate a Policy



Data Product Owner Does Not Provide Fixes to Data Writer when Data Writer generates Updates that Violate a Policy

4 Questions

Data Product Owner Does Not Provide Fixes to Data Writer when Data Writer generates Updates that Violate a Policy

Are there ever situations where ...

Unsafe Controller Behavior

... **YOU KNOW** Data Writer generates invalid data, but **YOU DON'T FIX** Data Writer?

Cabosky, R. (2020). Application of Hierarchy to STPA: A Human Factors Study on Vehicle Automation. MIT.

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STRENGTH OF CONTROLS

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UNKNOWN
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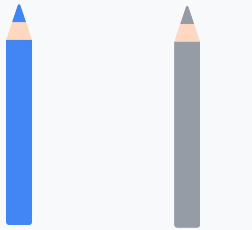

UNKNOWN UNKNOWN

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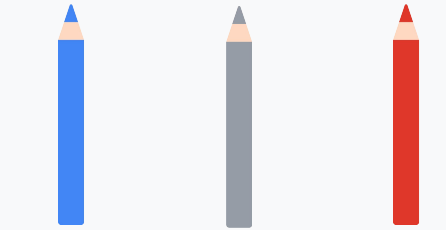

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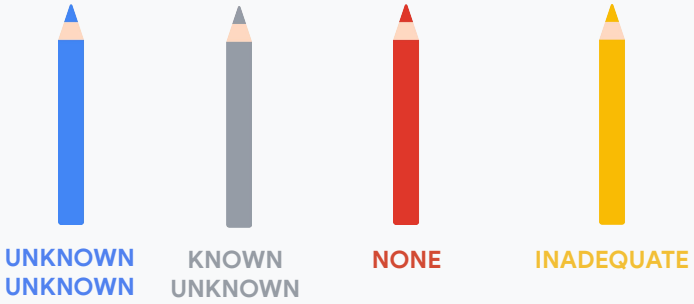

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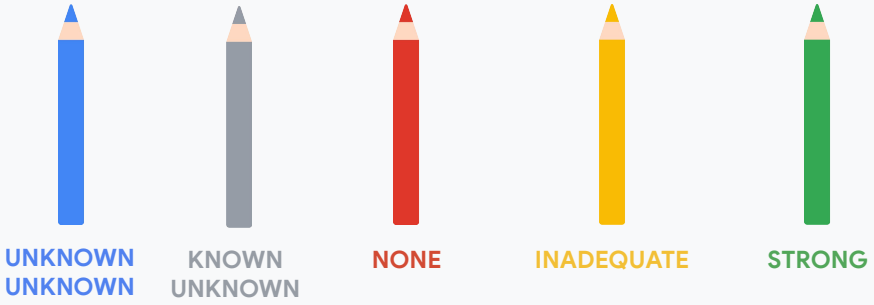
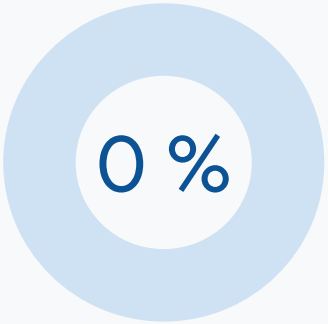
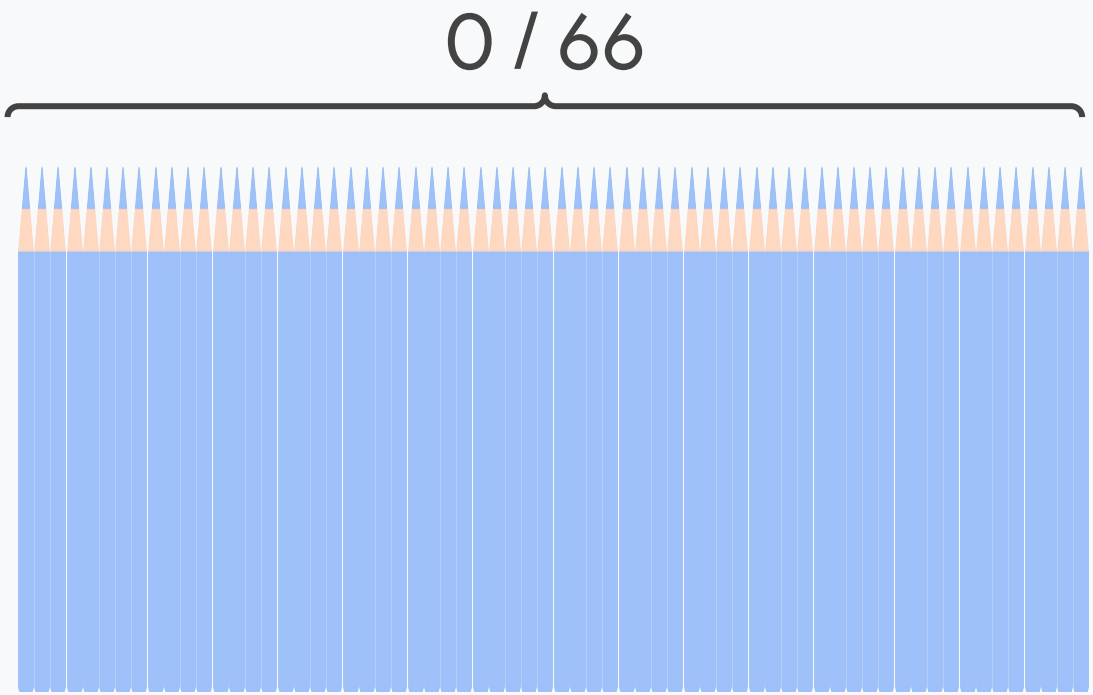


How Much Do We **Know**?





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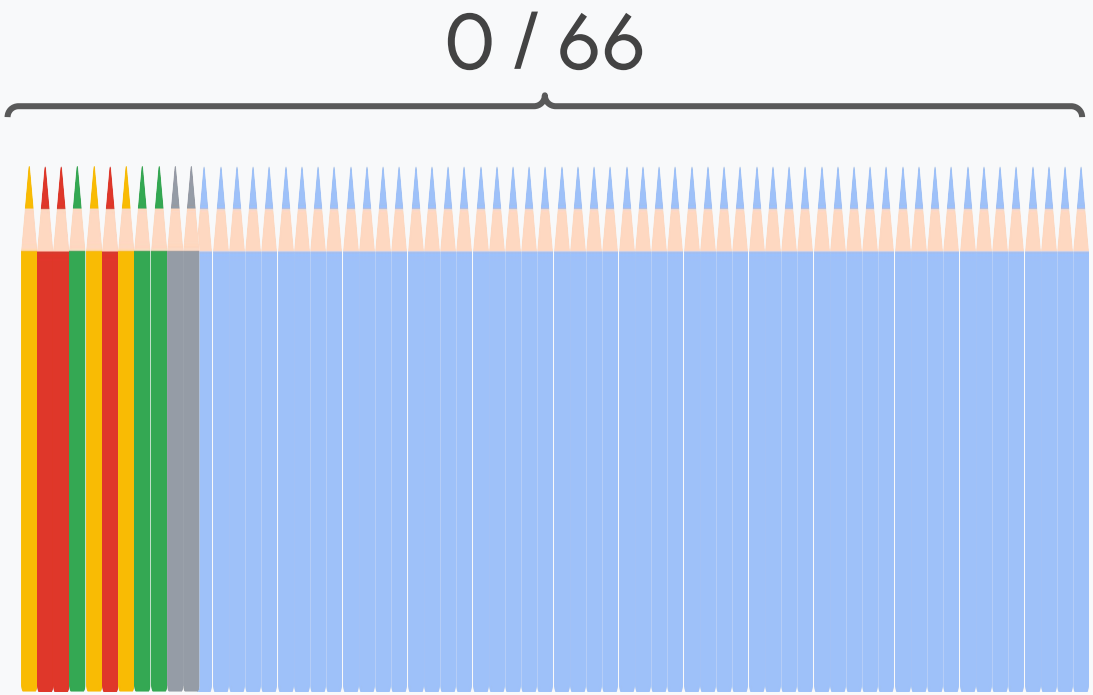

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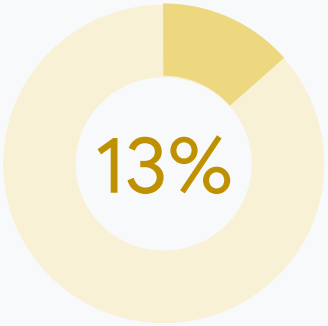
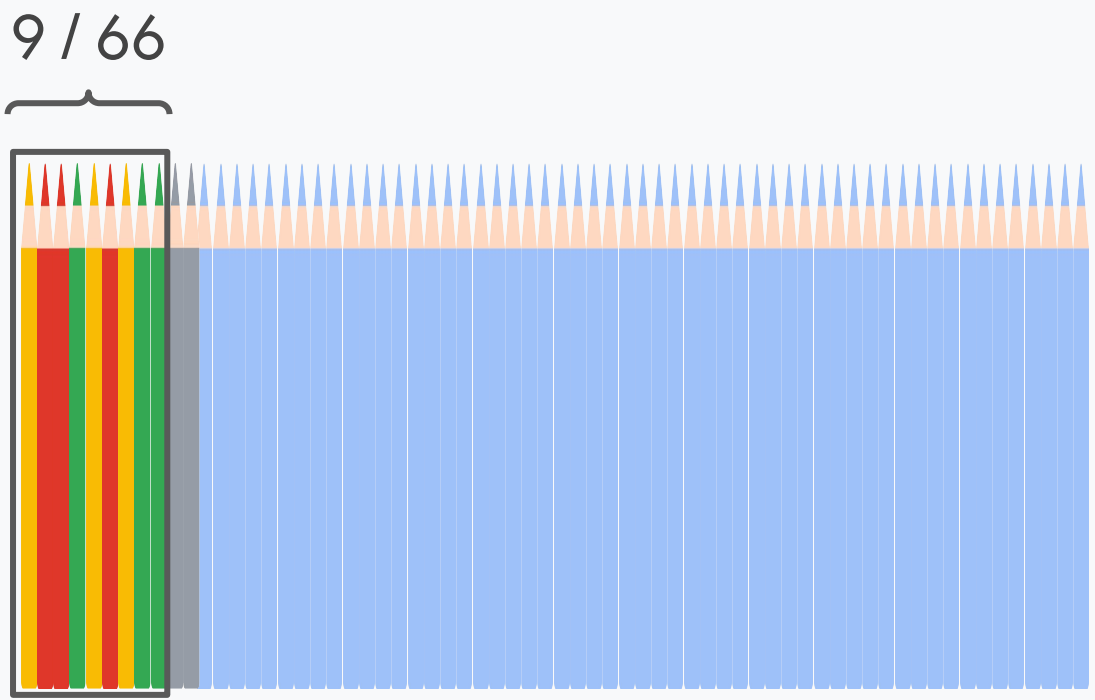
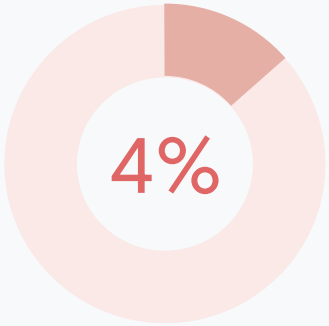
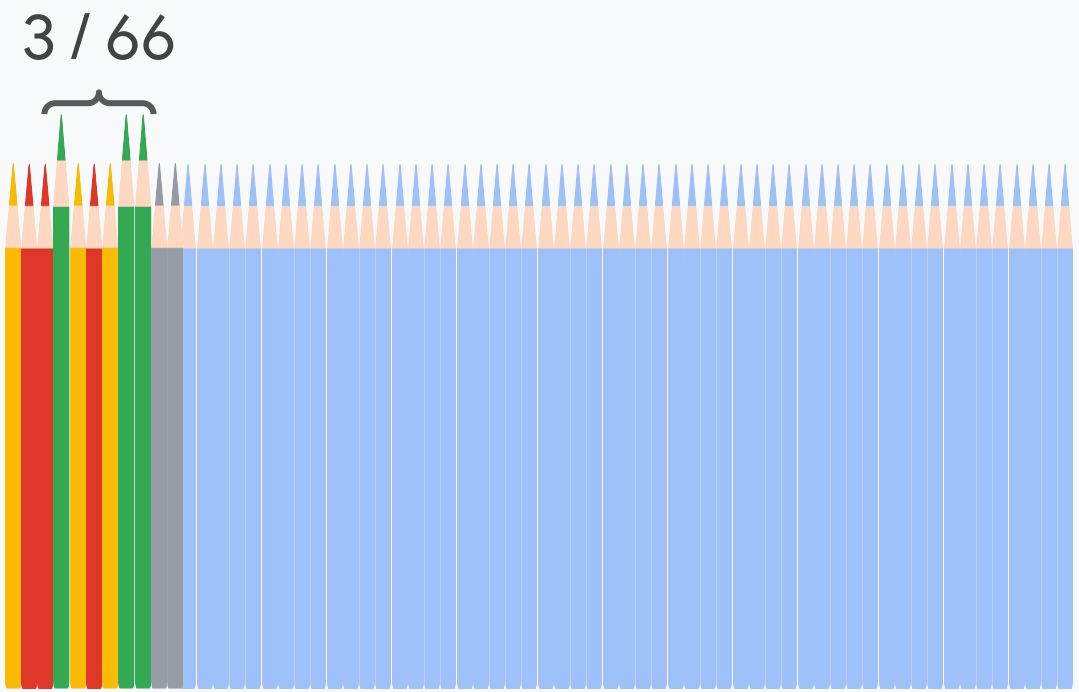




How **Strong** Are The Controls?





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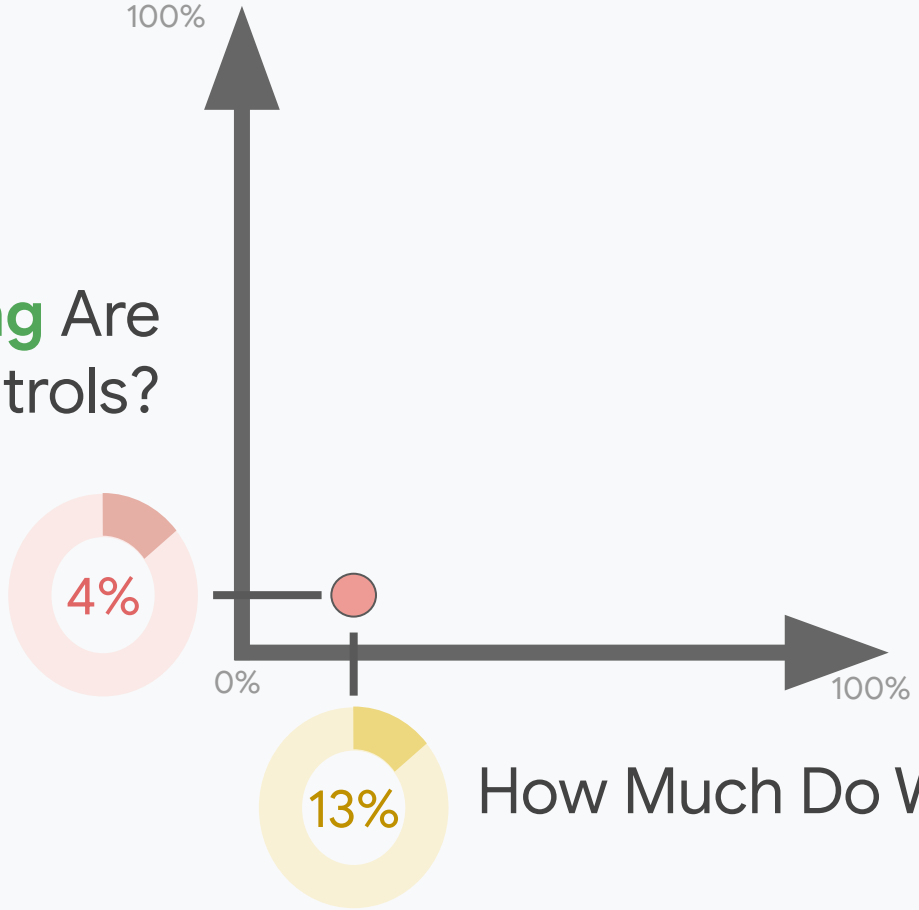

How Much Do We **Know**?

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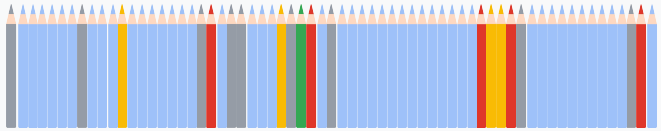
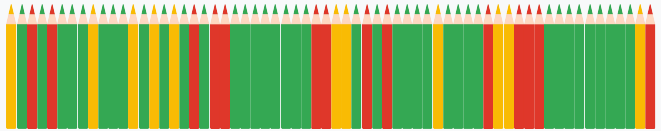
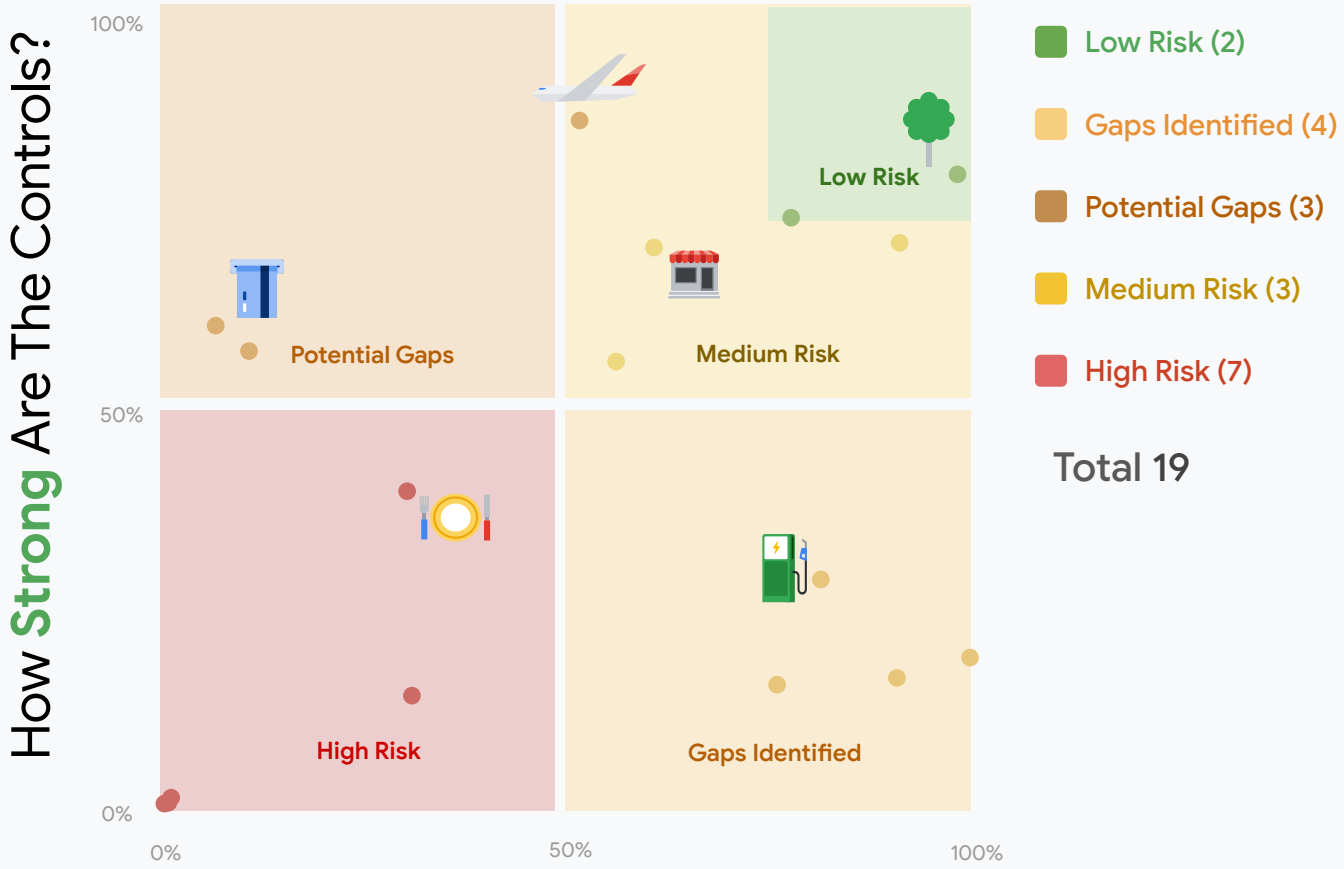
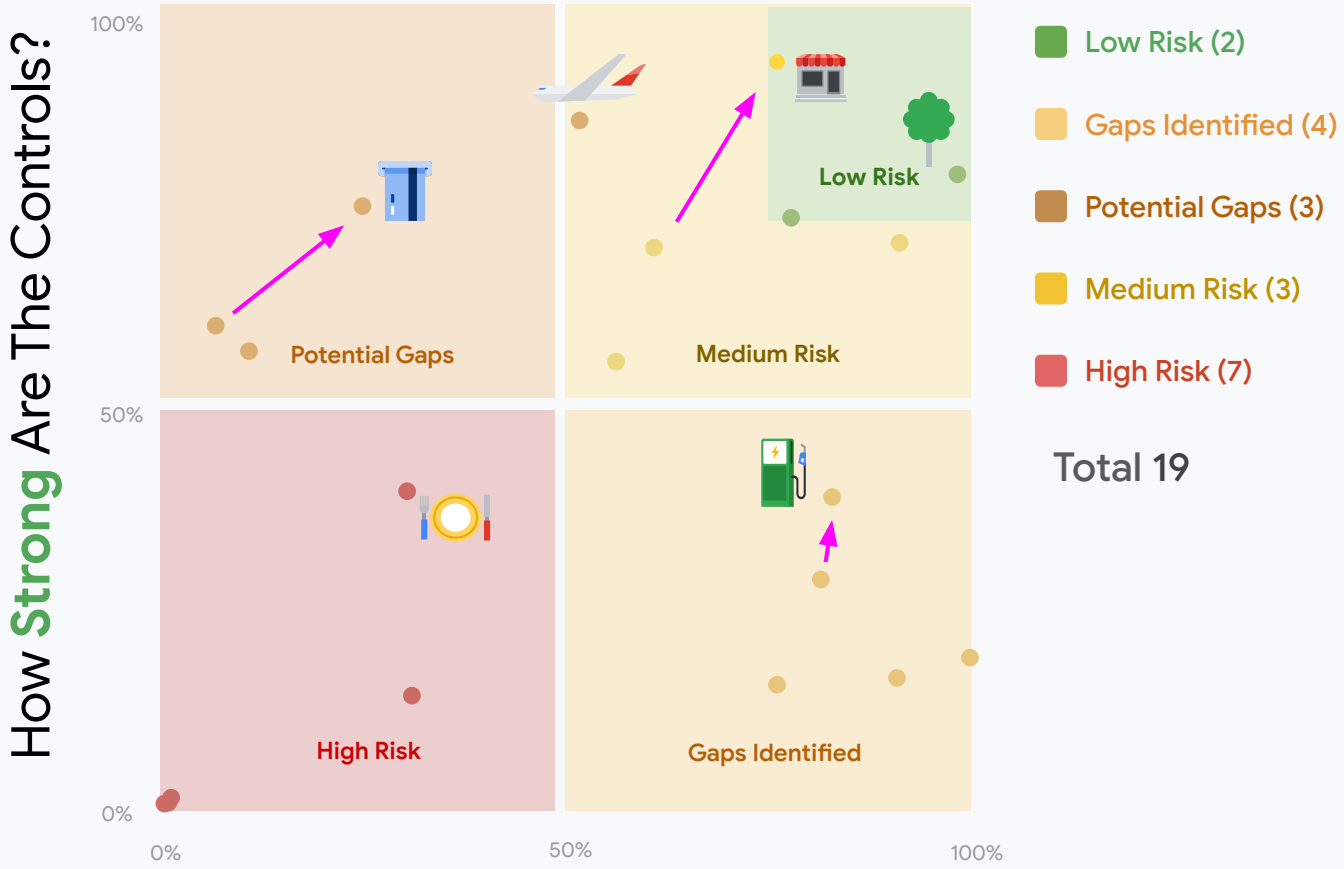
	How Much Do We Know?	How Strong Are The Controls?
	86%	4%
	47%	0%
	75%	9%
	15%	1%
	100%	59%


How Strong Are The Controls?
100%
50%
0%
0%
50%
100%
Low Risk
Potential Gaps
Medium Risk
High Risk
Gaps Identified
Low Risk (2)
Gaps Identified (4)
Potential Gaps (3)
Medium Risk (3)
High Risk (7)
Total 19
How Much Do We Know?


How Strong Are The Controls?
100%
50%
0%
0%
50%
100%
Potential Gaps
Medium Risk
Low Risk
High Risk
Gaps Identified
Low Risk (2)
Gaps Identified (4)
Potential Gaps (3)
Medium Risk (3)
High Risk (7)
Total 19
How Much Do We Know?

Buy-in



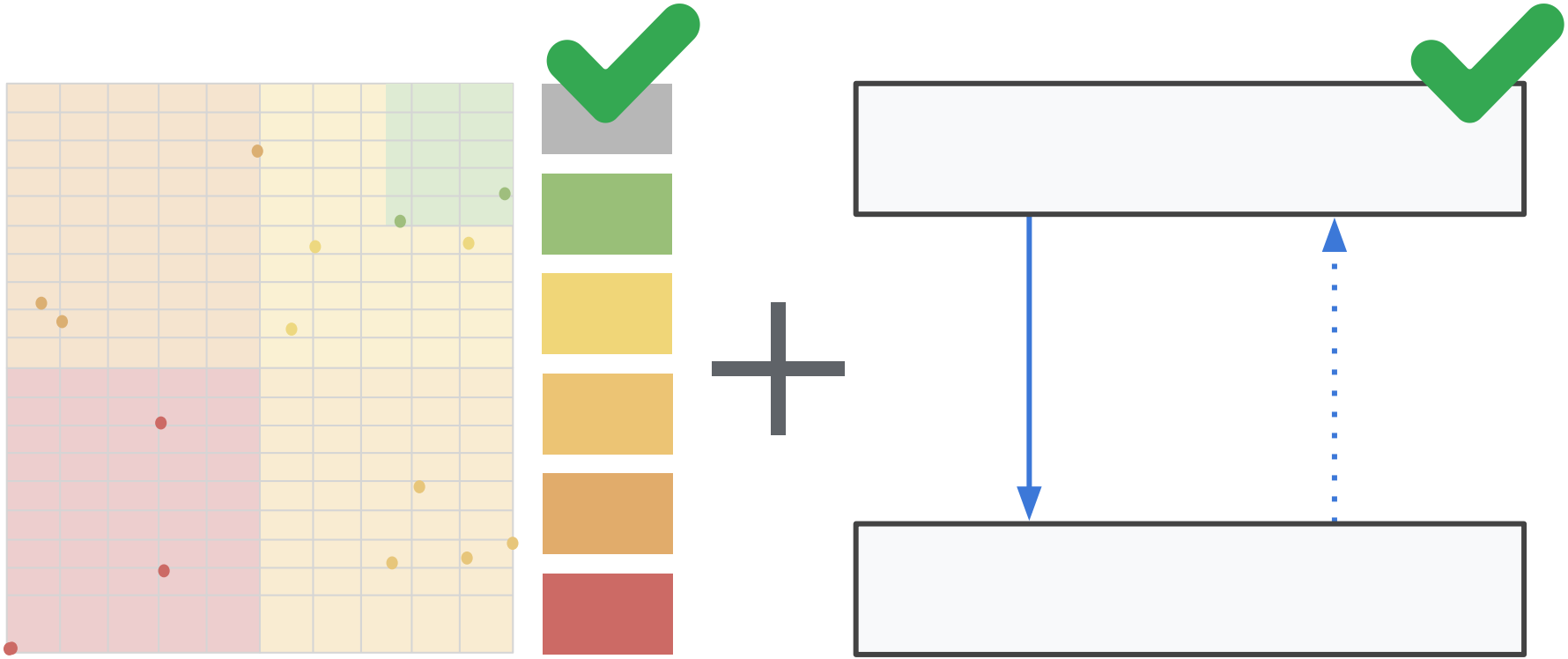
Buy-in 

Scalability 

Buy-in 

Scalability 

Efficiency 



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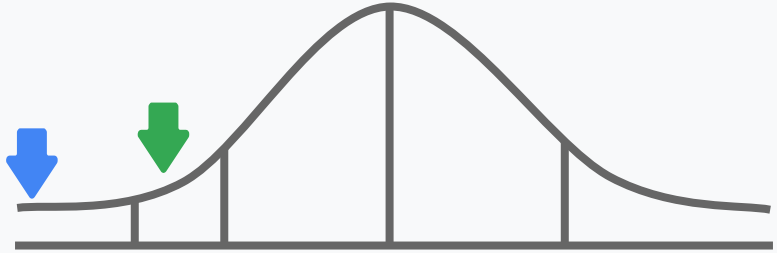
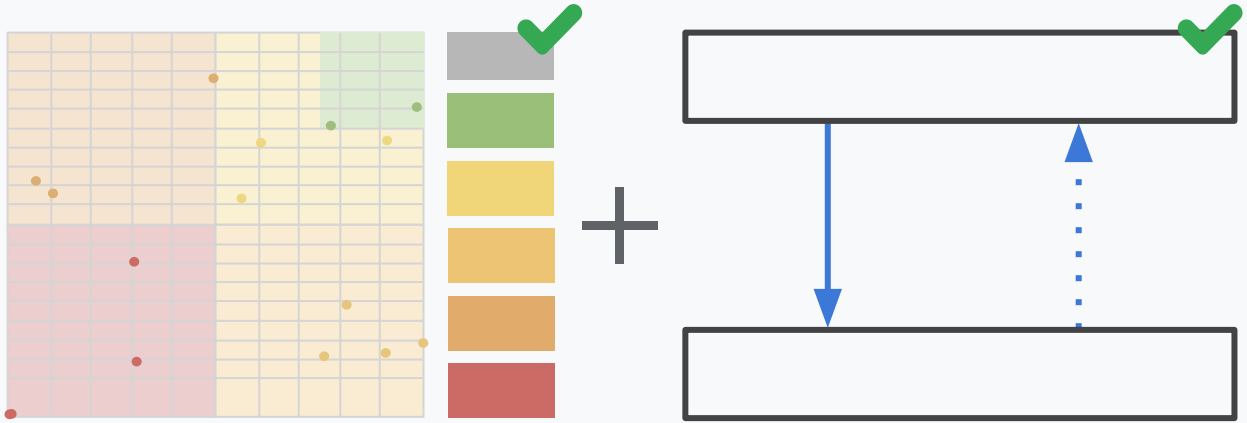
STPA ADOPTION

Recap

Google



Buy-in ✔ Scalability ✔ Efficiency ✔



Questions?