



Software Engineering Institute
Carnegie Mellon University

SATURN 2016
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Strategic Prototyping for Developing Big Data Systems

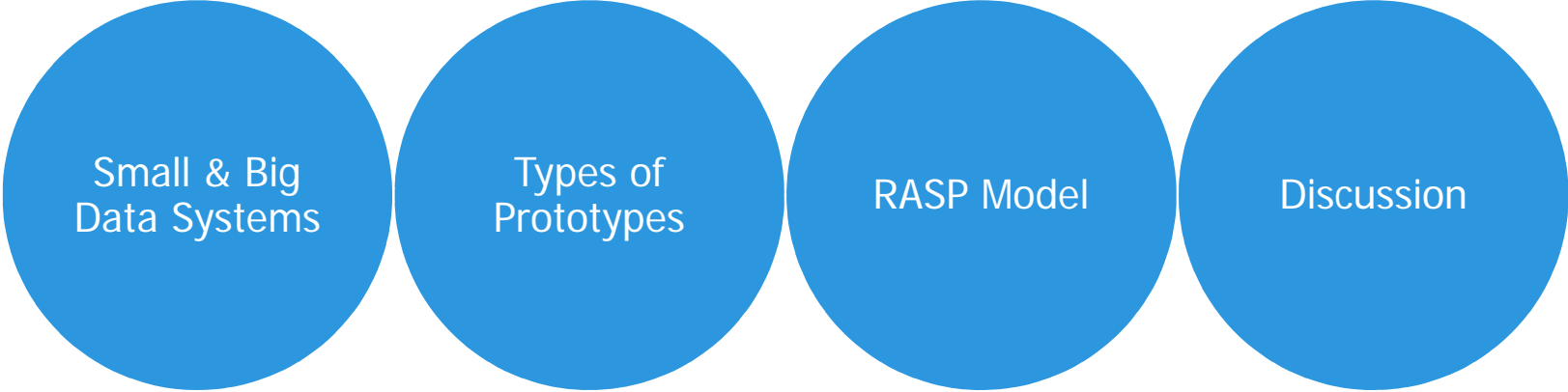
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Rick Kazman, University of Hawaii and SEI/CMU

Agenda



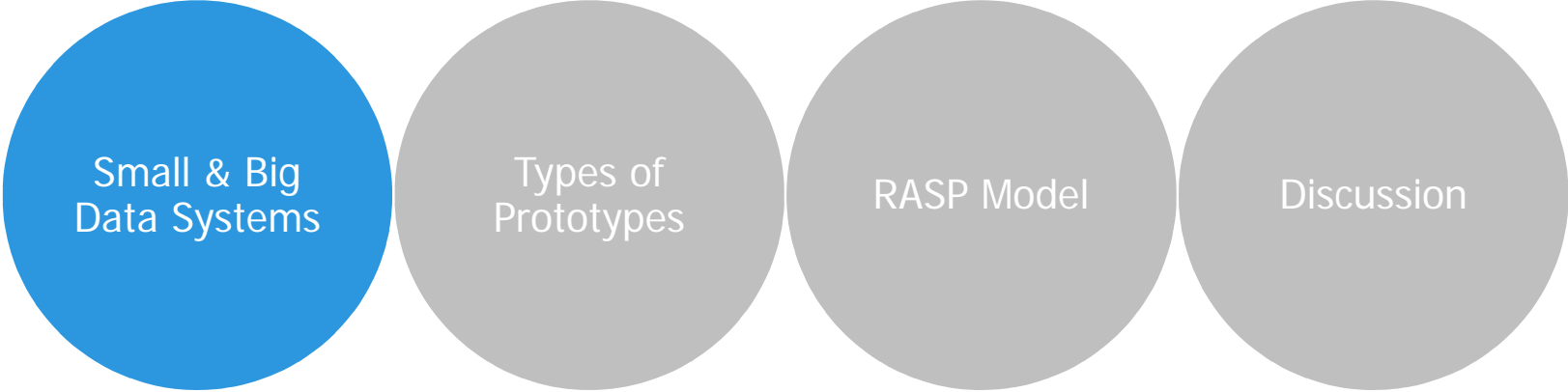
Small & Big
Data Systems

Types of
Prototypes

RASP Model

Discussion

Agenda



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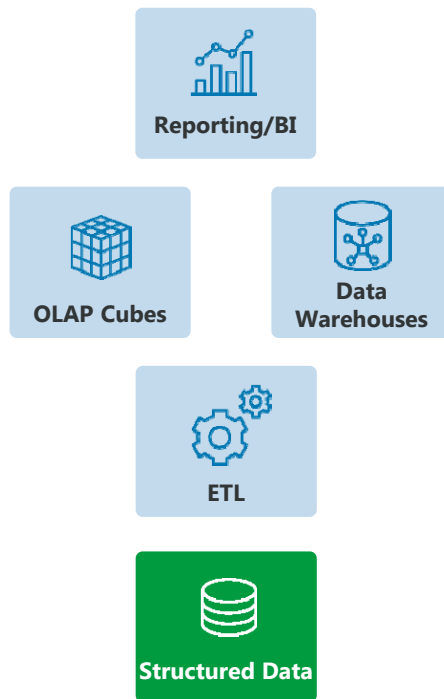
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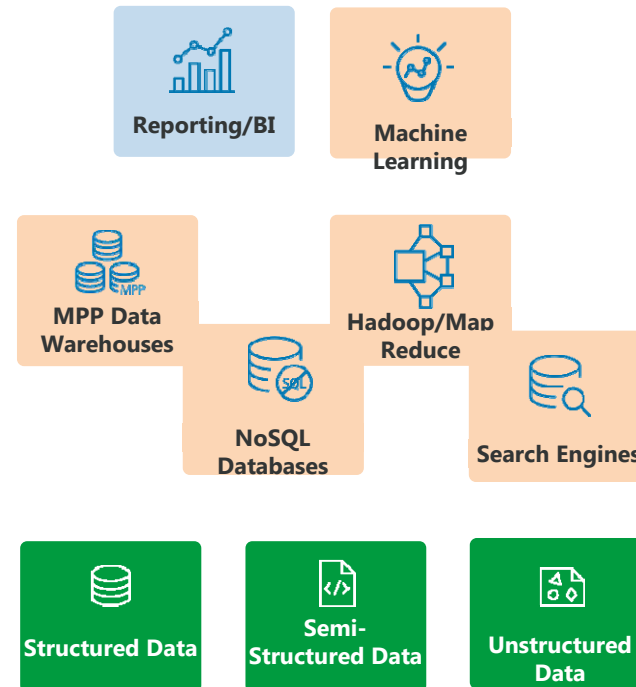
Discussion

Small (Traditional) vs Big Data Systems

Traditional Analytics (BI)



Big Data Analytics



Big Data Systems Challenges

- The five V's of big data (Volume, Variety, Velocity, Veracity, and Value)
- Paradigm shifts (Data Lake, Polyglot Persistence, Lambda Architecture, etc.)
- The short history of big data system development
- Rapid technology changes
- The difficulty of selecting big data technology

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Why Prototyping is Important?

Typical motivations for prototyping:

- Requirements are uncertain
- Technologies are new
- No comparable system has been previously developed
- No full buy-in from the business

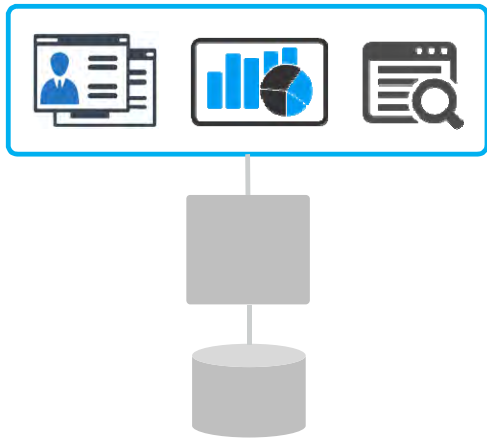
Architectural analysis alone can not address these risks!

They said they didn't need a prototype

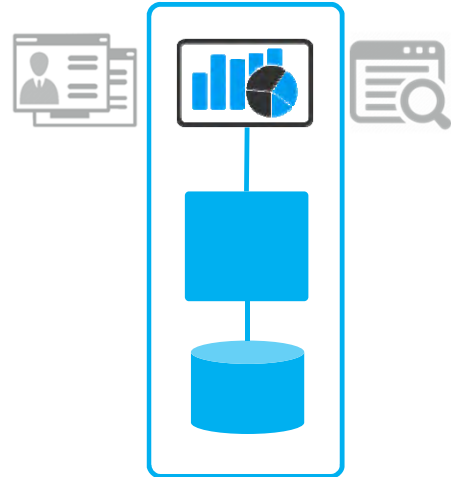


Types of Prototypes

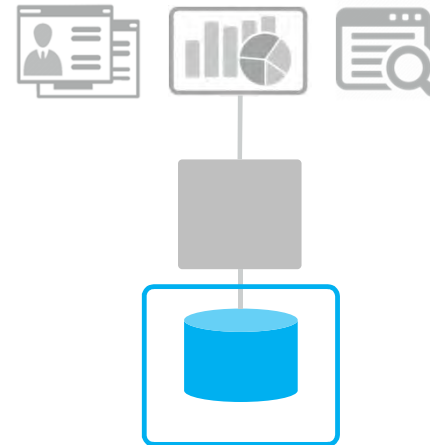
Horizontal Prototype



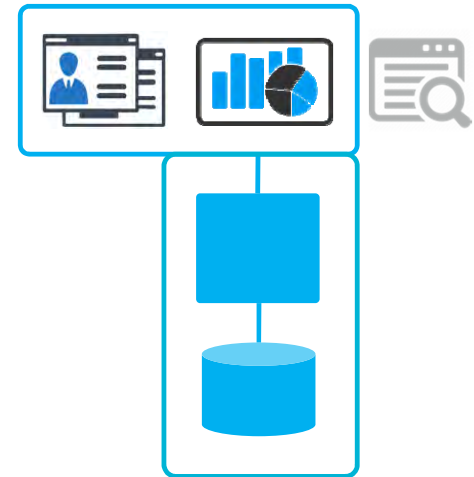
Vertical Evolutionary Prototype



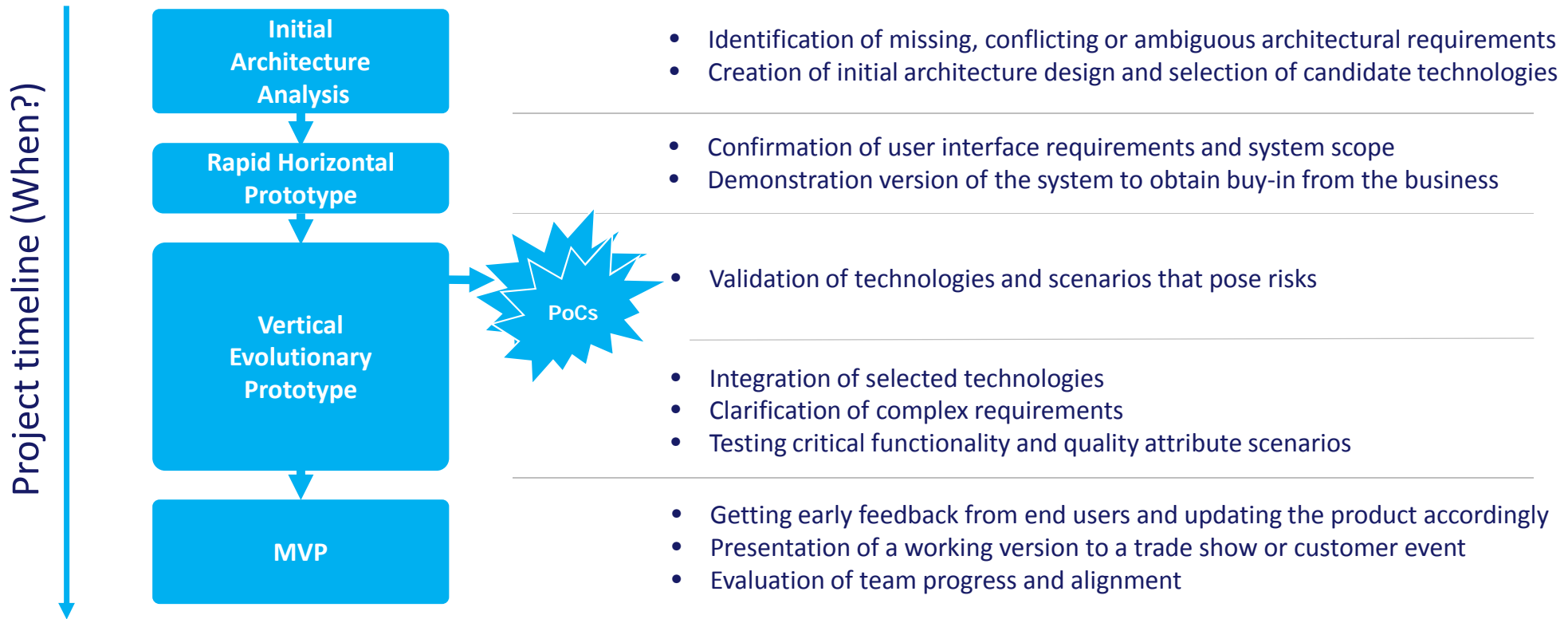
Throwaway Prototype (Proof-of-Concept)



Minimum Viable Product (MVP)



When and Why to Prototype?



Find more info at: *“Strategic Prototyping for Developing Big Data Systems”, IEEE Software, March-April, 2016*

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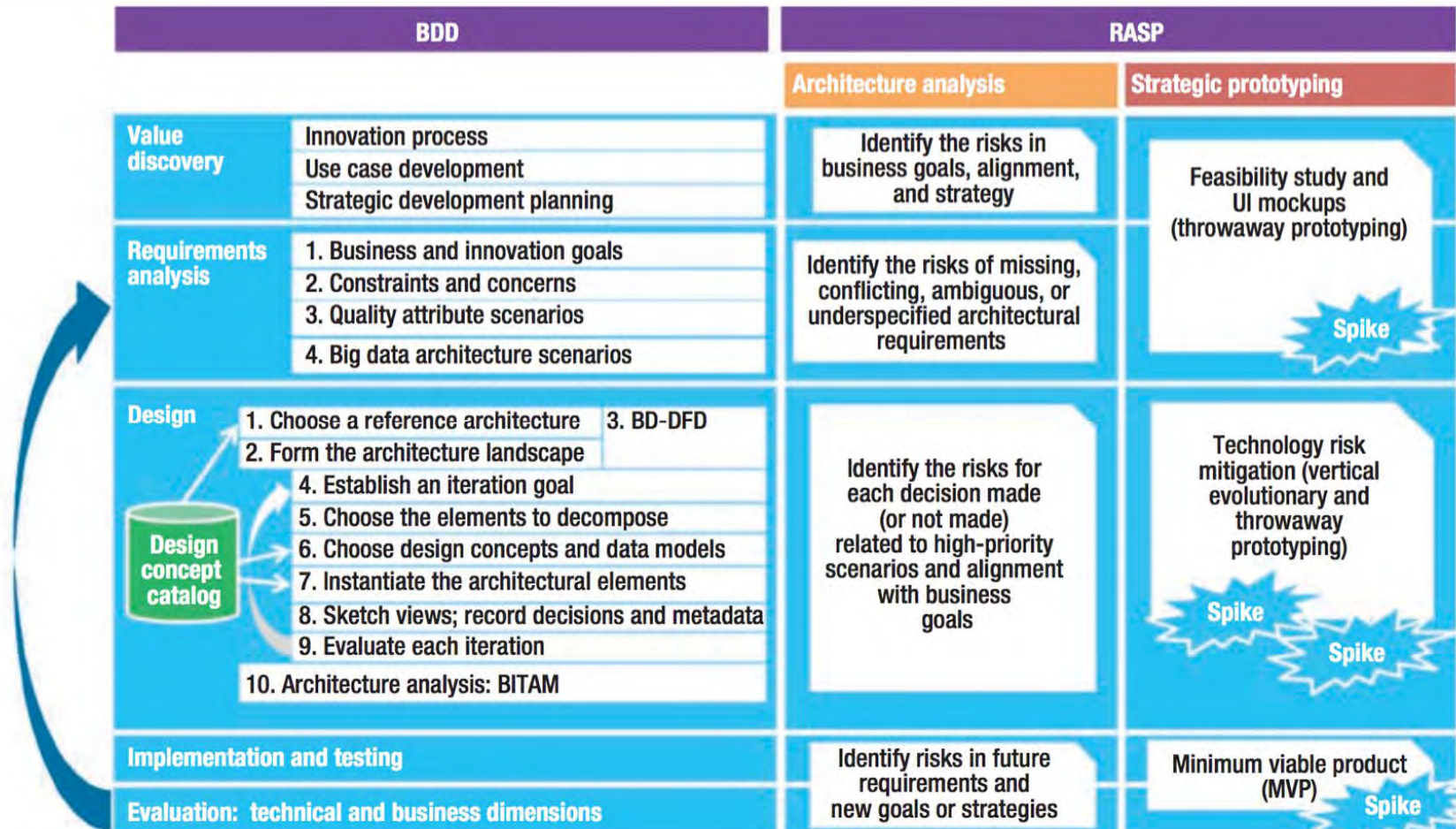
Discussion

The RASP Model

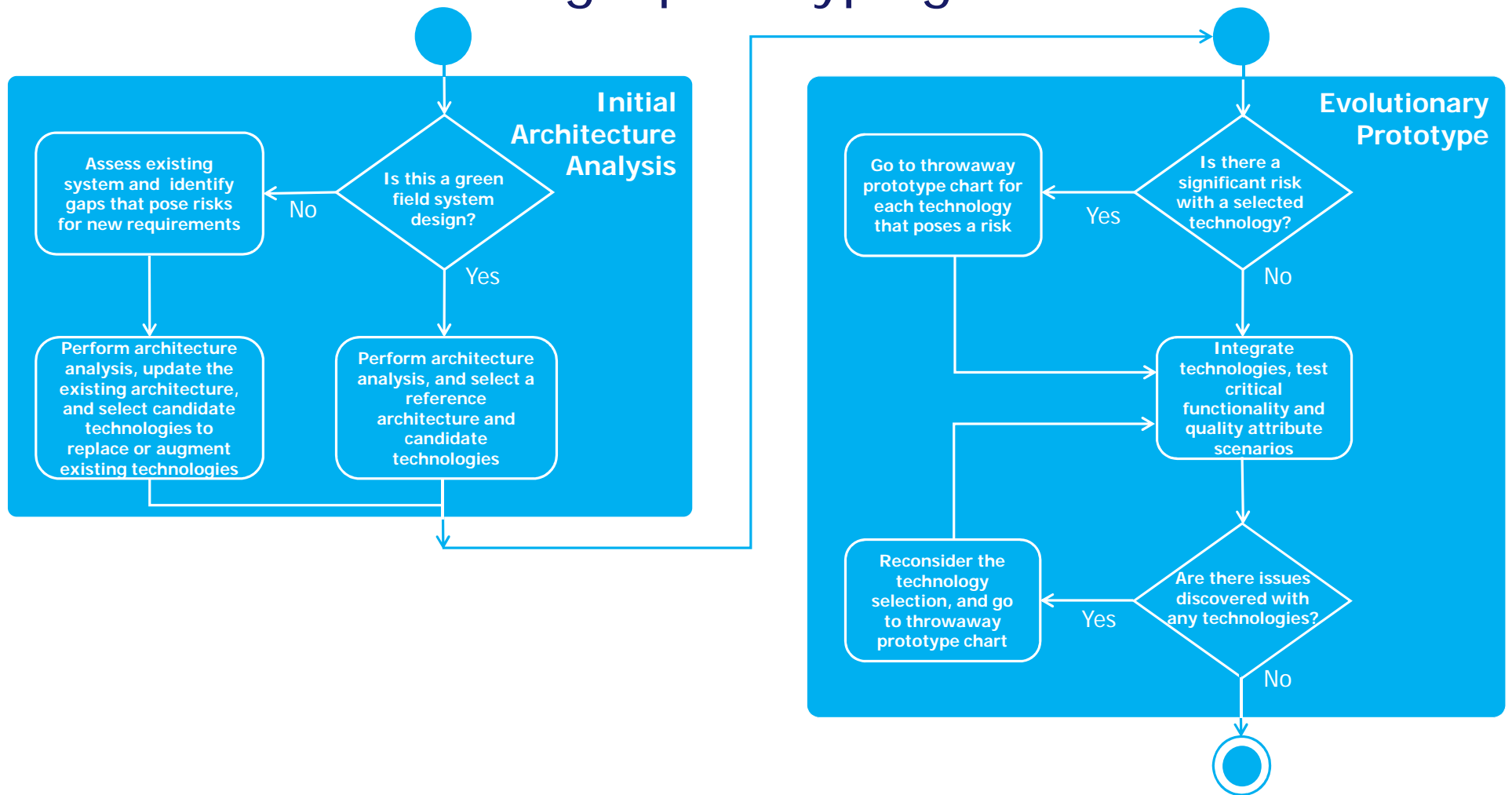
We created ***RASP*** (Risk-based Architecture-centric Strategic Prototyping) to provide guidance on how to employ strategic prototyping for risk management.

The RASP model can stand alone, but is ideally integrated with an architecture-centric agile development methodology, such as BDD (Big Data Design).

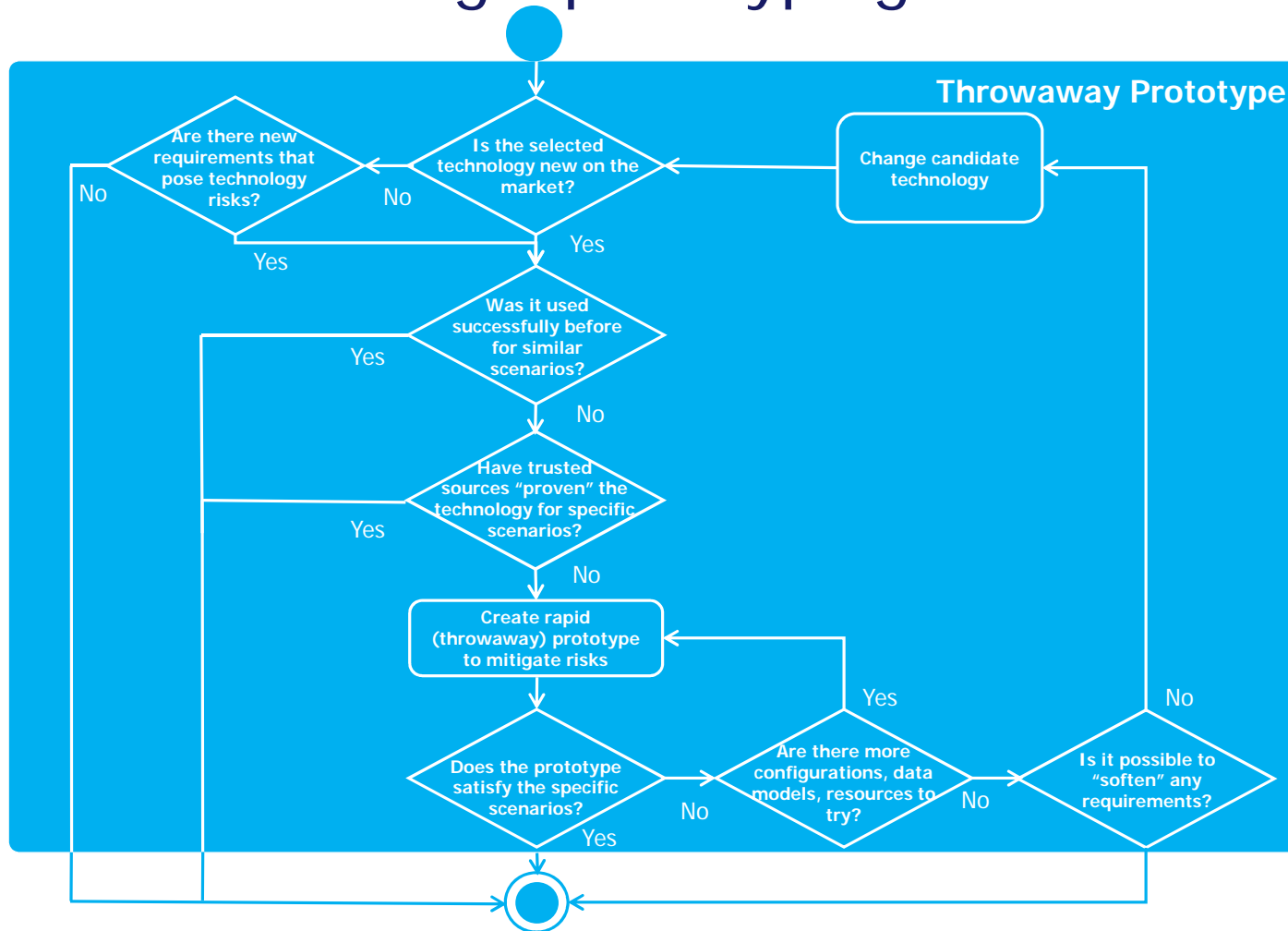
BDD and RASP



RASP Model: A strategic-prototyping decision flowchart



RASP Model: A strategic-prototyping decision flowchart



Validation

9 case studies were used to validate RASP

Diverse domains: Network Security/Intrusion Prevention, Online Coupon Web Analytics Platform, Cloud-based Mobile App Development Platform, Telecom E-tailing platform, etc.

Diverse BD requirements: data volume, latency, scalability

Details available at: <http://itm-vm.shidler.hawaii.edu/BDCases/CaseStudies.htm>

Summary: 7 Guidelines

1. Architecture analysis might be the only feasible option when you need to make early decisions
2. Architecture analysis alone is insufficient to prove many important system properties
3. Architecture analysis complements vertical evolutionary prototyping
4. An evolutionary prototype can effectively mitigate risk if you implement it as a skeleton
5. Vertical evolutionary prototyping might need to be augmented with throwaway prototypes
6. Throwaway prototypes work best when you need to quickly evaluate a technology
7. MVP is more of a business decision than a decision driven simply by technological risk

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Conclusions

Risk analysis has been advocated for controlling the evolutionary prototyping process.

Our research results demonstrate that an architecture-centric design methodology such as BDD makes risk management explicit, systematic and cost-effective.

It provides a basis for value discovery with stakeholders, for reasoning about risks, for planning and estimating cost and schedule, and for supporting experimentation.

The RASP model offers practical guidelines for strategic prototyping, combining architecture analysis and a variety of prototyping techniques.

