A methodology for *transforming* a *local* safety-critical cyber-physical system into a *distributed* safety-critical solution

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TRANSACT Impact Webinar, EUCloudEdgeIoT.eu

June 4, 2024

TRANSACT Reference Architecture

TRANSACT
transact-ecsel.eu/

ESI
Powered by industry, academia and TNO

ITI INVESTIGATE TO INNOVATE

Solutions:

- Safet
- Performa
- Secur
- Priva

Use-cases:

TRANSACT reference architecture:
a universally applicable distributed solution architecture concept

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TRANSACT Impact Webinar
*EU**Cloud**Edge**IoT**.eu*
June 4th, 2024

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Transition methodology overview

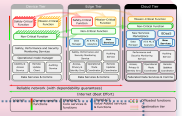
Transformation focus areas

Why?
to engage into the transition?

Business
- Business drivers
- Solution requirements

What?
system functionality needs transition to the distributed CPS solution?

Architecture



Product
- Architecture
- Development
- Operation
- DevOps

Infrastructure

Who?
can build and operate the distributed CPS solution

Organization
- People/skills
- Processes+ technology
- Structure

Cross-cutting aspects

- Safety
- Performance
- Security & privacy
- Regulatory & certification

Transition methodology overview

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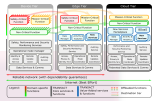
to engage into the transition?

Business

What?
system functionality needs transition to the distributed CPS solution?



Architecture

Who?
can build and operate the distributed CPS solution

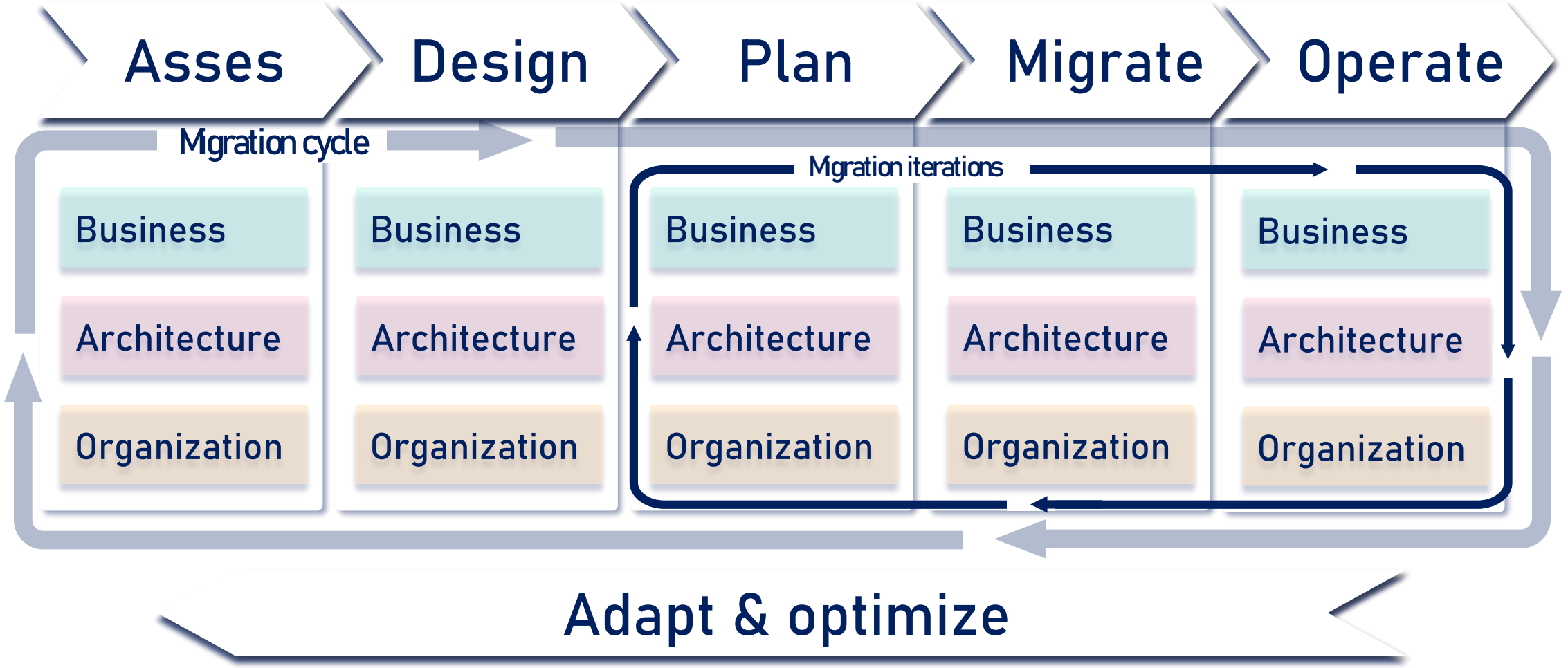
Organization

Cross-cutting aspects

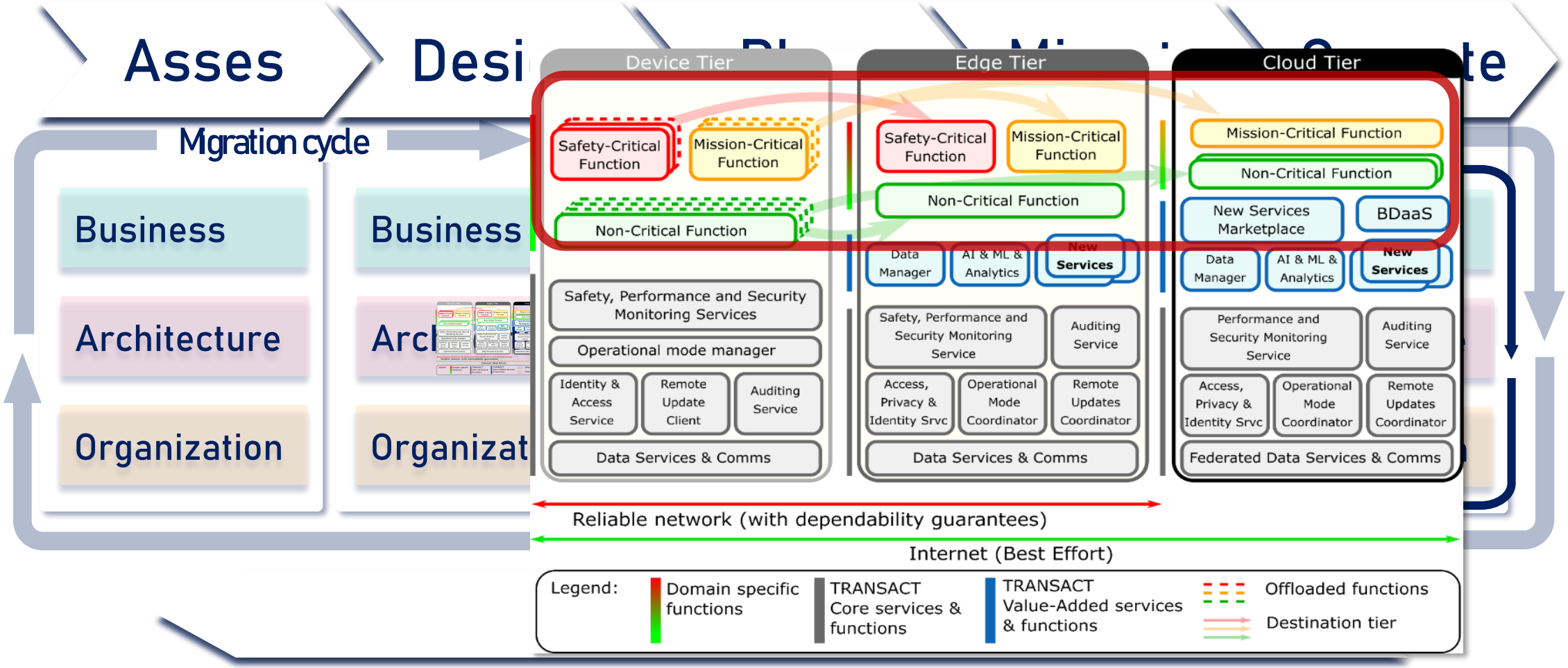
- Safety
- Performance
- Security & privacy
- Regulatory & certification

HOW?
to answer transition questions for Business/Architecture/Organization?

Transition methodology execution

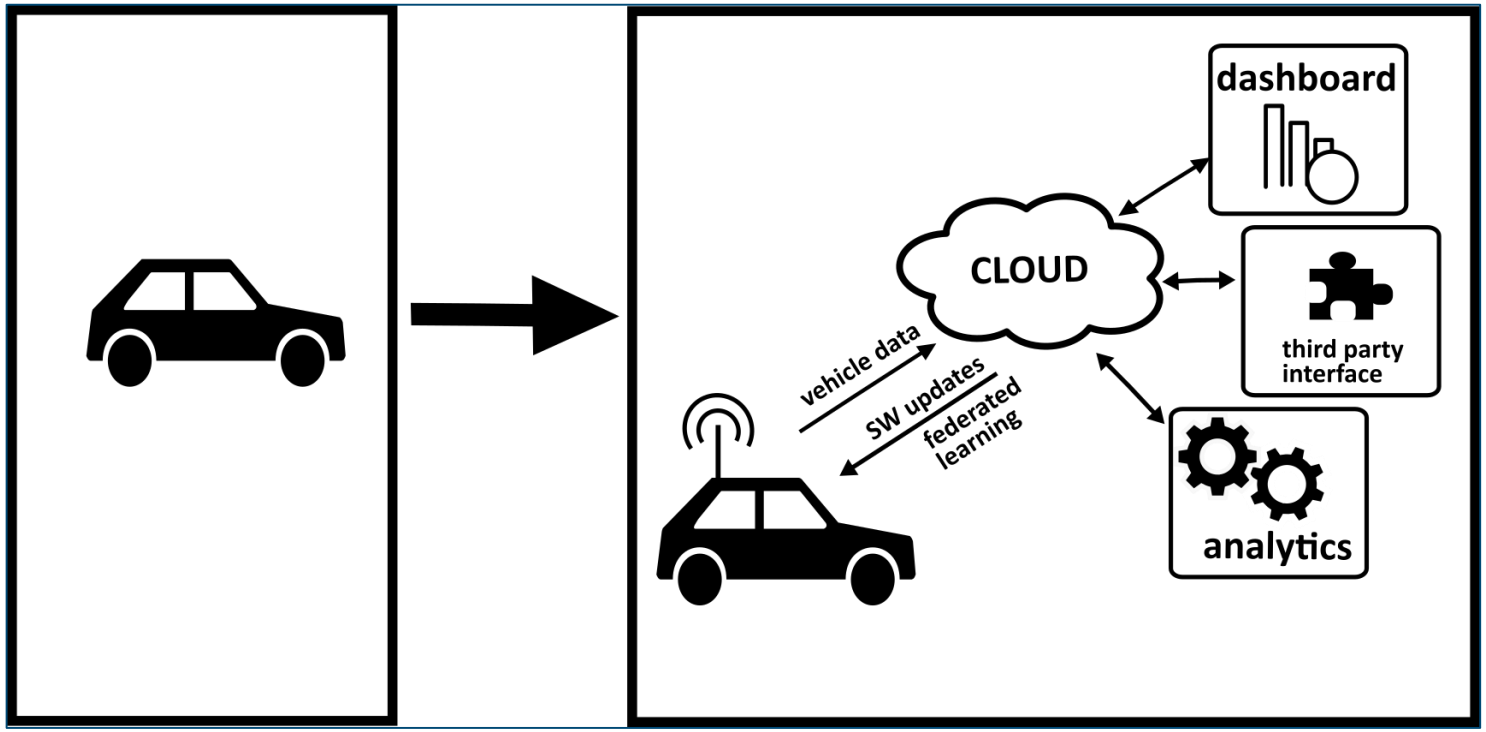


Transition methodology execution

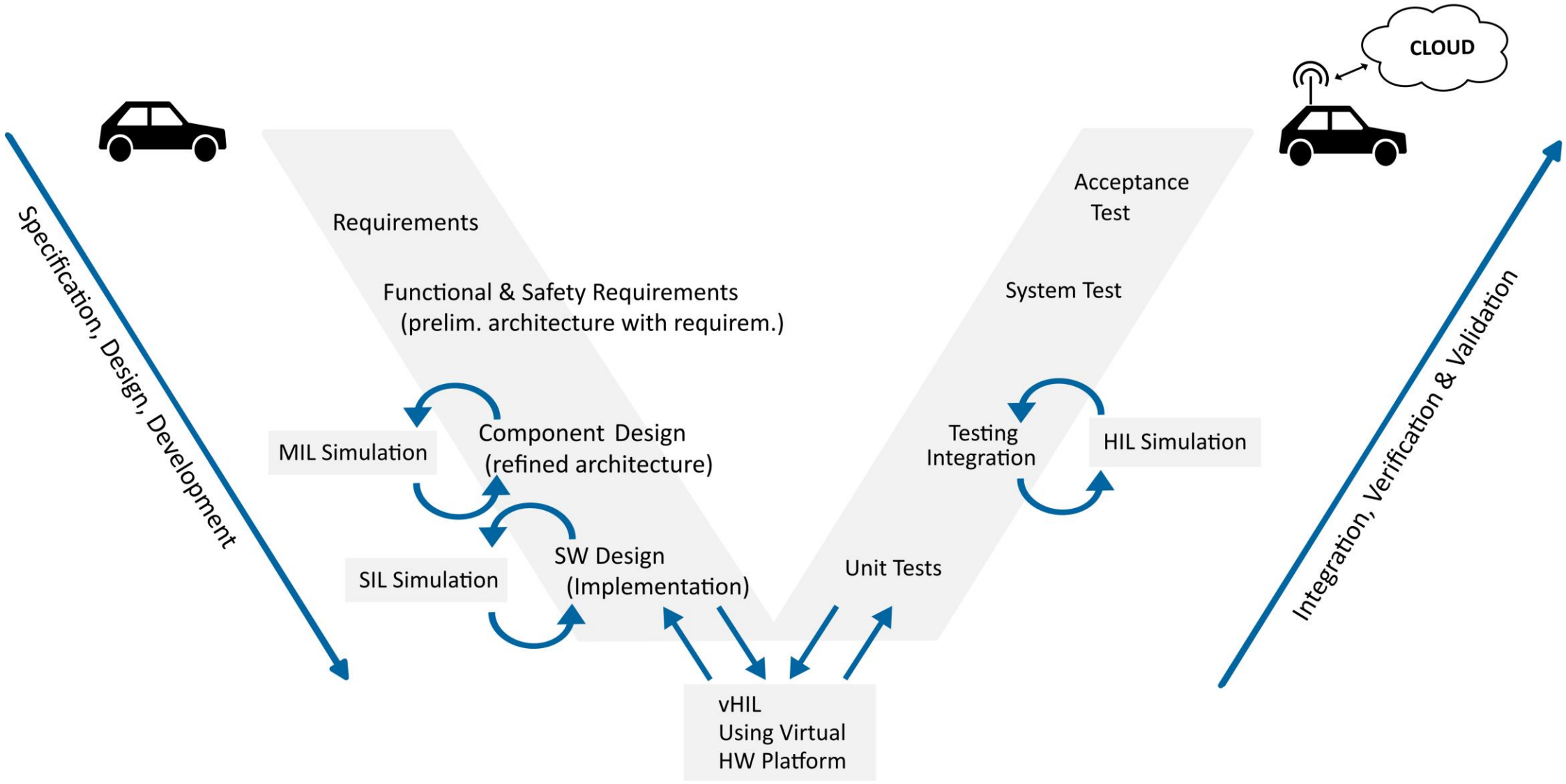


Approach for Validation & Verification

How to derive a distributed & trustworthy solution and exploit that a trustworthy initial system has been developed?



Development Approach for the Transition



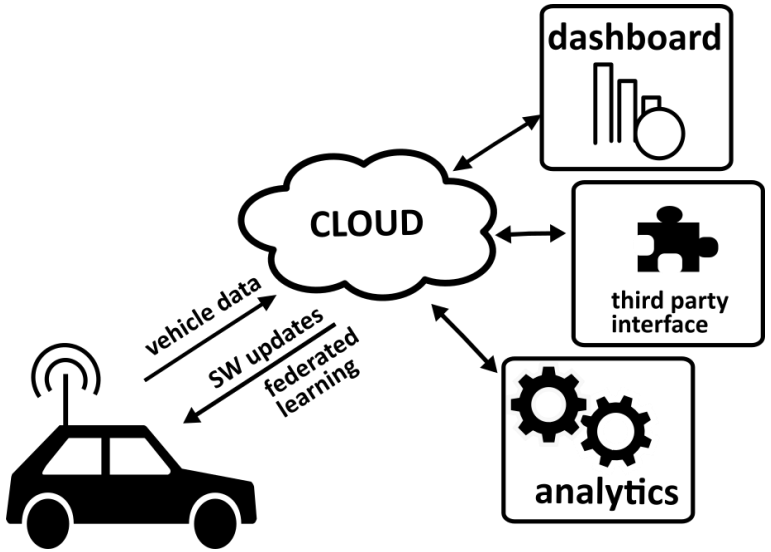
Exploiting the New & the Old

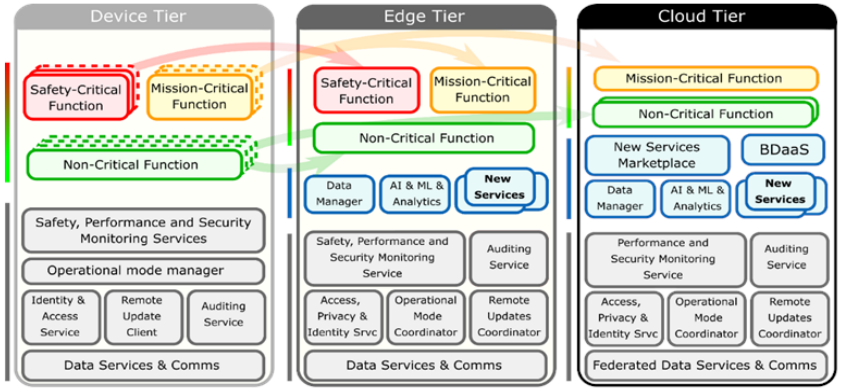
\+

requirements

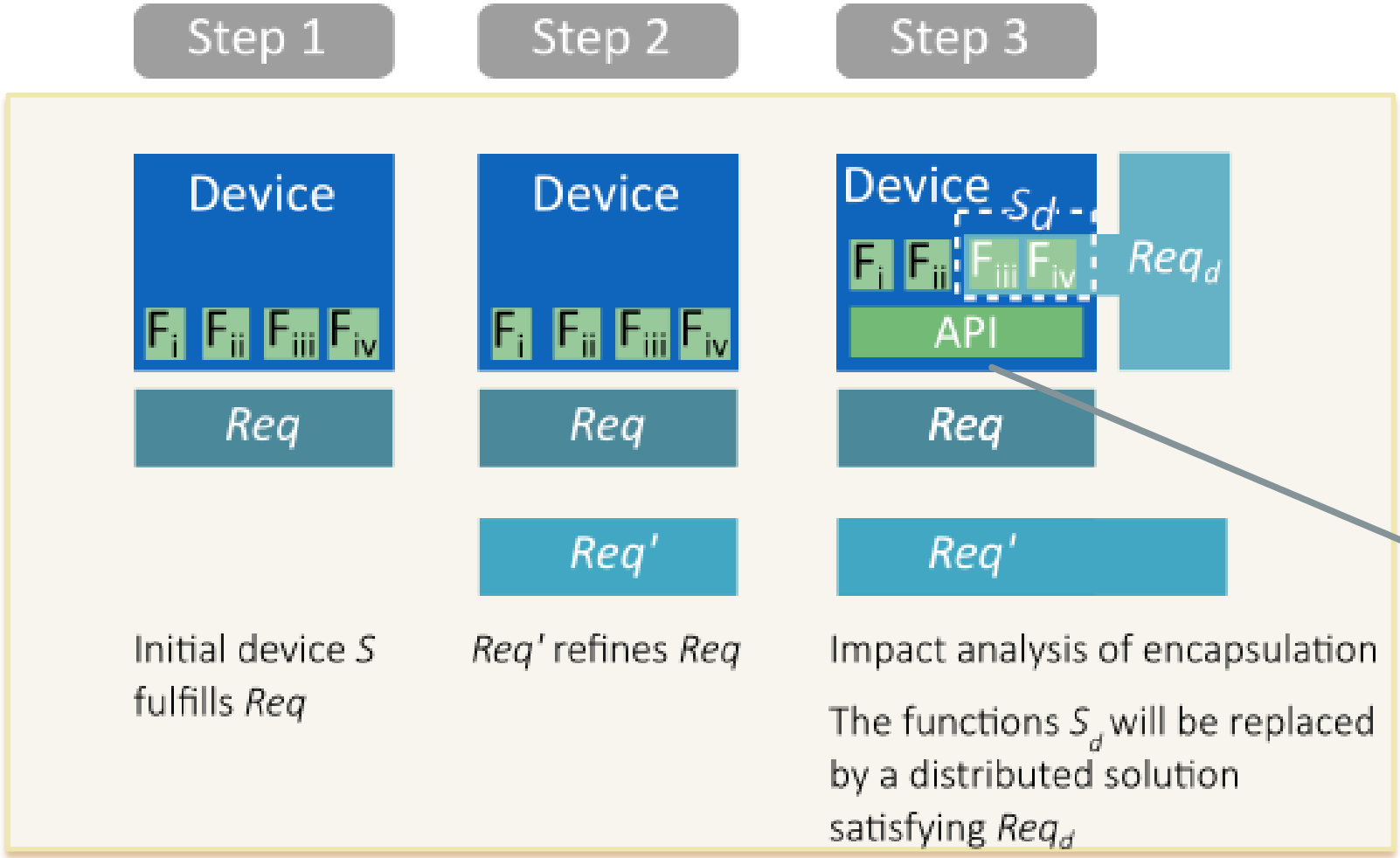
- Structured Design Space Exploration & Documentation
- Design Space: Architecture & Solutions (Off-The-Shelf)
- Verification & Validation
  - Front-Loading: Model-Based Design
  - Reuse of Previously Established Results

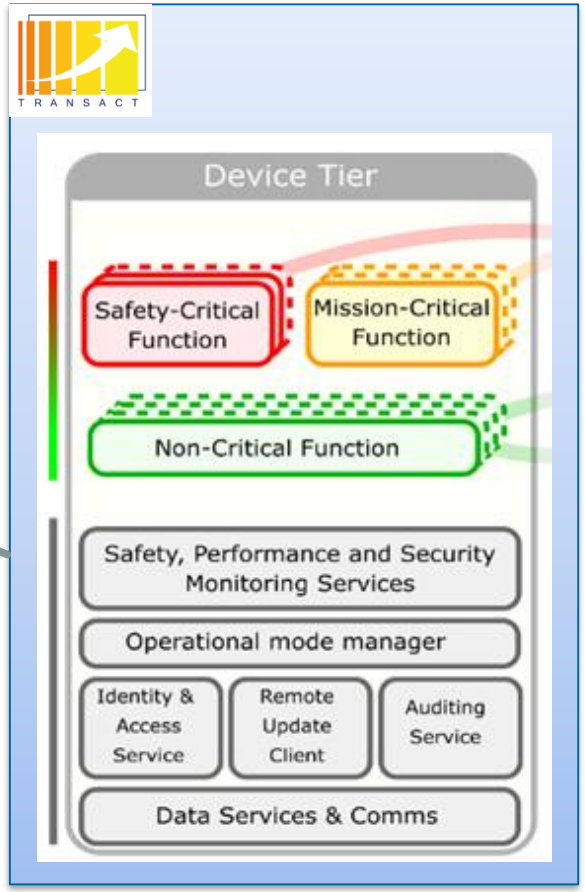
T&V Methodology



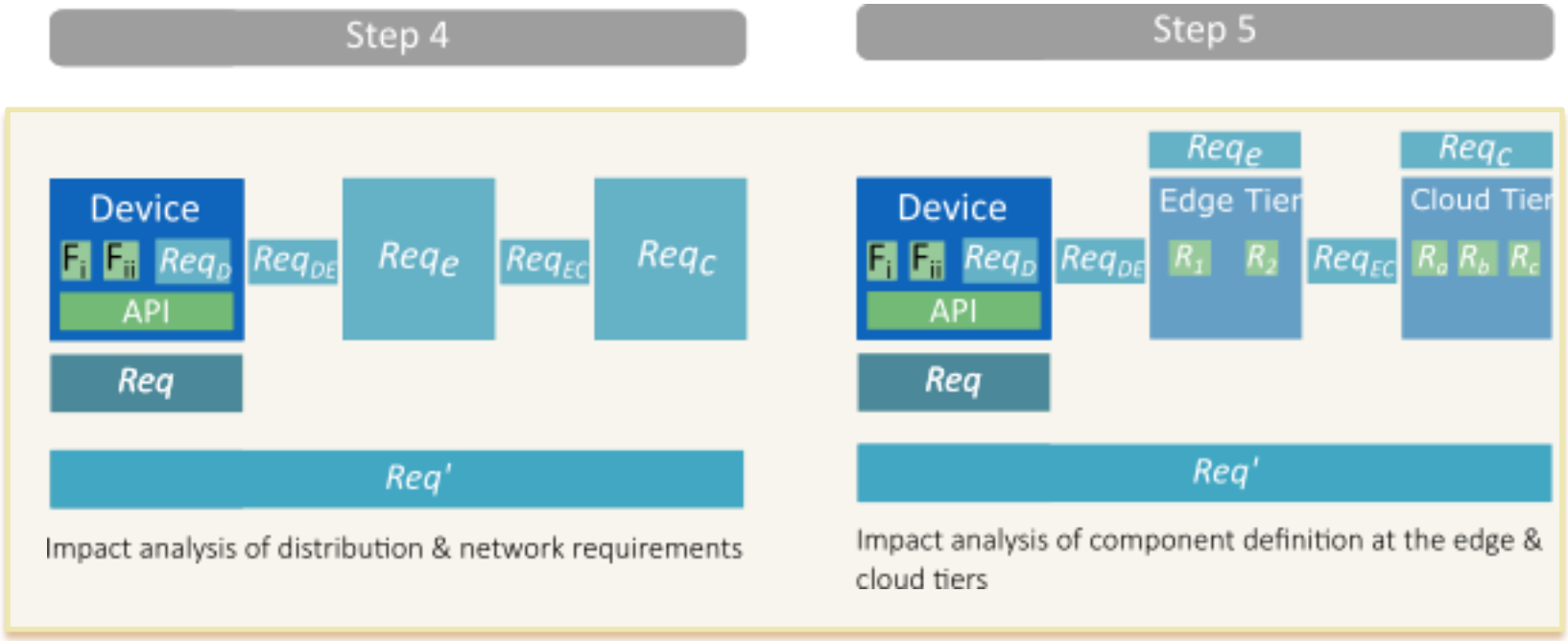


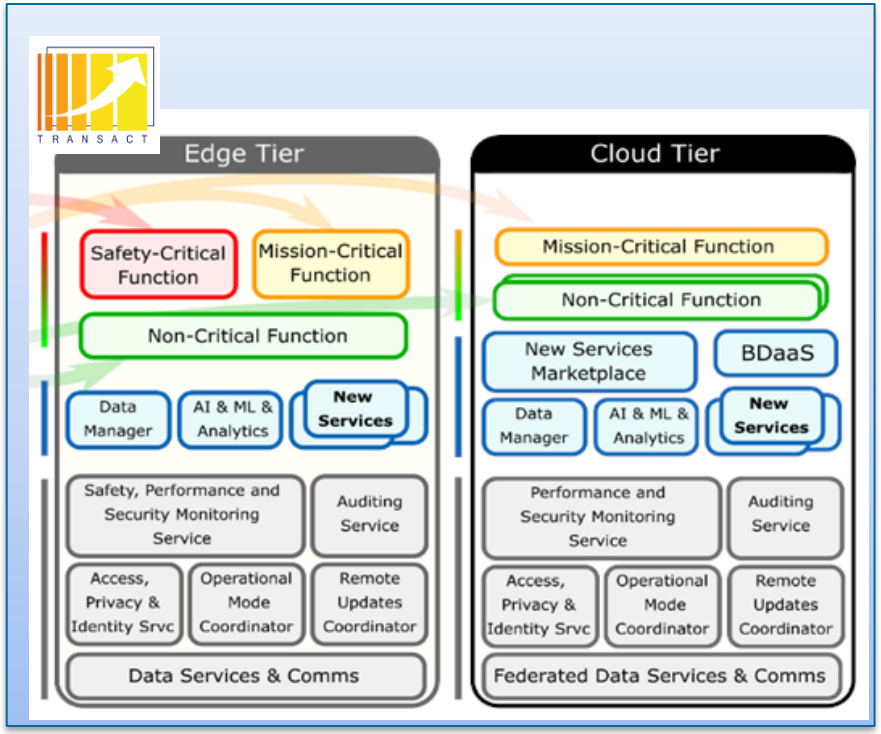
Stepwise Development of Requirements



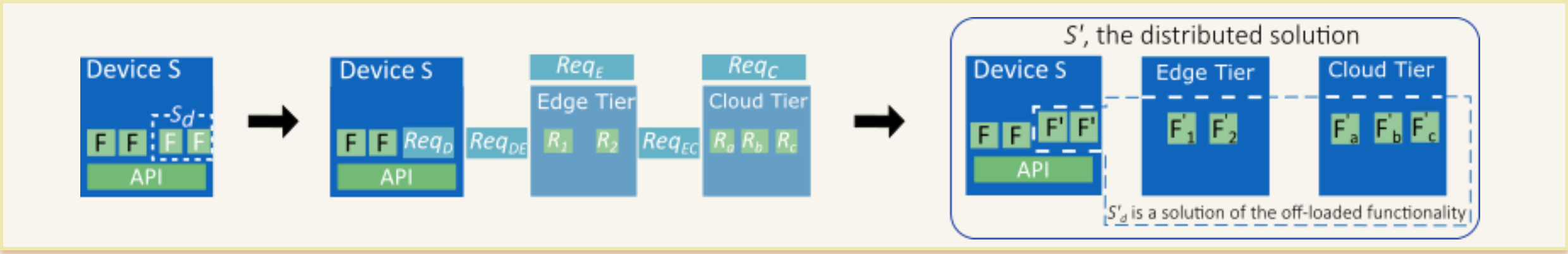


Stepwise Development of Requirements





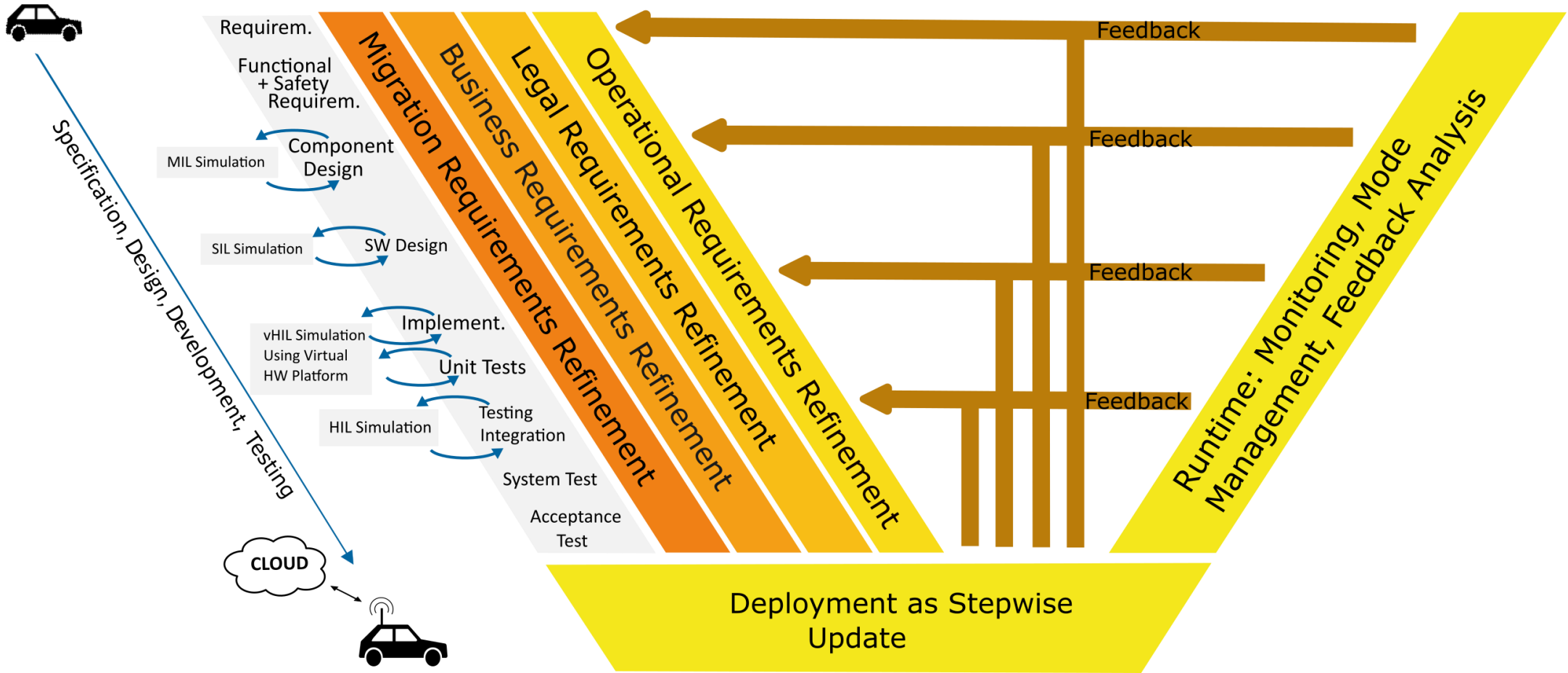
In a Nutshell:



- Structures
  - design space exploration &
  - documentation / recertification
- Early identification
  - of what to offload and
  - whether offloading is feasible

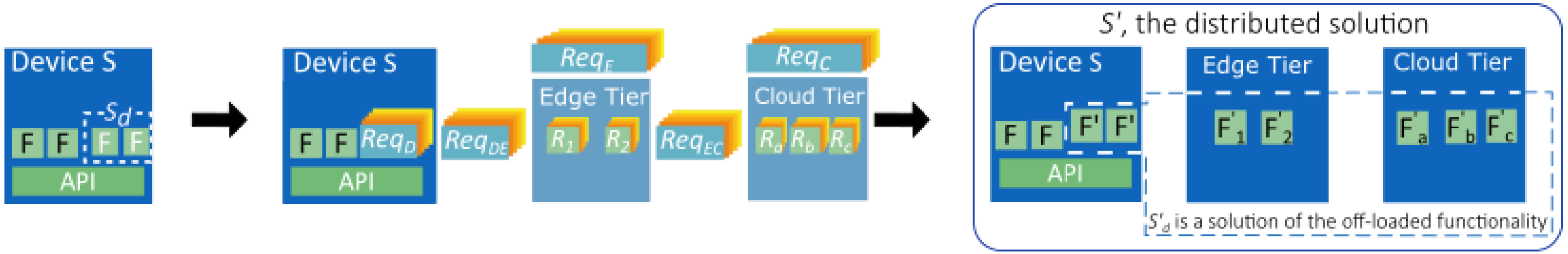
- Supporting the design of
  - interfaces and
  - mitigation strategies
- Verification & Validation
  - front-loading: models & contracts
  - reuse of "old" results

Development of the technical solution as part of the transition



⇨ Requirements on the migration activities

Development of the technical solution as part of the transition



- Strategy for design space exploration:
  - Check realizability of most critical decision first.
- Criticality
  - Criticality depends on multiple dimensions.
  - The dominant dimension(s) may vary for different design steps/solutions/companies.
- Verification
  - Evidences do not only refer to technical properties but also to the other dimensions.

Conclusions

- Proposed transition methodologies are complementing the TRANSACT Reference Architecture
- Transformation from on-device safety critical CPS towards a distributed solution involves not only *architecture* but also *business* and *organization* aspects
- T&V methodology
  - helps ensuring trustworthiness of the new distributed solution
  - emphasizes the multidimensional strategic aspects of the transition

TRANSACT PROJECT

towards safe and secure distributed cyber-physical systems

https://transact-ecsel.eu/

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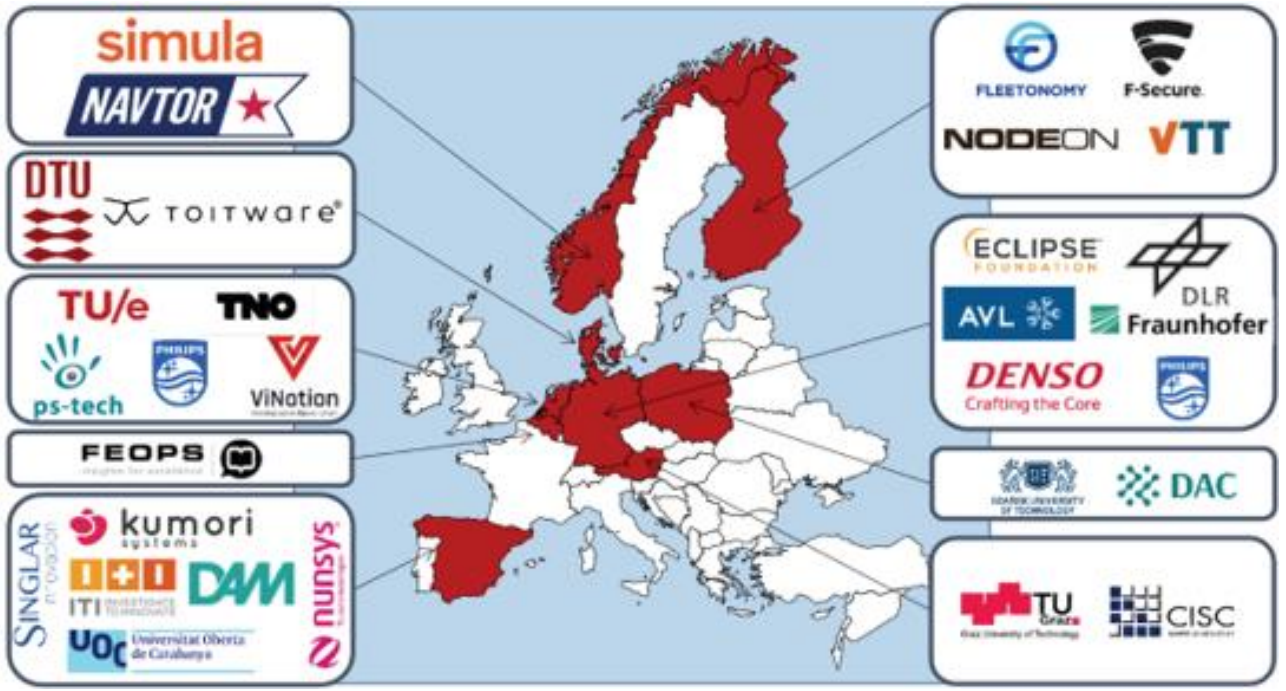

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Thank you!