INTRODUCTION OF A SYSTEM DEFINITION IN THE CPACS DATA SCHEMA

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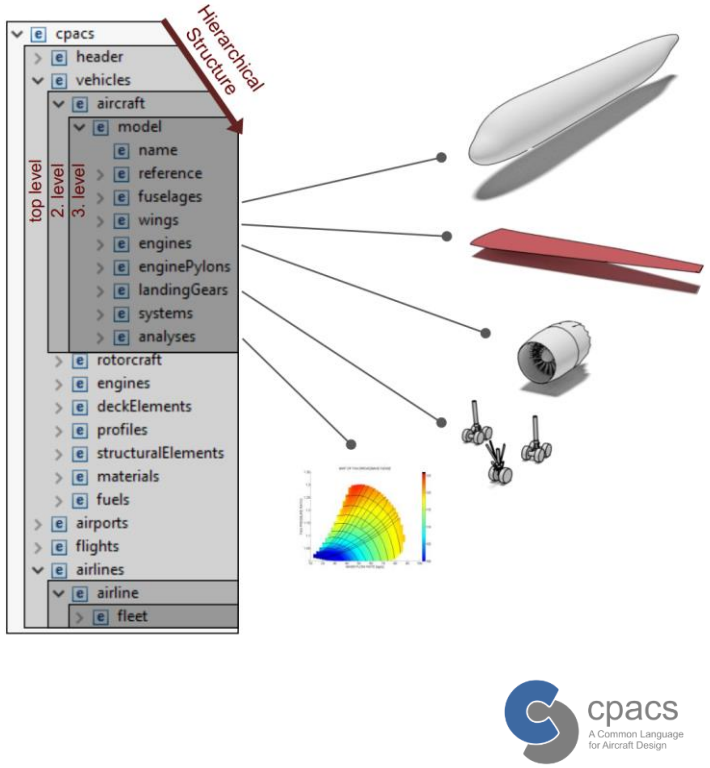
Motivation

Status Quo



Recent aircraft development topics:

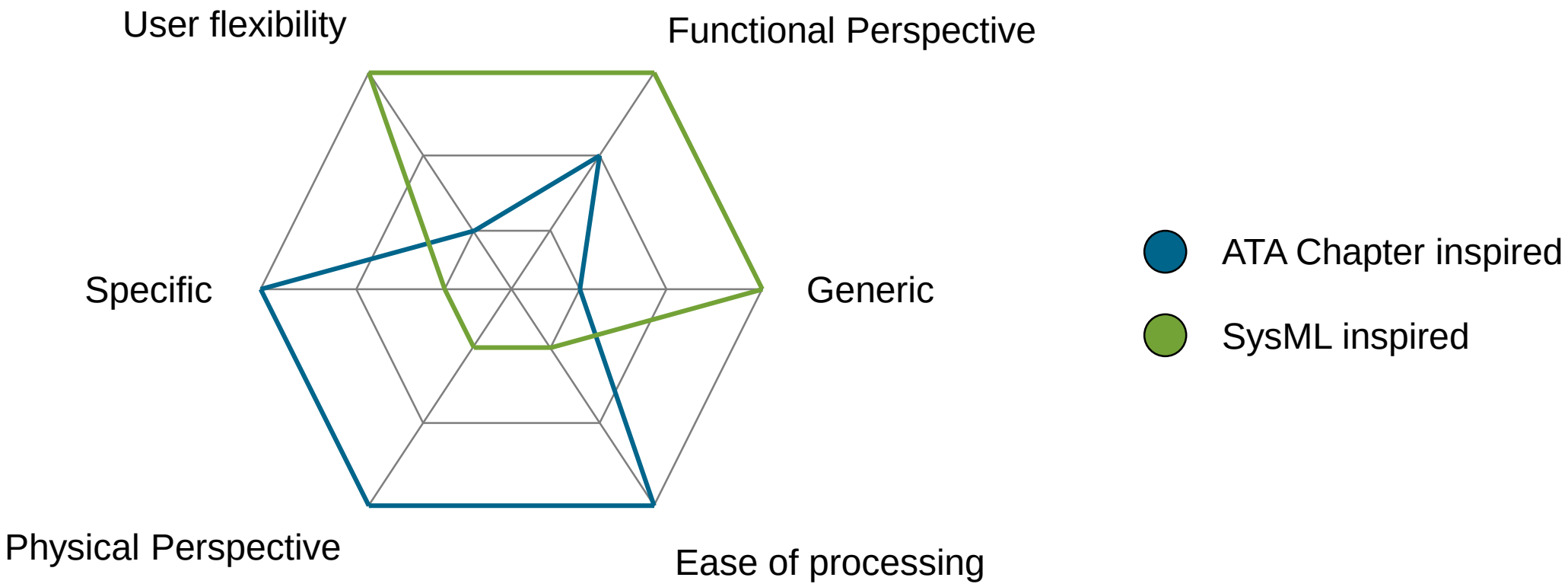
- Variety of propulsion architectures and energy carriers
- More electric aircraft
- On-board system engine interaction

System representation in CPACS v3.4:

- Whole system within mass breakdown (Mass, CoG)
- Geometrical primitives (Location, Geometry)

Development of a system definition in CPACS

Challenges for a system definition in CPACS

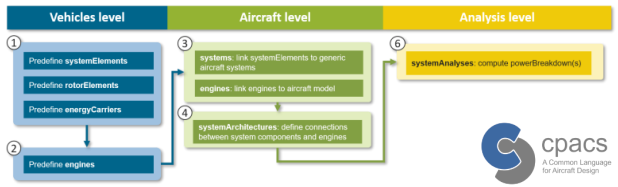


Objective: Enable collaborative design for a wide range of stakeholders

Agenda

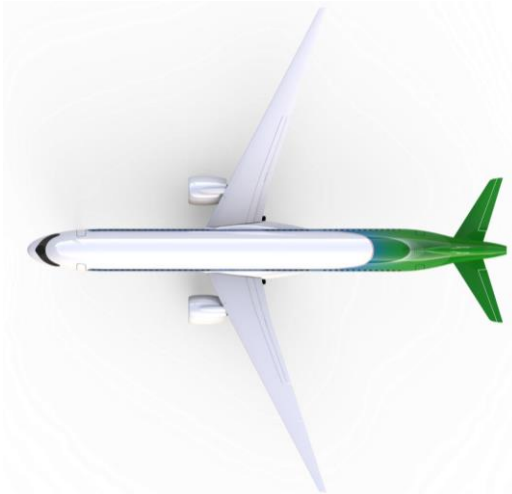
System Definition

XSD Schema Implementation

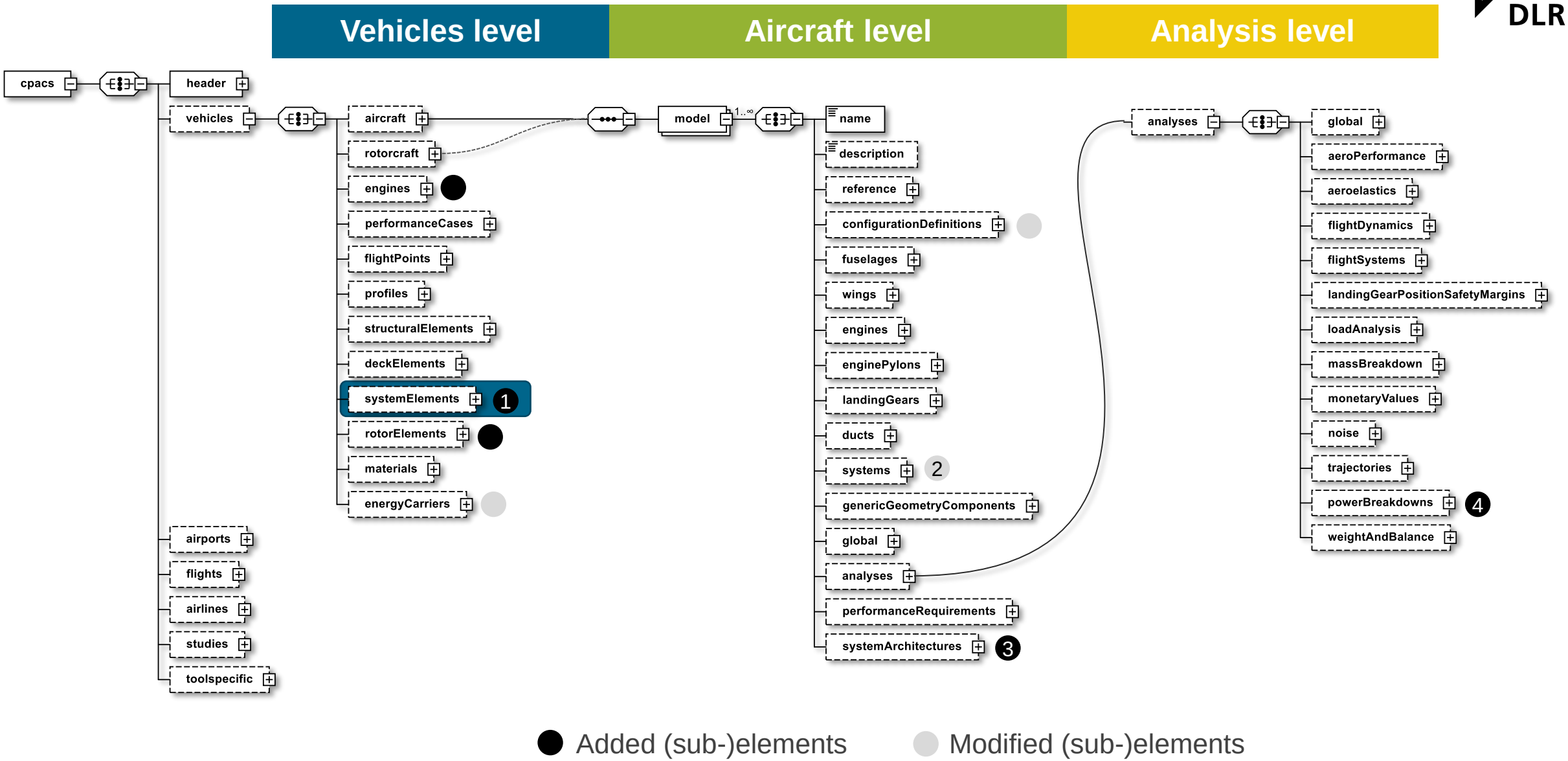


Application Example

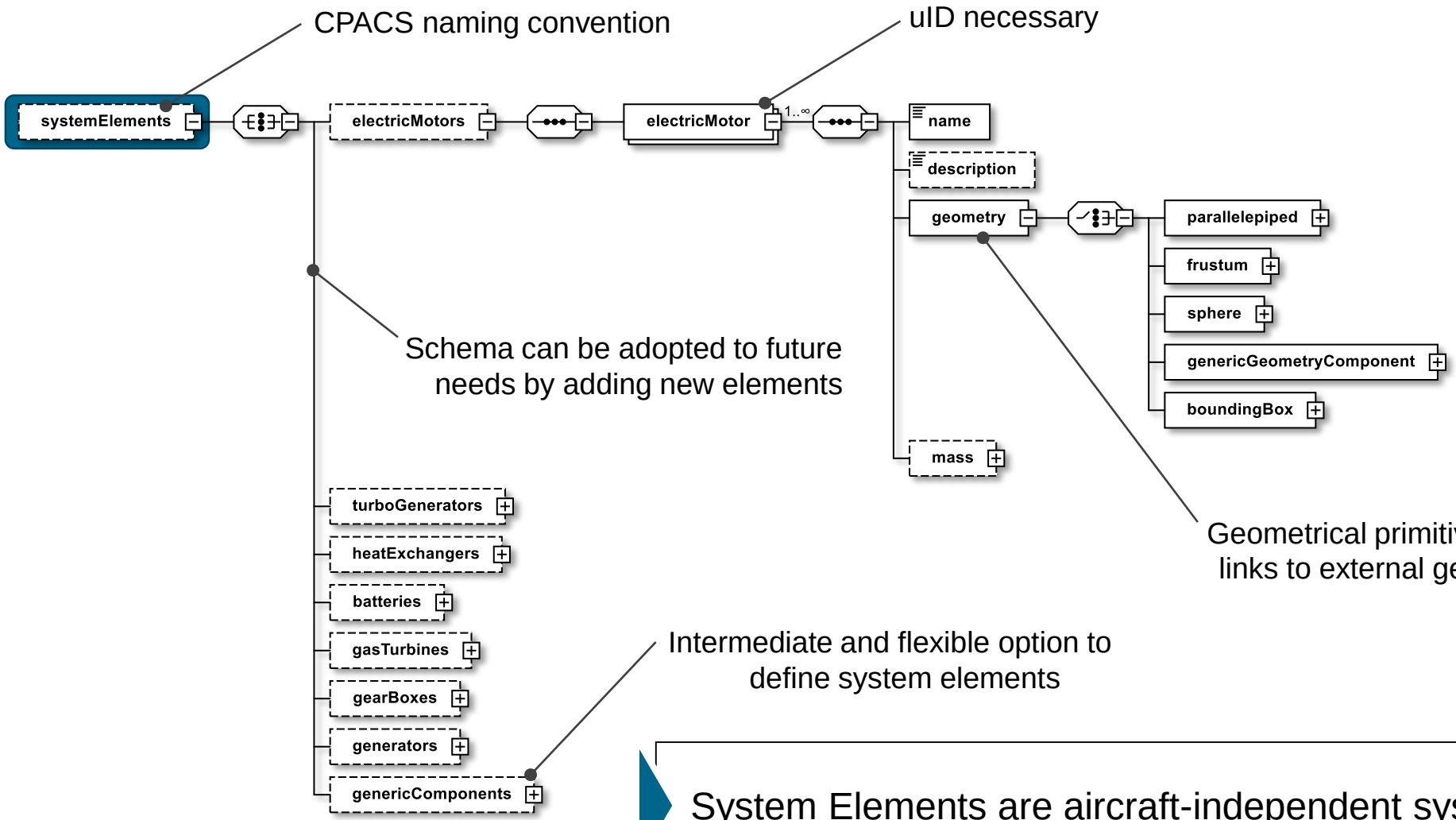
DLR-F25 On-Board Systems



System Definition Data Structure

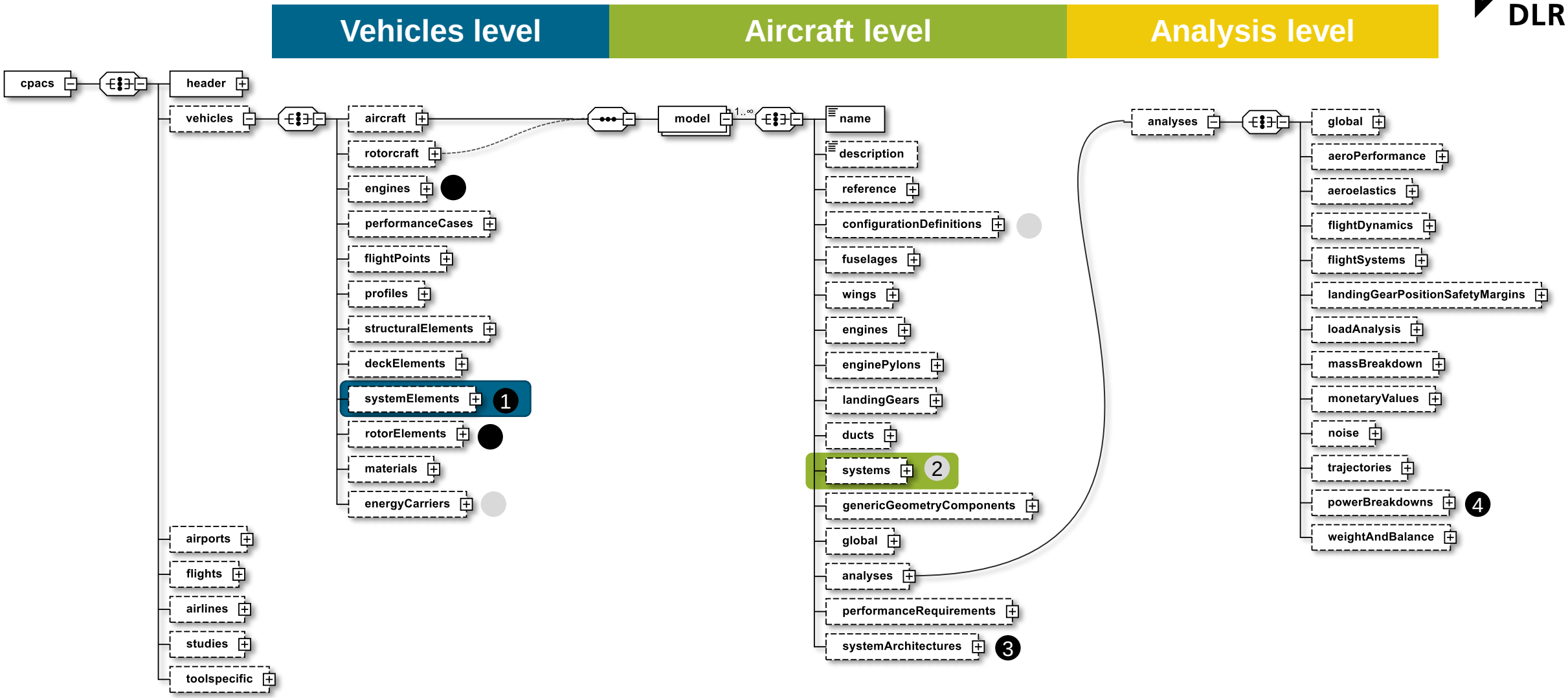


1 System Elements



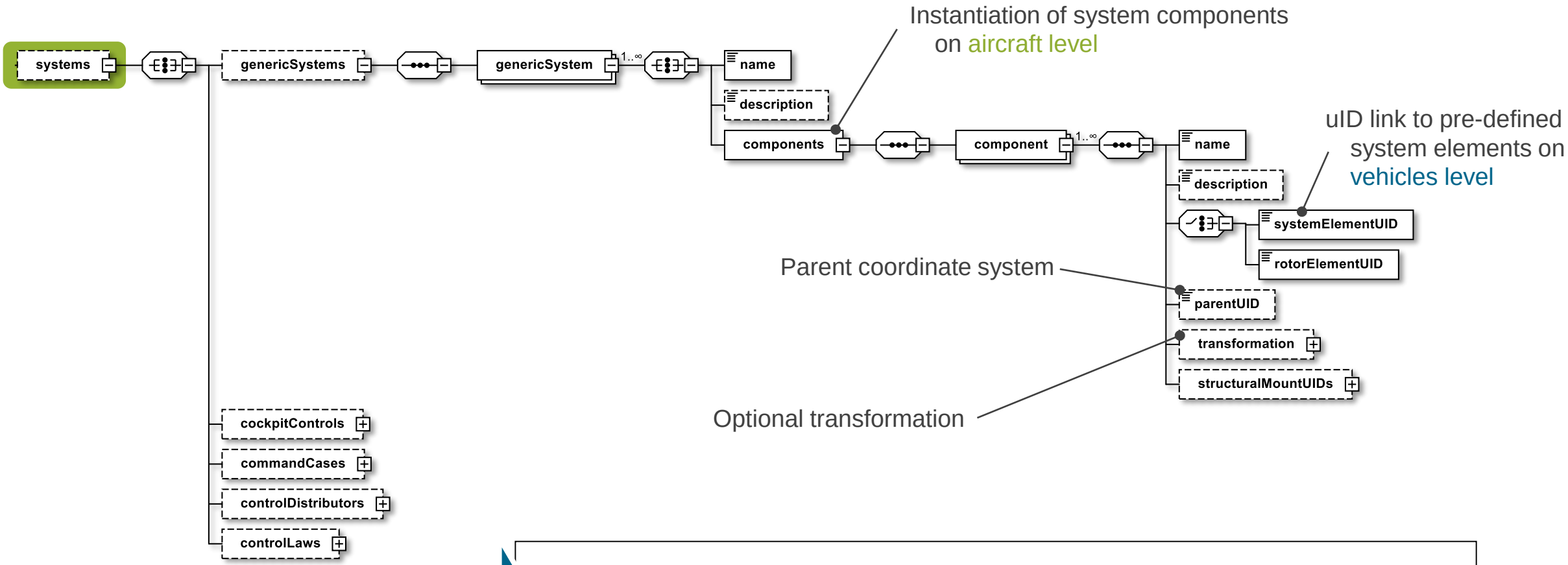
System Elements are aircraft-independent system components

System Definition Data Structure



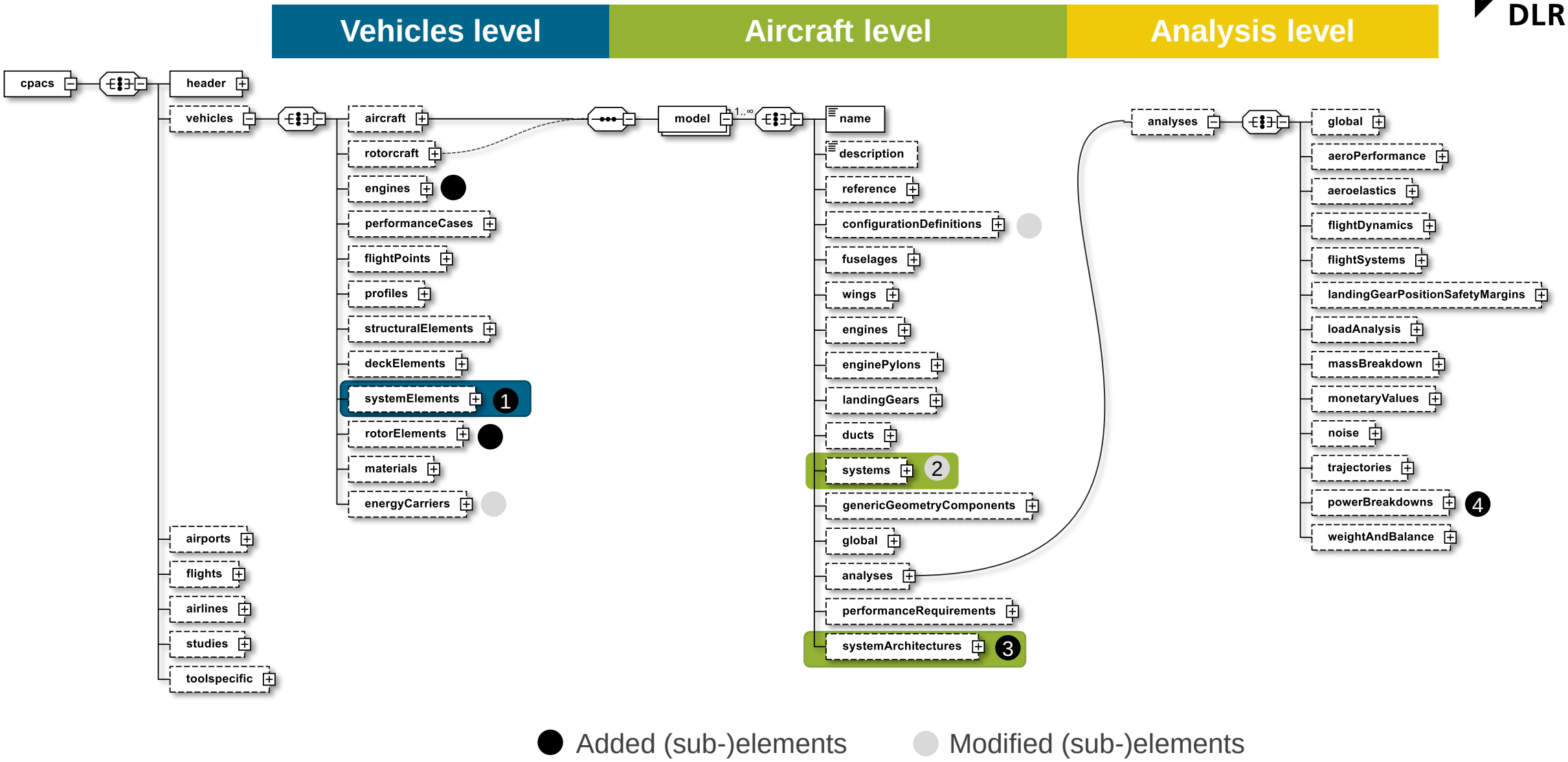
● # Added (sub-)elements ○ # Modified (sub-)elements

2 Generic Systems

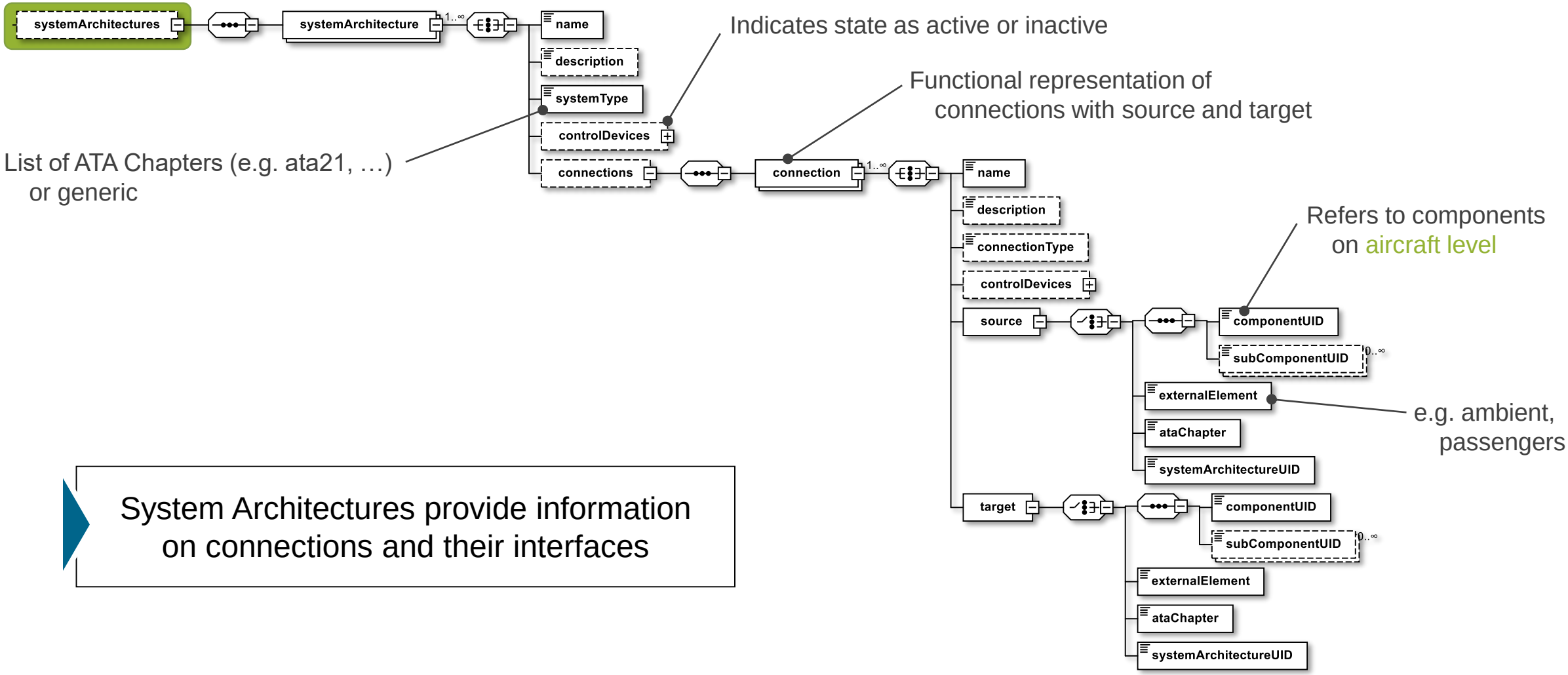


Generic Systems represent all physical components in the aircraft

System Definition Data Structure

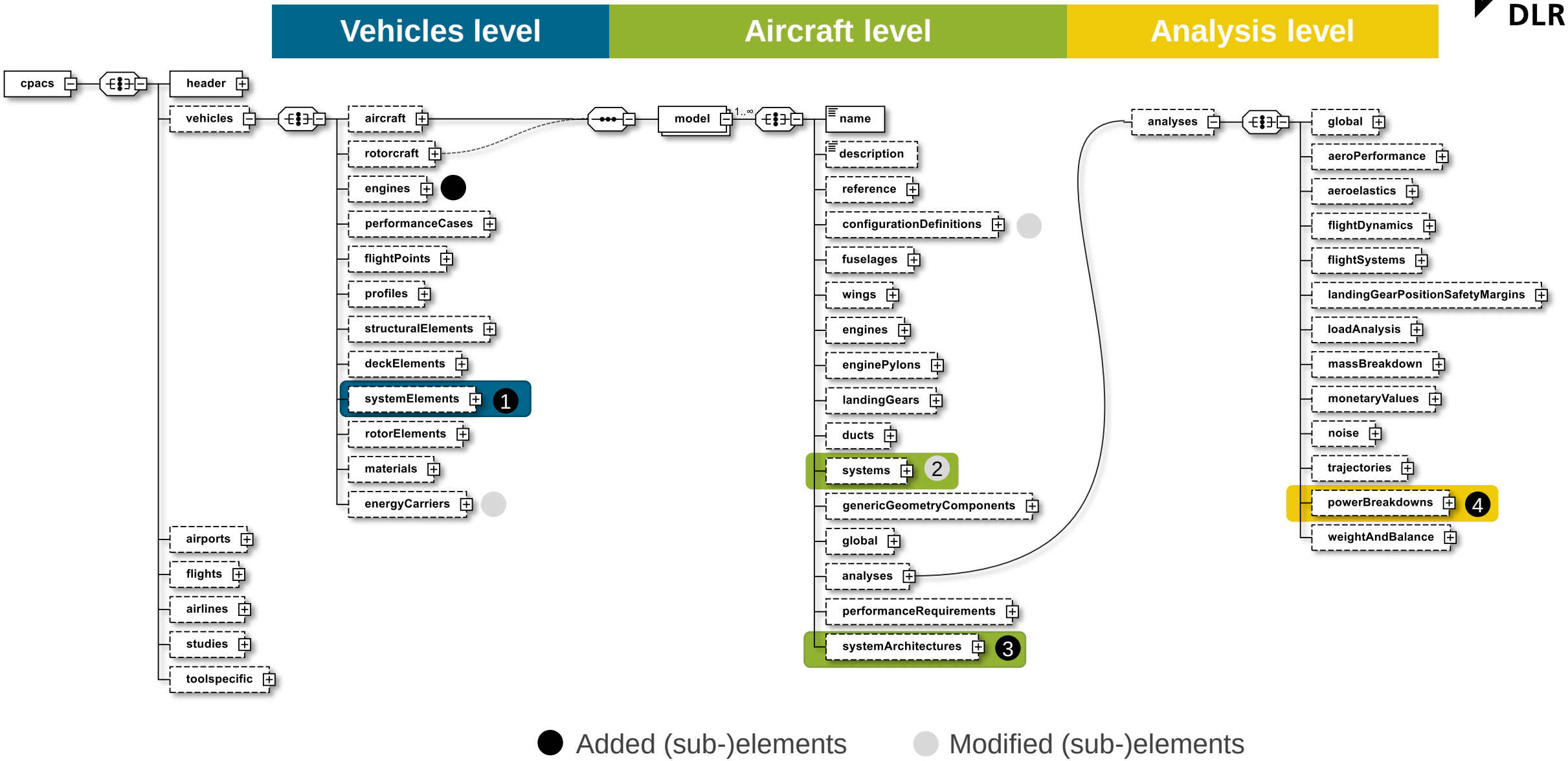


❸ System Architectures

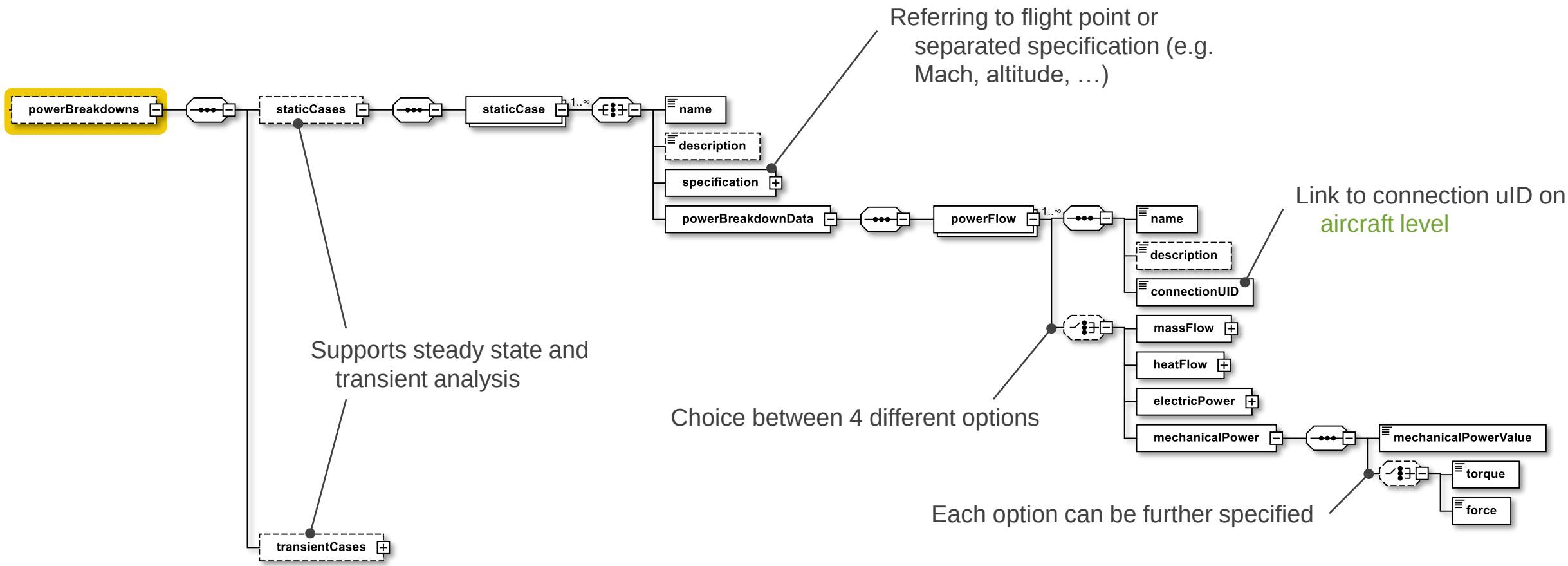


System Architectures provide information on connections and their interfaces

System Definition Data Structure

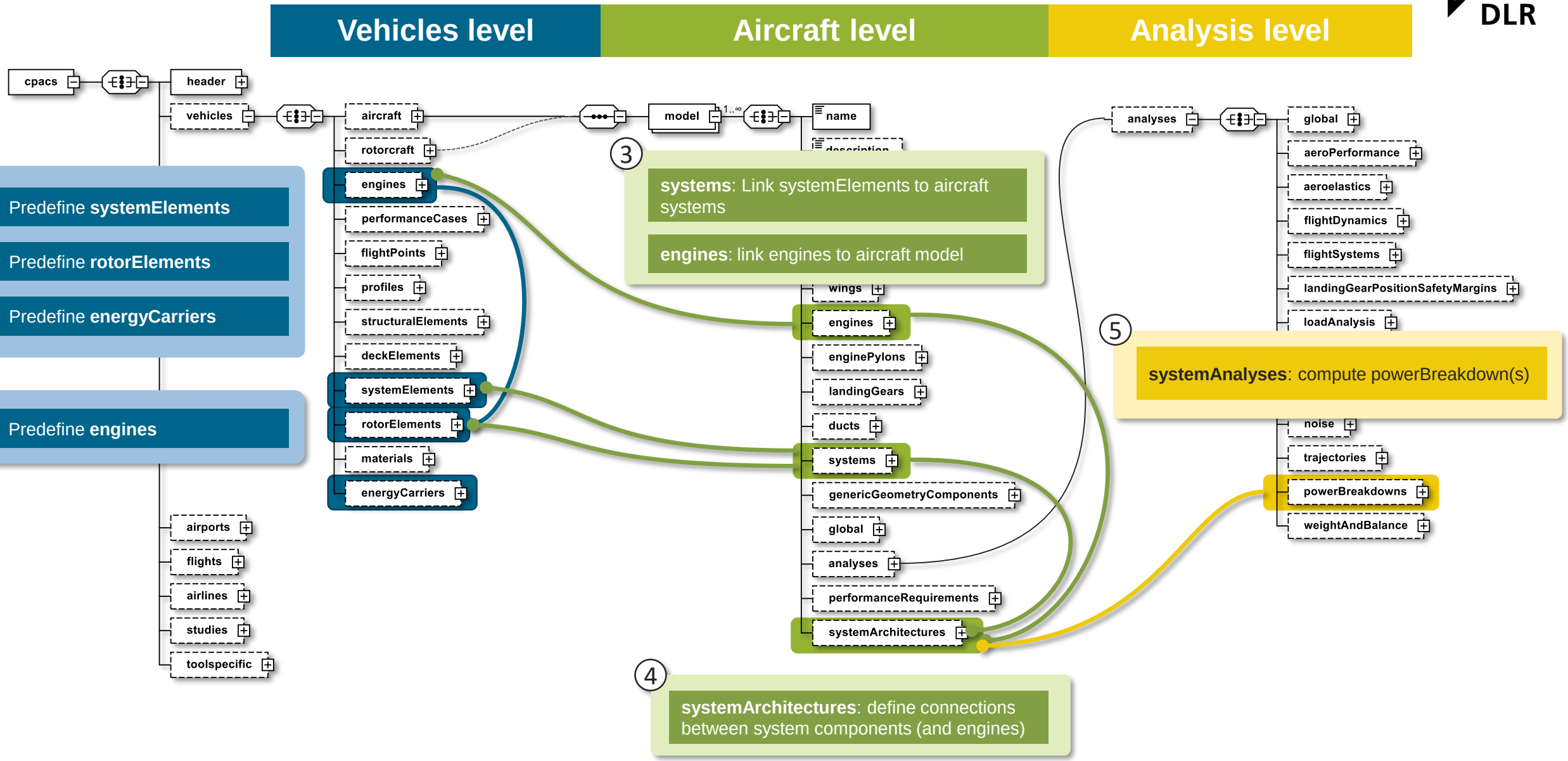


❹ Power Breakdowns



Power Breakdowns store analysis results of energy and/or mass flows for a specific system architecture

System Definition Data Structure – connected by uIDs



Agenda

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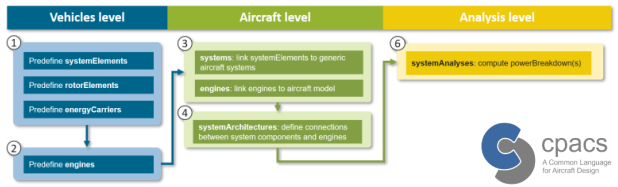
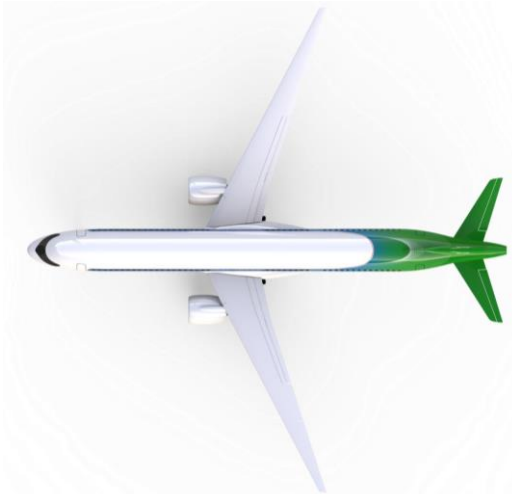


Application Example

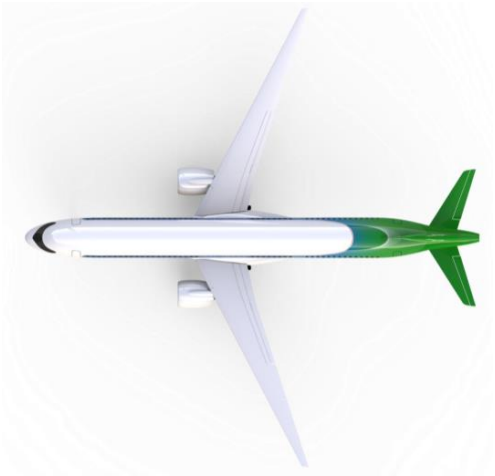
DLR-F25 On-Board Systems



Application Example: DLR-F25[1]

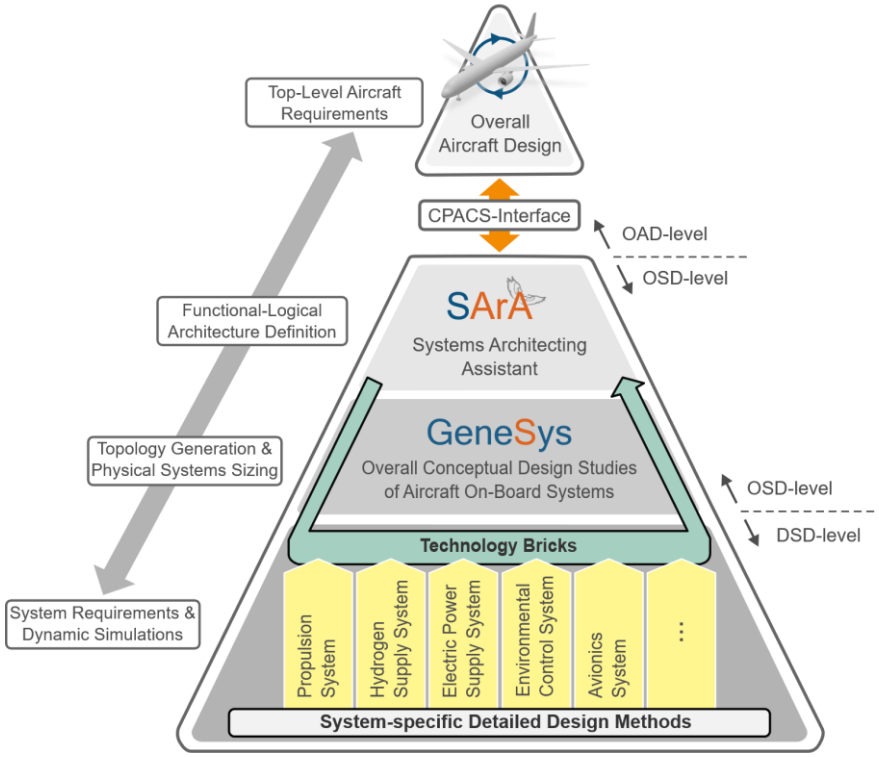
DLR-F25[1]

Research Baseline developed by DLR and TUHH



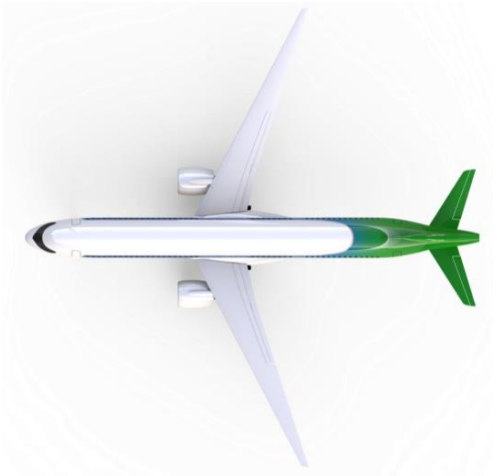
Design Range	NM	2500
Design Passengers	-	239
Max. Payload	kg	25000
Cruise Mach number	-	0.78
Max. operating altitude	ft	40000
Entry into service	-	2035

[1] Sebastian Wöhler, Jannik Häßy, and Vivian Kriewall. Establishing The DLR-F25 as a Research Baseline Aircraft for the Short-Medium Range Market in 2035. ICAS 2024, Florence, Italy, Sept. 2024



DLR-F25 On-Board Systems serve as use-case for CPACS system definition evaluation

Application Example: Different Perspectives



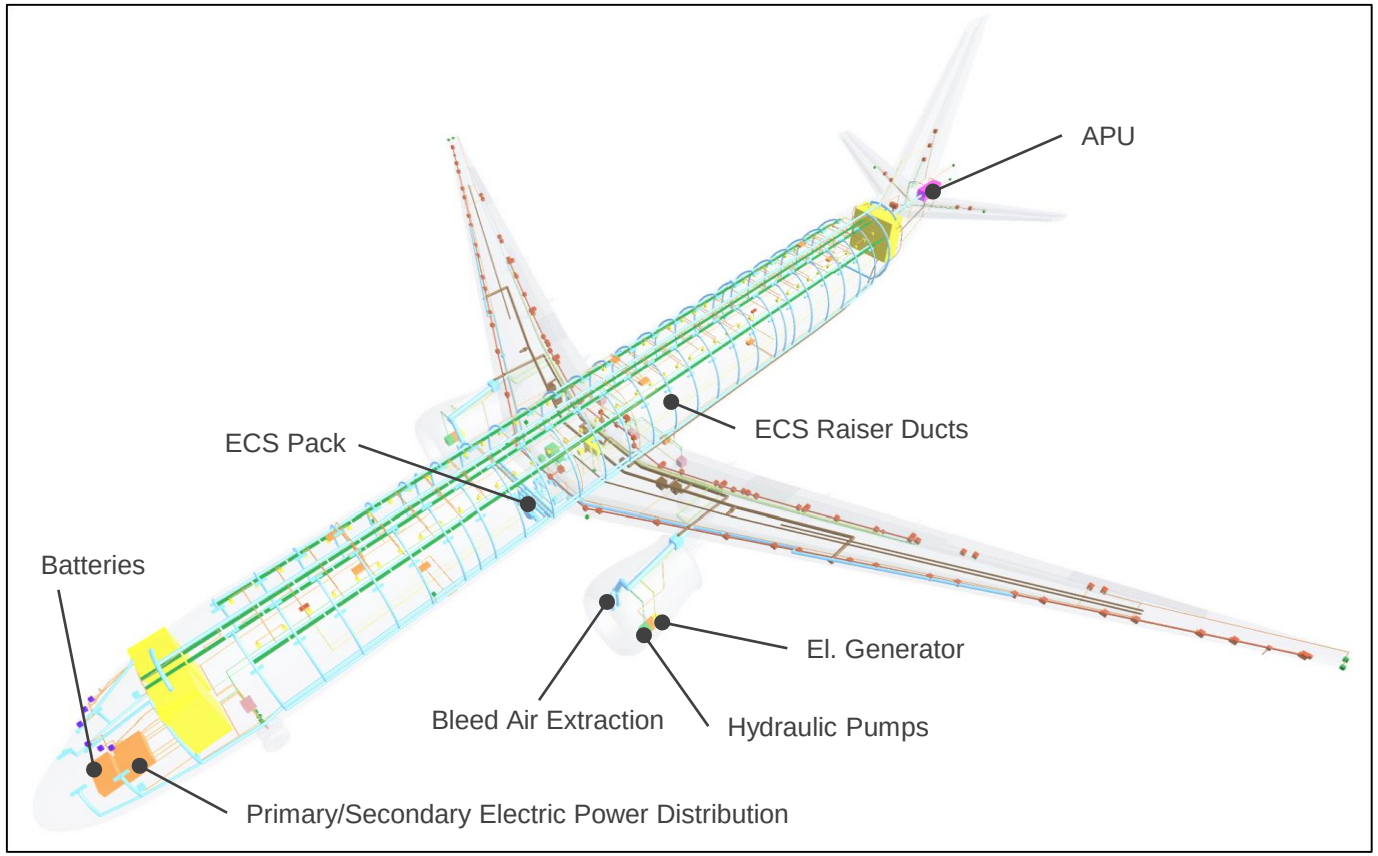
How are the on-board systems **physically integrated**?

How does the **architecture** of the electrical power supply system look like?

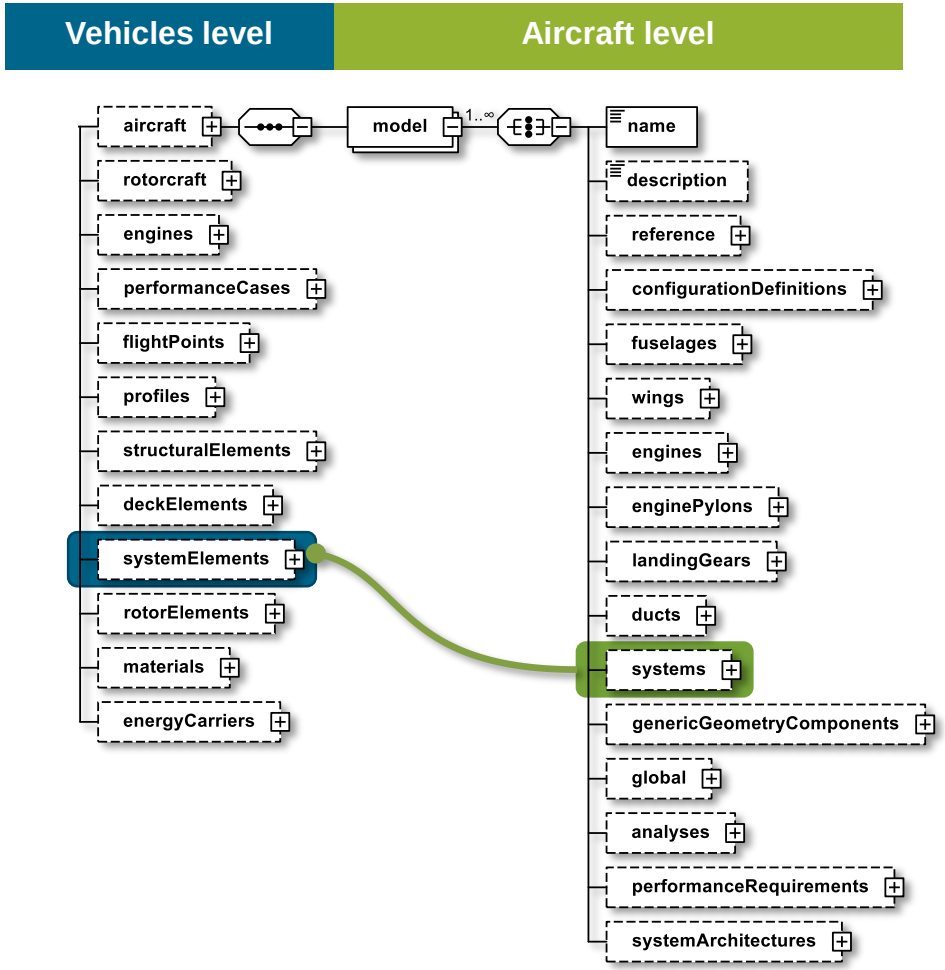
Which consumers do need most of the **electrical power** during climb?

Application Example: Geometrical Perspective

How are the on-board systems **physically integrated**?

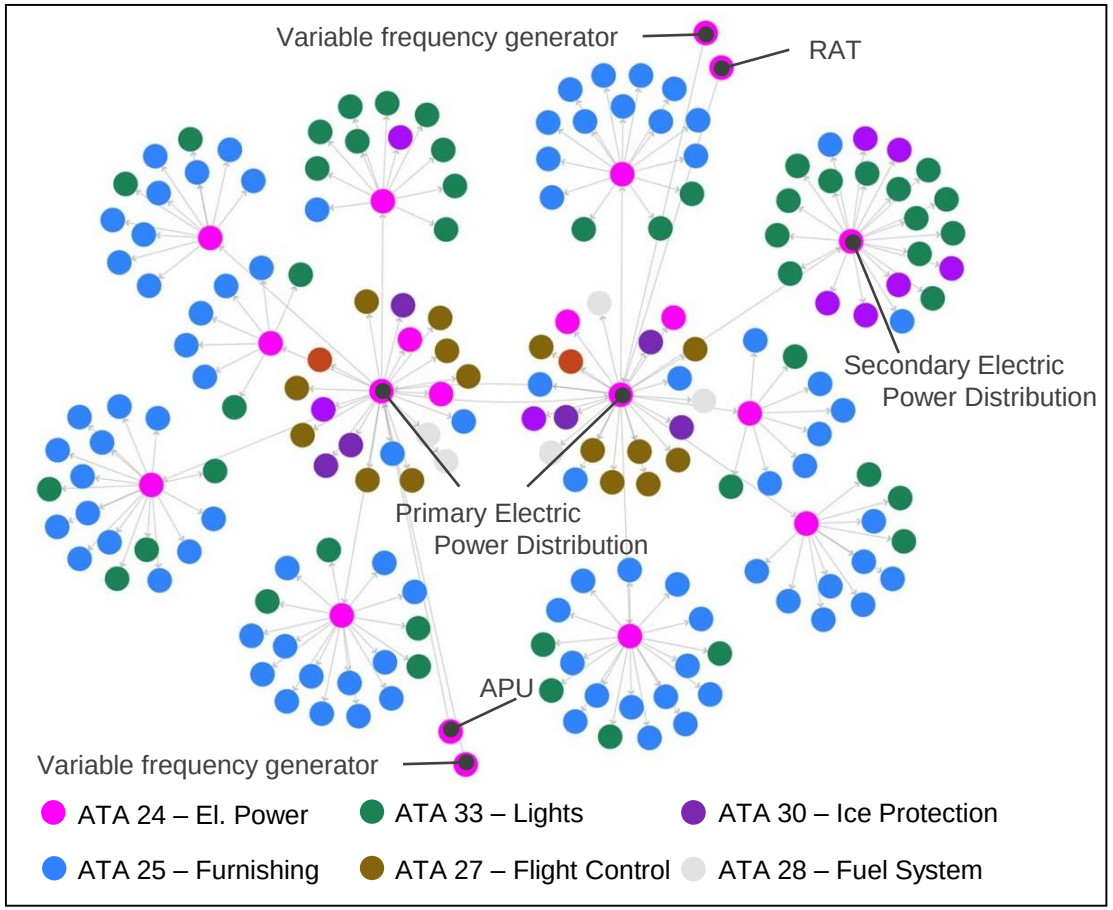


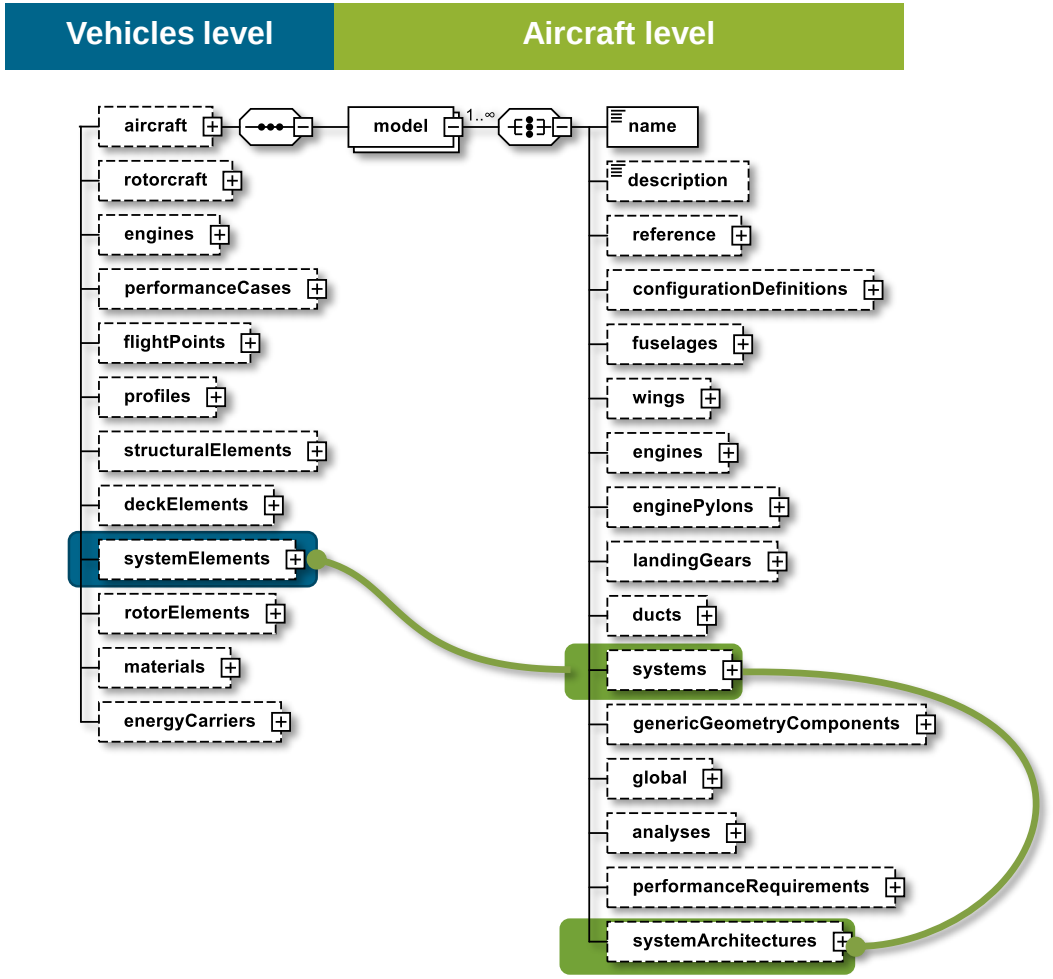
Topology of the overall on-board systems of the DLR-F25 visualized by *SysView*



Application Example: Functional Perspective

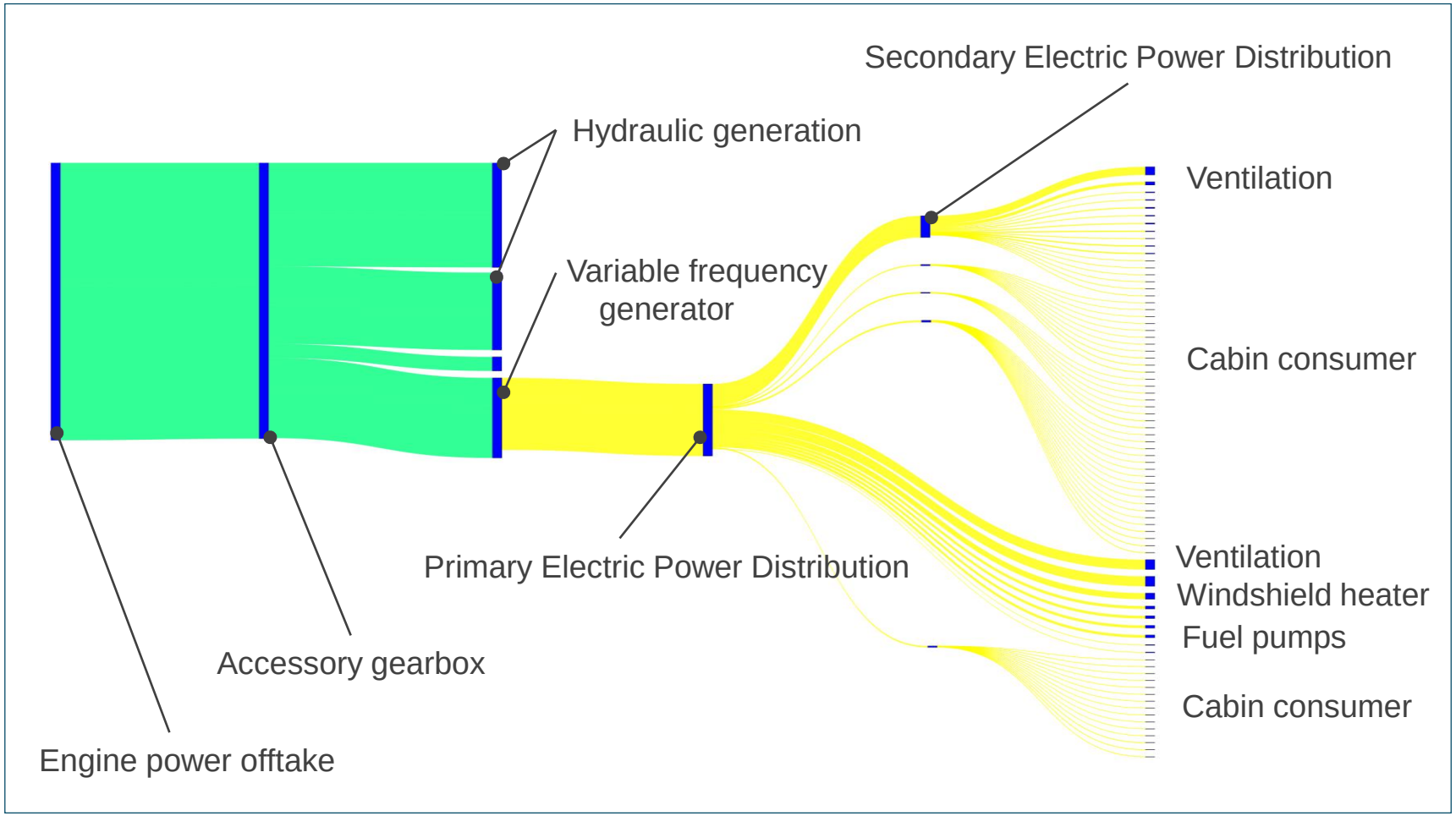
How does the **architecture** of the electrical power supply system look like?



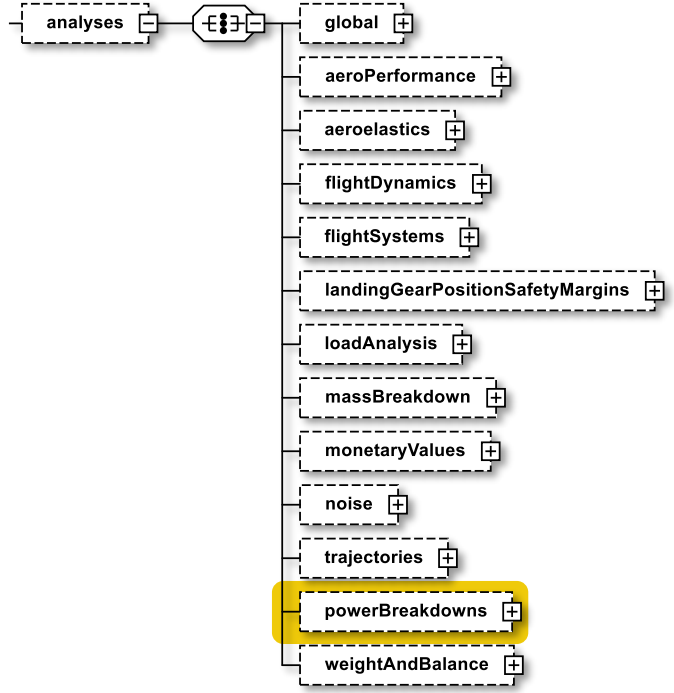


Application Example: Power-Specific Perspective

Which systems do need most of the **electrical power** during climb?

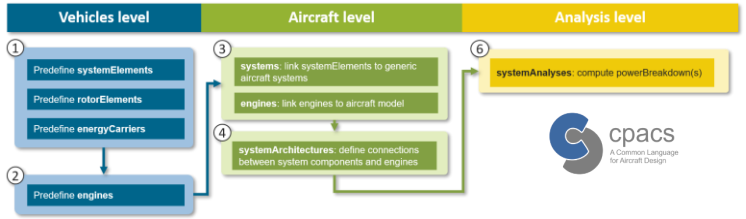


Analysis level

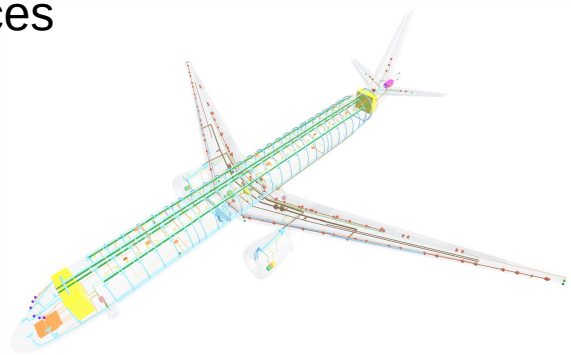


Conclusion

- Schema extension with system definitions is part of CPACS v3.5 release



- Example proofs applicability to on-board system design (and propulsion design)
- Schema improves the collaborative design possibilities by providing functional and physical interfaces



Outlook

- Adding more system elements
- Further work on the definition of electrical energy carrier
- Explicit definition for system distribution networks (routing of cables, pipes, …)
- Adaptation of CPACS processing tools
- System visualization

- **User feedback → Schema improvement**

Thanks for Your Attention!

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System Architectures in Aeronautics

Aviation System Concepts and Evaluation