# ThermoFisher
## SCIENTIFIC

# Company-wide Architecting Assets to Inform Design Decisions

*" The integration of a reference architecture into Capella has improved the capability of our systems engineers to provide more value to our customers.*

# Context

Thermo Fisher Scientific is a global company with 110,000 employees that supplies scientific instrumentation.

Its facility in Eindhoven, Netherlands, develops a diverse range of microscopes and analytical equipment, including Transmission Electron Microscopes (TEM) that can be used for applications such as virus and cell structure research, chemical and material analysis, and semiconductor analysis and control.

The TEM portfolio offers three product line families, composed of 400 modules with a total of over 1,000 active configurations, which are continuously upgraded and updated over a 20-year lifespan by 400 engineers across four sites in Europe.

Integrating new hardware and software components into such complex systems is very challenging as it requires ensuring backward compatibility across multiple versions, and ensuring that everything continues to function correctly.

In order to meet customers' expectations, Thermo Fisher Scientific's systems engineers must maintain traceability from requirements to the technical decisions made for each product configuration, and make these decisions accessible to stakeholders throughout the company.

### Joost DIERKSE

Joost Dierkse is Manager Research & Development at Thermo Fisher Scientific. He has been focusing on Reference Architecture and Modeling for the past four years and is leading the Model Based Systems Engineering activities for the TEM R&D department.

### Alexandr VASENEV

Alexandr Vasenev is an experienced researcher with systems background, who focuses on developing and applying design methodologies. His interests include eliciting requirements, analyzing systems, and creating user-oriented solutions. His work concerns identifying practical methods to employ platforms and reference architectures in enterprise context.

## Capella

# Solution

To improve the development of advanced electron microscopes, and support the decisions made by its engineers, Thermo Fisher Scientific has introduced a reference architecture with the help of TNO-ESI.

Based on a clear functional breakdown, it allows to specify the TEM according to three aspects: Workflows (what is expected by the system), Functions (what does the system do), and Decomposition (how does the system realize this). Following this architecture, a TEM is broken down into subsystems, i.e. combinations of hardware and software, interconnected by high-level interfaces.
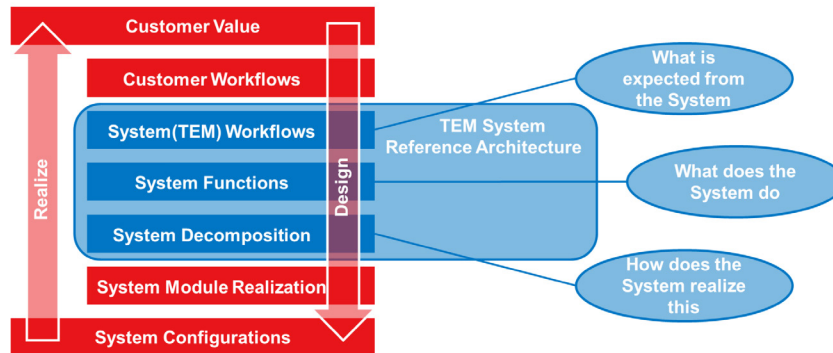


Capella has been chosen to implement this approach. With its native support of a Model-Based Systems Engineering (MBSE) method, and used with a system decomposition approach, Capella makes it easier to maintain consistency in the design of the systems. It also increases automation opportunities by leveraging the model's digital format.

In addition to Capella, a specific add-on has been developed to obtain quantitative information, such as throughput numbers, for a particular workflow. By using the open-source simulation tool POOSL, systems engineers can simulate Capella's Functional Chains, and visualize the results using the freely available TRACE4CPS tool.
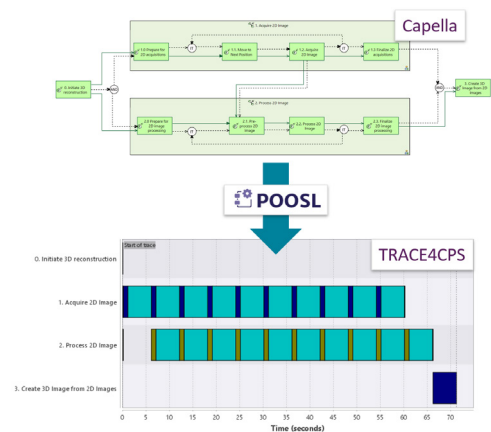


# Result

Replacing heterogeneous architecture description tools used previously, such as Powerpoint and Visio, the new solution dramatically streamlines the systems engineering process on a project.

One of its key benefits is the ability to allow systems engineers to quickly explore new options by re-using parts of the reference architecture, while preventing double recording the same information. It enables them to reason about design choices, such as function allocation and parallelism, and identify problems at an early stage.

The models created with Capella provide a complete overview and a clear traceability, which helps to explain the design to other stakeholders. They progressively become an authoritative source of truth, acting as company-wide architecting assets to inform about architecture decisions, and maximize customer value through design space exploration.

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