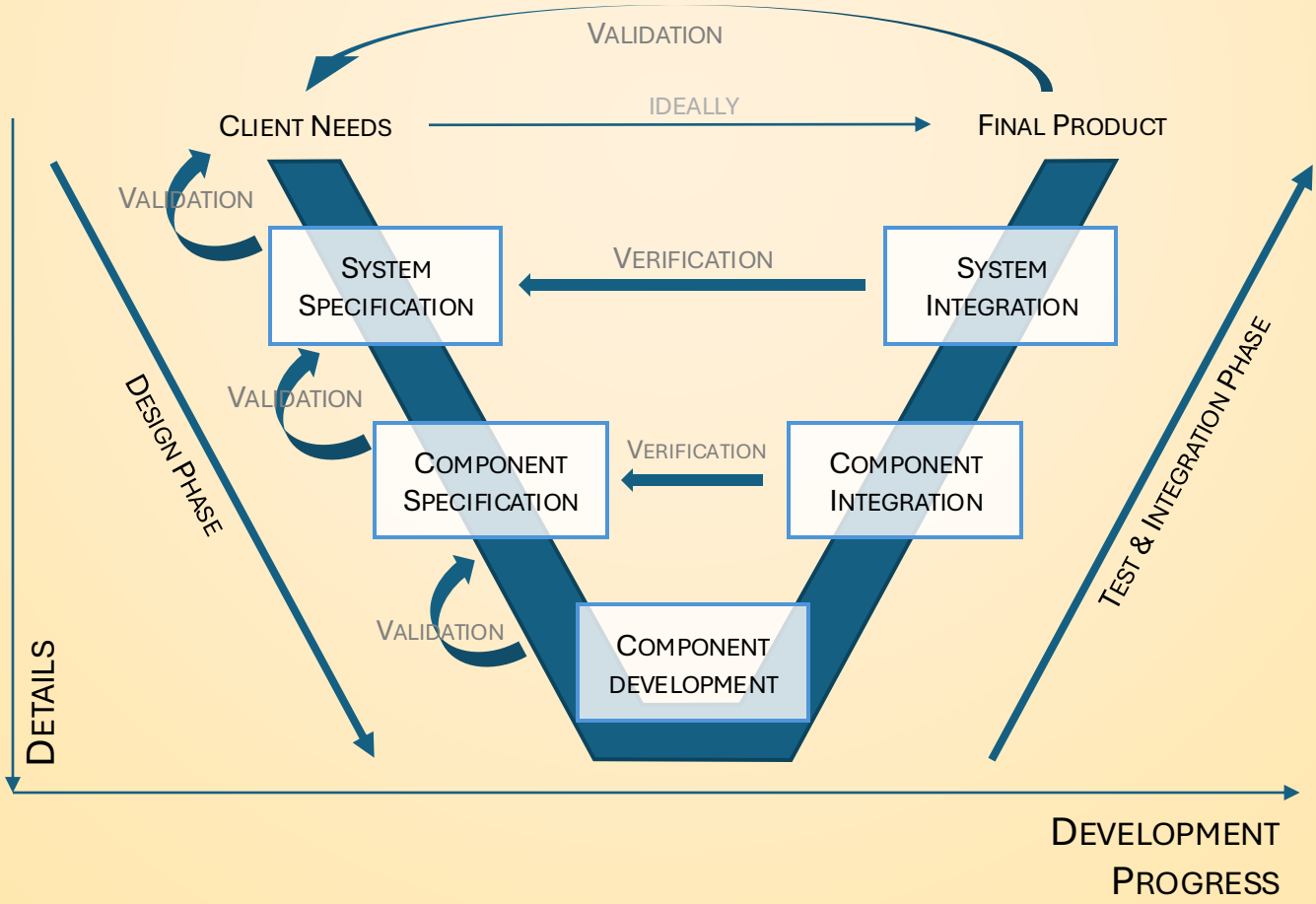
What is the System Engineering V-model?

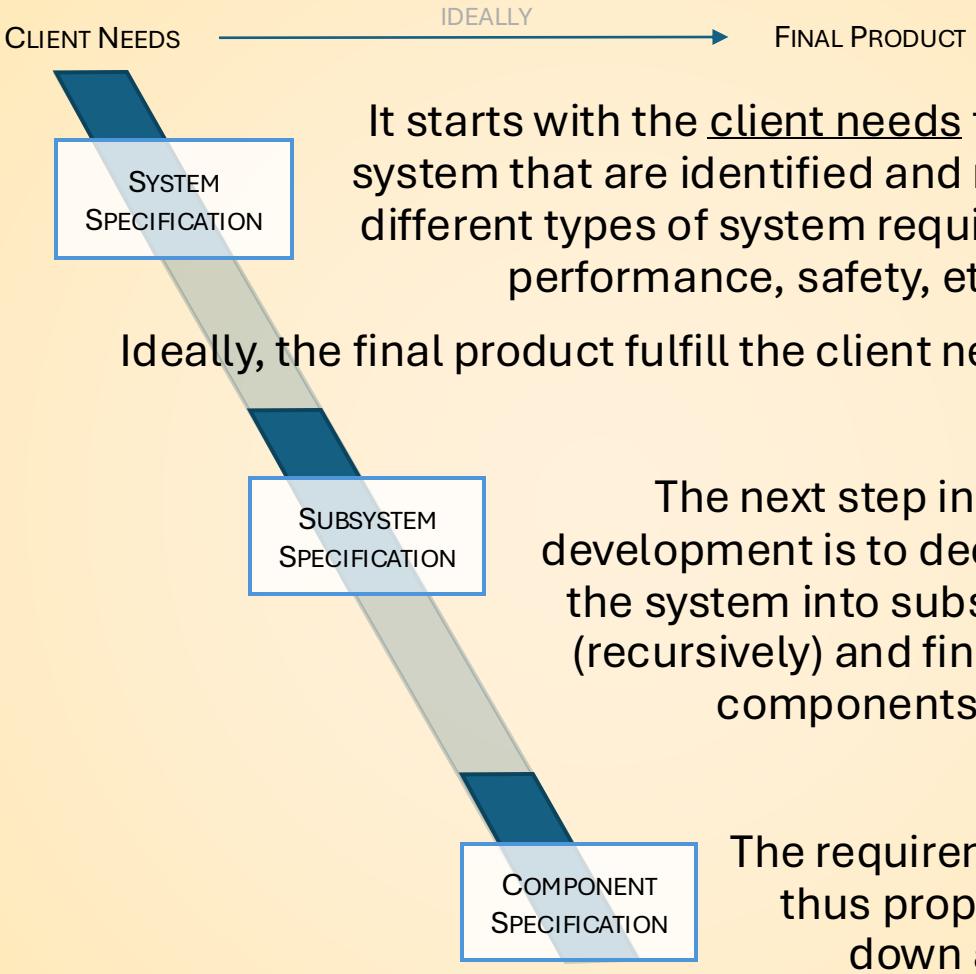
And on Wednesday… how is it evolving?



Dr. Clément Coïc

What is the System Engineering V-model?

The “V” (or “Vee”) model represents the development cycle of a product in a System Engineering manner.



It starts with the client needs for a new system that are identified and refined as different types of system requirements: performance, safety, etc.

Ideally, the final product fulfill the client needs.

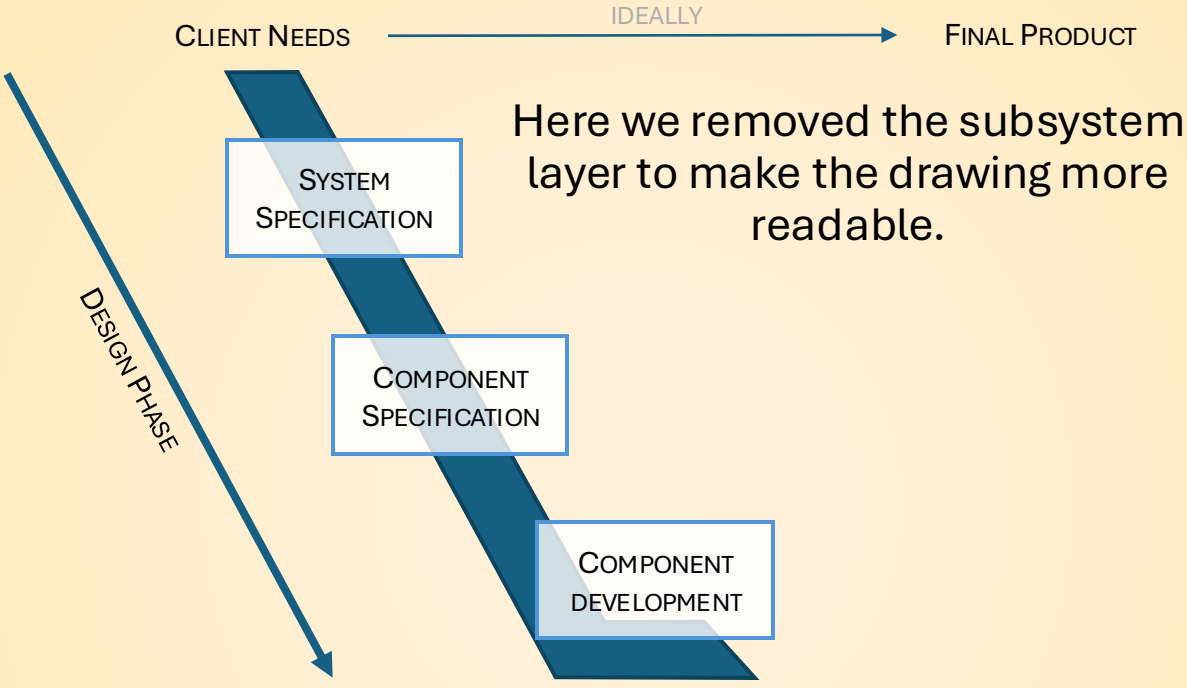
The next step in the development is to decompose the system into subsystems (recursively) and finally into components.

The requirements are thus propagated down and adapted or allocated to their subsystem scope. (Say a system – with a maximum failure rate λ requirement – is decomposed into two subsystems, each cannot have this same requirement, this would violate the system requirement → allocation is needed.)

Dr. Clément Coïc

What is the System Engineering V-model?

The descending part of the V leads to the design and development of all components.



Here we removed the subsystem layer to make the drawing more readable.

This is the Design Phase of the V.

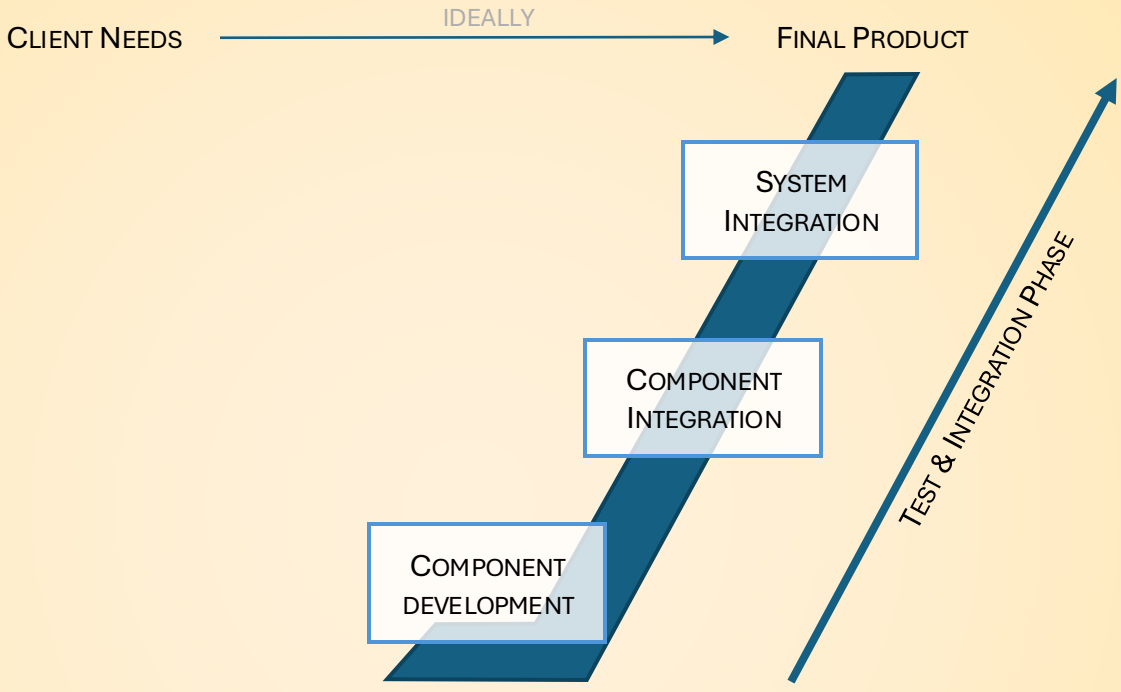
From system to component specifications, architectures, technologies and designs are studied, discarded and selected.

In the end components are sized based on their respective requirements.

Dr. Clément Coïc

What is the System Engineering V-model?

The ascending part of the V corresponds to the testing phase and integration of components and subsystems.



This is the Test & Integration Phase of the V.

The “V” shape is chosen to emphasize the different levels of system, subsystems and components – as horizontal bands on the development cycle.

Now comes the famous V&V of the V…

Dr. Clément Coïc

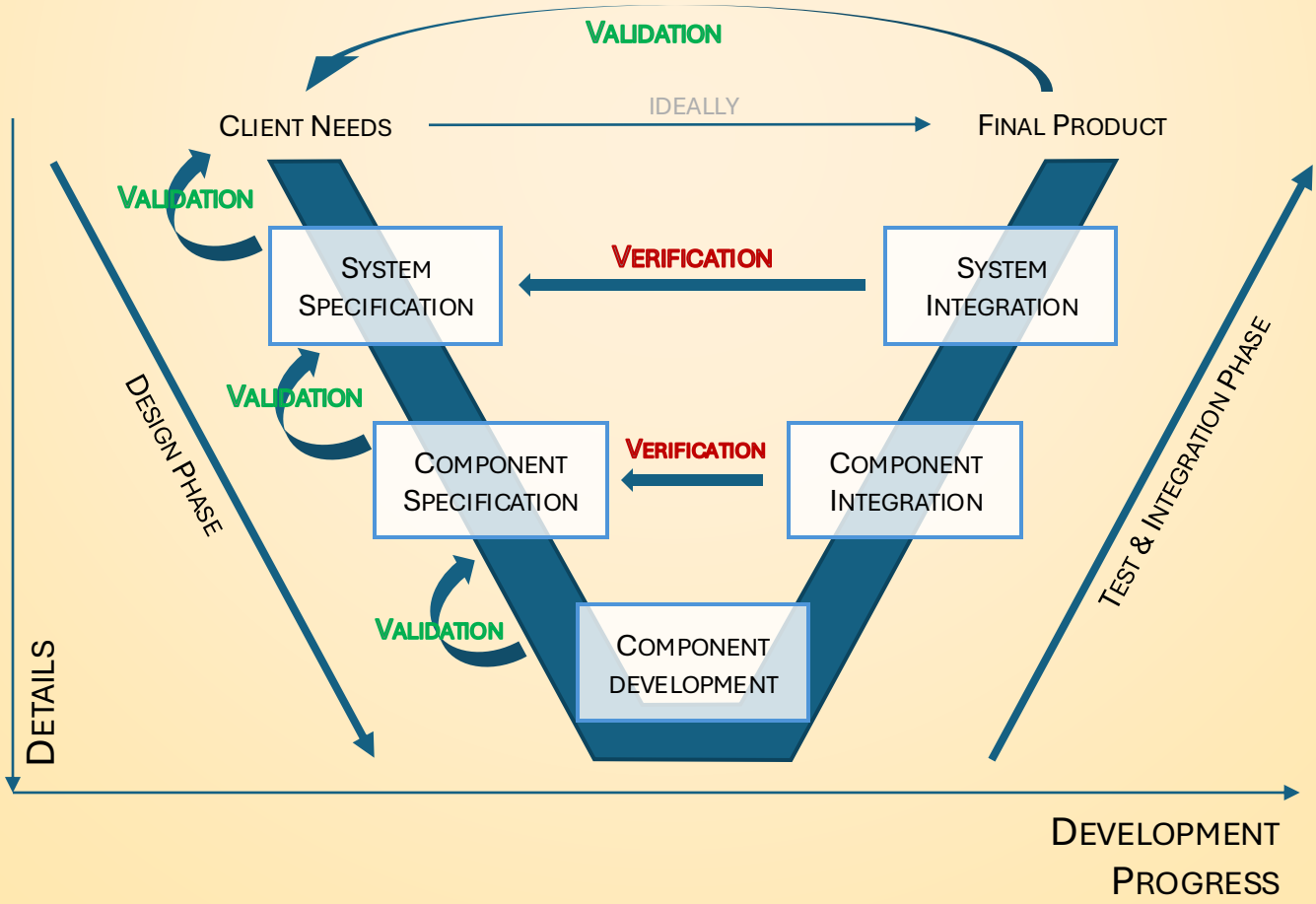
What is the System Engineering V-model?

V&V stands for **Verification** and **Validation**.

Validation answers the question: does my system fulfill the needs it is intended to?

Verification answers the question: does my system meets the requirements it is designed for?

The **Verification** happens when testing – as these allow for comparison with the specification (yet some requirements are not easily testable).



Dr. Clément Coïc

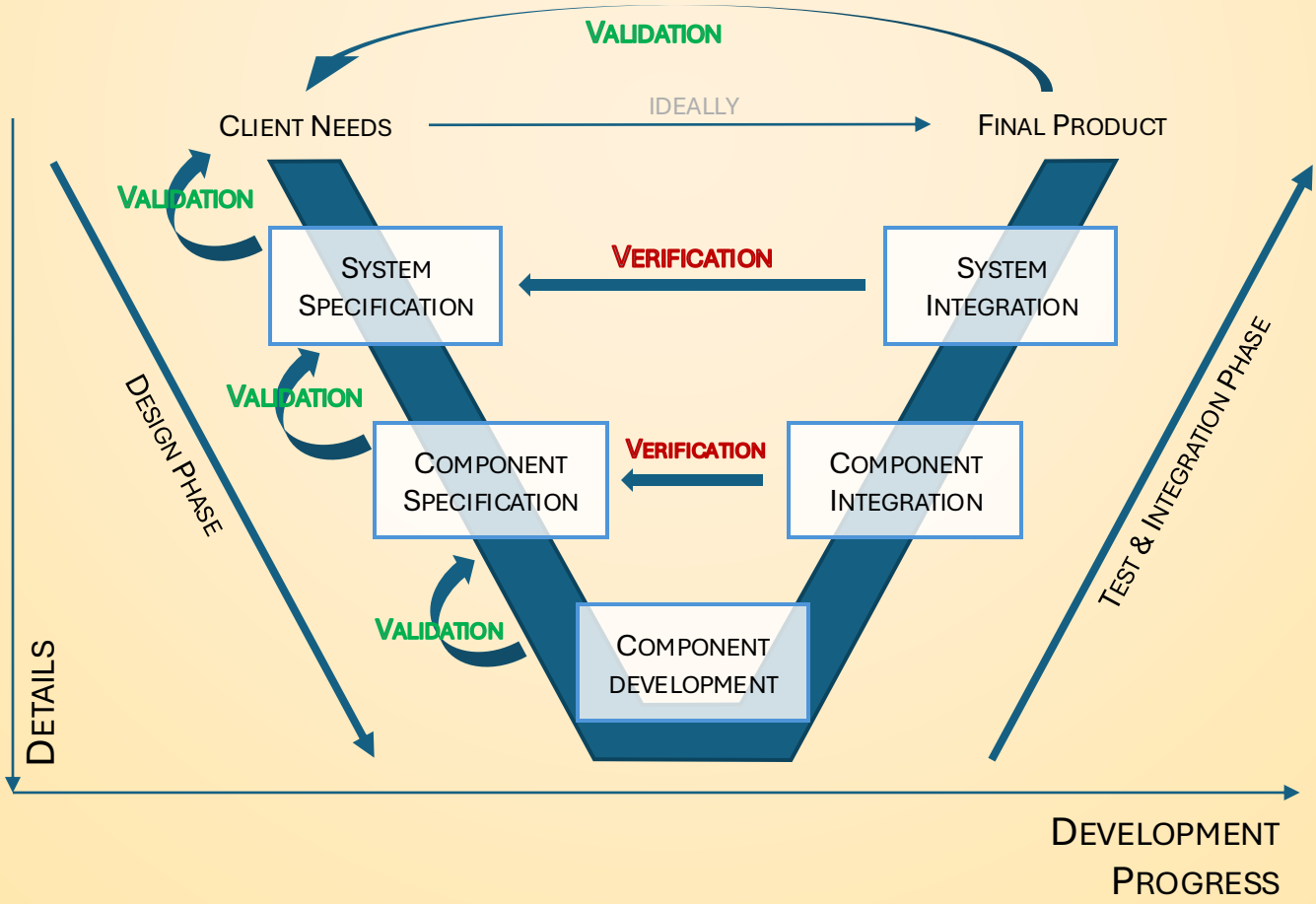
What is the System Engineering V-model?

V&V stands for **Verification** and **Validation**.

Proper **Validation** can only be performed by allowing the clients to use the final product and judge whether it fulfill their needs.

If the answer is no… this would be painful.

To minimize the risks, regular small "validation loops" can be conducted in the descending phase of the V to ensure the requirements are aligned with the needs of the higher-level system



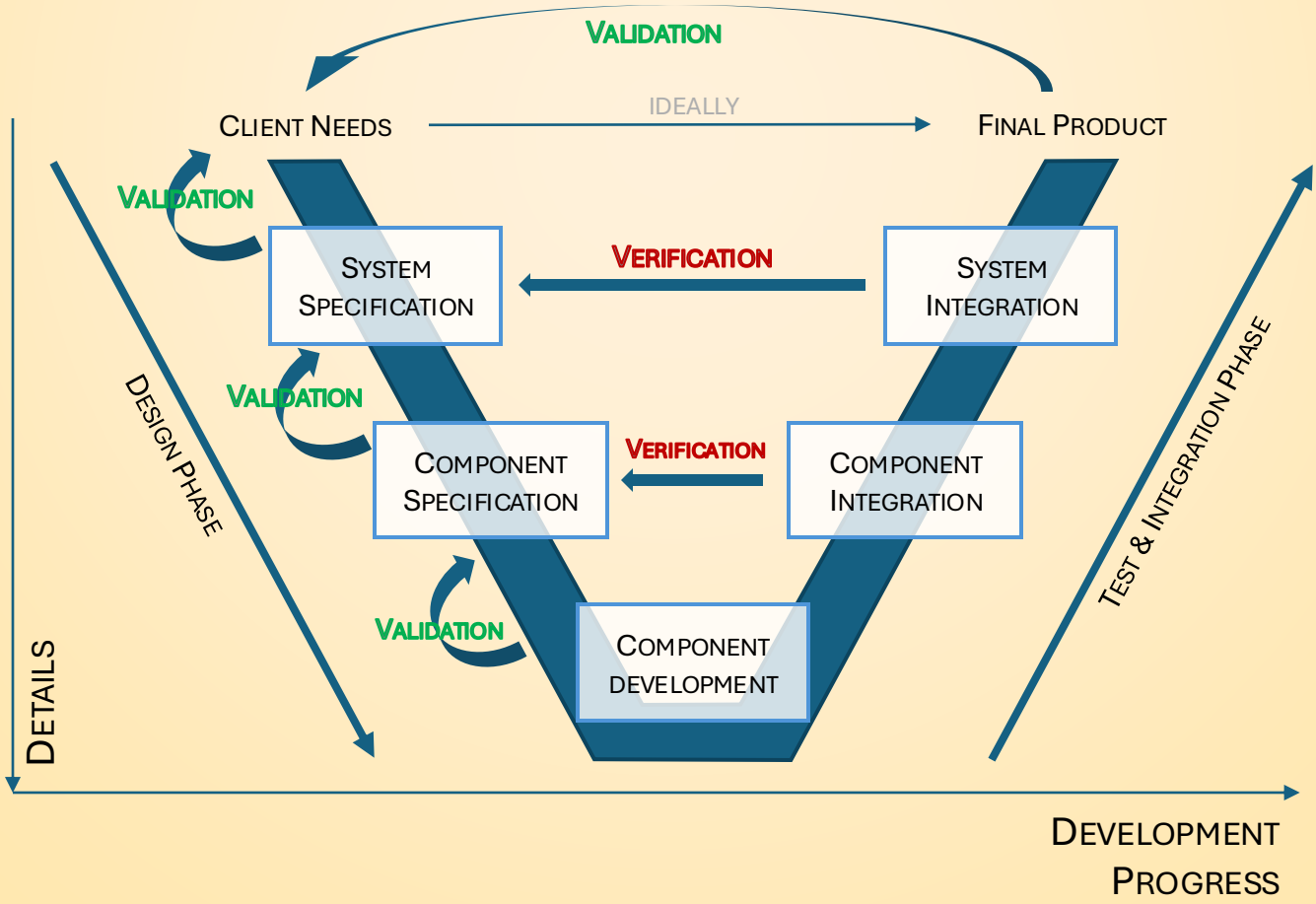
Dr. Clément Coïc

What is the System Engineering V-model?

Two axes are added here for guidance.

The V should be read as non-linear, as there could be iterations – if the verification fails, the system gets back to the design phase. However, the overall progress is toward the right side of the V.

And toward the bottom of the V, the level of detail increase. This is needed as component design shall be much refined before production than at system level for technology evaluation.



Dr. Clément Coïc

Two notes on the System Engineering V-model?

1. What is a system for one can be a subsystem for others. From the viewpoint of the aircraft manufacturer, the jet engines are a subsystem. From the perspective of the jet engine manufacturer, it is the system. This brings to the next point.
2. There is not a single V. As soon as the system is decomposed into subsystems, these are parallel developments until their integrations. Each would follow its own V.

There are more variants to this V model.
On Wednesday (Nov 27th), some will be presented.

Also, we are running a poll to understand which development cycle you are mainly using.
Please vote to let us know!

Comment if you need any further clarification or insights.

Dr. Clément Coïc