# Serenity® – a Cutting-Edge Framework to Drive Systems Engineering
## Create More with Less

**EVOCEAN's unique model-based Systems Engineering framework is called Serenity®. Focusing on improving Systems Engineering, Serenity® includes a common language to communicate and share more effectively and coherently. In combination with an inherent high re-usability, it helps speeding up development considerably, enabling innovative and prosperous organizations.**

*Serenity® is a proven and innovative method which positively affects the entire organization.*

A model is a representation of the reality, a simplified abstraction for a dedicated usage. Models not only contribute to a better understanding of structure and behavior, but also help to understand the system more clearly earlier on in the development phase. To ease the understanding of the purpose, models rely on graphical notations, e.g. a physical equation, a 3D mechanical drawing, an electronic scheme, or a behavioral description.

From a structural point of view, three pillars are essential for modeling:

▪ A **common language** is needed to enable the communication and sharing of knowledge between the stakeholders involved such as customers, designers, engineers (software, mechanical).

▪ A **robust method** is necessary to create sustainable models and to be able to reuse them.

▪ A **set of tools** is necessary to be able to produce the models.

Model-Based Systems Engineering is a way for organizations to enhance their engineering capabilities and efficiency. To pave the way towards the Digital Twin, EVOCEAN has developed a unique framework over the last years – Serenity®. As a framework, Serenity® provides a method, a tool set, guidelines, rules and principles, supporting documents and training, in order to drive the effective operational deployment. Serenity® is scalable and customizable, allowing having it adapted to each and every technical domain and organization. It can be introduced incrementally, having in scope the goals and needs with the highest value for the organization first.

However, Serenity® is not just a technical approach to improve the working processes in Systems Engineering. It is a proven and innovative method which positively affects the entire organization. By enhancing multi-disciplinary interactions and collaboration, it contributes to cope with the constant changes in the business environment and supports the transformation towards a lean and more collaborative organization.
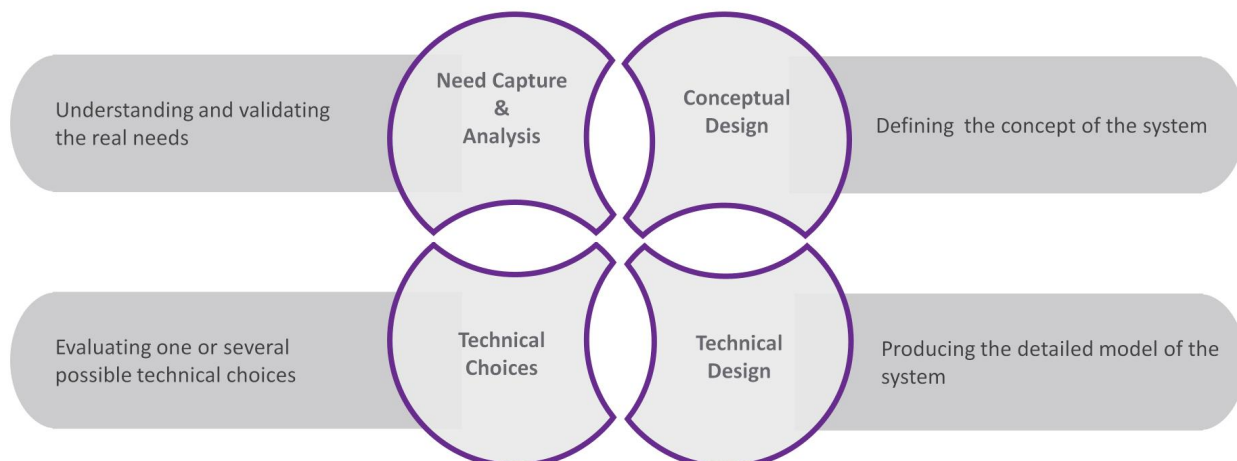
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## The Four Perspectives of Serenity®

Serenity® is an intuitive approach which is built-up on four perspectives. This coincides with corporate organizations and processes. Serenity® includes (1) the understanding and specifying of the real needs, (2) the definition of the concept of the system, (3) the evaluation of one or several technical choices, and (4) the development of the of the system.

1) Understanding the real needs is the purpose during the **Need Capture and Analysis**. This stage supports the requirement clarification and elicitation. It's a user centric approach where the system is seen as a black box. The overall behavior of the system is defined, as well as the interfaces with the actors.

2) The **Conceptual Design** is about defining the concept of the system. This perspective aims at searching for different principle solutions as well as validating them with respect to the specific needs. At this level, the system-breakdown into sub-systems is defined, however without any technical constraints. This helps to figure out new possible architectures and thus to innovate. The human machine interface principles are also defined at this stage, allowing to take into account the interfaces interacting with the system.

3) The **Technical Choices** turn the concept into a technical solution by evaluating one or several possible technical choices under consideration of the technical constraints. The Serenity® framework allows to manage several technical solutions for the same concept to evaluate alternative choices in parallel. It also supports the reuse of existing technical solutions to maximize the reuse from project to project.

4) The **Technical Design** perspective is the translation into a detailed model of the preferred technical choice. Serenity® proposes a pattern where the software part of the system – called virtual solution – is separated from the rest of the system – called real solution. The virtual solution intends to model all the elements that will realize the software-based behavior, such as features, drivers and communication networks. The real solution



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|---|---|---|---|
| Understanding and validating the real needs | Need Capture & Analysis | Conceptual Design | Defining the concept of the system |
| Evaluating one or several possible technical choices | Technical Choices | Technical Design | Producing the detailed model of the system |

*The Serenity® model organization supports a smooth integration of the perspectives, thus ensuring a perfect pattern to manage the complexity of large projects.*

Serenity® is an intuitive and iterative, seamless development process with clear interfaces. As Serenity® has an incremental approach, the practice stage (refer EVOCEAN's System Development Taxonomy[1]) may be adjusted for each phase within certain principles. The coherence of the models is ensured at all the times. Each work step adds information to the previous one and is validated. Execution and early validation capabilities are given in all stages and perspectives. The logical flow between the perspectives enables very high reuse of tests, inherent traceability and eases the change process. Further, as Serenity® is based on UML/SysML languages, it takes full benefits of them to provide consistency between the perspectives. The Serenity® model organization supports a smooth integration and flow of information of the perspectives, thus ensuring a perfect pattern to manage the complexity of large projects.

### An Agility Enabler

Systems engineering is a collaborative work and requires multidisciplinary teams. Each perspective of Serenity® involves several skills which get the synergies from this association. This helps to break the silos in organizations. The Serenity® framework supports the Systems Engineering activities and enhances these skills. Intuitive and customizable, it eases the communication all along the development process and between the teams. As such Serenity® facilitates agile and iterative approaches, as the model structure gives a clear frame for the system description. The first iteration to issue the model architecture should not exceed a couple of days. It is further not mandatory to have all needs identified to start the next phases. After each iteration, the model is enhanced to achieve a higher level of maturity. Serenity® also provides automation tools to check and validate the model, which efficiently supports any agile process.

*Serenity® facilitates agile and iterative approaches, as the model structure gives a clear frame for the system description.*

To get the maximum out of the Serenity® framework, five cornerstones have been identified:

1) **The Method**: Serenity® is documented thanks to a set of step-by-step tutorials.

2) **The Starter Pack**: A starter pack is provided including Model framework & compliant templates.

3) **The Training**: Trainings are provided for the teams involved, with several abstraction levels depending on the scope, goals and roles of the introduction/improvement.

4) **The Coaching**: Coaching includes periodical on-line and on-site sessions to support the team in an effective deployment and their continuous improvement efforts.

5) **The Management:** A management Communication Kit is provided to communicate on Serenity® benefits and to define goals and vision of the introduction.

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[1] Refer also to EVOCEAN Whitepaper „Mastering Challenges in Systems Engineering"

In summary Systems Engineering is a collaborative work and requires multi-disciplinary teams. EVOCEAN's cutting edge process framework Serenity® changes paradigms and allows organizations to considerably advance the quality and effectiveness of their Product Development and Systems Engineering. Intuitive and customizable, the framework facilitates the communication all along the development process and between the teams. Thanks to a coherent consistent and seamless framework, Serenity® provides a sustainable frame for a path towards engineering practices improvements sets the groundwork to benefit from the advantages of digital twins and helps organization to face the challenges of the future with more ease.

*Serenity® provides a sound baseline for organizations to take full advantage of the opportunity given by the Digital Twins in their Systems and Product Engineering.*
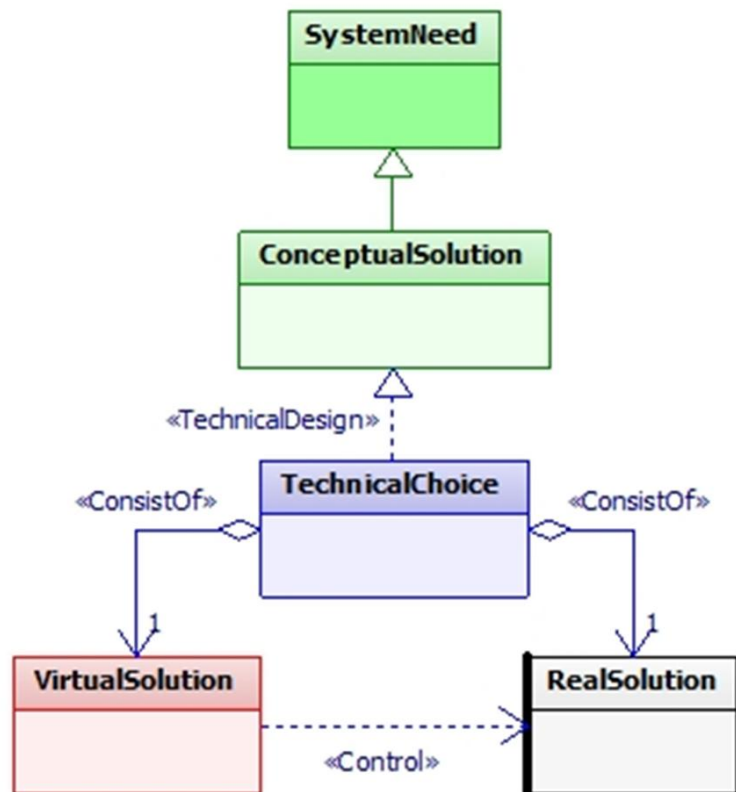


Serenity® Technical Overview Model