11 Service Oriented Simulator Kernel Architectures
In chapter 6.8 on simulator numerics the complexity of a simulator kernel was elaborated. A simulator kernel which is able to import the spacecraft system model topology to be simulated at simulator initialization time and which is able to register the components at the simulator kernel and at the solver is a quite advanced infrastructure and by far these days is not yet state of the art.

These dynamic loading functionalities shall be discussed in detail using first code samples of the issue 4.0 of the academic simulator toolkit OpenSimKit, which is currently\textsuperscript{28} still under conception. Before diving into technical details a short introduction into the technology of "Service Oriented (Software) Architectures", (SOA), shall be given.

\section*{Service Oriented Architectures}

Service oriented architectures are a technical approach from information technology to interconnect software systems company-wide. Service oriented architectures in most cases are applied to interconnect business software components. Services with higher levels of abstraction such as stock overview, stocktaking functions, stock value identification, necessary insurance cover, profitability calculation etc. can be created by interconnecting services of abstraction levels. This principle is called "orchestration" in SOA. According lower level functions e.g. can be automatic barcode scanning of parcels at company goods receipt department. Thus computing components are encapsulated into services and coordinated in such a way that their single functions can be integrated into higher services. Or higher abstracted modules can use intermediate results provided by lower services.

In order to interconnect components in an appropriate way, SOA requires an adequate design of the participating components - respectively an appropriate selection of such components, should commercial ones be chosen. Service oriented systems usually are distributed over diverse computing nodes. Each service is registered in a corresponding "directory" and - if applicable - not every service is permanently connected to the overall system. SOA is only a “paradigm” for system architecture. There exists no standard for online component interconnections comparable to a definition language such as UML for software design.

\section*{Service Oriented Simulator Kernel Design}

The service oriented approach becomes interesting for system simulation if the basic concept and idea are transposed to the internal software architecture of a system simulator. This implies that the simulator as a whole is treated as a SOA in which each module performs specific functions so that the overall functionality of a dynamical system simulation is aggregated. For this the overall simulator system architecture shall be analyzed, as it is depicted in figure 11.1 below. There the basic concept for simulator numerics from figures 6.10 and 6.11 can be recognized.

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