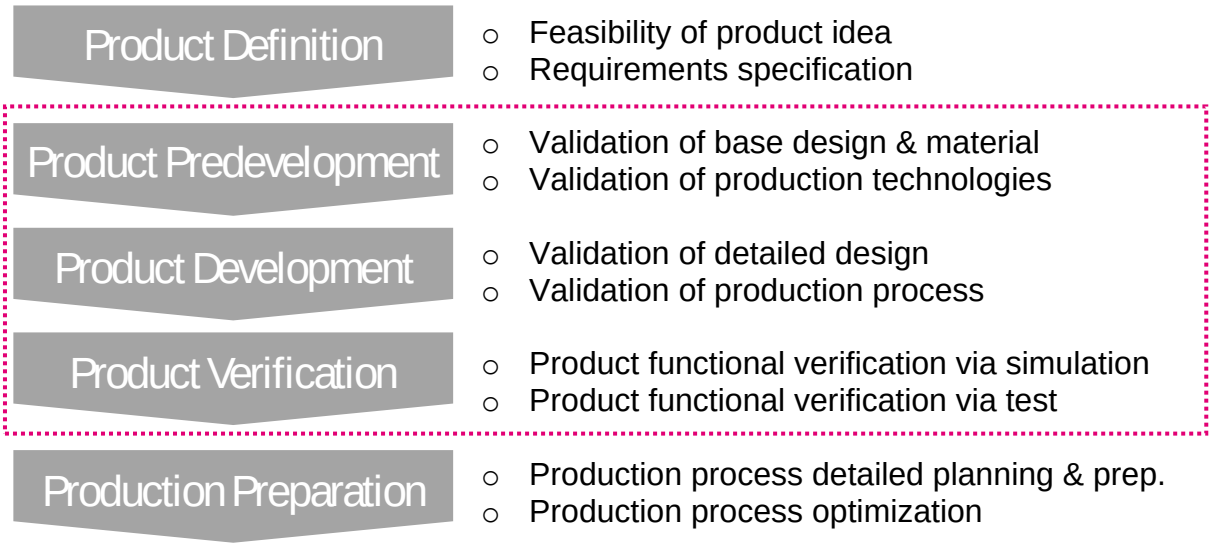
CAE as a Service as Cloud Platform for the full LS-Dyna Simulation Process

Alfred Geiger[1], Karl-Heinz Hierholz[2], Christer Neimöck[2]

[1]T-Systems Solutions for Research GmbH
[2]T-Systems international GmbH

1 Challenges for the manufacturing industries in the product development process

When focusing on the manufacturing industries and the core (level 0) process product development / PLM, the following phases with their specific tasks and challenges are typically to be performed.



CAE has emerged as important pillar along the marked phases of the product development process - from early predevelopment over the product development and product verification.

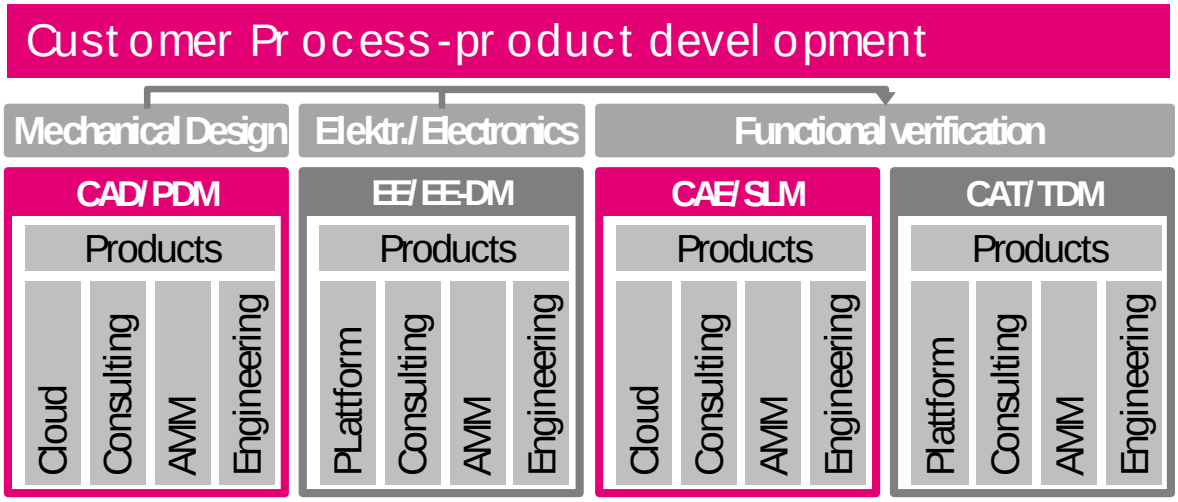
T-Systems will subsequently present a Software as a Service and Process as a Service Solution, lowering the entry barriers for CAE usage and replacing high CAE CAPEX with variable costs.

2 Cloud based solution concept

T-Systems is the No. 1 automotive IT-Supplier in Germany. It combines it's vast experience in supporting the PLM processes of Automotive, aerospace and manufacturing industries with it's worldwide network of high security and performance datacenters to systematically leverage the customer processes into scalable cloud based Process as a Service / Software as a Service offerings.

2.1 Business Process solution and customer Value

2.1.1 T-Systems addresses the standardization and cloudification of it's customer's product development sub processes one by one, starting with CAE and CAD/PLM as a Service:



2.1.2 The CAEaaS Solution addresses the whole CAE process and the infrastructure, platform, software and process level, as shown in the following business architecture overview:

2.1.3 CAEaaS addresses the following use cases, from access to the technical compute platform for capacity of capability peak load or full load coverage (1) over the full business process outsourcing, allowing the suppression for CAE related CAPEX in expensive and fast changing special Hardware and software, to OEM/OEM and OEM/OES Business2Business Plattform, e.g. as engineering hub between automotive OEM and the supplier ecosphere or for the collaboration with the e.g. Chinese joint venture partner:

Customer use cases

1. Tecnical Compute Plattform
   Scalable capacity for high throughput (via virtualized HPC Cloud-Plattform)
   Scalable capability for large problem sizes (via private-public partnership hww)
2. Simulation Process-and Infrastructure Outsourcing
   Provides the full PLM subprocess CAE as a service (Platform-, Software-, Process as a Service)
3. Business to Business (OEM/OEM/OES)
   B2B engineering hub with secured collaboration for OEM/OEM &OEM/OES cooper. projects

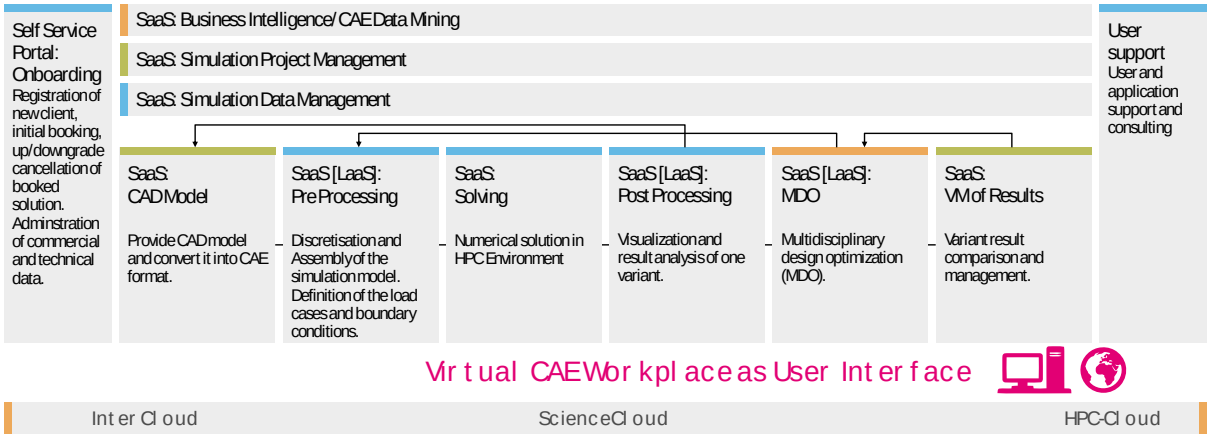
2.1.4 The generated customer value can be found in 2 domains dependent on the specific situation. (1) with the enabling or increase usage of CAE due to the easier accessability of this product development tool and (2) for companies who already use CAE intensively due to the benefits a scalable cloud based model offers versus a own local implementation of infrastructure, platform and Software layer:

Customer value

Benefits of faster and improved CAE usage (better accessible CAE)
- Faster time to market, higher # of variants and reaction to market
- Reach high maturity level early (frontloading), reduce costs
- Reduces # of expensive physical prototypes and buildup time

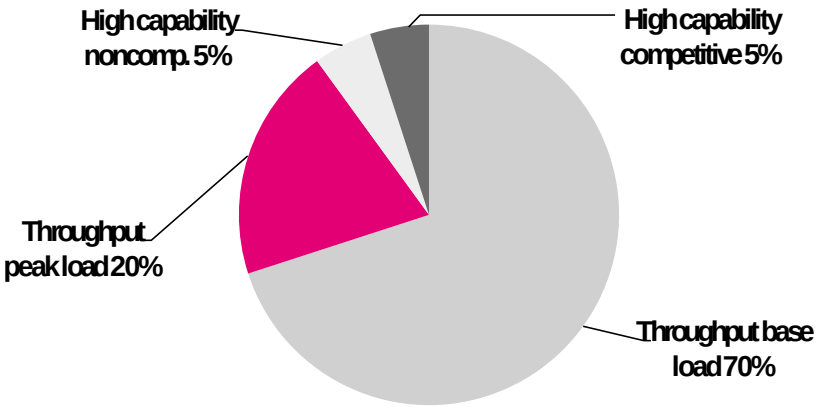
Benefits of offered SaaS model:
- Flexible, secured and fast accessible on demand CAE capabilities
- Replace fix or stepwise fix high CAE costs with "pay per use" costs
- Cost savings > 20% in infrastructure, licenses, storage & graphics*

2.1.5 The business architecture from 2.1.2 is now shown in a more detailed solution architecture with infrastructure and platform as technological base, the key elements of the CAE process on the horizontal axis, added data management, project management and optional business intelligence layer on the vertical stack, and the service and cloud specific user support and self service portal completing the SaaS Offering. The services are accessed from the engineers now fully focusing on the engineering problems via their virtual CAE workplace.



2.2 Infrastructure and security solution

The CAE workloads differ and can be clustered into the following 4 categories. CAEaaS is specifically designed to address all these 4 workload categories holistically:



Data security and integrity:

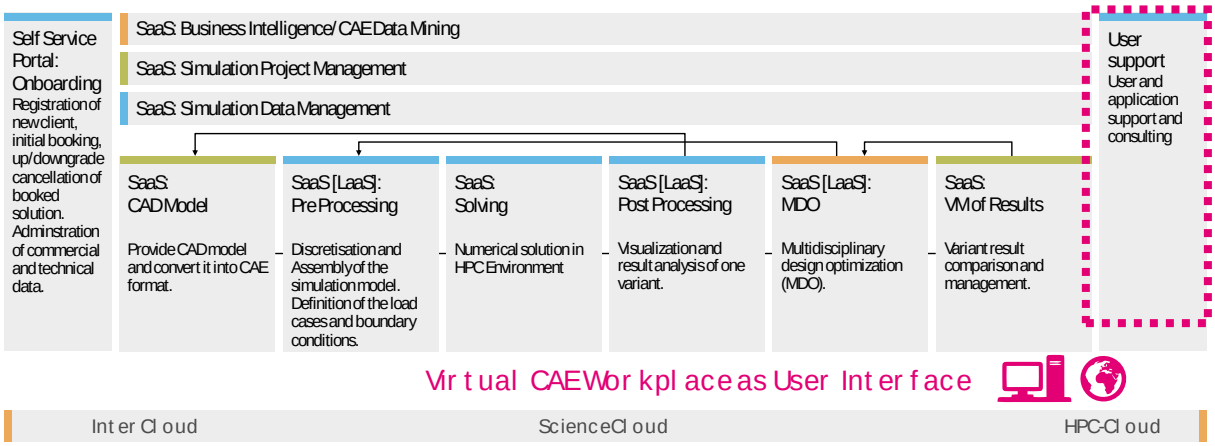
CAE data and environments typically contain highly confidential data of products still to be released. T-Systems ensures highest security, privacy, and integrity for data and processes via it's high security Twin-Core Data centers, T-Systems and Deutsche Telekom's german network and cloud security standards. The initial production environment will be the Magdeburg/Biere Twin core cloud data center - one of 11 Twincore Cloud-Data-Centers of T-Systems worldwide. Characteristics:

- 5.400m² Datacenter surface area, 2 × 7 MW IT connected power
- PUE Factor 1,3 for air cooled systems, Air- and water cooling
- Redundant and uninterruptible power supply
- SOX compliant distance of twin cores of >10 miles
- High distance to risk infrastructure (Airport, water, …)
- Optimal connection to supply infrastructure (Energy, grids)
- Full electromagnetic Shielding
- Multiple redundant grid connection
- Optimized Object security

Highest compute power to Solve large problems: Dynamic HPC-Capacities of the hww:

Flagship: Cray XC-40 (HORNET): 3.944 Compute-nodes with 94.656 Intel Haswell Cores, 3,84 Pflop/s (Upgrade > 7 Pflop/s in prep.). Other HPC-Systems: IB-coupled x86-Clusters, Ca. 1.500 nodes intel Xeon (SNB/IVB/HSW)

Application- and user-support solution
The user support starts with a 1st level UHD (user help desk) for technical and functional support. It is extended by the 2nd and 3rd level technical and functional support, in collaboration with the independent Software Providers (ISV's).



The support can also cover the adaption of code to ensure it's scalability on the used HPC platform.

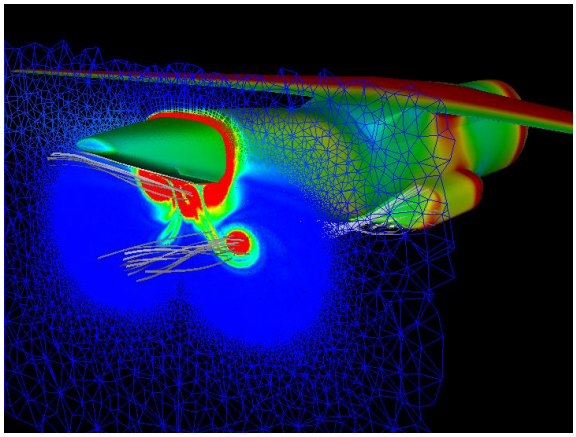
Support of Applications

In Collaboration with the ISV

Skalable industrial Appliactions

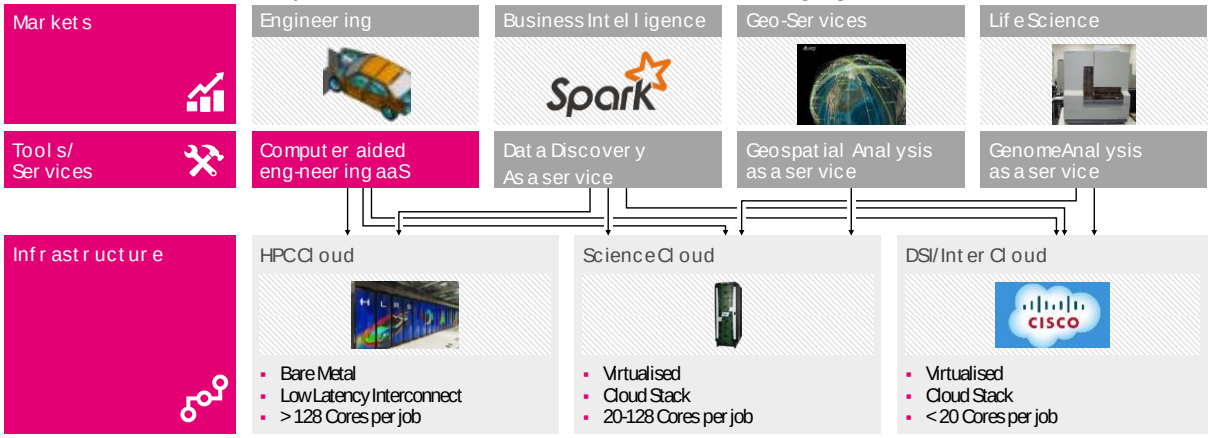
- Avoid degrading overall performance caused by reatreating performance of single compute nodes
- Solvability inf complex problems
- Maintainability of Codes
- Ensure Validation and Certification
- Portable performance

Service-environments



3 CAEaaS as part of the broader T-Systems Cloud-Initiative for the Industry

CAEaaS is only part ot a broader T-Systems initiative for cloud based industry solutions, an overview of some solutions developed in this initiative is shown in the following figure:



4 Summary and vision

CAEaaS is part of the broader T-Systems cloud initiative. For the manufacturing industry's level 0 core process product development, it is one first sub process which is systematically leveraged to a Software as a Service / Process as a Service Solution. Based on the same technology, T-Systems will provide CAD/PLM cloud based solutions and engineering workplaces and environments.

CAEaaS addresses main Market Trends, Business pain Points, IT Pain Points with a scalable Software as a Service / Process as a Service Solution lowering the entry barriers for CAE usage and replacing high CAE CAPEX with variable costs.