Problem:
- In a multifunctional teamwork aimed at concurrent design, various interacting tasks may be carried out by different developers with various software tools distributed remotely in different places.
- A concurrent engineering (CE) platform is needed to facilitate the communication, coordination and cooperation of the various tasks and software tools in the CE product development process in a distributed environment.
- The existing commercial CE support platforms such as Product Data Management system, Workflow Management system, Process Management system, Product Lifecycle Management system, and others lack of flexibility and reliability since they do not fully consider the fact that the network is inherently a dynamic environment.
- In recent years, research work on Service-Oriented Architecture (SOA) has progressed steadily from static SOA to dynamic SOA, and one of the implementation for dynamic SOA is SORCER (Service ORiented Computing EnviRonment), which is a dynamic SOA meta-computing infrastructure.
- SORCER-paradigm invented by Dr. Mike Sobolewski has proven to be efficient and deserving to be put into practice all the globe round.

Conclusion:
A flexible CE platform – Collaborative Service Oriented Architecture Meta-computing design platform (CoSOAM) able to integrate various software tools as loosely coupled services, which form a federation for specific computing jobs when requested, and providing reusability, scalability, reliability and efficiency for the platform, is needed.

Objective:
A CE platform should be developed to provide a distributed environment for collaborative product development spanning across several different departments in an institution (enterprise) or several institutions (enterprises).

Solution:
One of possible solutions may be a five-layer structure as can be seen from the figure:

1. The Internet/Intranet layer
2. The JINI/SORCER core service layer
3. The service provider layer
4. The integration and coordination layer
5. The CE product development layer

Approach:
- Literature Review and Study
  - Exertion-oriented (EO) programming
  - JINI/SORCER Technology
- Practise EO Meta-programming
  - In Home University
  - In Host University
- Develop a Specific Application Software Tool for Mechanical Engineering
- Wrap CAD / CAE Software Tools as Services for CoSOAM
- Develop CoSOAM methodology
- CoSOAM platform design
- CoSOAM prototype implementation
- Verification and validation of the CoSOAM platform
**Schedule:**

<table>
<thead>
<tr>
<th>Task</th>
<th>Date</th>
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<tbody>
<tr>
<td>Literature Review and Study</td>
<td>April 2008</td>
</tr>
<tr>
<td>Practise EO Meta-programming</td>
<td>August 2008</td>
</tr>
<tr>
<td>Develop a Specific Application Software Tool for Mechanical Engineering</td>
<td>December 2008</td>
</tr>
<tr>
<td>Wrap CAD / CAE Software Tools as Services for CoSOAM</td>
<td>April 2009</td>
</tr>
<tr>
<td>Develop CoSOAM methodology</td>
<td>August 2009</td>
</tr>
<tr>
<td>CoSOAM platform design</td>
<td>December 2009</td>
</tr>
<tr>
<td>CoSOAM prototype implementation</td>
<td>April 2010</td>
</tr>
<tr>
<td>Verification and validation of the CoSOAM platform</td>
<td>August 2010</td>
</tr>
<tr>
<td>Project defense</td>
<td>December 2010</td>
</tr>
</tbody>
</table>

**Money:**

- 2008 –
- 2009 –
- 2010 –
- Total –

**Benefits:**

- With the CoSOAM platform, CAD and CAE software tools can be integrated as services for CE product development projects
- Services can be distributed among different hosts to allow for reusability, scalability, reliability, and load balancing
- Service providers can be replicated and dynamically provisioned for reliability to compensate for network failures
- Service providers can be discovered dynamically in runtime by the service types they implement
- Based on exertion-oriented programming, a requestor can write exertions to invoke the CAD and CAE services in a dynamic federation without needing to know the exact location of a provider beforehand, so flexibility can be well achieved, and collaborative design in the CE projects can be implemented in the distributed dynamic environment
- Friendly and intuitive user agent for space-oriented grid computing
- SORCER-paradigm will be put into practice in one more country – Russia, for which such a project will be a significant innovation