Interlocking Design Automation

The Business Case
Introduction

This document aims to help infrastructure vendors developing rail control systems to create a compelling business case for investing in a modern Interlocking Design Automation process. A state of the art process based on formalized specifications and automation tools compared to traditional methods for developing signaling applications.

To be able to present a business case we compare traditional methods for developing signalling applications with a state of the art process based on formalized specifications and automation tools. Experience shows that using a modern Interlocking Design Automation process you will significantly reduce time to market, reduce life cycle costs to half, and greatly simplify the safety assessment process. Here you can find more information about IDeA and Prover’s implementation of this concept, Prover Trident.

This document will give you an introduction on how to go about developing the business case for this investment. To be able to finalize the business case for your organization we recommend that you discuss your needs with one of our experts, who will guide you through the process and help you quantify the specific data in your use case.

You can book a meeting with one of our experts by filling out the form on www.prover.com/expertise/businesscase-meeting
How to Structure the Business Case

The core part of the business case is a return of investment (ROI) calculation, comparing costs for the traditional/current process with the automated process. Some gains of the investment are however difficult to quantify in the ROI calculation and therefore the business case will also highlight additional values. Examples of such values include increased confidence in system safety and improved market positioning.

Compared to traditional signal design processes, the Interlocking Design Automation process focus more efforts on the development of a Generic Application (formalizing all design, test and safety requirements), from which Specific Applications (interlocking systems) can be generated by automation tools, Generic Products, licensed from Prover. Hence the benefits of this process increases with the number and the complexity of systems that are to be developed with the same, or similar, Generic Application, and this is a key component of the ROI calculation.

The ROI calculation is centered around analyzing the costs for the following components:

1. Generic Products (License fees or internal development costs)
2. Non-recurring engineering effort (Generic Application)
3. Safety case
4. Engineering efforts recurring for each installation, including specification, development, test and safety verification (Specific Application)
5. Design changes after installation, maintenance
6. Total life cycle cost
Benefits and Savings

Speed - Reduced Time to Market

By focusing development efforts on non-recurring engineering tasks early on in the project, establishing a validated set of requirements, you will be able to significantly reduce the calendar time from project start to final delivery. The process and the tools encourage an iterative, test driven development approach that makes it easy to have independent teams for design, test and safety working in parallel from the very start of the project.

Safety - Improved Quality, Safety and Reliability

Formalized requirement specifications and automation tools improve the quality by reducing the risk of human errors throughout the process and make it clear where manual efforts and expertise are needed.

Automated mathematical proof of safety gives 100% coverage using trusted, and certified, tools. With also the functional testing automated, much of the verification and validation work is no longer on the critical path of the system development, meaning that you minimize the risk that errors slips through the process due to the pressure to deliver on time.

Savings - Fewer Man Hours

The biggest, and most obvious, cost saving comes from replacing manual engineering efforts with automation tools. You simply don’t have to use as many man hours to produce the deliverables. But there are also other savings, for example, being able to establish the correct set of requirements from the start reduces the need for expensive design changes later on in the project.

By using modern tools and methods the maintenance costs are greatly reduced as you have a fully documented set of requirements, that are easily re-tested and re-verified when changes are needed. This will affect the operational cost to large extent and will prove a big difference compared with traditional methods.
Business Case Example

In this example, based on a real-life European commuter rail project, fifteen computerized interlockings were developed from scratch using Prover Trident (Prover’s Interlocking Design Automation solution). The infrastructure manager originally planned to hire an external engineering firm to develop the application software using a traditional (mostly manual) development process, and the table below compares the number of hours estimated for this process to those needed for the development using Prover Trident.

<table>
<thead>
<tr>
<th>Task</th>
<th>Traditional Process (Man Hours, estimated)</th>
<th>Prover Trident (Man Hours)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Generic Application (NRE)</td>
<td>1975</td>
<td>4200</td>
</tr>
<tr>
<td>CENELEC SIL-4 Safety Case (NRE)</td>
<td>2000</td>
<td>1200</td>
</tr>
<tr>
<td>Specific Application (code, test, safety case)</td>
<td>835</td>
<td>160</td>
</tr>
<tr>
<td>Total for installation of 15 specific applications</td>
<td><strong>16500</strong></td>
<td><strong>7800</strong></td>
</tr>
<tr>
<td>Design change after installation (code, test, safety case), per SA</td>
<td>200</td>
<td>80</td>
</tr>
<tr>
<td>Total maintenance with three design changes per SA</td>
<td><strong>9000</strong></td>
<td><strong>3600</strong></td>
</tr>
<tr>
<td>Total Life Cycle Cost</td>
<td><strong>25500</strong></td>
<td><strong>11400</strong></td>
</tr>
</tbody>
</table>
In this example, the effort (man hours) for the total life cycle cost of the application software for the fifteen interlocking was reduced by more than 50% compared to the estimated effort for the traditional process. The total project cost savings, considering also license fees for the Prover Trident software, training and other related costs, amounted to 30% - 40%.

The calendar time from project start to the acceptance of the fifteen interlockings was reduced from 28 months (planned) to 18 months. A significant part of this reduction was related to the safety case approval.

In addition to the savings quantified above, the process provided the infrastructure manager with an increased confidence in system safety, with 100% coverage in the safety verification which makes it easier to analyze the impact (functional and safety) of design changes and gives an excellent starting point when procuring new projects.
How to Build Your Business Case

You can draft a business case for using Prover Trident in your own project by completing a table like the one used in the example with your own data and figures. You also need the following data:

- Description of current process; including key tools, resources and skills that are used today.
- Description of the systems to be developed, including high level functional requirements, number of systems and their complexity.
- Safety approval procedure and any standards that the systems are to comply with.
- Expected system lifetime and maintenance requirements.

To support you in this Prover offers a two week pre-study performed by our experts to get a more detailed business case to use in your decision process. Such a pre-study will give you detailed information on:

- Total project costs, savings and investments
- Calendar time
- Manpower and skillsets required
- How to realize your safety case
NEXT STEPS

For a more detailed description on how to apply the Interlocking Design Automation Process to formalize your signaling software development, please check out our white paper *Interlocking Design Automation - The Process*.

To book a meeting to discuss your business case, please visit www.prover.com/expertise/businesscase-meeting and fill out the form.