Next Generation Train Control Systems Design by GE Transportation Italy:
A Universal Vital Platform Approach to meet Current and Future Rail Transportation Signaling Challenges

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Expoferroviaria, Torino 28/3/2012
## Mapping Requirements to Design Objectives

<table>
<thead>
<tr>
<th>Category</th>
<th>Objectives</th>
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| LCC Optimization          | • Lower Capex  
                           • Reduced maintenance costs  
                           • Better obsolescence management  
                           • Higher reliability and availability |
| Execution Excellence      | • Consistency with specific requirements  
                           • On-time delivery  
                           • Effective migration strategies  
                           • Effective Handholding |
| Operating Process Efficiency | • Improved operational efficiency                                    |
| Scalability               | • Flexible to changing needs over life cycle  
                           • Upgradability/downgradability |
| Flexibility               | • Adaptive architecture                                                  |
| Energy Saving             | • Contribution to sustainable growth                                      |
| Security                  | • Avoid signalling system intrusion                                      |
| Enhanced Customer Experience | • Smooth on/off boarding  
                             • Real time schedule adherence  
                             • Information on journey planning  
                             • Personalized experience       |
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- Less inventory & training – products built with same modules
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Current Cumbersome Rail Signalling Situation

Data
Application Software
Basic Software
Hardware
Interfaces

Array of train control systems

- 4 platforms to cover train control needs !!!
- 4 lifecycles to maintain

Voice of traditional systems users:
• Unhappy with high change costs
• Unhappy with high OpEx

Current Situation
Non optimized “Silo” based implementation
Non integrated set of engineering tools and processes
“Bottom up” step by step approach
Asynchronous Multi Platform R&D investments in multiple “vintages”/branches
Multiple product SW developments, product specific SW

Drawbacks
Non modular products (monolithic): little room for customization, impact of changes difficult to predict
System level, product level, dedicated project execution – not usable at tendering stage
Using and adapting legacy modules…requiring additional equipment – “glue ware” or “gateways” between sub systems
Great inertia and cost to make portfolio evolve
Little cross platform development re-use
New generation development increases sustaining cost of large installed base
Project Delta: A Team on a Mission

High Growth Train Control Market Segments and Geographies

Passenger Rail
- Conventional
- High Speed

Solutions: ETCS/IXL…

Mass Transit
- Metro
- Light Rail

Solutions: CBTC…

GE Tempo™

GE Transportation

Intelligent Control Systems

Imagine a new generation of train control solutions designed around:
- optimized project execution
- long term LCC effectiveness
- environmental friendliness in mind.

An Imagination Breakthrough Initiative
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**GE Transportation**

Intelligent Control Systems

60 M $US Investment

100 + people strong team of experts

Two Centres of Excellence:
- Paris La Défense (France)
- Sesto Fiorentino (Italy)

An Imagination Breakthrough Initiative
Sesto Fiorentino Office Opening

**Promotion of industrial research, transfer of technologies, pre-competition development; valorization of research and innovation**

- Creation of a Center of Excellence
- Recruitment of new skilled resources
- Develop the know-how in the region
- Tuscany as a worldwide player in the Railway sector
- Set up laboratories and a showroom

Activities: Research & Development

**Maximum funding** €6,589,496.64

**Steps**

- Submission
- Contract Signature
- Office Opening

**Date**

- 26th July 2010
- 7th Oct 2011
- 9th June 2011
Tempo™ System Architecture
A Universal Vital Platform Approach…

One system platform enables:
- standardized and a minimum set of HW/SW bricks
- APIs to application SW
- Flexible application SW using set of SW functional modules
- cross-functional features: Metafunctions
- Integrated end to end tools to manage entire project lifecycle milestones

“Top down” integrated system design capable of supporting all rail transportation control functions without complexity
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The value chains

**Key characteristic:** Common Vital Platform & Optimized Modular architecture

- **Optimized Maintenance effort**
  - Leaner and effective maintenance
  - Ease of troubleshooting and problem solving
  - Simpler training and maintenance procedures
  - Reduced number of different HW to be maintained

- **Less $ to sustain the system**
  - Fewer system cycles to maintain
  - Reduced complexity and Value of the stock
  - Reduced spare provisioning
  - Same spare parts for different functions

- **Less $ and Time to deploy the project**
  - Fewer SW code to be re-written (i.e. new functions on new equipment)
  - Lower bug generation and better traceability
  - Preferred set of principles to be customized

**Enabler:** Few Standard HW bricks

**Few Standard SW bricks**

FOR DISCUSSION PURPOSES ONLY
Expoferroviaria
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Conclusions

• Long term LCC effectiveness → Reduced Total Cost of Ownership

• Common platform - Commonality of Hardware: racks, PCBs, I/O cards,
  - Using set of SW Functional Modules
  → minimum set of common bricks

• Modular Architecture: flexibility in reuse, ease of interface, ease of standardization

• Taking advantage of State-of-the art integrated tool set through entire project lifecycle

• Environmental friendliness in mind