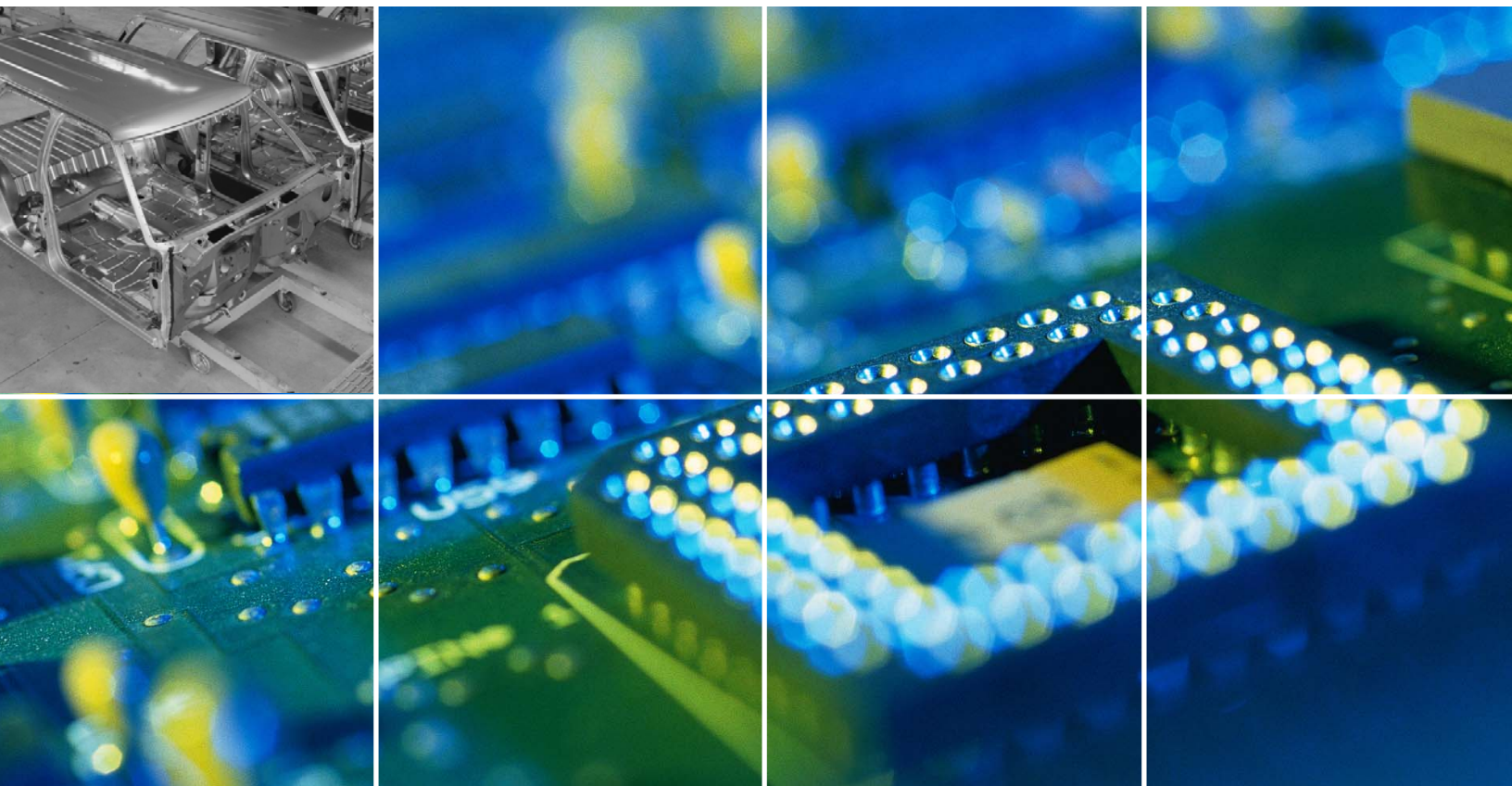


Embedded systems – here, there and everywhere



An IBM Institute for Business Value executive brief

The IBM Institute for Business Value develops fact-based strategic insights for senior business executives around critical industry-specific and cross-industry issues. This executive brief is based on an in-depth study created by the IBM Institute for Business Value. This research is a part of an ongoing commitment by IBM Business Consulting Services to provide analysis and viewpoints that help companies realize business value. You may contact the authors or send an e-mail to iibv@us.ibm.com for more information.

Contents

- 1 Introduction
- 1 Here, there and everywhere
- 2 The tipping point
- 3 What does the future hold?
- 4 About the authors
- 4 About IBM Business Consulting Services
- 5 References

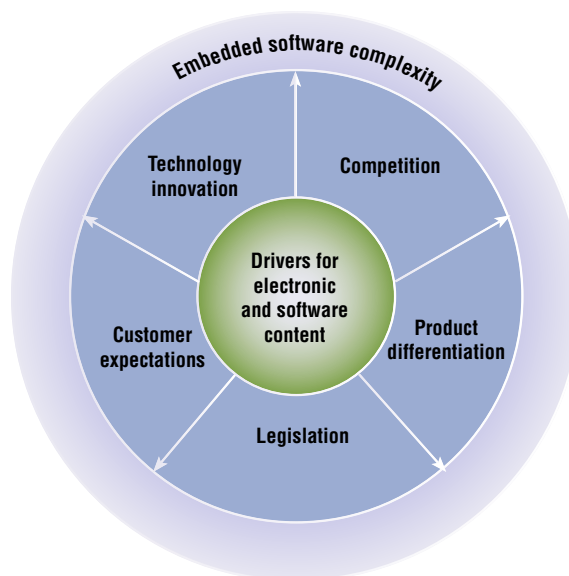
Introduction

This executive brief contains a summary of the findings from a study recently completed by the IBM Institute for Business Value on the effects of embedded systems in the automotive industry.

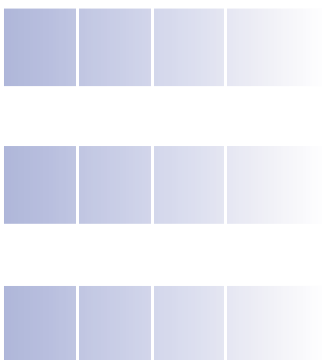
Here, there and everywhere

Embedded systems are found virtually everywhere today – in everything from flight control guidance systems, to mundane home appliances like washing machines and microwave ovens, to automobile engines and braking systems. Although an embedded system is typically a single purpose application, it is generally integrated with other embedded systems to perform sophisticated, and in many cases, mission-critical functions. The adoption of embedded systems in the automotive industry has increased exponentially in the last ten years and now represents about 25 percent of the value in a modern vehicle.¹ Furthermore, embedded systems account for a significant amount of complexity and a marked increase in quality issues.

There are five industry drivers within the automotive industry that are leading to the increase in the use of electronics and software in the vehicle. These include:



- *Competition* – Auto manufacturers are competing intensely for the consumer wallet, and the consumer has definite ideas about what they want.
- *Product differentiation* – Companies are working to differentiate their products from their competitors. By 2010, it is projected that 90 percent of the innovation and 35 percent of the vehicle value will be electronics related.²

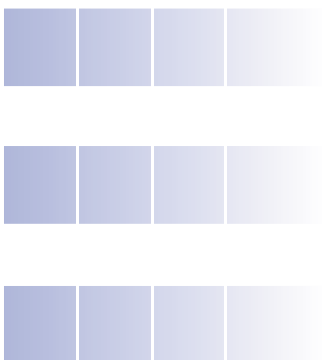
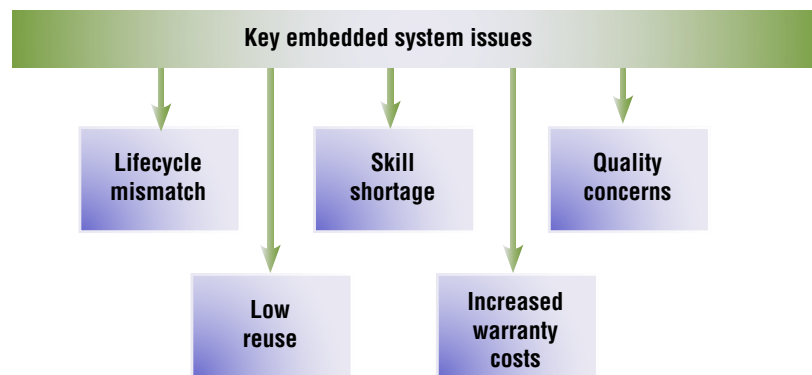


- *Legislation* – Safety and environmental issues are prompting the use of “sensing” technologies in vehicles. Features like smart safety systems, pedestrian sensors and new emission standards create greater demand for embedded systems.
- *Customer expectations* – The desire to have a more personalized driving experience, in everything from the appearance to the features on a vehicle, is encouraging the use of embedded systems.
- *Technology innovations* – New technological innovations such as electronic navigation systems, online monitoring and alternative fuel sources are developing quickly with the capabilities supported by the growth of electronics and embedded systems.

Although the features and functions provided by embedded systems readily contribute to product differentiation, they also contribute to the complexity of the product – and therein lies the challenge.

The tipping point

With the stated goal of producing a desirable, safe, efficient product that customers really want to buy, the automotive industry continues to increase the features and functionality of their vehicles – even including features that are so complicated that the customer can not or will not use them. Our findings identified five major consequences of the increased complexity generated by embedded systems, which have significant impact on the creation, implementation and deployment of embedded systems:



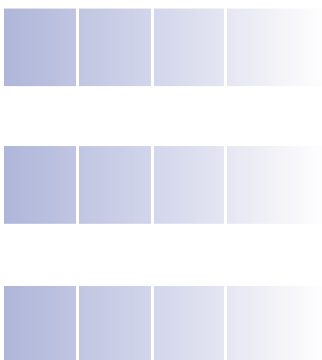
These five areas represent issues and challenges that all companies face when developing embedded systems. One challenge of building embedded systems is that the technology used can be outdated before the vehicle hits the assembly line because software and mechanical lifecycles are mismatched. The twin issues of a skills shortage of architects who have a complete system view, coupled with low reuse of existing assets, result in a cumbersome process and often lead to quality issues, which, in turn, contributes to increased warranty costs.

As part of our study, we interviewed several leading automotive manufacturers and suppliers to understand how embedded systems are being developed and what best practices currently exist. Our findings highlight the fact that leading companies recognize the need to build capabilities and process; implement tools that streamline the development process; ease the collaboration between manufacturers and suppliers; and encourage reuse of systems. However, companies are struggling with the steps required to accomplish these tasks.

What does the future hold?

To implement a robust embedded systems lifecycle, automotive companies will need to implement changes in their design, development and manufacturing processes. Some of the steps companies can take include:

- *Adoption of standard architectures* – The industry is interested in developing standards that the industry as a whole can adopt, rather than proprietary systems for each manufacturer or brand. One way to accomplish this is for the OEM's to solidly support the implementation of standard, industrywide architectures, rather than specific, component-driven requirements.
- *Separation of hardware from software* – Separating software components from the hardware platform allows more reuse of software among multiple hardware components. This can ultimately lead to a reduction in complexity and the number of engineering control units (ECUs) in a vehicle.
- *Collaboration throughout the value net* – A significant amount of the innovation in automotive is coming from the supplier community. Suppliers are continuing their investment in research and development, but are becoming more discriminating about sharing their breakthroughs. Our study found that suppliers are reexamining their client base, and choosing to share their innovations with manufacturers that are perceived to be more interested in collaborating for the longer term, rather than those that are focused on a transaction-based relationship.



Companies realizing success with embedded systems have adopted standardized processes and procedures for design and development, allowing them to respond to issues and develop new products more quickly. As an example, automotive supplier Magna Vectrics is working on leading-edge technologies to support the implementation of smart safety systems. They have adopted a standardized approach and methodology for development of their technology, allowing them to bring their product to market quicker than competitors.

The IBM Institute for Business Value is in the process of publishing an in-depth study detailing how automotive manufacturers and suppliers can implement embedded systems lifecycle management into their organizations. To obtain a copy of this report when it is released, or for more information on how IBM can help, please contact us at iibv@us.ibm.com.

About the authors

Stefan Gumbrich is a Managing Consultant with the IBM Institute for Business Value. He can be reached at stefan.gumbrich@de.ibm.com.

Penny Koppinger is a Managing Consultant with the IBM Institute for Business Value. She can be reached at pkopping@us.ibm.com.

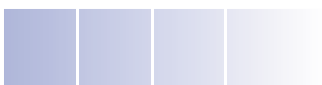
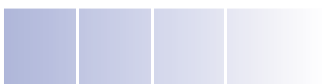
About IBM Business Consulting Services

With consultants and professional staff in more than 160 countries globally, IBM Business Consulting Services is the world's largest consulting services organization. IBM Business Consulting Services provides clients with business process and industry expertise, a deep understanding of technology solutions that address specific industry issues and the ability to design, build and run those solutions in a way that delivers bottom-line business value.



References

- ¹ IBM Institute for Business Value analysis, 2004.
- ² Joseph Beretta, PSA Peugeot Citroën "Goals and prospects of embedded electronic automotive systems", MINATEC 2003.





© Copyright IBM Corporation 2004

IBM Global Services
Route 100
Somers, NY 10589
U.S.A.

Produced in the United States of America
10-04
All Rights Reserved

IBM and the IBM logo are registered trademarks of International Business Machines Corporation in the United States, other countries, or both.

Other company, product and service names may be trademarks or service marks of others.

References in this publication to IBM products and services do not imply that IBM intends to make them available in all countries in which IBM operates.