



BMW CASE STUDY

Since the 1920's BMW has been a symbol of innovation worldwide. BMW has come a long way from their traditional approach of In-Vehicle Infotainment software development to where they are today - the first automaker to deliver a complete infotainment product based on the GENIVI Linux platform.

Overview

Country or Region: Germany

Industry: Automotive and Industrial Manufacturing

Profile

The BMW Group is the leading premium manufacturer of automobiles and motorcycles in the world with its BMW, MINI and Rolls-Royce brands. As a global company, the BMW Group operates 28 production and assembly facilities in 13 countries and has a global sales network in more than 140 countries.

Business Situation

The repeated effort and cost of vehicle infotainment development and maintenance demanded a more transparent and efficient approach to software delivery.

The Solution

In collaboration with other automakers and suppliers establish a community from which it would be possible to develop a production head-unit system leveraging from an open-source platform consisting of Linux-based core services, middleware and open application layer interfaces.

“With the delivery of our first Linux headunit BMW has proven the benefit of an open source development approach. Our suppliers are now providing a GENIVI compliant platform as default because they believe it’s the best way to build a quality IVI product.”

**Sajjad Khan,
SVP Infotainment and
Connected Drive,
BMW Group**



THE SITUATION

As early as 2007, BMW and a handful of partners set out to solve three business problems that were plaguing the automotive industry: the skyrocketing amount of software required in cars (the typical car can have between 50 and 100 million lines of code compared to tens of thousands a decade ago), the recurring cost of each program, and the need to reduce development cycle time, driven by the rapid rate of new consumer electronic device delivery (roughly 18 months vs. four years for automotive devices). Rising software costs and reduced cycle times meant that they, as an automotive manufacturer, needed to break out of their traditional approach of closed, proprietary software development.

The traditional approach to software development had been to specify requirements in an exhaustive document, execute a Request for Quotations (RFQ) process, select a supplier, and require the supplier to deliver a black box that aligned with the OEMs requirements. And, like the movie *Groundhog Day*, they would have to do this over and over again, paying a significant amount for software that effectively did the same thing. This approach had to change to facilitate more transparency in how the software was delivered and to maximize reuse across multiple products and programs.

In order to transform their traditional business and software practices, BMW's software development team became the driving force to build a community of other automakers and suppliers that could collaboratively define a common platform that nominated suppliers could then leverage and reuse on future production programs. This realization, confirmed by other automakers and suppliers, gave birth to the GENIVI Alliance.

Business Goals

Create a new model for software delivery that:

- Reduces development cycle time and cost
- Eliminates the need to recreate non-differentiating In-Vehicle Infotainment (IVI) features across multiple products
- Leverages a shared open development model that spreads the burden of creating new and maintaining existing features across multiple organizations
- Opens transparent dialogs with suppliers and partners to create a more agile delivery method

Formation of the GENIVI® Alliance

The GENIVI Alliance was announced in early 2009 at CeBIT in Hannover, Germany with eight founding members: automakers BMW, PSA Peugeot Citroen, General Motors; Tier1 automotive suppliers Delphi, Magneti-Marelli, Visteon; silicon vendor Intel, and operating system vendor Wind River. The goal was to define this common software platform, based on Linux and open source software, that implemented the non-differentiating functionality required by all IVI systems.

Within the automotive industry, IVI delivery and maintenance is a challenge for many automakers. IVI features and applications commonly include: navigation and location-based services; entertainment, radio and media player; connectivity to mobile devices, internet connectivity, and external communications. Few of these functions are unique to automotive and many are strongly influenced by the consumer sector. It is therefore logical to adopt an open source software development model and enable the transfer of innovation between adjacent industries. These feature- rich systems along with the requirement that the latest smartphone can seamlessly interact with the IVI system, play an increasingly large part in vehicle purchasing decisions. The IVI system including the hardware and software required is often referred to as the “head unit.”

The focus of the alliance thus became to deliver the pre-competitive elements of the IVI stack; Linux-based core services, middleware, and open application layer interfaces. Historically within the automotive industry, the automotive companies competed across the whole stack. However, much of that stack is non-differentiating from a customer point of view. The logic behind GENIVI was to identify which areas of the stack were non-differentiating and to bring a level of standardization so OEMs could continue to compete, but from a higher level in the solution stack. It was felt important that OEMs were able to differentiate between each other and place their brands before their customers. During product development the OEM or each first tier supplier builds the remainder of that solution on top of that non-differentiating middleware driven by GENIVI. This approach has enabled developers who historically found it difficult to work within the closed automotive industry to gain access.

GENIVI now has more than 140 automotive industry companies promoting the collaboration, the development and deployment of open source software in the automotive electronics business, specifically infotainment. Alliance members produce and maintain code in open source development projects, and in parallel collaborate in technical workgroups to converge technical requirements and interfaces with the aim of simplifying production of commercial implementations. GENIVI delivers a reusable, open-source platform, providing the industry at large with a competitive environment for faster innovation and lower cost of software development.

Linux is the basis for the platform and all software components defined and implemented by GENIVI members are hosted through the Linux Foundation in GENIVI repositories. GENIVI members also engage directly in established open source projects to introduce the automotive perspective and needs. In excess of 150 software projects make up what is called the GENIVI baseline, to which Tier1s and OEMs add additional open and closed source code to meet the OEM system requirements. Where no code exists, GENIVI will sponsor and launch a new project to develop the needed software. GENIVI baselines serve as reusable platforms for organizations to use in product development and commercial activities.



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**Graham Smethurst,
General Manager,
Infotainment and
Communication Systems,
BMW Group Chairman
of the Board, GENIVI Alliance**



THE SOLUTION

BMW uses the GENIVI open-source infotainment platform to power their Entry Media and Navigation head units. In the spring of 2013, they introduced their product offering to the GENIVI membership at the GENIVI All Members Meeting in Barcelona. In the late fall of 2013, several BMW product lines started the production of vehicles containing GENIVI based head units, bringing to fruition the goal of using open source software in a production head unit.

The delivery of this open source head unit is proof that the new development approach works. The new headunit delivers increased functionality and the quality required by a premium supplier such as BMW. In fact, we now see not only BMW's suppliers, but also several Tier1 suppliers leading with a product aligned to GENIVI's platform because it helps these companies meet their development goals of maximizing code reuse, reducing cost, and shortening cycle time.

While BMW reaped the rewards of greater transparency and flexibility in the development of its initial product, the real value of this approach is being realized in their second and subsequent generations of head units. BMW is maximizing the reuse of the open source developed middleware allowing more efficient allocation of effort and money to produce enhanced customer functionality. BMW has already launched its second generation production program and is well ahead of where it would have been if it were using a traditional software delivery method.

BMW is also receiving value from its usage of the GENIVI platform because even during their busiest months of delivering the new head unit, the platform was improving as other GENIVI members collaboratively enhanced existing components and added new ones to the GENIVI platform. BMW is contributing production-ready open source components back into the GENIVI repository and also introducing enhancements to upstream code projects from which they adapted some of their software. This community-based development model of "give a little, get a lot" is moving the platform closer to a near product-ready state while spreading the burden of maintaining and improving the software across multiple organizations.

Don't Do This Only Once

By BMW's own admission, an organization should not set out to do a GENIVI project only once. As with any initial project using a new technology (open or proprietary), there were some challenges faced by BMW and its suppliers (including: Magneti Marelli, Harman, NVIDIA, Wind River, BearingPoint, and XS Embedded) but there were also many positives. Leveraging Linux and open source components required these suppliers to re-visit their internal processes to ensure license compliance and to provide the level of transparency BMW expected with this new model of software delivery. But once the processes were updated, they can now be used in subsequent programs with only minor tweaks resulting in smoother and more efficient delivery of future software offerings.

BMW was careful to measure many key success indicators in their new product and enable the validation of the GENIVI "80-15-5" assumption. This assumption is that upwards of 80% of the non-differentiating platform content could simply be adopted directly from existing open source community code. An additional 15% of the software could be adapted (i.e., adopted and made automotive ready) from available open source code. And finally, that 5% of the software would need to be developed from scratch, since no reasonable starting point was available in the upstream community. At start of production the actual code was measured at 60% adopted, 30% adapted, and 10% created. Though the inheritance is impressive for the first development cycle, initial assumptions were not met, but BMW is confident that in subsequent GENIVI based production programs the GENIVI assumption will be surpassed. The benefit of community-based development is that meeting the target does not depend on BMW alone, as each OEM, Tier 1 engaged in a product program contributes code upstream the amount of high quality, IVI relevant software increases making future programs easier and less expensive to complete for all involved.





GOALS MET

BMW recognizes that not all business goals were met in their first project. However, their commitment to using the same model in their next generation programs suggests that it is only a matter of time until they experience the level of cycle time and cost reduction that they expected when they started.

BMW needed to break from the traditional model of software delivery. The growing cost of development and maintenance coupled with the increasing functional expectations of today's connected drivers required a different approach.

BMW found this different approach through the use of open source software and an active development community delivered by the GENIVI Alliance.

Their new model has produced a highly transparent and efficient method of software delivery. Several suppliers have introduced new core processes that enable BMW and others to have a more agile relationship with its supply chain both in their discussions of requirements and in the selection of best-in-class modules resulting in a feature-rich and innovative end product.

And, with many other GENIVI members engaged in production programs contributing back to the reusable platform, the starting point for future production programs will improve over time as the shared development model continues to succeed.

As the BMW head unit is incorporated rapidly into the full range of BMW Group vehicles, BMW will be able to re-focus developers on differentiating functionality that really matters to the end customer.

Looking Ahead

BMW is strongly committed to GENIVI for future production IVI programs. Their contributions back to GENIVI have enhanced the platform and made it a stronger starting point for others and their future programs.

The reach from GENIVI continues to grow as more stakeholders in the automotive supply chain adopt and enhance the GENIVI platform. With production programs at other OEMs currently in process, the probability of this new model of software delivery becoming a new automotive "norm" are high.