**GENIVI: Strong Momentum Continues**
By Egil Juliussen

The GENIVI Alliance had its membership meeting in Shanghai in mid-October. IHS Automotive was invited as part of their analyst track and was asked to give perspectives on HMI and apps for auto infotainment. This is the fourth time we have attended and given a presentation at the GENIVI Alliance meeting. We have previously been asked to do presentations on Software Security and HTML5 Infotainment Impact. Does this mean that GENIVI is now focusing on HMI technologies and/or a HMI framework?

This impression will update a previous version that was done in November 2011 and will focus on the following topics:

- What is new with GENIVI?
- How does GENIVI compete with other OS platforms?
- What is the outlook for GENIVI success?

**What is new with GENIVI?**

The GENIVI Alliance is a non-profit organization that is developing a software platform for in-vehicle infotainment (IVI) systems that uses Open Source Software (OSS) business model. The software platform is based on the Linux operating system (Version 2.6 Kernel) and additional middleware that are needed for running automotive infotainment applications in head-units, telematics and navigation systems.

The GENIVI platform can be based on any Linux distribution, but a major goal of GENIVI is to avoid fragmentation of Linux in automotive systems—hence the compliance program. To assure a high level of compatibility between Linux versions, GENIVI released its first edition of the compliance testing program in August 2011 after 14-months of development. The second version of the compliance testing program was announced this spring and the third compliance version was announced in Shanghai this October.

The next table shows the growth of GENIVI compliant versions. Each compliance entry specifies which microprocessor is used. Each compliance version has an expiration date for starting a new Genivi-based infotainment system development project. The data is from the GENIVI website. New entries are added regularly.

| Genivi Compliant Versions: November 11, 2012 | | | |
|---|---|---|---|
| | **Genivi 1.0: Exp. 4/23/2013** | **Genivi 2.0: Exp. 9/10/13** | **Genivi 3.0:Exp. 10/2014** |
| Accenture | Intel Atom | Intel Atom | |
| ADIT* | None | Freescale i.MX6 | |
| Canonical Ubuntu | Intel Atom<br>ARM Cortex A8 | None | |
| Freescale | None | Freescale i.MX6 | |
| KPIT Cummins | Intel Atom<br>ARM Cortex A8 | None | |
| LG Electronics | None | X86 Oki IOH Board | |
| Linux Foundation:<br>Intel & Samsung | MeeGo:<br>Intel Atom<br>ARM Cortex A8 | Tizen:<br>Intel Atom | |
| Magneti Marelli | Nvidia Tegra 2 (Cortex A9) | None | |

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| Mentor Graphics | Intel Atom<br>ARM Cortex A8<br>ARM A9 | Freescale i.MX6;<br>Freescale iMX6 Sabre Lite<br>Intel Atom Crossville | |
| MontaVista | Intel Atom Crossville<br>TI Jacinto<br>Freescale i.MX6q<br>Freescale Sabre i.MX53<br>Renesas R-Car M1 | Intel Atom Crossville<br>Freescale i.MX6q; Sabre<br>Freescale i.MX53 Sabre<br>Freescale i.MX53 QSB<br>Renesas R-Car H1 | Renesas R-car H1<br>ARM Cortex A9<br>Boundary Device Sabre<br>Freescale i.MX6 Quad |
| Nvidia | Nvidia ARM | None | |
| Pelagicore | None | Freescale i.MX53 QSB | |
| Renesas | Renesas R-Car H1<br>Renesas M1A<br>ARM Cortex A9 | Renesas Marzen SBD;<br>Renesas Milan SBD | |
| Symphony Teleca | None | Freescale iMX6 | |
| Wind River | Intel Atom<br>ARM Cortex A8 | Freescale i.MX6 Sabre Lite<br>Renesas R-Car M1A<br>Renesas R-Car E1<br>TI Jacinto 5 EVM | |
| *Advanced Driver Information Technology (ADIT) is a Bosch and Denso joint venture | | | |

The growing list of GENIVI compliant versions indicates that there is a strong effort to get the GENIVI platform ready for major deployment over the next few years. Currently there are at least 11 GENIVI-based infotainment projects in development and a similar number of development projects expected to be started in the next year or less.

There are other indicators that GENIVI continues to grow. The membership has now surpassed 170 companies compared to the 8 founding members. The number of registered attendees at the GENIVI membership meetings has grown from about 300 in April 2011 to about 500 in Shanghai. The most impressive growth was in the GENIVI Showcase, where companies show their hardware and software products—this time 62 companies were present.

GENIVI has also opened up its own software development to be fully open to any OSS programmer. Previously GENIVI developed software projects were only for GENIVI members. Three GENIVI projects are being turned over to the OSS community—the Layer Manager, Audio Manager and Automotive Diagnostic, Log and Trace.

Additionally GENIVI is also reaching out to the Linux Foundation and was a major sponsor of the Automotive Linux Summit in September in the UK. The Linux Foundation has started its own infotainment workgroup called Automotive Grade Linux (AGL). AGL is currently focused on the Tizen version of Linux, which has a GENIVI compliant version. Many of the GENIVI members are also AGL members including Jaguar Land Rover, Nissan, Denso, Harman, Intel, Fujitsu, Renesas and others. Toyota is also a member of AGL, but is not a member of GENIVI. AGL is expected to strengthen the role of Linux in automotive and it is likely that GENIVI and AGL will be complementary organizations. It looks like AGL is planning to expand Linux use to non-infotainment systems such as Instrument Cluster Display (ICD) and possibly for driver assist and ADAS products.

**How does GENIVI compete with other OS platforms?**

The main competitors to the GENIVI platform is Microsoft's automotive OS platforms, RIM's QNX platform and the Android platform (modified to work in an automotive environment). Top down

perspectives will be used for comparisons in this impression, but IHS Automotive is in the process of releasing a report on infotainment OS platforms that evaluates each platform and their future prospects.

The infotainment software platform market battle is currently between two established proprietary platforms—Microsoft and QNX—and two emerging Open Source Software platforms —GENIVI and Android.

Microsoft and QNX platforms have been used for over a decade and many infotainment systems are based on these two platforms. Both Microsoft and QNX have spent many years developing and tailoring their platforms for auto infotainment. Both companies are charging a licensing fee for each unit shipped. Each company is improving their software platforms with new features and more middleware. They are also growing their 3rd party support that can add more middleware and can provide infotainment applications that the auto OEMs need. All of this software tailoring to meet an auto OEM's specification has significant development costs, that is normally handled by Tier 1s and companies specializing in automotive middleware.

The OSS business model is different in the sense that the OSS platform and middleware components have no software licensing fees. However, the same tailoring of the OS platform and middleware has to be done to meet the auto OEM's specification for each infotainment system. The OSS platform tailoring is often done by the GENIVI platform suppliers since they have the most platform expertise. The platform tailoring can also be done by a combination of GENIVI platform supplier and Tier 1s or some other combination of companies. In all cases, the companies get paid for this tailoring work and this is the way the Genivi platform supplier gets paid—via professional services, but not via software licensing fees. However, much of the middleware components have licensing fees as do nearly all the infotainment applications.

Currently, the software platform tailoring is more costly for GENIVI compared to QNX and Microsoft because GENIVI is still a work in progress. Microsoft and QNX tend to provide pre-configured software platforms that can save on total software development costs. As the GENIVI software infrastructure grows and becomes established, their cost will decline from both the experience base (learning curve effect) and from competition among GENIVI platforms and middleware suppliers. The key question is how fast the cost of the GENIVI OSS approach tailoring will drop compared to the established QNX and Microsoft approach.

There are, of course, many other factors that impact what software platforms the auto OEMs choose. These factors include software reliability, third party application availability, software support issues and specific platform features that are available at the decision time. Most of these selection factors are unique to each auto OEM and it is difficult to generalize how each platform compare.

Android is a special case as an auto infotainment platform. Android has been amazingly successful in the Smartphone industry, which has made it a potential option as an auto infotainment platform. The problem is that there is no company or organization that is making a standard Android IVI platform or at least providing some guidance that can avoid multiple and incompatible versions (from the apps viewpoint) that we have seen in the Smartphone industry.

If there was a GENIVI-like organization for Android, it would become a formidable competitor in auto infotainment. Android could still become a strong competitor, but would probably be used as a proprietary platform by a large auto OEM. Since most of the Android Smartphone development expertise is present in Asia, it is likely that Android will have the most success in this region initially.

GENIVI continues to track the importance of Android. Another way for GENIV to leverage Android is to focus on the Android apps, which are mostly written in Java. These apps can be leveraged by using a Java virtual machine as part of GENIVI middleware. This has not been done by GENIVI yet, but is a likely future event by GENIVI or one of its members. QNX has already implemented Java VM.

**GENIVI Outlook**

The GENIVI outlook remains good for several reasons. The Alliance continues to build momentum and is making good progress in developing a software platform for auto infotainment applications. The business model of OSS has an advantage in platform software production costs since it is free compared to a license fee from QNX and Microsoft. Total software development costs are currently higher for GENIVI than for QNX and Microsoft. It is difficult to estimate if or when GENIVI may have similar or lower total software development costs than QNX and Microsoft. IHS Automotive believes this is a when question and it could happen in the 2015-16 timeframe.

In summary, GENIVI has made excellent strides forward in the past three years and will soon be ready for deployment. In a year or so, GENIVI deployment stories will emerge and we will quickly know how it will do against current competitors.

In IHS Automotive's view, GENIVI will establish itself as a formidable competitor by 2015 and will take an IVI software platform market share in the 30% range or higher by 2020. This is a significant opportunity as infotainment OS platform sales for 2020 are forecasted to be in the 100M unit range.