New Software Era Could Crimp Auto Infotainment Hardware Makers

Research Question:

Will the fast-evolving auto infotainment industry and the plethora of competitors entering the space increase dollar content per car for embedded system providers like Harman?

Summary of Findings

- The value and innovation in automotive infotainment systems are shifting from the hardware to the software. This could hurt margins and dollar content per car for hardware manufacturers like Harman International Industries Inc. (HAR) and Panasonic Corp. (TYO:6752), according to Blueshift Research's 11 of 20 sources.

- The trend toward software dominance is being driven by Google Inc. (GOOG/GOOGL) and Apple Inc. (AAPL) as well as by car makers' desire to control the in-car experience and use it as a sales differentiator, all of which could turn infotainment hardware into a commodity.

- Three sources said some hardware makers, such as Delphi Automotive PLC (DLPH) and Denso Corp. (TYO:6902), appear to be adapting to the changing dynamics faster than Harman.

- Some automakers will resist ceding control over infotainment systems to Apple and Google, but seven sources think Google especially will become a dominant force. Google could marginalize hardware makers by setting standards for head units in much the same way it exerts control over Android phones.

- Apple's CarPlay software is mainly geared toward enabling its phone apps in cars. No source expects Apple to become involved in making auto infotainment hardware.

- Eleven sources said BlackBerry Ltd.'s (BBRY) QNX is the top underlying software platform for the infotainment market, similar to the findings in Blueshift's May 23 report. Five others said Linux is gaining on and could overtake QNX.

- Most sources see a continuing split between in-built infotainment systems and those centered on smartphones; the latter is more prevalent in lower-end and midrange vehicles.

- Blueshift's online survey of 181 U.S. consumers found that 61% of those in the market for a new car considered an infotainment system to be very or extremely important to their buying decision.

Silo Summaries

1) Auto OEMs
Sources were split regarding the future for infotainment hardware makers like Harman. One believes **margins and dollar content per car will take a significant hit if Google gains a foothold in car software** and dictates hardware specs. A second source thinks Harman and its competitors will continue to be valued partners for integrating hardware and software. Three sources said **BlackBerry's QNX is the leading auto infotainment OS**. Sources also were divided regarding whether infotainment systems will be completely in-built or centered on smartphones, with two expecting hybrid systems.

2 Infotainment Software Developers
Six of eight sources said Harman and other infotainment **hardware manufacturers will feel significant pressure on pricing and margins as Google's auto software gains acceptance and automakers try to wrest control of the in-car experience**. Automakers may resist giving Google or Apple too much control over infotainment systems, according to four sources, but two of those four believe Google ultimately will be a major force. **Five sources said QNX is the top infotainment OS, but one source is convinced that automakers will move to Linux**.

3) Infotainment Hardware Providers
One of these two sources thinks the dollar content per car for infotainment hardware makers will fall as software becomes the system focal point. **Both sources expect Apple and Google to be significant players in car software and to disrupt the current model**. Linux has been gaining acceptance among automakers, but one source said QNX remains the leading OS. **Smartphones and embedded systems each will play a role in providing Internet connectivity in cars**.

4) Industry Specialists
Three of these six sources said **Harman and other infotainment manufacturers will see declining margins and per-car revenue as new software platforms relegate hardware to commodity status**. Two others, however, think **manufacturers can protect their profits by serving as integrators of hardware and software**. Three sources said Internet connectivity and app accessibility in cars will be delivered by both smartphones and embedded systems.

5) Online Consumer Survey
In **an online survey of 181 U.S. car owners**, the 41 car owners that are currently in the market for a car **showed significant interest in infotainment systems**. Navigation and Bluetooth connectivity were the most sought-after infotainment system features.

Auto Infotainment

	$ Content Per Car for Hardware Makers, including Harman	Google to Dominate Infotainment Software	Smartphones As a Basis for Infotainment Systems
Auto OEMs	→	→	↑ (green)
Infotainment Software Developers	↓ (red)	→	→
Infotainment Hardware Providers	→	→	↑ (green)
Industry Specialists	↓ (red)	→	↑ (green)

Background

Auto infotainment is an estimated $30-billion-a-year global business and growing. Infotainment features like navigation, entertainment and Internet connectivity have become important selling points for car dealers and key in attracting coveted younger customers and first-time car buyers. The huge revenue opportunity has led to intense competition among infotainment hardware makers like Harman, Panasonic, Continental AG (ETR:CON) and Delphi, and between software innovators like Google and Apple. Harman claims about 22% market share of auto infotainment systems worldwide. Blueshift's April 5, 2013, Harman report found that Harman's main competitive advantages were its brand-name recognition, its entrenchment with auto manufacturers, and a range of products that will allow it to go beyond the luxury segment. However, all silos described the car audio and infotainment space as crowded with competitors and stated that Harman did not differentiate itself from others in terms of technology or quality.

Until now, infotainment system manufacturers have been able to boost their hardware margins by also acting as software integrators, something for which they may not be needed in this new landscape. On the software side, Apple's CarPlay allows car owners to sync their iPhones to their dashboards to access apps, music and other content. It will debut this fall in Ferrari, Honda, Hyundai, Jaguar, Mercedes-Benz and Volvo models. Initially, CarPlay will require a preinstalled hardware system such as Harman's Aha, but some in-built system makers fear that Apple may develop its own embedded systems. Google's Android Auto will appear in some Chrysler, Dodge, Honda and Audi vehicles this year, allowing car owners to integrate their Android phones into their auto controls. BlackBerry also is a significant software player through its QNX subsidiary. Sources for Blueshift Research's May 23 BlackBerry report said QNX was best in class in real-time operating system (RTOS) technology. However, QNX faced a challenge in the car market from Linux, an open source platform. Meanwhile, the Car Connectivity Consortium, a group led by smartphone makers, has developed a software standard called MirrorLink, aimed at allowing drivers to access their smartphones through their cars' controls.

Current Research

In this next study, Blueshift Research examined the effect of the changing auto infotainment software landscape on hardware makers like Harman. We employed our pattern mining approach to establish six independent silos, comprising 20 primary sources (including 10 repeat sources) an online survey of 181 U.S. consumers and four secondary sources focused on the latest trends in infotainment:
1) Auto OEMs (4)
2) Infotainment software developers (8)
3) Infotainment hardware providers (2)
4) Industry specialists (6)
5) Online survey of U.S. consumers (181)
6) Secondary sources (4)

Next Steps

Blueshift Research will gauge OEM and consumer response to the first vehicles with Apple's CarPlay and Google's Android Auto. We will undertake another consumer survey to assess interest in and demand for auto infotainment systems, especially among those in the market for a new car. Lastly, we will explore which hardware manufacturers are making the most progress in developing technologies for integrating infotainment hardware with other systems in the car, such as engine monitoring and climate control.

Silos

1) Auto OEMs

These four sources were split regarding the future for infotainment hardware makers like Harman. One believes margins and dollar content per car will take a significant hit if Google gains a foothold in car software and dictates hardware specs. A second source thinks Harman and its competitors will continue to be valued partners for integrating hardware and software. Two others did not comment on per-car revenue, but said growing demand for infotainment systems will boost overall revenue for Harman and others. Three sources said BlackBerry's QNX is the leading auto infotainment OS, though one believes Linux poses a competitive threat. Sources also were divided regarding whether infotainment systems will be completely in-built or centered on smartphones, with two expecting hybrid systems. Infotainment screens eventually will control other functions like air conditioning and engine monitoring, according to one source.

KEY SILO FINDINGS

Hardware
- 1 of 4 said Harman and other hardware makers could be reduced to commodity vendors if Google dominates infotainment software.
- 1 thinks Harman and others will continue to play key roles as integrators of hardware and software.
- 2 said growing demand for infotainment systems will benefit embedded system makers like Harman.

Software
- 1 believes Google could control the car infotainment software market and dictate hardware specs, much like it did with Android phones.
- 3 see QNX as the leading OS for auto infotainment, though 1 said Linux could challenge it.

Technology
- 1 said infotainment systems will be smartphone-based while 1 thinks car makers want to move to in-built systems.
- 2 expect a hybrid system of both smartphones and embedded hardware.
- 1 is worried that auto brands could be diluted if Google gains a foothold in auto software.
- 1 thinks infotainment screens will evolve to control other car functions like climate control.

1. Connected vehicle technology executive for a major automaker; repeat source

Google has a chance to take control of auto infotainment software, which would turn Harman and other embedded system manufacturers into commodity hardware vendors. Infotainment systems that allow consumers to bring their own apps and content into the car through their mobile devices are likely to win out, with platforms based on a combination of Linux and Google software. If Google does dominate infotainment system software, it could erode the brand identity of the automakers, much as the adoption of Android has done to mobile phone makers.

Hardware
- "The market leaders in embedded systems are Panasonic, Harman, Continental, Delphi, Denso and quite a few others. Panasonic claims to be No. 1."

Auto Infotainment

- "The current infotainment model is, you buy the software from the same [embedded system manufacturer] that sells you the hardware. In the future, if [Google gets into the space], it will provide the software, and then Harman's going to be more and more just providing the hardware. And the margin in hardware is very small, so it's going to be a loss for Harman and the [hardware] providers. They'll just be hardware manufacturers."
- "The tier 1 [infotainment system manufacturers] are going to be under increasing pressure to make money. As we put more things into the infotainment unit, it becomes more like a computer. As we move towards that, there's increasing pressure on companies like Harman, Continental, Panasonic, Delphi, Denso. There are over 21 tier 1s all claiming to build head units."
- "When Google started in the cell phone space, over time they started telling the hardware manufacturers what the hardware should do, what the minimum specifications were if they wanted to license Android. They began dictating hardware specs to the OEMs because they wanted to have software platforms."
- "Google will begin doing the same thing in [auto] head units. It will dictate head unit hardware, and all the auto manufacturers will be on it. The Harmans and Continentals will begin building the same head unit. They're all going to begin using Google and will all have specs for the size of the screen and all else. Companies like Harman, Panasonic and Continental will be under pressure to differentiate themselves, and it's going to be very hard to do that. Hardware is going to become a commodity."
- "You'll be seeing the impact of this probably in 2015."

Software
- "The leaders in auto infotainment software are [Microsoft Corp.'s/MSFT] Windows CE, QNX, Linux and Green Hills [Software Inc.'s] Integrity."
- "Any decisions being made in the next year won't come to market for two to three years. It takes that long."
- "Google's approach in the automotive industry is the same as when they came into the cell phone business: 'We will give you software for free,' and that's what they're doing. And now how many traditional handset manufacturers no longer exist, like Motorola?"
- "Google has different approaches. They give you a very thin layer and say you can choose everything you want in the head unit, and as soon as there's a Google-enabled handset in the car, they'll take care of the rest. They only ask the OEM to make sure the software is on the head unit."
- "Another approach is to give away the entire Android software stack on the hardware, and they even take care of the software licenses. It's the same approach as with cell phones. They don't give a hoot about the phones or the cars. They're looking for more eyeballs and the ability to deliver and understand the relevant audience to better provide targeted advertising."
- "QNX does have an opportunity in the automotive space, but as Google gets more of a foothold, QNX's opportunity will come under assault and Google will be more of a competitor. Android will be a competitor, and that's Linux with the additional stuff Google puts on it. So the biggest competitor to QNX will be Linux. And if Google wins in this space, it will be Linux that wins."
- "CarPlay is a hardware solution. The Apple protocol is enabled through a hardware license. There's also the chip, but Apple's probably licensed that out to TSMC [Taiwan Semiconductor Manufacturing Co./TPE:2330]."

Technology
- "As the market stands today, it's a combination of the two [smartphones and in-built systems handling connectivity]. If you look at what [we've] done, you bring your content into the car and it interacts and integrates with the vehicle. [The] strategy is to integrate the content into the speakers and sound control. The car becomes a very expensive set of speakers."
- "That approach has been mirrored, and other people who are following it include Apple, Google and others. MirrorLink is an attempt by Nokia [Corp./NOK] and handset makers to find the technology for the connection."
- "The traditional hardware manufacturers like Continental, Harman and Panasonic also believe they're in play. They've partnered up and bought content solutions. Harman bought Aha. Continental is doing a partnership with Cisco [Systems Inc./CSCO]."

> In the future, if [Google gets into the space], it will provide the software, and then Harman's going to be more and more just providing the hardware. And the margin in hardware is very small, so it's going to be a loss for Harman and the [hardware] providers. They'll just be hardware manufacturers.
>
> *Connected Vehicle Technology Executive, Major Automaker*

- "Everyone is recognizing the need for technology to bring the offboard content inboard. So what is the future going to be? I believe it's not going to be in the vehicle. The lifecycle of the vehicle is too long. I think the winner is someone with an incredible sound system and with a … bring-in-content solution. [OEMs that allow you to bring your content] will win in that space. But it's also what Google's going to do."

- "The auto manufacturers believe or have believed they own that screen. Google is coming in and saying, 'No, you don't. The customer does. And we're going to make it easy for the customer to put whatever they want on that screen.' And when that happens, the automakers will be left in the lurch."

- "If Google's vision wins, the automakers don't even play anymore. The automakers basically give you hardware, and Google will take care of everything else. OEMs will lose their brand."

- "If Google goes to any auto manufacturer and guarantees money over X years for Y million cars, every one of the auto manufacturers would jump at that chance because they want to keep their factories open. That's the beginning of the end because then you'd have Google cars all over, not Ford or Toyota cars."

- "By putting the Google name on the car [or the head unit], you're eroding the brand, taking away more and more sticky pieces and the relationship with the customer."

- "If people get caught up in the experience of the car, they won't care about the brand of the car. My interaction with the car is with the steering wheel and looking out. What comes out of the center console—the information, the knowledge, the entertainment—if that screen is branded Google, I'm a Google guy and that's a Google car."

- "None of the companies concerned are worried—not the tier 1s and not the auto manufacturers. They're not seeing the parallels with the cell phone industry. The companies that exist for cell phones using Android are making hardware only. Google owns more and more of its ecosystem, and profits are going more and more to Google. I don't think the automotive manufacturers are prepared to fight the fight."

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> *Connected Vehicle Technology Executive, Major Automaker*

2. OEM engineer specializing in embedded systems; repeat source

Embedded system manufacturers like Harman will continue to play a key role in infotainment systems as integrators of hardware and software. BlackBerry's QNX will retain its lead in infotainment software because it was built specifically as a real-time operating system (RTOS). Google was smart to have its auto software be a mirror interface for phones rather than an underlying auto OS. Car manufacturers are pushing for 4G connectivity to be embedded rather than accessed through mobile phones.

Hardware
- "The tier-1 infotainment manufacturers as well as the software developers will benefit from the added capabilities of infotainment. Everyone will be getting their share of these growing revenues."
- "If Google develops an infotainment solution, it will be powered by Android—specifically an Android version for car operating systems. That would put you in the Google ecosystem like Gmail and Google Maps. But I don't see Google developing an infotainment [hardware] solution because they always work from the operating system. They would let third parties make it for them."
- "Just like car companies don't make their own parts but buy them and integrate them in their cars, embedded infotainment system manufacturers will do the same. They will do the integration of the software and hardware. Companies like Delphi and QNX will still have a lot of say in what happens."

Software
- "QNX is an end-to-end operating system. The infotainment system is a complete package. They also provide their software and operating system to other companies like [General Motors Co.'s/GM] OnStar, who are developing infotainment systems. It will maintain its lead because it was designed from the ground up to work in real time. It would be hard to beat something that was built for a specific task that it's performing so well, like QNX."

- "I don't believe Apple and Google are disruptors in this. Google's advantage is customization, which iOS doesn't do. iOS is more stable and user-friendly. That's the competition between the two. And Google is now exploring a completely different kind of future. They're working towards the autonomous vehicle."
- "Google [just announced] that Android Auto would run on mobile phones. It simply mirrors the interface from the phone onto the car's infotainment screen. This way, Google is getting involved without becoming a competitor to QNX and other companies. They will have no problems in updating the software and won't have to get into the nitty gritty of a real-time OS. It's a smart move."

Technology

- "Car manufacturers always listen to customers and will provide the features customers want. The feature I'd like to see would be complete end-to-end connectivity—connecting with the infrastructure, notifications of roadblocks, detours—a complete real-time experience when I'm driving so that my vehicle is communicating all the time with the environment."
- "You can think of your infotainment device as a laptop. Once you have Internet in the car, you can check email and all that and download apps on the fly."
- "The connectivity will be through both the infotainment unit and the smartphone. That would be the easiest. But the best would be to have everything in the embedded unit so as not to have to use your smartphone at all. After all, the screen in the car is bigger and better. Car manufacturers would like to push for that, and that's why they're pushing for having 4G technology embedded in the car."
- "Infotainment and cell phones are going to form an ecosystem. All the car companies are going to push for having onboard connectivity. 4G technology will be integrated in the car. The cell phone won't be a standalone component but they will all be working together."
- "There will be an app ecosystem for cars, and you will be able to download apps for the car in the same way you can download them for the cell phone."
- "The infotainment system is not just serving the purpose of infotainment. Many of the controls will be done through the infotainment screen, such as air conditioning. It will be moved from the dashboard onto the screen, as a touchscreen."

3. Vice president of technology for a major U.S. auto manufacturer; repeat source

Smartphones will play a key role in infotainment systems during the next few years, but automakers eventually will want to move to in-built connectivity and infotainment systems contained entirely within the head unit. Head units will evolve to control not just entertainment and navigation but other vehicle systems like climate control and engine monitoring. QNX offers the best solution for software that can handle multiple tasks.

Hardware

- "Panasonic, Pioneer [Corp./TYO:6773] and Harman are the dominant companies making embedded systems right now. Then there's Garmin [Ltd./GRMN], Mitsubishi [Electric Corp./TYO:6503], Alpine [Electronics Inc./TYO:6816] and a few smaller ones."
- "[Automakers] are dedicated to giving the car buyer what he wants, but that also means proven, reliable technology. Embedded infotainment has the edge over the smartphone."
- "QNX can provide the software for integrating with the head unit. They have probably the best real-time solution for these systems. QNX can also be deployed for smartphones, of course, but there are real advantages to having a total system working with the vehicle to monitor everything from engine performance to road conditions. There is other software that could work. Delphi has a good platform."
- "In time, the head unit will become the central point of control for the driver—not just a delivery system for streaming content or navigation but a control center that manages everything from climate control to cruise control while monitoring engine performance and fuel economy."
- "Brand recognition is still important. Our dealers report that customers will ask for a specific system by name."

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>
> *VP of Technology*
> *Major U.S. Auto Manufacturer*

- "Embedded infotainment is considered a must-have for our customers shopping for our top vehicles."
- "We're definitely seeing a decrease in production costs from our end. The technology is improving so fast that we expect time to market will also decrease, but again we have to ensure reliable operation. I think car makers would be slow to adopt a new and unproven technology. That's not to say we wouldn't investigate new opportunities, but malfunctions cause serious problems. There's a big difference between recalling 10,000 vehicles versus 10,000 smartphones."

Software
- "QNX and Delphi are the strongest companies in infotainment software. QNX has industry relationships and probably has the better reputation of the two. Their ability to multitask operations in real time is just a huge benefit to embedded systems monitoring multiple car functions at once."
- "I don't see Linux becoming a major force in infotainment beyond Android phones. Google may use them in the development of their open-source solution. More developers would be able to produce apps for that system, but I think Google's main interest is creating an autonomous car operating system for the future."
- "We're not really interested in MirrorLink. QNX software integrated with the head unit hardware promises to be the most effective solution for integrating vehicle systems with an operating platform that can run them all."

Technology
- "We would like to offer infotainment systems that do not require a smartphone. An embedded system is easier to view and control than trying to work a smartphone while driving."
- "We expect to see larger and more vibrant displays, which are a major selling point."
- "Voice command will eventually become the norm."
- "The ideal infotainment system is contained entirely within the head unit with 4G connectivity for an uninterrupted experience. Our customers are going to demand that once they see the difference between 3G and 4G."
- "Smartphones will still have a place in the infotainment environment. Short term, it will be mainly in midsize vehicles and smaller cars. It's a less expensive way to deliver infotainment, but not as nice or even necessarily as easy to operate as in-dash systems. In the next two to three years we'll see smartphones working with head units. You'll be able to download GPS updates, apps, or stream your content either to the phone or through the head unit."

4. VP of supply chain management for a major U.S. auto manufacturer; repeat source

Consumer demand for infotainment systems is expected to explode, which will benefit embedded system manufacturers like Harman as well as software providers like QNX. Within five years, virtually all new cars will be equipped with some form of infotainment, priced in line with the cost of the vehicle. An ecosystem will develop that integrates smartphones with head units, allowing consumers to control numerous car functions through their phones.

Hardware
- "Head units are getting more sophisticated, and they are becoming an integral part of the driving experience. We expect customer demand for embedded infotainment to keep growing."
- "Right now a head unit is superior to a smartphone interface. The screens are bigger and positioned for easy operation. You can see every aspect of the vehicle's operation at a glance, plot a route, play your music. It's much easier than trying to work a smartphone while driving."
- "There will be plenty of opportunity for [hardware providers such as] Panasonic, Alpine and Harman to deliver embedded systems. These are good-looking systems and customers want them, so we will satisfy that demand."
- "We'll eventually see complete integration between head units, smartphones and other mobile devices all communicating with each other."
- "Going forward, all embedded systems will be equipped with software for updating GPS maps or upgrading the system itself, and downloading entertainment apps."
- "Customers are very brand-conscious, whether they are selecting a new phone or shopping for a new vehicle."

> "We're moving toward an ecosystem where the head unit and smartphone will work together for a variety of applications. You'll be able to unlock and start your car using your phone. You'll be able to monitor your car remotely through the phone. If someone sideswipes your vehicle while you are away, you'll receive notification on your phone.
>
> *VP of Supply Chain Management*
> *Major U.S. Auto Manufacturer*

- ▪ "Production costs and time to market [for infotainment systems] are going down."

Software

- ▪ "Google's Android rides on Linux, and it appears they are going to go the smartphone route for infotainment. QNX is the leading real-time solution, and they will do well in the embedded systems market. I don't think there's a lot of consumer awareness of QNX, but it doesn't really matter if they're working directly with infotainment manufacturers."
- ▪ "MirrorLink connects a smartphone to the vehicle's head unit for a dual display. It's essentially a two-way data link. One of the disadvantages of the system for aftermarket installation has been the limitations of the SIM card installed in the vehicle. The cards have not been programmable for new users, and that can affect the sale of a used vehicle. New systems allow the SIM card to be modified remotely."

Technology

- ▪ "All of our 2015 vehicles will be equipped with 4G."
- ▪ "In the next five years, all cars coming off the assembly line will feature an infotainment system."
- ▪ "We're moving toward an ecosystem where the head unit and smartphone will work together for a variety of applications. You'll be able to unlock and start your car using your phone. You'll be able to monitor your car remotely through the phone. If someone sideswipes your vehicle while you are away, you'll receive notification on your phone."
- ▪ "Voice-activated infotainment systems are the next step in improving the customer experience."
- ▪ "On vehicles equipped with cameras, you'll be able to conduct surveillance on your phone. All of these features will require smooth integration between the head unit and the smart phone."

2) Infotainment Software Developers

Six of eight sources said Harman and other infotainment hardware manufacturers will feel significant pressure on pricing and margins as Google's auto software gains acceptance and automakers try to wrest control of the in-car experience. Two sources said Harman has been slow to adapt to the new industry dynamics. Automakers may resist giving Google or Apple too much control over infotainment systems, according to four sources, but two of those four believe Google ultimately will be a major force. Five sources said QNX is the top infotainment OS, but one source is convinced that automakers will move to Linux. Five sources think completely in-built infotainment systems will dominate the luxury market but that other segments will have systems centered on smartphones.

KEY SILO FINDINGS

Hardware

- – 6 of 8 said per-car revenue and margins for manufacturers like Harman are at risk from Google and from automakers' desire to control the in-car experience.
- – 2 said Harman is among those struggling to adapt to the changing industry dynamics.
- – 1 thinks demand for infotainment software could rebound in 7 to 10 years as wearable technologies replace phones.

Software

- – 4 said automakers will resist letting Google or Apple take control of the in-car experience, but 2 believe Google will be a significant factor in infotainment software.
- – 5 believe QNX is in the best position as an underlying operating system, while 1 sees automakers moving to Linux.
- – 1 thinks Google will only dominate the car market if it succeeds in developing driverless cars.

Technology

- – 5 think we will continue to see a split market for infotainment systems—completely in-built for high-end cars and smartphone-based for low-end cars.
- – 1 said location-based in-car advertising could subsidize embedded Internet connectivity so that consumers do not have to use their phone data or pay for a second data plan.

1. Marketing vice president of a developer of mapping and navigation services for phones and cars

New car-based software from Google and Apple will help expand the market for infotainment systems by pushing them into lower-end cars. However, the growth of such software will hurt the margins of manufacturers like Harman by making

them purely hardware providers rather than complete systems integrators. Harman and Pioneer are among those struggling to adapt to the challenge of integrating infotainment systems with other systems in the car. Competitors like Denso, Continental and even Garmin may be better positioned as the infotainment market evolves.

Hardware

- "In the past, [embedded system manufacturers] have become integrators and acted as a full integration shop for the systems that go in the car. That has had positives and negatives. There have been some negative experiences for some of them, but there's also more margin in that than just providing a piece of hardware."
- "But [the way infotainment software is evolving] does eliminate the margins in some of these deals because if you just let Google take it over, there's nothing really to integrate. You're just providing a piece of hardware."
- "On the other hand, the volume of units they can sell and their addressable market is increasing because they can now push these lower-cost systems down into lower-end cars."
- "Car OEMs are trying to push at least a display audio unit down into their [low-end] vehicles, and companies like Continental are responding to that with pretty low-cost units that are maybe under-powered, but that's fine. That's a market where they would have [in the past] lost that business to a cheap tier-1 provider like Panasonic or someone like that. Now they're providing a more sophisticated unit with a large touchscreen, which will ultimately be connected to a phone in a low-end car, but does increase the volume and the addressable market."
- "[Harman and Panasonic] are struggling with the same issues. They're having a tough time adapting to some of these trends. They haven't yet made the leap to integrate into other systems in the car, so they're very much still focused on the infotainment head unit as the device they're offering."
- "If they don't react and create more integrated experiences and systems, I think they will struggle competing on the low end. And then on the high end, [they will have trouble] competing with people like Garmin or Denso that are creating these more integrated experiences. They've yet to react to that. It doesn't seem like they've caught on to this challenge."
- "Denso is pretty well positioned as a systems provider. I think Continental is doing a good job of looking at the broader market and lower-end systems. Garmin is an interesting story because I think they're coming from a different perspective with consumer devices and providing systems in planes. They own a big percentage of the cockpit in a lot of new planes, so they're an emerging player."
- "The other thing we're witnessing is this integration of the cockpit with the infotainment system. That's where the opportunity is and where you're seeing the growth. Someone like Denso has already migrated into the cockpit display, and they are providing more functionality there. Garmin has a desire to do that as well. They're emerging in the new car and hardware and infotainment space. I think you're going to see more expansion opportunities in the high-end and midtier for those companies in merging and blending those environments."
- "I'd be very surprised [if Apple got into the embedded system hardware business]. They really don't have much of an outreach to Detroit or Tokyo. ... For Apple, the volumes are so low and the hassle of dealing with the car companies is pretty significant."

Software

- "Within the OEMs themselves, there are often two schools of thought about [software]. There's the camp that says, 'Let's just ride the Google and Apple wave and fully embrace that momentum.' But what you lose with that is a differentiated and unique experience. So the other camp is saying, 'Let's provide a unique user experience and have more control over the functionality.'"
- "The groups that want a dedicated and unique experience are probably going to win out. The voice that says 'We want our own experience, a Cadillac experience' will win out."
- "For someone like Hyundai, the cachet of Apple and Google is very important because it helps build their brand equity with drivers. Some of those OEMs will adopt that [smartphone-based] plan. Some of the Chinese brands will do the same thing because it adds value and cachet to their brand to adopt [Apple's] CarPlay."

> " In the past, [embedded system manufacturers] have become integrators and acted as a full integration shop for the systems that go in the car. ... If you just let Google take it over, there's nothing really to integrate. You're just providing a piece of hardware
>
> *Marketing VP*
> *Auto Mapping & Navigation Developer*

- "OEMs that want to offer a high-end integrated solution are going to adopt reliable solutions that enable that—QNX or companies that can deliver Android to the car like Green Hills Software. For some time in the future, there will be low-end offerings powered by [Google's] Open Auto Alliance companies with Android. Android will be a dominating OS in the future. I think you'll see that become more proven, but OEMs will want someone like Green Hills to secure it and make it more reliable and automotive grade in the car."
- "MirrorLink is mostly about a technology to project your phone into the car. I think there are something like 12 different technologies to do that. Who's going to win there? I don't really know. Each of the hardware providers are going to have their own too. Pioneer has their own. It's a very fragmented market tight now. There doesn't seem to be a clear winner. It's going to have to shake out to some manageable number, but I would say MirrorLink is not a clear leader at this point."

Technology

- "Most car OEMs will adopt different [infotainment] systems based on the demographics of their cars and their buyers. In a high-end BMW 7-series car, you're going to have the margin and room to embed a very expensive and sophisticated navigation system. But for lower-end cars, you're going to have a display for the backup camera or something like that and have the ability to plug in a phone and project [phone apps] into the car."
- "The OEMs will attempt to deliver an experience in the dedicated head unit that, in the short term, will replicate the app experience on your phone. That has a play short term. Ultimately, they're going to go for more integrated experiences. For example, the navigation system might sense more things about the car's performance and ADAS [advanced driver assistance systems] information to provide additional driver safety and aid. Your smartphone just won't be able to do that."

2. Lead auto executive for an OS used in cars and other devices

Automakers want to separate infotainment software from hardware so they can control the customer experience, which means tier 1 manufacturers like Harman must change their business models or risk becoming commodity hardware vendors. Also, many automakers are considering moving to open-source platforms like Linux to avoid ceding to Apple and Google. Meanwhile the fight is just beginning over whether smartphones or in-built systems will be the portal for auto infotainment services.

Hardware

- "Traditionally, the tier 1—Continental, Bosch [Ltd./BOM:500530], Harman—would build a black box. The OEM would give them a spec and say, 'It has to have this plug, take this kind of power and cost no more than this much.' They would go off and build it, and the OEM wouldn't know or care what software was in there as long as they met the spec."
- "That model has been around for decades, whether it was a radio or a modern infotainment system. That's how the [tier 1 manufacturers] made margins on it. That model is completely being blown up because the OEMs are realizing how far behind mobile phones they are in terms of innovating, adding new features."
- "When a new web service like Twitter or Instagram pops up, how do [car makers] add that to the car rapidly? Their cycles are three to four years and these new services pop up in six months. They need to reconcile that."

> They're adopting open source and Linux because that's a platform that can move fast.
>
> *Lead Auto Executive*
> *OS used in Cars & Other Devices*

- "The way they're approaching it is they're adopting open source and Linux because that's a platform that can move fast. Secondly, they're trying to break up this model because they don't want black boxes anymore. They want a software platform where they decide what goes in and the tier 1 manufacturers become just a hardware vendor, an ODM [original design manufacturer]. The separation of hardware and software is definitely what the OEMs are wanting."
- "Some of the [embedded infotainment system providers] are figuring out how to change their business models and monetize, whereas others are very stubborn and are not. Those that are stubborn will be in serious trouble. If they're still in the business of trying to sell black boxes, and not adapting to open platforms and having the OEM control that platform, they're going to fail—at least in infotainment."

- "I'm not comfortable naming specific companies, but I can tell you that in regions like Japan and Korea [the hardware providers] get it and are moving fast. Regions like Germany and USA are not moving fast. ... The whole ecosystem in Japan seems to be adopting Linux and open source much more rapidly."
- "Once you separate hardware and software, then really the [automakers] can go to any ODM, say in Taiwan, and ask them to build a box for them. That will put a lot of pressure on margins. Making money on the hardware will be difficult. It becomes a commodity because the OEM has the software platform for all the innovation, and they just want a cheap hardware platform."
- "[Embedded system providers] have to jump on the new model as soon as possible. If they're holding on to an old piece of software technology, they just need to abandon it ASAP. They need to retrain their engineers to be Linux guys and HTML5 guys and to retool. If they can do that, there's business to be had for quite a while. I don't think the ODM route will happen anytime soon. If they do retool like that, there's still a lot of hardware to sell."
- "Apple is not going to get into [auto hardware]. I just think they probably have bigger fish to fry, like the TV in the living room. Apple's solution will be to stick an iPad in the car."

Software

- "That's the battle that is brewing [between smartphone-based infotainment systems and in-built systems]. I don't think anybody knows what the outcome will be. The OEMs are going to fight [phone-based models] because they want in on this game. They want in on being the interface with their customers."
- "A car is one of the most expensive purchases you're ever going to make, so especially with the high-end manufacturers, they want to be able to tailor the feeling the customer has to their brand. They want to be able to provide all these things that the mobile device manufacturers are providing—a customer portal, back-end website that has all the information about their driving habits, etc."
- "In order to do that, they have to control the platform in the car. They can't concede it to Apple and Google. What the OEMs are struggling with is, they're not moving fast enough to innovate the platform to get there. No one knows whether smartphones will be the portal. I think we're going to see both until the OEMs get their act together."
- "The industry has been looking for an alternative to QNX for some time. QNX has been dominating the space, but after they were acquired by BlackBerry, their focus has shifted to BlackBerry tablets and phones. There was a big concern at that time about what would happen to QNX; would [BlackBerry] completely get out of the auto business?"
- "That was one catalyst [for OEMs to look at alternatives]. The other thing that was happening is that all of the big vertical markets—whether it's IT, telecom, consumer electronics—have all gone to Linux. The auto industry saw this and asked, 'Why don't we go to Linux?' So the Linux adoption [in cars] started about three years ago."
- "[Automakers are] finishing their cycles with their current proprietary stuff or QNX stuff, and they're planning to move to Linux, almost all of them. There's also Microsoft [as OS alternative for automakers], but in the marketplace that's been seen as a huge failure. Consumers were not happy with it, and Microsoft was controlling the platform and not allowing Ford to control features. It's been really bad. No other OEM is going to touch Microsoft."
- "Google is really a late comer with the Open Automotive Alliance. Nobody knows yet what that is. People are confused about whether it's just going to be a mirror type [of software to access an Android phone through the car] or whether it's actually going to be a run-time [operating system] for the car."
- "If it's a run-time [OS] ... they will require [automakers] to sign a non-defragmentation agreement like they've done with mobile phone manufacturers. I can tell you for a fact that OEMs, at least today, are not going to sign that. They feel that they own the car, the infotainment system and the customer interaction."

Technology

- "Location-based services are going to happen, and people will be pleasantly surprised. They're using it on their phones today but maybe don't realize how valuable it will be in the car. I'd like to drive down the street and say, 'I'm looking for a restaurant' and have Yelp reviews pop up to tell me the best restaurants nearby."

> They have to control the platform in the car. They can't concede it to Apple and Google. What the OEMs are struggling with is, they're not moving fast enough to innovate the platform to get there. No one knows whether smartphones will be the portal. I think we're going to see both until the OEMs get their act together.
>
> *Lead Auto Executive*
> *OS used in Cars & Other Devices*

- "If you own an electric car, crowdsourcing will be helpful. One of the things Google Maps doesn't give you today is topology information, so you don't know if you'll make it [to your destination]. If I'm driving to Tahoe in my electric car, that's different from driving through the Great Plains. I'm using a lot more energy."

3. Software engineer for a developer of mobile traffic information apps; repeat source

Infotainment system hardware from manufacturers like Harman and Panasonic could lose value everywhere but in the luxury car market as Google develops software that standardizes head units and integrates with phones. Google, however, faces pushback from automakers, who want to maintain distinct brand identities. QNX, which has the software to operate with Google and Apple devices, will gain ground in infotainment and could render Linux irrelevant. As infotainment hardware costs continue to fall, Harman and other manufacturers may struggle with pricing, especially if consumers perceive the value of infotainment systems to be more closely linked to the underlying software.

Hardware
- "Companies like Harman and Panasonic, the leaders in embedded infotainment, are going to have to present a value proposition to hold market share. Google and Apple are coming though from the software side."
- "Panasonic and Harman still control most of the market for embedded systems. I think these will continue to have a place in the luxury car market, but on the lower end, smartphones integrating with a basic head unit will probably become the norm."
- "For people who want high-quality displays on the dash and in the backseats, embedded systems will be their best option. For basic navigation and listening to music, a smartphone interface is a lot less expensive."
- "If consumers come to value apps and experience more than gear, then installation of embedded head units will decline."
- "Head-unit manufacturers will need to partner with a company like QNX to promote the value of their hardware. With high-end automobiles, I think Harman and Panasonic and many of the others are safe. If Google can penetrate with software that works across multiple devices and delivers a sterling experience, head units could become obsolete in five to six years."
- "We're seeing some progress from Google getting Android into more vehicles through their partnerships with GM, Audi and Honda."
- "The markup on embedded infotainment systems is at least 100%."
- "Ease of use is critical. Hands-free operation for the driver is also a big consideration, so voice command is an important feature."
- "Hardware costs continue to fall. The challenge hardware makers are dealing with is to remain relevant in an industry where software rules. It's the apps. Are they easy to use? Do they function as advertised? Embedded systems look very nice and they're designed to integrate with the overall operation of the vehicle, but the price point is significant."

Software
- "Google, Apple and QNX are all players in the infotainment industry. QNX probably stands to gain the most because they have a real-time operating system, and it's ready right now."
- "OEMs and automakers may be reluctant to deal with Google, which has a tendency to absorb and assimilate everything it touches. Car sales are all about brand awareness, differentiating your vehicle from others in a crowded market. I think there's a certain identity that automakers and OEMs will fight to hold onto."
- "Linux has the Android market, but that's not enough. I'll bet QNX cancels them out if QNX can develop for the Android the way it has for the iPhone. Apple's CarPlay is built on top of QNX."
- "I can see QNX working with Panasonic and Harman to build that functionality into head units. That would certainly add to the value of the hardware."

> If Google can penetrate with software that works across multiple devices and delivers a sterling experience, head units could become obsolete in five to six years.
>
> *Software Engineer, Mobile Traffic Information Apps Developer*

> Google, Apple and QNX are all players in the infotainment industry. QNX probably stands to gain the most because they have a real-time operating system, and it's ready right now.
>
> *Software Engineer, Mobile Traffic Information Apps Developer*

Technology

- "The landscape is shifting all the time. Right now, smartphones are the device of choice for average drivers. Once you get into a certain economic bracket, the desire for sharp, in-dash systems starts to appeal."
- "Automakers are a conservative bunch. They want proven IT and resist rushing new tech features to market in their vehicles. Fear of recalls is a big factor, especially when the IT controls and monitors major operations on the car. On the other hand, consumer demand for the newest tech is ramping up competitive pressures on automakers."

4. IT executive with a focus on automotive technologies; repeat source

Smartphone-based infotainment systems likely will dominate all but the luxury segment of the car market. Drivers may not want to bother learning the nuances of an in-dash system when they are accustomed to navigating apps with their mobile devices. Brand loyalty for hardware manufacturers like Harman and Panasonic is fading. Apple, Google and QNX will be the primary competitors on the infotainment software side, leaving Linux behind.

Hardware

- "Panasonic, Harman, Alpine, Pioneer and Garmin are the big names in embedded systems. Harman and Panasonic probably own most of the market."
- "Name brands and consumer loyalty work in favor of Harman and Panasonic. I'd say 25 to 30 years ago people were more devoted to a specific brand. Car audio enthusiasts and audiophiles would buy all Harman or all Sony [Corp./TYO:6758] components for a complete branded system. I think there's been a generational shift away from that. Consumers aren't as brand-loyal as they used to be."
- "Smartphones are becoming more integral to the infotainment experience. First, there's the lower price for entry. The second thing is people twiddle with their smartphones almost constantly, so they are more familiar with operating the device. Some of the embedded systems I've seen look like they would take awhile to master."
- "Google will eventually introduce a system for autonomous car operation, but that's a decade off. Right now they're putting Android-based systems into cars with an open-development plan."
- "Apple already has something similar in play with their iOS. Right now they're both focused on the IT side. If either company gets into hardware, I suspect it won't be for at least another five years. It might make more sense for Google to come out with an embedded system that works with an Android phone. Apple has great consumer loyalty, but I don't know that the numbers are there for them to get into embedded hardware. Their profits are in the iPhone."
- "If you pay $1,000 for an embedded [infotainment] system, it's likely the OEM got 40% to 50% of that."
- "For head units, production costs are definitely falling. I think we'll see the time to market decrease as these companies scramble to get new products out there. Development has really started to accelerate."

Software

- "QNX, Apple and Google are the big names in software for infotainment. QNX has a lot of flexibility, and there are many ways developers can code apps that ride on top of QNX."
- "QNX doesn't have that instant name recognition of an Apple or Google, so QNX is liable to remain behind the scenes as a platform provider rather than a go-to product that consumers want."
- "Linux is a nonstarter in this race. Android works off a kernel built on Linux, but QNX has a real-time operating system and scalability that Linux doesn't have."
- "A big issue with software is control. Google wants to be ubiquitous. … The major car manufacturers spend millions on their brand identity, creating images that set them apart, and I wonder if they will see Google-based infotainment as a selling feature or brand dilution."

Technology

- "Touchscreens are going away—too many safety concerns. Voice-activated apps will replace physical interaction with the infotainment system, whether it's embedded or tethered to a smartphone."

> "Smartphones are becoming more integral to the infotainment experience. First, there's the lower price for entry. The second thing is people twiddle with their smartphones almost constantly, so they are more familiar with operating the device. Some of the embedded systems I've seen look like they would take awhile to master.
>
> *IT Executive w/*
> *Automotive Technologies Focus*

- "Consumer buying power is driving the divide between embedded systems and smartphone infotainment. Anyone who can afford a sports car, a BMW, a Caddy—any luxury vehicle—will probably demand a head unit as the nerve center for infotainment. The displays and capabilities are excellent and look impressive. For the midrange vehicle, the economy cars, I think smartphones will take over that role."

5. IT software developer with a focus on automotive HD radio technologies; repeat source

The major players in embedded infotainment systems like Harman and Panasonic are going to be challenged by the growing use of inexpensive smartphone apps for car functions like navigation. QNX, Apple and Google will battle for infotainment software supremacy. Retail markups on infotainment hardware are substantial, so a manufacturer like Harman might make only about $300 to $400 on an infotainment system that costs the car buyer $1,200. Lower-priced vehicles will use primarily smartphone systems integrated with a basic head unit, while consumers for luxury vehicles want a head unit that does it all and looks sharp. Simple, reliable smartphone integration with head units remains an issue.

Hardware
- "Harman and Panasonic still hold a huge chunk of the automotive infotainment market. Their competition may not be so much from other embedded system manufacturers but from smartphone apps that can deliver navigational tools and audio for much lower cost. There are free GPS apps for smartphones. Even the best ones are less than $20."
- "Harman has a really good reputation among consumers, that brand awareness."
- "This is a market in flux. I think the main challenge [to hardware vendors] will come from mobile app developers and smartphone manufacturers. Google wants in. Apple already has CarPlay."
- "Manufacturing and wholesale costs are pretty hard to come by, but with infotainment, as a general rule the cost has doubled at the point of sale. It's a heavy markup. If an embedded infotainment option carries a $1,200 price tag for the consumer, the car manufacturer probably charged around $600. That leaves a company like Harman with a per-car sale of around $300 to $400."
- "Demand for an embedded system seems tied to the price of the car. On high-end vehicles like BMWs and Mercedes, car buyers seem to want that head unit in the dash. It looks sharp and has great graphics and response. With lower-priced cars, the trend seems to be toward apps on a smartphone, or some blend of smartphone apps that integrate with the head unit so they're easier to use."
- "Voice recognition is a must. Also, whatever system is in place, it must be able to update through downloads. A big drawback of the early embedded GPS systems was getting an updated map disc to run in the disc player. Now GPS systems can be updated almost in real time."
- "Apple will have to prove itself with CarPlay, I think, before the big automakers will change over from established partners like Harman. Apple also charges a premium for its products and automakers draw a hard line on controlling costs. If the value proposition is there with Harman or Alpine, for instance, then Apple could face pricing pressure for any embedded system it might introduce."
- "Production costs and time to market are both coming down. Competitive pressure is responsible for the former; technology advances spur the latter."

> " This is a market in flux. I think the main challenge [to hardware vendors] will come from mobile app developers and smartphone manufacturers. Google wants in. Apple already has CarPlay.
>
> *IT Software Developer w/ Automotive HD Radio Technologies Focus*

Software
- "QNX is getting a lot of attention and adoption. Ford abandoned Microsoft to go with QNX as the software for their cars' embedded systems. The semiconductor company ARM [Holdings PLC/LON:ARM] also supports QNX because they want software building blocks that can work across all infotainment systems that ARM supplies chips to."
- "Any battle for software dominance will play out between QNX, Apple and Google. MirrorLink is fairly limited in its capabilities although they do have some major customers like Toyota and Volkswagen. I think MirrorLink will be chasing QNX and the others and ultimately will fall behind."
- "Automakers seem reluctant to adopt an open-source solution. I don't think Linux will play a big part in next-generation infotainment unless it works with a major developer like Google, and then Google sells its own brand.

That could work for many different car makers, but [auto manufacturers] would be giving up control and a certain amount of their own brand recognition. Part of the cachet of an infotainment system is either the brand or whether it is exclusive to a particular vehicle or line of vehicles. I'd say a Google solution is iffy right now."

Technology
- "Voice activation is rapidly replacing touchscreens, mainly for safety reasons. In-dash and backseat LCD screens especially will get larger. There's only so much diagonal measurement you can get on an in-dash screen, maybe 10 inches, but for passengers in the back, screen sizes could conceivably increase."
- "With increased streaming in vehicles—video content in particular—connection speed becomes an issue in creating a seamless, enjoyable experience. Wireless companies will probably enjoy a pop in revenues as that demand for speed continues to grow."
- "I don't think smartphones will entirely replace head units for some time, certainly not in luxury cars where demand for shiny things comes at a price that those consumers can afford."
- "I suspect we'll see a mix of smartphone apps either standalone or integrating with the head unit in less-expensive vehicles."
- "Connectivity in lower-end vehicles will be through cell phones with a 4G connection. The opportunity for developers will be making that connection easier for consumers. The interface between vehicle and smartphone can be challenging at times. It has to be simple if consumers are going to use their phones with their on-board infotainment system.
- "One of the advantages to a head unit is that it doesn't require another connection point like a smartphone. In time, these systems will become more intuitive. Most of the head units I've seen look great, but operating them takes a bit of a learning curve."

> With increased streaming in vehicles—video content in particular—connection speed becomes an issue in creating a seamless, enjoyable experience. Wireless companies will probably enjoy a pop in revenues as that demand for speed continues to grow.
>
> *IT Software Developer w/ Automotive HD Radio Technologies Focus*

6. Executive of a real-time system architecture and design firm for automotive and other markets; repeat source

Infotainment system manufacturers will benefit from demand for new features and increased communication in cars. Embedded system providers will have to reach out to Apple and Google to integrate their infotainment systems with smartphones. The source expects two uplinks for Internet connectivity in cars: through the phone but also through an in-built system for software updates and data mining. Google could dominate the auto market with driverless cars.

Hardware
- "The [automakers] decide what they want in the infotainment unit and then solicit bids from the tier 1 suppliers like Harman, Delphi, Bosch, JCI [Johnson Controls Inc.] and then pick the cheapest. These tier 1s would benefit from increased features in the car and increased communications between cars."
- "Apple's announcement [of its CarPlay software] at the WWDC sparked enormous amount of interest and debate. In the end what Apple released was nothing but a concept and a thin layer of software for how they think it's going to work. Yet that was enough for so many people to get motivated and jump on a bandwagon led by Apple."
- "Apple in particular is opening up APIs to communicate with the hardware in the car. It is incumbent on the hardware manufacturers to reach out to Apple and say, 'We want our infotainment system to talk to your iPhones.' They work together, and it evolves. That's what I see happening, rather than letting Apple or Google move into the car [as hardware makers]."
- "I don't see that Apple wants to get in the car as a manufacturer of hardware or chips. I don't know about Google. I know Microsoft tried to do that originally and were unsuccessful because the last thing the auto industry wanted is a Microsoft branded car. It dilutes GM or Ford. It dilutes the brand to have a Microsoft logo show up anywhere."
- "I don't think the OS vendors are going to get into manufacturing hardware and splashing logos in the car. Even 10 years later the auto industry hasn't changed and won't want that."

Software
- "The infotainment system will have software that is either Linux-based, QNX-based or Microsoft-based that connects to the Apple API and in between there'll be a shared code. I believe right now QNX is the leader."

- "Tesla decided they wanted to go with Linux and refused to use QNX. They're making Linux work."
- "I only see Google becoming a dominant player in the automotive space in a scenario if it buys Uber and wires up a fleet of driverless taxis to shuffle people around the Bay Area to work or after Friday happy hour. That will happen in the future, and that could make Google dominant in the automotive space. Whether it will get into manufacturing cars and retrofitting them is a whole other issue."
- "Google today believes it can drive a car more safely than a human. How long will it take for that technology to replace taxi drivers? … A lot of it will depend on regulatory issues."
- "Android is in the car because of the cell phone technology. It's the pressure by the cell phone consumers that drives the direction of automotive."

Technology
- "Cars are going to need two uplinks, two connections to the Internet. You still need connectivity [from the car] to the phone, which offers Internet connectivity. But there's a need for a reliable connection also for software updates and data mining. I think you'll need both, but they won't be mixed. There would be cost savings if they were together but there are security and reliability issues, so they will have to be separate."
- "Automotive has always moved at the speed of a snail. … They're slow to adopt because of risks of callbacks or failure or accidents. They're slow to qualify technologies. Even once the technology gets into the car, it can take three to six years to get sold. The ROI for the manufacturers is six to nine years because they have to invest three years just to develop the product before it gets tested."

> I don't see that Apple wants to get in the car as a manufacturer of hardware or chips. I don't know about Google. I know Microsoft tried to do that originally and were unsuccessful because the last thing the auto industry wanted is a Microsoft branded car. It dilutes GM or Ford. It dilutes the brand to have a Microsoft logo show up anywhere.
>
> *Executive, Real-time System Architecture & Design Firm*

7. Yo Koga, CEO of Drivemode, an Android-based personal driving assistance platform

Automakers and infotainment system manufacturers alike should be worried about Google. Previously closed infotainment systems will be open in the future to allow updates, new apps, services and hardware. As a result, infotainment hardware makers will lose share to smartphone-based systems. High-end cars will continue to have embedded infotainment head units while midrange to low-end cars likely are to have connectivity through smartphones.

Hardware
- "High-end cars will continue having head units. But in the midsegment, many drivers prefer Google Maps and don't even like the head unit experience of navigation and integrated Pandora or other music applications. They prefer what they use all the time, which means their phone."
- "Ffor now that [smartphone-based] solution doesn't work well enough because the systems themselves aren't built for cars. For example, voice recognition and noise reduction aren't ready yet for the driving experience."
- "It's going to take some time for smartphone operating systems to optimize the experience for drivers using the existing platforms. And even if the technology is ready, the implementation will take time. Imported automakers in particular have to push this production in order to avoid a huge investment in infotainment systems."
- "For mass-produced high-end cars, Apple and Google will have a hard time getting into the system because of the current quality not being optimized for the driving experience and because of regulation issues."
- "It will be very difficult for the embedded infotainment system makers to maintain their current share. A comparison would be TomTom [N.V.]: Look at what happened to their share as new technology came in."
- "In the long term, an open platform will innovate much faster than a closed platform. If it's open, you will get better faster than others. And even though the open technologies are not good enough today, they will improve very fast and then the scale will provide profit. Then as the open platform gets scale, closed high-end systems will be pushed up to the very high end until they have limited market only at the top. Then 80% to 90% of the market is going to be taken by the low end, which is going to improve very fast. This is not just about embedded but because of the nature of an open platform."

- "Infotainment suppliers should be more worried about Google than Apple. Google wants data, which they have a lot of ways to monetize. There are gigabytes of data in the car. For Google, the cars look like a bunch of sensors that provide a lot of information about the driver."
- "Google isn't necessarily interested in the car. It's interested in the data. It's conceivable that Google could even give away the car for free just to get the data, if they are confident they can monetize the information."
- "For Apple, what matters is a consistent experience from screen to screen."
- "Overall, I think it will take time for the industry to change. There's no cause for concern immediately even if Google will have an announcement at Google I/O. Automakers are going to be excited. Tier 1s are going to be scared."
- "There won't be a drastic landscape change immediately, but the ecosystem will move gradually over the next 10 years. Smartphone applications will bring completely new solutions every year, and you'll see completely different applications from the smartphone, and if they're so much better than [embedded] infotainment [hardware], then infotainment should be very worried about it."

Software

- "There are other ways of monetization. You can sell hardware, software or services. Currently, the infotainment system is so closed that you cannot add services or software or hardware as drivers would want. But when there's an open platform, we can provide apps to the driver and the driver can choose to install them or not. That wasn't possible in the past."
- "There are a lot of opportunities for platform providers, advertisers, software makers, hardware makers and service providers. There are a lot of people who weren't able to reach customers previously who will be able to access them directly. It will open up the market."
- "I don't think the tier 1s will benefit that much from this. They will lose market share to other third-party companies. For example, if you want to upgrade [an infotainment system] now, you have to go to a dealer."
- "There are two applications for software: One is for the platform, like QNX, and the other is for applications. If Google Maps runs on QNX, then both will benefit. But if QNX is replaced by Android, then it won't benefit."
- "When it comes to software, hardware, integration and services, how will the money be distributed by the platform provider? The platform provider has control about what to integrate, the protocol and what the conditions will be. If QNX is an open platform and integrates Google Maps, then they could control the market although Google would try to prevent that."
- "There are some great applications but not too many because automotive driving software is not open, so there's no point to develop applications for the car. … But when it becomes open, it will trigger software developers to migrate to that new platform. For now the applications are mostly navigation and music. If it's open, there could be all sorts of interesting location-based applications."

Technology

- "For high-end users, everything will have to be integrated in the car. But for midrange to low-end customers who don't have infotainment [systems], I see them using smartphones as the main method of infotainment."

> Infotainment suppliers should be more worried about Google than Apple. Google wants data, which they have a lot of ways to monetize. There are gigabytes of data in the car. For Google, the cars look like a bunch of sensors that provide a lot of information about the driver.
>
> *CEO, Android-based Personal Driving Assistance Platform*

8. Chief executive of a strategy and development firm for platforms and services in connected cars

The outlook for infotainment system manufacturers like Harman is not great because automakers view such systems as key differentiators for buyers and want control of them. Further pressure will come from Google and Apple enabling the use of smartphone apps in the car, which embedded system makers will be hard-pressed to replicate or improve. QNX has the top software platform for embedded systems. By 2025, the trend could be away from smartphones and toward wearables with sensors, which will push a rebound in embedded platforms in cars.

Hardware

- "The long-term play for [infotainment hardware makers] is poor. They will be crunched by two factors. One is the OEMs trying to seize more control of this as it becomes more of a key differentiator. [Infotainment] platforms could subsidize the cost of a lot of other activities that are being commoditized in the vehicle. The OEMs will fight to keep them embedded or in some kind of controlled environment for themselves."

- "The other push is from the Apples or the Googles of the world coming in. Some manufacturers are letting portions of the vehicle be converted to Apple- or Google-enabled, either through voice … or touchscreen experiences."
- "What's going on with the embedded systems, I believe, is not necessarily a technology problem but in some cases a business problem for the car makers and their pricing models. Their approach is very car-centric as opposed to consumer-centric. They're disconnected from the reality that people have more and more mobile devices with either the same or similar apps or even complementary apps that they prefer to have connected into the vehicle."
- "The onus is on the embedded system platforms to replicate that and improve on that in ways that are dramatically better. Otherwise, people will just bring in the apps and either just bring it into the vehicle or just use their phone illegally, which creates problems with compliance and distracted driving issues."
- "Over the next several years there will be an upward trend in the penetration of embedded systems. They're becoming ubiquitous. More people expect them as a core part of the vehicle, and it's becoming one of the key differentiators for purchase."
- "The tier 1s are creating their own platforms—clones of the Apple ecosystem, a walled garden. It's the war of the walled gardens. Each is creating their walled garden with their own certified apps, their own app stores. Pioneer has their own, and half of them are the same as you'll find in Harman's."
- "If the OEM embeds their hardware and software system in a vehicle, they will have these app store opportunities. It's also available for after-market from the Pioneers and the Harmans, for example, that are putting together their own ecosystems."
- "This is causing massive problems for the software companies building these things because they have to certify across, not just Apple and Google, but multiple auto manufacturer platforms. … It's very costly to rebuild an app just for Ford. The comparison to how many buyers are in that market compared to how many buyers they can get from the app stores is ludicrous."
- "Unless the car companies get smart about how they're playing with the developer ecosystem, there are some challenges. The [infotainment hardware makers] are going to get squeezed in this trend."

> *QNX is the cream of the crop, the gold standard. In my mind, there is no platform that's better. It's well received by the OEMs as well as the integration partners.*
>
> *Chief Executive, Strategy & Development Firm for Platforms in Connected Cars*

Software

- "Where we see Google, Apple and even MirrorLink coming into the equation is a situation where they create a common experience across a number of the OEMs."
- "The four big operating systems, Google, Apple, Microsoft and QNX, are battling it out but coming from completely different directions. It is yet to be seen if they will converge in the middle around a common approach."
- "Microsoft, as an early player with Sync, has struggled in redefining the marketplace. But I expect they'll come back in the next year or so with a much improved play that is closer to QNX."
- "QNX is actually an OS for the embedded systems designed specifically for that. QNX is the cream of the crop, the gold standard. In my mind, there is no platform that's better. It's well received by the OEMs as well as the integration partners."
- "The Googles and the Apples coming into the equation are just saying, 'Us, too.'"
- "Google has three to four different layers to what they're doing, whether it's a Google initiative—traffic and mapping initiatives—or whether it's an Android-driven operating system for applications or their Open Auto Alliance."
- "The last thing the auto manufacturers want is to give control to Apple or Google over the in-vehicle experience. They also don't want to cede control to them so Google Play or iTunes generate the revenue from the infotainment experience in the vehicle. The data of the experience in the vehicle would not be owned by the OEM but by Apple or Google."
- "MirrorLink is somewhat unique, and it may be stillborn. It's hard to tell at this point, but there's potential for it to be irrelevant."

Technology

- "We'll be seeing the world divided where you'll go into an auto dealership and they'll say, 'What kind of a phone do you have?' If you have an iPhone, they'll tell you your choices. You can have the embedded system; they'll integrate your iPhone into that and they'll tell you the benefits or problems. If you have an Android, they'll tell you your options for that and show you their embedded systems to compete with that. They will have vehicles that are Google-friendly and others that are Apple-friendly, and you can choose your vehicle from that perspective."

- "QNX and Microsoft are much more under the hood. QNX and Sync are [device]-agnostic. You can have any kind of phone."
- "CarPlay was a PR move. There's nothing going on there. Google is more open, but it's also an illusion as they build out the Google and Android platform for the vehicle. We haven't seen the other shoe drop there yet."
- "There's a strong trend towards contextual location-based advertising and content. The content you'll receive in the vehicle will be like product placement sponsored by advertisers. … This will subsidize, it is hoped, the connectivity, so you don't have to buy the extra connectivity package when you already have one for your phone. And it will sponsor enhanced content and the ability of these content providers to monetize their investment in converting them for the OEMs. There's universal interest but it's at a very early stage."
- "Once we get to 2022–2025, smartphones as we know them won't exist. It'll be the trend of the wearables with sensors embedded in your clothing and glasses. The smartphone is a temporary platform for personal ubiquitous computing."
- "Building apps for smartphones and tethering them into the vehicle has a window. Experts predict in 2020 we'll be seeing a trend back to embedded getting a stronger rebound. In the interim period, we're seeing the smartphone impact as all of this shakes itself out and wearables come into the equation to replace and augment them."
- "The center console head unit will be disappearing. We'll have a dynamic digital dashboard that can also be replicated in the backseat, and the wearable sensors will communicate with that."

> "
> The last thing the auto manufacturers want is to give control to Apple or Google over the in-vehicle experience. They also don't want to cede control to them so Google Play or iTunes generate the revenue from the infotainment experience in the vehicle. The data of the experience in the vehicle would not be owned by the OEM but by Apple or Google.
>
> *Chief Executive, Strategy & Development Firm for Platforms in Connected Cars*

3) Infotainment Hardware Providers

One of these two sources thinks the dollar content per car for infotainment hardware makers will fall as software becomes the system focal point. Both sources expect Apple and Google to be significant players in car software and to disrupt the current model. Linux has been gaining acceptance among automakers, but one source said QNX remains the leading OS. Smartphones and embedded systems each will play a role in providing Internet connectivity in cars.

KEY SILO FINDINGS

Hardware
- 1 of 2 believes the evolving infotainment software landscape will hurt hardware makers like Harman.
- 1 said automakers will dictate the look and feel of infotainment systems to hardware manufacturers and use the systems as differentiators.

Software
- 2 said Apple and Google will both be major players in auto software and will upend the status quo.
- 2 said Linux is gaining traction in the auto industry, though 1 thinks QNX is still the leader.

Technology
- 2 expect both smartphones and embedded systems to be involved in delivering Internet connectivity for now.
- 1 said connected cars are the first step toward autonomous vehicles.

1. Infotainment product specialist and a former director for an embedded system provider

The dollar content per car for infotainment system makers is likely to decrease because the value in such embedded systems is shifting from the hardware made by companies like Harman and Panasonic and toward software developed by Google and Apple. A move toward Linux-based platforms could complicate embedded system manufacturers' ability to add value to infotainment systems beyond hardware. For now, Internet connectivity will continue to be delivered both

through the smartphone and the infotainment unit. The development of internal Internet connections in car infotainment systems raises privacy issues for data coming from the driving experience.

Hardware

- "The tier 1s who are system integrators may find themselves a little less valued if the value is in the Google name. Google doesn't manufacture hardware; they'll need Delphi, Harman, Panasonic and Bosch to put the box in the vehicle. But the value of that box to the [manufacturer] may become somewhat less than it is now."
- "The tier 1s are busy [competing against each other], and there are only so many automotive brands around. The fortunes of the tier 1s wax and wane. Panasonic looked like they were exiting a few years back, and they've come roaring back to take the Ford business. I don't think the tier 1s are looking at Apple and Google as the enemy yet. I think they believe they can all live together."
- "Production costs for [infotainment] hardware are down. That's the only direction hardware goes. The challenge for the tier 1s has been to counter that and add value. The OEMs want the tier 1s to give them a bill of materials at cost with a negotiated markup. Tier 1s hate that. They want to be able to say they're selling value. That's going to be hard to do because the value is shifting to third-party software."
- "Everyone is being squeezed on the bill of materials, and the challenge is to be able to persuade your customer of the value of the system to the end user."
- "The challenge for companies like Harman or Panasonic is they don't have a high profile in the infotainment sector. Harman might if they were given the opportunity."
- "I don't think Apple wants to become an embedded hardware provider. The volumes are too small relative to personal electronics and handsets. The numbers just aren't there."

Software

- "Apple and Google are the two biggest disruptors around. There was a rumor about Apple buying Tesla. That combination would be unstoppable."
- "Google and Apple are game changers because of the way they project their ecosystems. Once Apple develops an Apple system in the car, they won't want anything else on it. They have brand loyalty that is the envy of the consumer electronics world. And Google will put ads in front of you wherever they can."
- "Apple is all about the experience, and Google is all about revenue."
- "Both Apple's and Google's announcements for the vehicle are projections in the sense that what's on your smartphone would be projected onto the vehicle's screen. You'd be interacting through the [vehicle] controls. It's a step forward from the first systems that were called terminal mode, which wasn't deeply integrated into the vehicle."
- "All the OEMs have business cases on how much money they want to make on vehicles above the original equipment. Google will tip that over. None of the OEMs want to see Google in the car. They are the 600-lb. gorilla."
- "The [infotainment manufacturers] will be flexible because they're in the business of selling hardware. They'll build an infotainment system on Google as long as they make money on the infotainment system."
- "QNX's advantage is that it's a real-time operating system. Their major competitor is [Intel Corp's/INTC] Wind River, which has been around for a long time and is now rebounding with the Internet of Things and automotive. Wind River could compete with QNX, whose biggest threat is that they're owned by BlackBerry."
- "There's a lot of interest in automotive Linux. It's a question of proprietary systems versus open architectures and which will win. I don't know of any tier 1 that is supplying a proprietary system design based on Linux. But every open-standards committee in automotive is talking about Linux. There could be a place for it."
- "The way Linux could come to dominate is if hardware becomes a complete commodity and there's no value added to having a Harman or Panasonic head unit. You just need a GENIVI Linux-compliant box that will have a Google or

> **"** The OEMs want the tier 1s to give them a bill of materials at cost with a negotiated markup. Tier 1s hate that. They want to be able to say they're selling value. That's going to be hard to do because the value is shifting to third-party software.
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Apple user interface on top of it. If a generic Linux box with enough computing power is competitive, there's no reason for an OEM to contract with a Panasonic or a Harman."

- "There's a long timeline in automotive from announcement to getting something on the road. Model year 2015 is done, and model year 2016 is virtually locked down. It probably won't be until model year 2017 that all these systems could start to deploy."
- "That pattern is repeated in several other innovations that are being discussed for the connected vehicle space. The electronics in cars in 2017–2018 will probably not look anything like what we're interacting with today. Cars will interact with each other differently and with the infrastructure differently."

Technology
- "Consumers are getting much more savvy and demanding [when it comes to] technology. The consumer is going to be demanding an experience like they have with their phone. When they get in their car, they will expect the screen of the infotainment system to be an extension of that experience, and it will seamlessly hand it back to their phone when they exit their vehicle."
- "The connectivity is going to have to be a combination of through the car and the smartphone for the time being. There are internal cellular modems in infotainment systems, but there are also systems which use the user's data plan as the Internet connection."
- "Ford's [Sync] Generation 3 will have an internal modem. High-end systems for Chrysler will have the same. GM just announced their partnership with AT&T [Inc./T] for the next generation. The modems are coming, but it's still a second data plan the user will have to have in addition to what they have on their phone. I don't think there's a clear winner yet. It will be decided when 3G/4G/LTE is ubiquitous. The auto industry is at the mercy of the cell phone companies and their rollout plans."
- "The infotainment system and its internal Internet connection are now the central player in the latest privacy debate. What information about your driving experience is being connected and who gets access to it is a very valid and lively debate."

> **The consumer is going to be demanding an experience like they have with their phone. When they get in their car, they will expect the screen of the infotainment system to be an extension of that experience, and it will seamlessly hand it back to their phone when they exit their vehicle.**
>
> *Infotainment Product Specialist & Former Director for Embedded System Provider*

2. User interface architect for an embedded system provider

Infotainment system makers have the difficult task of integrating mobile phone and desktop functionalities that customers are familiar with into the car, where the primary focus needs to be on safe driving rather than on a screen with a unique experience. Although QNX is easy to use in cars, Linux's lower licensing costs work in its favor. Connectivity will be embedded in high-end cars but be provided through a smartphone in cheaper vehicles. The connected car is the first step toward an autonomous car, but that will take years and many cycles to develop.

Hardware
- "We partner with all the systems, and we have to have all of them run on the hardware we sell. That's part of the requirement, not a competitive issue. When we develop these products, we need to put in what the OEMs want."
- "The large OEMs like Ford and GM dictate the interface they want and how it's going to be done. That's where the differentiation will be for the OEMs. Low-volume OEMs like Ferrari ask for what's on hand because they can't develop a special interface."
- "The tier 1s need the capability to do these interfaces in-house, or purchase them from somebody else and sell it with their product."
- "There's a look and feel to the interface, but there's also a logic because it needs to be operational."
- "This is going to take years, many cycles, but eventually all the [hardware manufacturers] are going to come down to the same thing. We have a wide range of functionalities we're trying to integrate, and in time it'll all get in the car and it will all be the same. It'll take time until we get there, and we

> **Advertising will be part of the user experience. It's always been here, and it's not going to go away. But we need to rethink how we're going to integrate this in the vehicle.**
>
> *User Interface Architect Embedded System Provider*

have to prove the best way to integrate. There are unique design challenges in the vehicle."

Software

- "With Apple's CarPlay, Apple wants to control every aspect of it. It'll be interesting to see how it plays out. Apple is extremely focused on what the customer is doing with the phone and not what's going on with the vehicle."
- "A vehicle has to have more interaction with the user than just what's coming over the media. There's more interface than just the music. I see Apple as being more for just the infotainment options and not being well integrated into the vehicle."
- "In the vehicle environment, you interact differently. A lot of vehicle information has to come in, like the map. Phones are coming from a desktop environment and they're trying to soften it down and make it more usable, but they still put their interface first to capture you into it. They want you to have the experience. But when you're driving a vehicle, that's not what you want to happen."
- "Your primary focus has to be the vehicle. This is why I'm having a problem with guys like Android coming in."
- "Advertising will be part of the user experience. It's always been here, and it's not going to go away. But we need to rethink how we're going to integrate this in the vehicle."
- "Android is already a player because of Linux. It's just another step up from the operating system. These systems have been embedded for a very long time—in radios, CD players—but they didn't interact with anything. As you start getting these systems developed, you need an operating system like iOS or Android to start getting all the new content in. Android would have more long-term potential because Google is very interested in getting that content to the user. They do all kinds of crazy projects, whereas Apple has the control mentality of having to have it the way it wants it."
- "Google and Android are what they are because they took down all those barriers and are experimenting, and that's the way they'll move to the future."
- "The industry is shifting toward Linux because of less licensing fees, though Linux requires additional things too."
- "Software still has to be written on Linux. Android is also on Linux, and Apple is not that different because it's a variant of Unix."
- "QNX has tool chains that can quickly develop the interface to run a machine. They have tools to help software people and user interface people with built-in routines. That's what you need from a design standpoint."

Technology

- "Telematics, with the ability to connect everything and help the user do things, [will be in demand]. ... The challenge now is the connectivity. How do we present this information so the user understands it?"
- "The cost involved in doing those correctly—the automotive industry didn't realize they had to spend this much money to get there, or that the technology has to become cheaper for them to use it."
- "The connected car is the first step to the autonomous one. As soon as that's figured out, the cars will drive themselves. For now a lot of the technology is pulling them away from driving. We need to flip that around to where the technology is actually helping them drive. That will help us go forward before we get too much regulation."
- "Before, embedded systems couldn't even have connection capabilities, but cell phones have helped get us this far, where you can have embedded systems from the phone connectivity. Now it looks like connectivity will be more embedded. I think you'll be seeing a combination. Midrange and higher-end cars are looking at embedding it in the vehicles versus low-end, which would be a mobile-phone based connection. But it still needs to get the information from the mobile phone to the user in the future. So there'll be a combination."

> **The connected car is the first step to the autonomous one. As soon as that's figured out, the cars will drive themselves. For now a lot of the technology is pulling them away from driving. We need to flip that around to where the technology is actually helping them drive. That will help us go forward before we get too much regulation.**
>
> *User Interface Architect*
> *Embedded System Provider*

4) Industry Specialists

Three of these six sources said Harman and other infotainment manufacturers will see declining margins and per-car revenue as new software platforms relegate hardware to commodity status. One source predicts significant consolidation among hardware makers as a result. Two others, however, think manufacturers can protect their profits by serving as integrators of

hardware and software. Two sources said Apple and Google will be key players in infotainment software, while two others think QNX will have a major role of integrating Android and iOS into infotainment systems. Three sources said Internet connectivity and app accessibility in cars will be delivered by both smartphones and embedded systems.

KEY SILO FINDINGS

Hardware
- 3 of 6 see the evolving infotainment software landscape as ominous for Harman and other manufacturers.
- 2 think embedded system providers can remain profitable as integrators of infotainment hardware and software.
- 1 sees an opportunity for Harman and its competitors to expand from luxury cars to lower-end vehicles as infotainment production costs fall.
- 1 expects consolidation down to about 15 embedded system manufacturers.

Software
- 2 believe Apple and especially Google will play key roles in infotainment software.
- 2 think QNX will top the operating system because of its ability to integrate Android and iOS.
- 1 sees automakers moving from QNX to Linux due to licensing fees.

Technology
- 2 predict both embedded infotainment systems and smartphone-based systems will coexist.
- 1 thinks completely in-built infotainment systems eventually will win out.
- 1 believes embedded Internet connectivity will expand from luxury to lower-end segments, but phones still will be the portal for accessing apps and content.

1. Author and journalist covering connected cars and other technology topics

Embedded system providers can continue to profit from the changing landscape of connected cars if they become software integrators and not just hardware makers. More cars will have embedded connectivity as modems become cheaper rather than relying on phones for accessing the Internet, but mobile devices will continue to drive access apps and content. Key car-based apps of the future will combine navigation with third-party data and driver preferences to identify services and points of interest.

Hardware
- "The smart hardware providers are moving into the role of software integrators. For example, Delphi and Continental both are providing software as well as hardware, and Delphi specifically defines itself as a systems integrator. If they can handle some of the software for car makers, they'll continue to see profits."
- "I don't think Apple has designs to create automotive hardware. I think it just wants to reinforce usage of its mobile and tablet apps and content."

Software
- "When it comes to connectivity, higher-end cars already are moving toward embedded connectivity, and as modems get cheaper, moderately priced cars will also have embedded connectivity."
- "When it comes to content and apps, it's a different story. Mobile devices—including tablets as well as phones—will continue to be important for two reasons. One, consumers spend a great deal of time personalizing the apps and content on their phones, and they want the same choice on their car without having to configure the car system all over again. It's a lot easier and more convenient to have your phone apps available through the car interface."
- "The second reason is identity management. Having to plug in all your account names and passwords to the car system is laborious and unnecessary."
- "Apple seems to be most concerned with enabling its phone apps to work in the car. Google is seen by many in the auto industry as more concerned with harvesting data from drivers and basically delivering ads to them."

> " The smart hardware providers are moving into the role of software integrators. For example, Delphi and Continental both are providing software as well as hardware, and Delphi specifically defines itself as a systems integrator. If they can handle some of the software for car makers, they'll continue to see profits.
>
> *Author & Journalist Covering Connected Cars and Technology*

- "MirrorLink is simply a way to mirror the phone's interface in the car, which could be important for the use of non-Apple/Google apps. Linux will remain important for the operating system of infotainment systems, whether or not the car maker or infotainment hardware maker chooses to implement some kind of phone mirroring in the car. I believe that QNX software can enable CarPlay, MirrorLink and whatever Google wants to provide outside of its Android OS."

Technology

- "Everyone is hoping to figure out some killer app for cars, something that consumers didn't know they wanted until they got it. I think enhanced navigation that combines not only third-party data like Yelp but also the driver's preferences—expressed and inferred—to highlight points of interest specific to that driver will remain the most important infotainment feature."
- "For electric vehicles, enhanced POI [point-of-interest] information will be important so that drivers could identify charging stations that had services, dining and retail that were of interest."
- "Google will go ahead and deliver some kind of electric, autonomous vehicle, independent of the auto industry."

2. Consultant specializing in embedded software design

Traditional infotainment hardware vendors like Harman and Delphi will suffer as standardized software platforms open up the field to more competitors and head units become commodities. Anybody already playing in the smartphone ecosystem could move into car infotainment. Apple and Google can make money in infotainment, as can app developers and providers of customization and integration services like Green Hills and Intel's Wind River. Cars will have in-built Internet connections so the infotainment system can be upgraded while driving.

Hardware

- "The development of relatively standardized real-time operating systems with a user interface and an established ecosystem is going to be very disruptive to the existing embedded hardware suppliers like Harman and Delphi."
- "The tier 1s typically create the system to the specifications of a car manufacturer. Up until now, they were highly customized, unique systems, and the automotive supplier was effectively locked in. If the supplier wanted an update for a new model, the hardware infotainment supplier had total control of the situation. And it was expensive because it all had to be done in their shop."
- "You have Android, iOS, QNX. You have these platforms that have an ecosystem with a look and feel the customer is familiar with. The ecosystem is key. Anybody playing in the ecosystem space can potentially move into car infotainment."
- "People think you can just plug in your iPhone or Android in the car, but there are a lot of complications involved with that. To do well, you need to modify the user interface, and you need to worry about security and integration. And those things aren't trivial. People are saying, 'Don't give that project to Delphi, but let us do it.' The upgrades are going to be easier."
- "A lot of people are going to be making money on this at the expense of the traditional hardware vendors. Google is going to make money with their advertising, Apple is going to make money. Vendors that have car-relevant applications are also going to make money. The professional services companies that do the customization and integrations—like Wind River, Green Hills, Mentor Graphics [Corp./MENT] and [Symphony Technology Group LLC's] Symphony Teleca—are also going to make money."
- "The traditional embedded system vendors are going to be losing big time unless they can make the transition from doing customized software and hardware to doing a well-layered, partitioned architecture and getting on board ... as a key partner."
- "It is three to four years minimum from the time you choose an architecture

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>
> *Consultant, Specializing in Embedded Software Design*

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>
> *Consultant, Specializing in Embedded Software Design*

as a key component of the car and go through the development, testing, approval and launch. I would say all the major car companies are already locked in to different kinds of infotainment and soon will be coming out with a first- or second-generation system."

- "There's still going to be hardware required to meet the demands of the operating system and the applications, but those head units are going to become more commoditized and they're going to have to differentiate themselves by having the most performance and capabilities for the least cost."
- "One could gain an advantage if they end up developing the de facto standard head unit, which has the most flexibility and highest performance. Then they could become the PC or Apple computer of the automotive world."
- "The upgrade revenue is going to be moved and the embedded system manufacturers are going to be forced to reduce the cost of their head units."
- "The total spend on infotainment systems is getting bigger because it is becoming a more significant differentiator for the car manufacturer. At the same time, development costs [for automakers] are getting smaller because you have a lot more vendors competing now. Production costs are going down 15% to 20% per year."

Software

- "The head units are going to become more standardized, and the differentiation and upgrades are going to be focused on the software. The differentiation is going to be in the software."
- "Apple and Google will have operating systems, the application layer on top of the software."
- "The operating system needs to be customized to different devices, and often you need to modify the software stack so you can support the security and performance requirements of the audio system."
- "Android is probably the best-placed operating system. Android is a relatively open platform compared to iOS, and it's easier to go in and do framework adjustments inside that OS to make it optimal for the car environment, compared to iOS. It also has a lot of customers."
- "From a software vendor's perspective, there's about two years of development, but for the car manufacturer, it takes four years to implement."
- "Security is going to become a bigger and bigger issue with software more open to attack. Performance is a key issue. For example, how long does it take to put the car into reverse or put the video up on the display?"
- "Google has similar security issues. It's a problem with open architecture systems."

Technology

- "I see the car also as having its own 3G/4G connection. And the infotainment system will be updated as you're driving along."

> The head units are going to become more standardized, and the differentiation and upgrades are going to be focused on the software. The differentiation is going to be in the software.
>
> *Consultant, Specializing in Embedded Software Design*

3. Automotive technology evangelist; repeat source

Google is expected to create a blueprint for infotainment head units that will enable its software to become more prevalent, which will turn infotainment hardware from manufacturers like Harman and Delphi into a commodity. Apple also will be getting into the game but probably not as an embedded hardware maker because the volumes are not high enough. QNX will have an opportunity to build platforms that can accommodate both Android and iOS devices. Linux is late to the game but could gain acceptance through Android.

Hardware

- "Infotainment systems will be evolving more rapidly than previously. The connected car has been talked about for about 10 years, but it's remained relatively static. Now it's due to evolve relatively quickly with Google getting into the space and being more serious about tackling it."
- "I don't think Google will get directly in the hardware business, but they may end up doing something similar to what they've done on the phone, which is to create a design or the blueprint for other people to do that so they can

> Everybody can see clear parallels from the phone industry to what's going on now in the automotive industry and parallels as to how Google does business.
>
> *Automotive Technology Evangelist*

commoditize the head unit business, which allows their software to get out more. Their endgame is to have that space be all 'Google Village.'"
- "Everybody can see clear parallels from the phone industry to what's going on now in the automotive industry and parallels as to how Google does business. Their mantra is 'Do no evil.' That's their company culture, but there's nothing in there about wiping out entire ecosystems or other companies' values."
- "This is going to hurt the hardware suppliers. If you talk to them, they'll say no, it won't be quite that simple, but I think this is just the first step to doing it. The Open Automotive Alliance has automakers helping Google do that."
- "The OEMs always feel somewhat beholden to the tier 1s because they're building those systems and the OEM doesn't have direct control over it. In one sense, the OEM will take back some level of control by being directly involved, but on the other hand, they're handing it over to somebody much worse, which is Google. At the least, the tier 1s are going to work with [Google] to build the system."
- "It's hard to draw any other conclusion except that the [infotainment hardware makers] will have a reduced amount of dollars from the pie. But there's definitely more things going around to pay for. As the value of the electronics goes up, there's more people to feed with that same dollar. There are all kinds of companies that will be able to capitalize on the standardization of the infotainment platform."
- "What's going to happen to the Harmans and Delphis and all the rest? They're going to basically be creating a commodity product, and they're going to be going down to the lowest common denominator."
- "Some of them will try to specialize different aspects of things that may be challenging for the Google world to do, just like Samsung has specialized in augmenting their version of the Android phones. There's only so much room for that kind of specialization. There probably will end up being one or two major tier 1s who will be left over if Google gets in there."
- "Apple wants to have complete control over the experience and the environment. I don't necessarily think they will want to [make infotainment hardware] because there's a big ramp and there's not enough volume in it to make it interesting for them. But they will probably partner with somebody to build Apple-branded head units."

Software
- "The space is more complex than just Google. There are still people with Apple and other types of phones. The OEMs will have connectivity options for those with non-Android types of devices. There will be room for people building Linux platforms for Android connectivity and Apple connectivity."
- "Those platforms will be built by a combination of tier 1 and tier 2 suppliers. That could be Harman with QNX, where QNX could provide operating system pieces that would allow you to integrate with both Apple and Google, and Harman might be the one who puts that into a head unit."
- "Linux won't make it because they're too late to the game. Linux isn't really adding anything in this particular scenario because what the industry needs is a level playing field. Right now GENIVI is just giving away for people to create this open-source base, but it's not moving fast enough because the various companies collaborating on it don't want to share their IP. It's challenging for GENIVI to move as quickly as an individual company. But of course, it will eventually get out there through Android because Android is built on top of Linux."
- "QNX is definitely going to have to figure out how to make Apple and Android work together."
- "QNX won't be completely shut out, but they'll go from having a much bigger piece of the potential pie to having the traditional kind of QNX piece. They were on the cusp of being a name brand with the BlackBerry purchase. It's going back to where they'll be an ingredient brand and not a front brand. And until you're a name that the consumer recognizes, there's less willingness for the OEMs to pay for it."

Technology

> *It's hard to draw any other conclusion except that the [infotainment hardware makers] will have a reduced amount of dollars from the pie.*
>
> *Automotive Technology Evangelist*

> *Apple wants to have complete control over the experience and the environment. I don't necessarily think they will want to [make infotainment hardware] because there's a big ramp and there's not enough volume in it to make it interesting for them. But they will probably partner with somebody to build Apple-branded head units.*
>
> *Automotive Technology Evangelist*

- "From the supplier standpoint, they've always thought guys like Google didn't know enough about the space to get in, so they'd always be providing the connections. But if Google gets into the space or has partnerships, that changes the equation in a big way."
- "Now that Google is doing it, Apple will want to accelerate their game. Up till now they've been working with various partners trying to create solutions, but Google is always a disruptor and that's going to change the pace and the expectations."
- "There's also a whole move toward getting rid of the head unit all together—the autonomous car. This is another interesting tactic with regards to Google because they are heavily pushing that. With the car always in control and never needing a driver, people in the autonomous car can read their news on their tablets, and that would be the endgame for the removal of infotainment."
- "It would be interesting to see how readily the public adopts this kind of technology. I think the technology could be there in the next five years, and that would be pretty fast, but that won't yet mean that public adoption is rampant."
- "Personal ownership of a vehicle is going to be on the downslope as car sharing is on the rise. The people growing up now don't see the same needs for personal mobility and transportation like we did. There'll be a change in the entire demographics about what it means to have a car or have somebody else drive you around or use Uber. And that would have a drastic impact on the number of vehicles sold as well."

4. Industry consultant on automotive electronics hardware and software

Infotainment hardware makers must find creative ways of staying relevant as car makers start to rely on third parties for software integration and try to control as many of the features as possible. The automotive industry is moving away from QNX and toward open-source Linux because of the licensing costs. Internet connectivity is expected to be split between embedded connections in higher-end vehicles and some form of tethered connection for the smartphone in midrange to low-end cars. Voice recognition with natural language is a key feature that customers and automakers want.

Hardware
- "Tier 1s used to carry the entire burden of the system, including the software and the hardware. Now the tier 1s will have to be much more creative because some of the OEMs will split the responsibility for who's going to do the software. They will bring in partners who'll do software integration like Mentor, Wind River, Symphony Teleca."
- "It's opening up opportunities for these third-party vendors and service vendors that the OEMs will be engaging with directly, or [force] the tier 1s to subcontract to them."
- "[Infotainment hardware makers] won't be responsible for as much as they used to be so they will have to be creative about how they differentiate themselves."
- "The tier 1s will still be responsible for the integration of the smart device, or the OEM could work directly with a service provider for that smartphone connectivity."
- "The financial models are being discussed all the time as to who benefits. The OEMs are going to try to do their best to own as much of the new services in connection—or charge for as many of the services—as they can."

> "[Infotainment hardware makers] won't be responsible for as much as they used to be so they will have to be creative about how they differentiate themselves.
>
> *Industry Consultant on Automotive Electronics Hardware & Software*

Software
- "Some of the major tier 1s have completely abandoned QNX. They are focusing solely on open-source Linux-based solutions because they see the reusability of the software as something that is going to create a huge benefit to the industry as opposed to all the licensing of a proprietary RTOS."
- "With open source, every time you need a new software component, you just write it and plug it in. With QNX, you have to go back to QNX every time and certify it."
- "I see a trend towards Linux and Android. They are the powerhouse of the industry today. I see QNX losing quite a bit of market share in the next five years or so."
- "Security issues around Linux will be dealt with by the tier 2s and the OEMs on an architectural level. It's the tier 1s' responsibility to solve the security issue regardless if it's open source or proprietary. They are the typical system integrators."

- "The Android software … got an initial kick in the industry because they had an Android focus team going around helping OEMs integrate the Android software in the vehicle. The Android software is very specific to a smart device, not a car. There were configurations and other software to replace the QNX stack. The advantage is easier interface with all the Google applications communities."
- "Google has some partners working with the Open Automotive Alliance, but unless they put some investment in it to get the automotive people to adopt it—even though it's not developed for automotive—it's a big question mark."
- "It's the same about CarPlay and Apple. For now, they've created a few more features that add to the user experience. It's still not like, let's say, a full QNX operating system. They would also need to invest in developing iOS or CarPlay or anything that gets loaded into the vehicle. That's a big question mark too."
- "A lot of OEMs are signed up with CarPlay, and a lot are going to be launching Android systems. The OEMs are always excited about starting a development activity around something that comes from companies with big names like Google or Apple. It's a honeymoon period until we see what happens."
- "I don't see the OAA or Android, as it stands today, as projecting some kind of a winning scenario unless the Apples or Googles throw a lot of money at it."

> I see a trend towards Linux and Android. They are the powerhouse of the industry today. I see QNX losing quite a bit of market share in the next five years or so.
>
> *Industry Consultant on Automotive Electronics Hardware & Software*

Technology

- "For the next-generation infotainment systems, the No. 1 feature towards which everyone is moving is voice recognition with natural language."
- "Connectivity to the vehicles is through every wireless channel, and that includes cellular, satellite, Wi-Fi or Bluetooth through a smart device providing updates to the vehicle. In the future, I see it as a split, where you'll have embedded connectivity … and you'll also have a tethered connection through the smartphones."
- "The high-end luxury vehicles will still have the embedded connections because people will count on that regardless of whether they have their smart device with them. The midrange to lower-end vehicles will carry the tethered ability to provide updates through the smart devices."

5. President of an automotive trade association

Embedded system providers will have a large role to play as the connected car integrators of the future. Their per-car revenue, however, will be split with other players, and consolidation will occur among hardware manufacturers. For safety reasons, connectivity should be through an embedded system rather than through a phone. Automakers are looking for the best way to do this as Wi-Fi is still not ubiquitous and most consumers are not interested in second data plans. Automakers are about 20 years away from an autonomous car.

Hardware

- "The tier 1s will have a huge role in connected cars of the future. The number of tier 1s in the world will probably get to down to about 15 through consolidation. The tier 2s [such as hardware component suppliers] and tier 3s [like chipmakers] will also grow exponentially."
- "People want the technology they have on their phone in their car. And if people want to enjoy that technology in the car, the industry has to protect their safety. You'd use the car's speakers and screen as the output device. All you need then is the connectivity and you can concentrate on the vehicle."
- "What's the next step in infotainment? It's whatever is on your phone. It's coming into the car. The problem is the ability to support it."
- "There are already car app stores, about 75 of them worldwide. Do we want every car maker to have their own app store? It's not a reasonable business model moving forward."
- "The automakers have never participated in the ecosystem outside the vehicle. They will have to partner with entities like those that have capabilities and expertise."
- "It's not about having the Apple brand in the car. That wouldn't sell the car. It would just end up being an expected feature. It would dilute the car's brand. A white [label] brand would be more acceptable."

Software

- "The market thinks that all that's in the Internet can be transported over to the car. You can't do that, however, because the phone is a device designed for the user to focus your attention on. The car environment's rule of thumb is you have to locate or control a piece of information in two seconds while you're driving, for safety reasons."
- "The market forces do not prioritize automotive because the market is not large enough. For example, chipset makers prefer the gaming market, which has the potential for higher revenue."

Technology

- "Until Wi-Fi becomes ubiquitous and as available in the middle of Oklahoma as in downtown Chicago, connectivity won't be resolved. Right now people are reluctant to pay an additional data plan to what they already pay for their phone plans."
- "People say if they have music on their phone and voice navigation that works better on the phone, why should they pay more to have a different system in the car?"
- "GM has a new model called the Chevy Spark, their cheapest car. It allows you to bring in your cell phone and plug it in, although some of it is disabled for safety. They're taking a chance. Typically, the high-end capabilities are for luxury cars but this is expensive until you have a high production volume."
- "The high-end market is the most forgiving, and they're likely to want to have an embedded system because it's available, not just because they like using Pandora."
- "It's all changing. The OEMs are seeing that now as a competitive threat not to have embedded systems, and the major OEMs are looking not only at embedded devices. But they're also coming up with their own aftermarket devices that gives some capability, a sort of light version."
- "I ask people what additional capabilities they would like in their car: e-mails read out to you? Stock quotes? Sports scores? In transit routing updates as opposed to navigation?"
- "Or do I want to give up control of my vehicle so it can take over while I take my eyes off the road for a few minutes? Eventually people will want that. But automakers are 20 years away from doing that; first we have to learn over time how the vehicle will work in all cases, how the brakes or tracking control system work on wet pavement versus icy versus dry dirt road. This will be modeled into the vehicle."
- "You don't want more entertainment in the car unless you can relinquish control of your need to observe for any kind of road, weather and traffic."
- "The connectivity for the car's safety is primarily going to be built into the car by the automakers. For infotainment, it could be satellite or Wi-Fi, but the real issue is going to be cellular, to decide if you're bringing it in through your phone or through an OnStar type of system that has its own cellular connectivity and how much it will cost. But we have to do what we're doing now to figure out what people will buy and what will work."

> **People want the technology they have on their phone in their car. And if people want to enjoy that technology in the car, the industry has to protect their safety. You'd use the car's speakers and screen as the output device. All you need then is the connectivity and you can concentrate on the vehicle.**
>
> *President*
> *Automotive Trade Association*

6. Vice president of an IT consulting firm; repeat source

Harman, Panasonic and other infotainment system manufacturers will have an opportunity to expand from the luxury car market into less-expensive vehicle segments as production costs come down on head units. QNX is a logical software partner for embedded hardware given its real-time capabilities and cross-platform functionality. Google's goal of developing autonomous cars is a decade away from reality.

Hardware

- "Panasonic and Harman have great brand awareness. If they can deliver lower-cost embedded systems for midline and economy cars, I think consumers would jump at the chance to have that gear in their dashboard."
- "For consumers, there's always the question of cost to value. Production costs keep coming down, so tier 1 operations like Panasonic and Harman can still hold their own in this market. With the most expensive vehicles, I think the demand for a sharp-looking in-dash system isn't going away."
- "Google and Apple aren't going to invest in hardware in any big way. They're too focused on platforms for integrating apps. Google especially wants to put their ecosystem in every vehicle on the road."
- "Google's pursuit of the autonomous car model is still 10 years down the road."

- "The markup on embedded systems probably varies at different price points. A 100% markup is not uncommon with these systems."
- "All [infotainment] hardware, whether through a smartphone or a head unit, must be able to download updates as they become available. Voice activation will replace touchscreens and most controls."
- "Technological advances are cutting the time to market. Production costs and the price of materials are also falling. It's an opportunity for head unit makers to develop lower-cost products and get into the broader market of midrange and compact cars, not just the high-end vehicles."

Software
- "Google, QNX and Apple are in the strongest position to control the software side for infotainment. If Google sticks with Linux as the underlying platform for Android, then Linux will still play a role in this industry. I'm thinking QNX offers the better solution—real-time processing and massive scalability to handle apps across multiple devices."
- "QNX can work collaboratively with Apple and Google. MirrorLink has some decent partnerships—Toyota is a big one—but I don't see MirrorLink staying aloft with QNX and Google."
- "Apple presents different issues. They want that sweet pricing that they get on the iPhone, but it's a tougher sell with embedded systems and existing competition. Plus, they want to play in their own universe, so infotainment with the iOS is the obvious play."
- "For in-car infotainment to really catch on, there will have to be interconnectivity protocols, some universal standard so all of these devices can integrate and communicate. When that happens, I think you'll see the cost start to come down."

Technology
- "Connectivity has to reach 4G. Speed is essential."
- "At minimum, voice activation either though the smartphone or the head unit will have to be the user interface. There's already a growing number of states passing 'no texting while driving' laws. Operating GPS navigation or accessing web content through a phone or a head unit is essentially the same issue."
- "There's room for both embedded and smartphone systems. There's demand for both types of infotainment infrastructure."

> Technological advances are cutting the time to market. Production costs and the price of materials are also falling. It's an opportunity for head unit makers to develop lower-cost products and get into the broader market of midrange and compact cars, not just the high-end vehicles.

> Voice activation either though the smartphone or the head unit will have to be the user interface. There's already a growing number of states passing 'no texting while driving' laws. Operating GPS navigation or accessing web content through a phone or a head unit is essentially the same issue.

VP of IT Consulting Firm

5) Online Consumer Survey

In an online survey of 181 U.S. car owners, the 41 car owners that are currently in the market for a car showed significant interest in infotainment systems. Navigation and Bluetooth connectivity were the most sought-after infotainment system features. The few car owners whose cars already have infotainment systems reported being able to connect them to their smartphones.

Car owners who are considering buying a car are looking for an auto infotainment system in the car.
- 22.9% of car owners are considering buying a car. (Q6)
- Car owners looking for a car considered having an auto infotainment system as very important (36.6%) or extremely important (24.4%). (Q6 filtered, Q7)
- Car owners currently considering buying a car are very likely (43.9%) or extremely likely (19.5%) to be swayed by the embedded auto infotainment system. (Q6 filtered, Q8)

An auto infotainment system could influence some car shoppers to buy a specific vehicle.

- 20.1% of car owners believe an embedded auto infotainment system could have a moderate effect in enticing them to buy a specific car. (Q8)
- 517.9% believe having an auto infotainment system is moderately important in their next car purchase. (Q7)
  - 15.6% believe having an auto infotainment system is slightly important. (Q7)
  - 14.5% believe having an auto infotainment system is very important. (Q7)

Car owners reported being willing to pay more for navigation, voice-activated calling and Bluetooth connectivity.
- Navigation (35.9%), voice-activated phone (26.5%) and Bluetooth connectivity (25.4%) were the top three auto infotainment features that car owners were willing to pay more for when purchasing a car. (Q2)
- 21% of car owners have navigation installed in their cars. (Q3)
  - 20.4% have Bluetooth connectivity installed in their cars. (Q3)
- Navigation (25.6%) is the most used auto infotainment feature. (Q4)
  - Bluetooth connectivity (10.6%) is the second most used feature. (Q4)
- 31.7% of car owners would prefer an integrated auto infotainment system, compared with 23.3% of car owners who would prefer a connection to use their smartphones and apps. (Q5)

Car owners (17) who already have an auto infotainment system mostly have connectively through their smartphones than through a completely embedded unit. These sources had complaints about the size of infotainment screens and the interfaces, and said their smartphones offer betters apps than the embedded system.
- Only 9.5% of car owners currently have an auto infotainment system in their car. (Q9)
- 88.2% who have an auto infotainment system installed in their cars can connect their smartphone. (Q10)
- Car owners who have an auto infotainment system that can connect to their smartphone use both equally (46.7%) or use the built-in auto infotainment system (40%). (Q11)
- Complaints about auto infotainment systems include the screen being too small (47.1%), the screen being too big (35.3%), smartphone apps that work better (29.4%), and confusing interfaces (23.5%). (Q12)

Roughly one-half of car owners do not have or want any auto infotainment features, and would not be enticed to buy a car based on these features.
- 45.9% of car owners would not pay extra for any auto infotainment features. (Q2)
- Most car owners (66.3%) do not have any auto infotainment features installed in their vehicles. (Q3)
- Most car owners (54.4%) do not use any auto infotainment features. (Q4)
- 45% do not want either an integrated auto infotainment system built in or a connection to use their smartphones and apps. (Q5)
- Car owners said having an auto infotainment system in their next car was not at all important (44.1%). (Q7)
- Car owners believed an embedded auto infotainment system was not all likely (39.1%) to entice them to buy a specific car. (Q8)
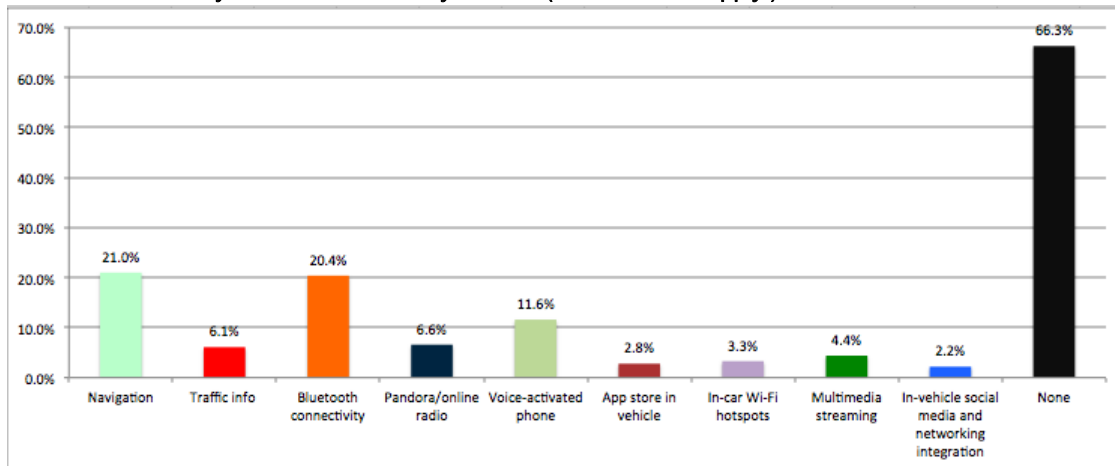
1. Do you own a car?
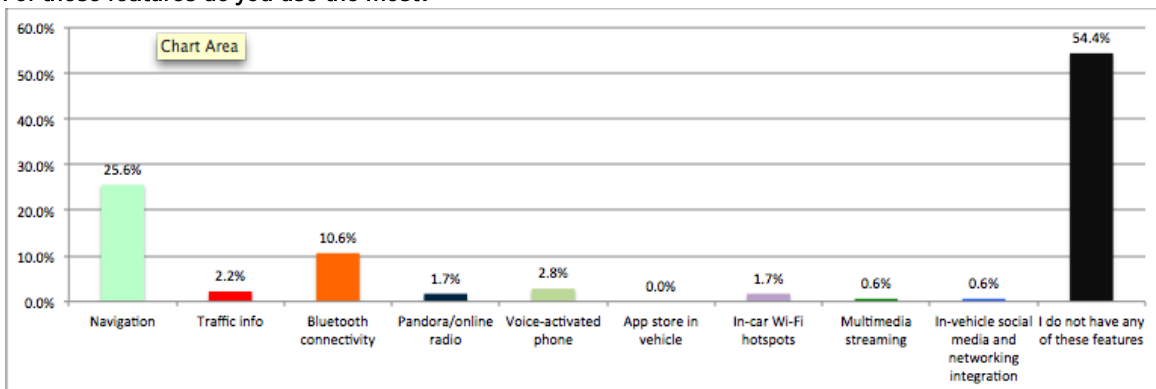

4.2%

95.8%

- Yes
- No
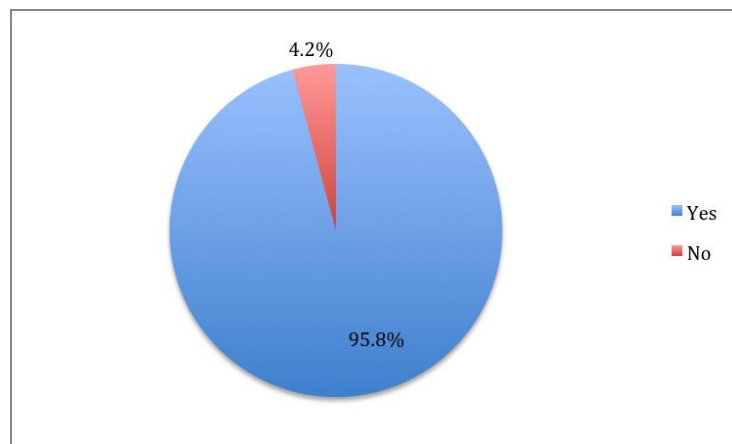
2. Which of these features are you willing to pay more for when buying a car? (Select all that apply.)
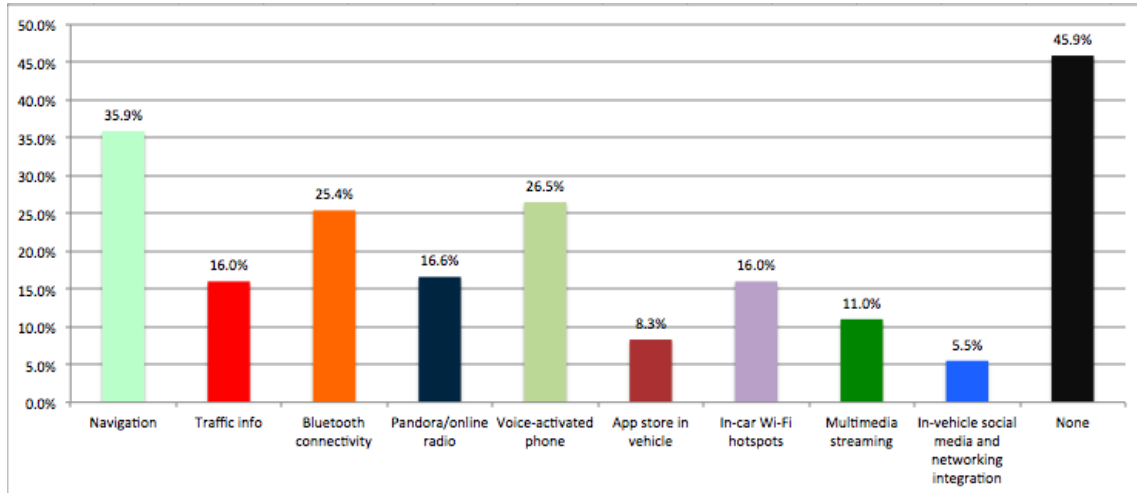
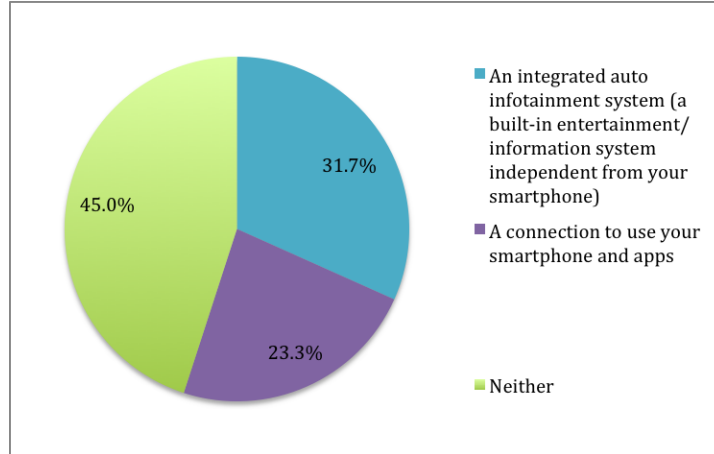3. Which of these features do you have installed in your car? (Select all that apply.)

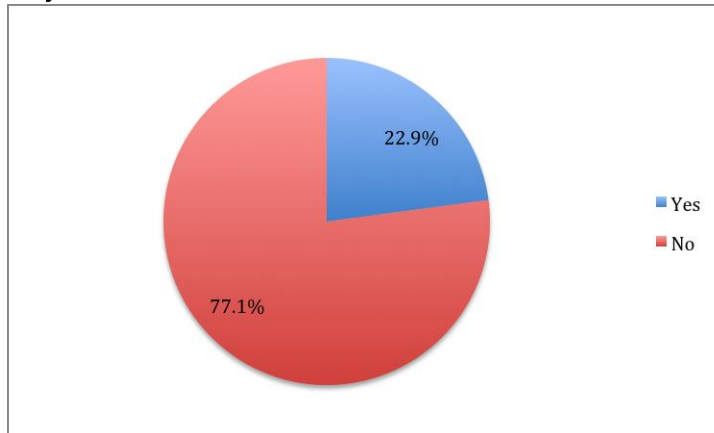4. Which of these features do you use the most?

5. Which would you prefer?
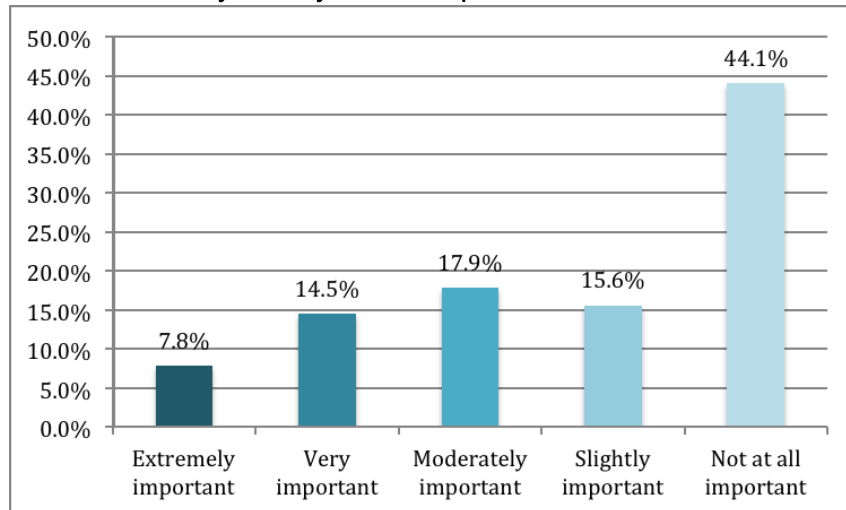

An integrated auto infotainment system (a built-in entertainment/information system independent from your smartphone)

A connection to use your smartphone and apps

Neither

- 31.7%
- 45.0%
- 23.3%

6. Are you currently looking to buy a car?

- 22.9% Yes
- 77.1% No

7. How important is an auto infotainment system to your next car purchase?

Extremely important	7.8%	
Very important	14.5%	
Moderately important	17.9%	
Slightly important	15.6%	
Not at all important	44.1%	

8. How likely would an embedded auto infotainment system entice you to buy a car?
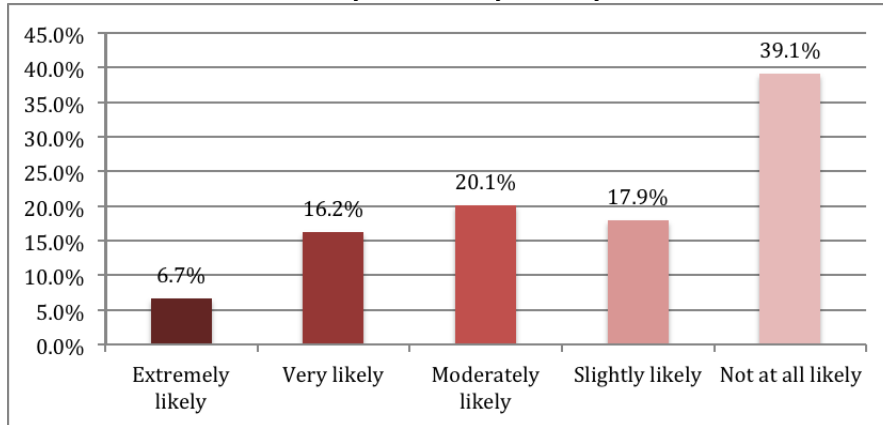
9. Do you currently have an auto infotainment system in your car?
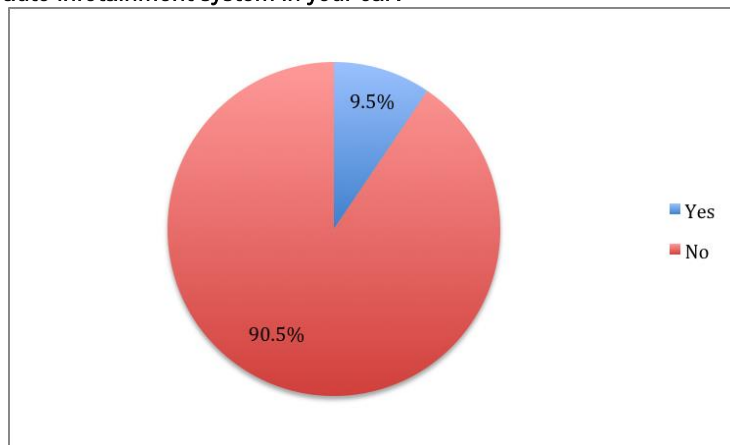
10. Can you connect your smartphone to your auto infotainment system?
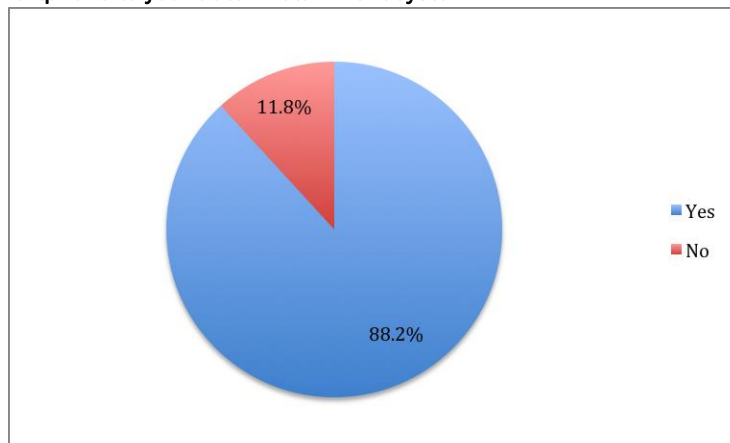
Auto Infotainment

11. Which do you use more?
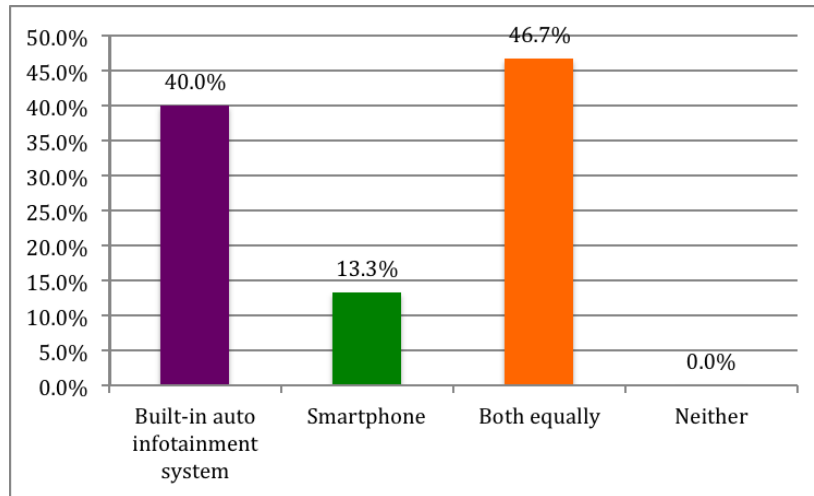
12. What are some issues or complaints you have with your auto infotainment system? (Select all that apply.)
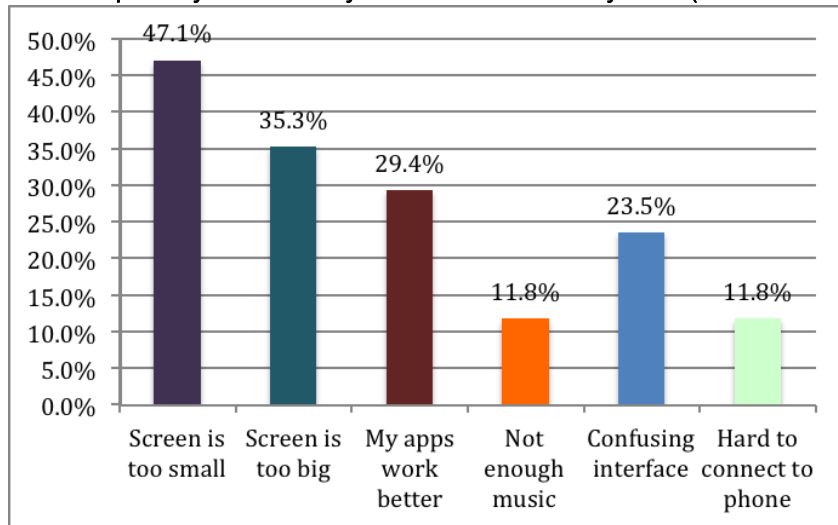
Secondary Sources

The following four secondary sources highlighted the growing auto infotainment market, Google's Android Auto software, QNX's software expanding beyond infotainment functions, and a chipmaker's view of infotainment trends.

June 4 WhaTech report
The global auto infotainment market is expected to grow 12.26% each year through 2018.

- "The Global Automotive Infotainment market is expected to grow at a CAGR of 12.26% over the period 2013-2018."

June 26 Wired article
Google's Android Auto was launched to seamlessly adopt Android phone apps into an interface on the dashboard, all while being voice-controlled. The new system already has signed on 28 automakers.

- "Android Auto, revealed at the tech giant's I/O conference Wednesday, will let you plug your Android phone into your car, making the screen in your dashboard a big phone interface, one that's optimized for driving. You'll be able to find your way with Google Maps, stream music from Spotify, and send and receive texts while driving, among other things. Of course it's got voice control so you can do all of this without taking your hands off the wheel."
- "The technology, which we'll start seeing in cars by the end of the year, will be far better than anything offered by automakers, but then, the stuff offered by automakers couldn't get any worse. It will offer a seamless transition from using our phones to driving our cars. We've already seen 28 automakers sign on, including Audi, Chevrolet, Ford, Honda, Hyundai, Kia, Nissan, Volvo, and VW."
- "There are three key upsides for Google. Android Auto could make it difficult to switch to an iPhone as long as you own your car. It could give Google a level of control over automakers whose customers may demand it. And it will provide Google an intimate look at our driving habits, providing invaluable data for a company busily building a autonomous car it expects to fundamentally disrupt the auto industry."
- "On average, Americans hold onto a phone for 20.5 months before ditching it for a new one. For Android users, that's a chance to switch to an iPhone every two years. We keep cars a lot longer: 71.4 months, to be precise. That works out to three and a half phones in the lifetime of one car. If your car is built to support Android, not IOS, won't you be more likely to stick with Google when it's time to upgrade your phone? (The 11 automakers working with Apple CarPlay *and* Android Auto will decide whether to offer one or both systems in any given car.)"
- "'Google is realizing that in order to really dominate all kinds of mobile devices, they have to embrace the automobile,' says Thilo Koslowski, a Gartner analyst who studies automotive and consumer electronics."
- "Consumers who like Android or IOS may happily use their preferred OS on all their devices, including their car. That pushes the automakers out of the infotainment space, which happens to be worth more than $31 billion."

June 24 CTV News article

QNX has uses beyond an entertainment system, such as providing technical assistances from far away, showing drivers the nearest gas prices or parking lots, integrating smartphones and transcribing text messages. QNX also has been updated with the latest vehicle acoustics and noise-reduction technology.

- "Whether it's realigning the sensors that prevent you from backing into a pole, or updating the guts of the dashboard software, new technology from a subsidiary of smartphone maker BlackBerry will give car manufacturers the tools to communicate directly with vehicles linked to their system."
- "QNX Software Systems executive Derek Kuhn said automakers will work as technical assistants from afar."
- "'Instead of going into the dealer to get something fixed or adjusted, that could be done remotely,' the sales and marketing vice-president said in an interview."
- "While the technology isn't yet built into vehicles, Kuhn said it will soon be available to consumers."
- "The development is part of Project Ion, a move by BlackBerry to become a leader in the technology that connects everyday things, such as home appliances and smart watches, to wireless networks."
- "Kuhn spoke from CE Week, a consumer electronics show in New York City, where QNX is showcasing its latest vehicle acoustics and noise-reduction technology. The event also brings experts from the industry together to discuss what's on the horizon."
- "Audi uses QNX's technology to give drivers instant access to the cheapest gas prices and parking lots near their destination. Drivers can also link their smartphones to the dashboard computer system to read out and transcribe text messages."
- "The in-car retail technology is already in the works, said Kuhn. He believes the fast food industry will likely be early adopters—giving drivers the ability to select a restaurant, a location, and a menu."

June 10 EE Times article

An executive with chipmaker Texas Instruments discussed the key features for infotainment systems.

- "First, in-vehicle infotainment systems are rapidly becoming the key differentiators for mid- to entry-level cars."
- "Second, the number of screens inside a car is rapidly growing, and their ability to display high-resolution images is increasingly required."
- "Third, sub-system vendors and car makers are looking for ways to integrate a growing number of ECUs [engine control units]. One ECU to drive both in-vehicle infotainment and the information cluster is one good example."

- "Fourth, Advanced Driver Assistant Systems' functions are progressing further. The ability to display views captured by surround video cameras is now adding a variety of functions. They range from red light detection to autonomous braking."

Additional research by Eva Cahen and Steve Evans