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The changing role of distribution

As OEMs look to operate with smaller in-house engineering teams, so distributors are well placed to provide much greater technical input.

The electronics industry continues to evolve and that is having a major impact on how distributors engage with OEMs and design engineers, many of whom are relying on distribution to pick up the slack as they look to cut back on their own direct sales and marketing capabilities.

Across the electronics industry procurement and technical support continues to evolve and design engineers are looking for more technical support.

Many distributors have developed in-house design expertise and have acquired great industry knowledge and, as such, it’s not unreasonable to look at exploiting this.

Distributors’ technical teams are well placed to answer questions about designs or to address component requirements and the sector is committed to supporting customers through all the phases of a project’s life, from initial design through prototype to volume production.

The rapid acceptance and expansion of electronics use in virtually every aspect of daily life is now a given and one area in which we are seeing rapid development is in autonomous driving – the potential of which is enormous.

According to a report from Intel business use of Mobility-as-a-Service (MaaS) is expected to generate $3trillion in revenues by 2050, while consumer segment could account for $3.7trillion. Over $200billion of revenue can also be expected from rising consumer use of new applications and services that will emerge as pilotless vehicle services expand and evolve.

Being driven is now considered as being the ‘essential nature of future transportation’, according to Intel’s Christian Lamprechter, Country Manager Germany and this will help to open up a whole range of different autonomous driving experiences that have not yet been explored.

A change in how consumers and businesses see transportation has already begun, look at the rise of peer-to-peer and ride-hailing services such as Uber and Lyft.

Manufacturers are making enhanced reliability and functionality automotive grade components to address the extreme reliability requirements of ADAS, a key step on the road to fully autonomous vehicles.

As electronic designs ultimately migrate to the highest quality component and best design practice the role of distributors can only become more important.
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High Level Synthesis

First steps

Case studies detail C++ synthesis methodologies

As established semiconductor and systems companies look to design chips for the automotive market, they need to differentiate their products while conforming to ISO 26262. This is a complex task given that ICs, especially for autonomous driving systems, are employing increased levels of integration of highly complex and relatively new system functions. Thus, the most advanced design teams are turning to high level synthesis (HLS) as the correct-by-construction first step in their design flows.

Two recent case studies by Mentor, a Siemens business, profile the C++ methods employed by the IC design teams at STMicroelectronics’ Imaging Division and Bosch Visiontec. In both cases, their design teams were not only able to use Mentor’s ISO 26262 compliant Catapult HLS Platform to perform architectural exploration and converge on the right designs for their applications, but cut the amount of time they would normally spend doing register transfer level (RTL) verification. This HLS-driven, correct-by-construction approach reduced the engineering hours, RTL licensing costs and time to market required for each project.

The ST case study details how using this approach with the Catapult HLS Platform, their Imaging Division team quickly developed an image signal processing (ISP) device derivative for the automotive market and still meet the ISO 26262 requirements of the design.

The Imaging Division have been using an HLS methodology since 2007 and have developed an ingenious parametrized template/library system that helps the group reuse common functions described in C++. The major benefit of the team employing the HLS flow with templates is it heavily reduces development time and cost with no compromise in results and design quality (Table 1). Using the flow, the team created the design 3X faster than hand-coding, and a single designer can perform verification, typically eliminating the need for a separate verifier resource.

Bosch Visiontec used an initial Matlab model to write synthesizable C++ based on their automotive vision system-on-chip (SoC) specification. They then created parameterized functions across multiple designs. Each of the algorithms evolved during the development stage. By using Catapult HLS, the team simply changed the clock frequency and Catapult synthesized the C++ code without a change in the directives to meet the post-synthesis timing specification.

Then to catch bugs prior to synthesis, the team employed Catapult Property Checking (CPC), which cut weeks off verification debugging time, as CPC identifies and formally proves hard to find issues like uninitialized memory reads and divide-by-zero violations. The team then used the SCVerify flow within the Catapult HLS Platform to automatically generate the infrastructure for verifying the functionality of the Catapult-generated RTL against the source code, and they reused the original C++ testbench. This eliminated further verification cycles that would have been required if they had started with the older, traditional RTL-coding approach.
The personal commitment of the founding family characterises the international success of the independent METZ CONNECT group of companies – strength in innovation, highly effective processes and partner-spirited business relationships. METZ CONNECT offers a broad-spectrum portfolio of highly specialised, superior quality plug connection components. Worldwide, METZ CONNECT employs approximately 800 staff.

**Product range**

U|Contact: Connection systems for Printed Circuit Boards. Spring, screw and IDC type terminal blocks, board-to-board connectors, pin headers, USB, RJ12, RJ45 jacks and M12 Ethernet connectors.

P|Cabling: Copper and fibre optic structured cabling network solutions.


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**Interconnection**

**A flexible solution**

METZ CONNECT has developed the SM99 and SR99, a safe and simple single pole spring clamp terminal block aimed specifically at compact and low profile devices. The flexible circuit board connection solution suits most industrial and building automation applications and meets today’s safety, reliability and convenience requirements.

In the race to stay ahead of the competition, demand for smaller devices as well as additional functionality continues to grow. Within the industrial and building automation market, new product design trends focus on integration, migration, miniaturisation, and of course, reliability. As a result, the space available for components on the PC board becomes more and more limited. METZ CONNECT provides ideal solutions for innovative PC board connection to meet these requirements.

As a single pole connector solution and also its compact size, SM/SR99 allows design engineers to take a flexible approach to connector placement on a PCB with the very limited space that is often available to them. At just 6.6mm in height and 5.8mm wide SM/SR99 carries a very small PCB footprint and can be placed on the circuit board in any number of orientations.

For such a compact connector, the SM/SR99 is feature rich. Accepting solid core and stranded cables with cross sections ranging from 0.2mm² to 1.5mm² and rated up to 9A, SM/SR99 features a unique finger operated actuator that not only allows for quick and easy wiring, but which also enables the operator to make multiple connect and disconnect cycles should they require. Once the cable is inserted, the operator will find an inspection window on the top side of the housing allowing a quick visual check to be made. Next to the inspection window, the operator will find a continuity test point to ensure that a quick, safe, and reliable connection has been made. SM99/SR99, is also offered with different colour actuators for additional colour coding benefits. The single pole spring clamp terminal blocks in SMT and THR versions are available in bulk packaging or on tape and reel.

**Colour options**

METZ CONNECT also offers the single pole terminal block in seven different colours for the finger latch for your individual coding on the PCB.

**Example Applications**

Access Control Systems, Smart Home Control Systems, Photoelectric sensors, Level measurement systems and LED lighting.

**SM99 and SR99: single pole spring clamp terminal blocks offering safety and convenience**

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**Benefits**

- Connection convenience through push-in technology
- SMT and THR options
- Reflow-capable to JEDEC 20 MSL 1
- Automation-compliant packaging (Tape and Reel)
- Connection direction 90°
- Compact design (5.6 x 5.6 x 14.5mm)
- Finger pushbutton
- Wire connection
- Inspection Window
- Continuity Test Point
- Cable range 0.2 to 1.5mm²
- Nominal current 9A
- Colour variants for finger latch

**Example Applications**

Access Control Systems, Smart Home Control Systems, Photoelectric sensors, Level measurement systems and LED lighting.
Autonomous technology will soon touch nearly every part of our lives, changing the products we build and the way we do business. The challenge is understanding what this shift means and how to successfully integrate autonomy into the systems and services we build.

Autonomous technology provides the ability for a system to act independently of direct human control, under unrehearsed conditions. We are now able to train computers to tackle problems which we can’t explicitly programme them to solve.

What does it take to develop and integrate autonomous technology? Consider a common example: the self-driving car.

The first step toward autonomy is to give the car the ability to sense the world around it using cameras, GPS, radar, and LIDAR to gather data and fuse it into one coherent information stream.

The car then needs to interpret the data and this is where autonomous systems start to differ from automated systems.

Algorithms must be developed that can make sense of data that hasn’t been encountered before. Machine learning, and deep learning algorithms classify the data, taking in details such as the location of lanes on the road and the relative speed of vehicles.

Learning algorithms can be trained how to react in new situations - to decide and plan. With every decision made, the system’s experience is increased and the decision-making process is improved.

A truly autonomous system takes action on its own, without human intervention.

A critical success factor here is integrating the learning algorithms with control design and development.

Autonomous technology is impacting every aspect of our lives, some are more unexpected than others.

Art history for example. The challenge of studying influence among artists and works of art is that there are practically infinite permutations of art and artists to explore.

A research team at Rutgers University has developed algorithms that automatically classify painting styles and can even use similarities between images to reveal artistic influences. This application focused almost exclusively on the ability of the computer to perceive, which is the most fundamental element of autonomous technology.

A research team at Rutgers University has developed algorithms that automatically classify painting styles and can even use similarities between images to reveal artistic influences. This application focused almost exclusively on the ability of the computer to perceive, which is the most fundamental element of autonomous technology.

The researchers tested many different techniques for feature extraction, and eventually landed on the combination of two: an unsupervised technique for determining low-level features like corners, and a supervised technique for recognising higher-level, semantic objects like chairs and people.

Supervised techniques require training on known images, while unsupervised techniques work without training datasets.

The researchers then use machine learning algorithms to classify the style, genre, and artist of a piece of work. They again tried several techniques, eventually finding that support vector machines (SVM) worked best for this application.

Too much data
Sometimes too much data is not always better.

Baker Hughes supplies oilfield services and systems to the oil and natural gas industry.

At the heart of its rigs is a series of costly pumping stations.
Understandably, Baker Hughes wanted to make better decisions on when to service its pumps, to save maintenance costs and improve the overall management of its assets.

To monitor the pumps for wear and predict failures before they occurred, Baker Hughes analysed pump sensor data and applied machine learning algorithms.

They had to process vast amounts of data to better detect the vibrations in the valves and valve seats and the engineers discovered that data captured from pressure, vibration, and timing sensors was the most relevant for predicting machine failures.

The autonomous technology provided operators with more insight into the machinery’s condition so that they could make better decisions.

But that brings us to the second step in building an autonomous anything: What will help your autonomous anything to make a good decision? What will be the best predictors for your application?

The answer to the first is obviously the data. Baker Hughes found it needed to filter the data and use only the sensor data that made the most sense. It then needed to reduce the data further using statistical and frequency domain analysis to obtain the required information.

It’s crucial that you use your domain knowledge to help determine those predictors. Sometimes that domain knowledge is captured in models used to design the system.

An American company called Bigfoot Biomedical is developing an autonomous blood glucose level management system. The controller uses an insulin pump to administer insulin to a patient, whose glucose levels are measured by an embedded continuous glucose monitor. The pump and monitor work together to maintain the appropriate glucose level.

Bigfoot Biomedical’s blood glucose management system, includes a continuous glucose sensor, an insulin pump, and a smart phone app for managing and glucose levels.

Its engineers felt it was critical to design a system that required the person to be actively engaged in managing this life-critical process, while still making it much simpler and much safer than a manual approach.

Bigfoot needed to ensure that the control system comprising the pump and glucose monitor behaved correctly under a wide range of conditions and would be able to handle all sorts of potential error conditions, and anticipate them.

While a virtual lab allowed Bigfoot engineers to design and simulate their control system, they needed to develop algorithms that could handle the variability in human physiology and human behaviour. Everybody is different, so the algorithms had to account for variability across the population.

To address this Bigfoot needed much more data than it could gather in the clinic with real patients. In effect it needed to work with thousands of patients over months or even years to assess system behaviour.

To address this, the company built a simulator which is, in effect, a virtual clinic that lets it test virtual patients.

The last remaining challenge was scaling the simulation to generate the massive quantities of data needed. To do this, Bigfoot leveraged the Amazon Web Services infrastructure to run 256 simulations simultaneously, giving it the ability to simulate 50 million patients a day.

### Getting to production

The Bigfoot example was complex due to its need to address safety and variations in patients, but getting an autonomous system to production is, for many, a real challenge.

Case New Holland (CNH) developed an autonomous trailer-filling system to reduce the demands on the harvester operator.

The first challenge was figuring out how to sense the trailer, the forage, and the fill level. CNH turned to a 3-D near-infrared camera that could measure distances, detect different
trailer shapes and sizes, and handle environmental conditions such as dust, bright sunlight, and darkness. They could then generate a 3-D point cloud to piece together a 3-D model of the physical world. Here they used computer vision algorithms to extract the relevant parameters to use in their filling strategies.

Once they could perceive the scene, they needed to decide how they would fill the trailer, and of course how to control the spout. For these tasks, they used Model-Based Design.

The team started by using closed-loop simulations to test their algorithms on a desktop to develop and debug their algorithms.

The CNH team then built a 3-D scene simulator to mimic the field conditions so that they could test the computer vision, state machines, and controls algorithms through simulation.

The next step was fine-tuning the algorithms in the field. To do this, they connected their computer vision and controls algorithms running on a laptop to the 3-D camera and the spout actuators.

Once confident that the design was robust and ready for production, the CNH team implemented its algorithms onto the vehicle ECU. The feedback from operators was that the system performed the same as when the algorithms were running on the laptop.

Field testing using computer vision and controls algorithms on a laptop to run the 3D cameras and spout actuators. After testing and refining, CNH automatically generated code for the operator display.

The resulting IntelliFill autonomous system adjusts the spout’s height, rotation, and cap position to fill the trailer. Once a trailer is full, the system can switch over and start filling the next trailer even if it is a different size — seamlessly.

No matter the final product or goal, the elements of an autonomous system include: large amounts of data and computing power, a diverse set of algorithms, and the flexibility to leverage the cloud and embedded devices.

The complete recipe for building an autonomous anything starts with focusing on perception - looking for creative places to add autonomy once a computer is capable of perceiving like a human. Next, it is important to find the best predictors. Sometimes you’ve got a lot of data and need to figure out which works best for your learning algorithms, but you can also rely on your expert knowledge of your domain.

Lots and lots of data, reduced to manageable pieces, is needed to train these learning algorithms. You’ll likely want to take advantage of big data processing abilities, and you can even simulate data to supplement measurements.

Finally, be aware of the challenges of bringing an autonomous system to production. This often means putting algorithms on embedded processors with Model-Based Design or putting them in the cloud or on enterprise IT systems - or sometimes both.
Light pipes for status display

SCHURTER improves upon a classic product: the new 6600-5 series IEC outlets are available with integrated light pipes. An intelligent, space and cost-saving solution for PDUs used in data centers and other multi-distributed power applications.

The human need for information continues to expand at record pace, while continual advancements in information and communications technology (ICT), strive to keep pace with this demand. New data centers continually appear in the most unconventional of places to support this growing demand. These data centers are under constant pressure to improve upon efficiency and reliability under growing regulatory requirements to reduce energy use and cost. Meanwhile, the demand for reliable transmission with increased speed must keep pace. At the base of this modern day economic demand and supply phenomena is an intelligent, reliable power supply and – at the base of that – a simple connector. SCHURTER is pleased to introduce its IEC outlets with integrated light pipes, which bring a simple yet improved solution to intelligent power distribution.

Freely configurable
Today, PDUs often use LEDs mounted in between outlets to display a current status. The high packing density of servers in modern data centers demands the same of power distribution units. With SCHURTER’s appliance outlet, the integrated light pipes provide space and assembly cost savings over conventional strip designs. Service technicians are able to clearly see which systems are working properly, or respond to required maintenance adjustments. The triggering of the LEDs is freely configurable, wherein each state can be clearly and independently represented. An outlet could, for example, signal an outage with a red LED, or a critical power consumption pattern with a yellow LED.

Cord retention
In order to prevent against unintentional removal of a power cord, the new sockets offer a pull-out safety device. Depending on the arrangement of the sockets in the bar – horizontally or vertically – the SCHURTER V-Lock or other cord retention systems with side latches can be used. Both systems are possible with outlets the 6600-5.

The outlet’s snap arms are currently designed for front panel dimensions of 1.7 or 2.0 mm. Versions for 1.0, 1.5 and 2.5 mm will follow shortly. And a 16 A version of the device socket with up to 4 light pipes will be launched in the near future as well.

Optionally the SCHURTER 6600-5 is also available with only one or without light pipe.

Connectors

SCHURTER is an internationally leading innovator and manufacturer of electric and electronic components. The company focuses on safe power supply and easy-to-use equipment. Its extensive product portfolio comprises standard solutions in the fields of circuit protection, plugs and connectors, EMC products, switches, input systems and electronic manufacturing services. SCHURTER’s global network of representative offices ensures reliable delivery and professional customer service. Where standard products are unsuitable, the company develops client-specific solutions.

Product ranges
Circuit protection; connectors; switches; EMC products

Certifications
SCHURTER products are certified according to the following standards and carry country specific approvals: UL, CSA, VDE (ENEC10), METI, CCC, KTL

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Hearing aid technology is continuing to improve continuously improved and newer types of digital hearing aid can now be programmed to amplify some frequencies more than others; they can also be adjusted to the wearer’s individual unique hearing needs, tuned to certain listening environments, and can be programmed to focus on sounds coming from a specific direction.

These features make hearing aids much more sophisticated than simple sound amplification.

The two most popular models, in the US, are the behind-the-ear (BTE) style hearing aid, and the receiver-in-the-canal and receiver-in-the-ear (RIC/RITE) type hearing aid.

For a BTE or RIC/RITE type hearing aid, the most common powering solution today involves using a non-rechargeable small Zn-Air primary battery (0.9V – 1.25V). This battery chemistry has extremely high volumetric energy density, resulting in a long run time and a small form factor. However, Zn-Air batteries cannot be recharged, forcing the user to change out the battery every 7 to 10 days.

In contrast, a Li-Ion battery offers reasonable run time, plus it can also be recharged, thus it does not need to be replaced frequently. However, there is currently no single-IC battery charging solution available on the market. Typical hearing aid electronics run directly from a single-cell Zn-Air battery, and the Li-Ion output voltage is roughly three times higher than this. Therefore, a Li-Ion based solution requires both a battery charger and a step-down regulator to deliver the correct voltage to power the hearing aid ASIC (application specific integrated circuit) chip. This multiple-IC approach is relatively large and generates switching noise/EMI which can be

“Recharging a battery removes the need for frequently swapping out battery cells; this is very beneficial for the manual dexterity challenge.”

Steve Roth

Products in Focus | Wireless Charging Solutions

Can you hear me now?

As the demand for hearing aids grow so too does the search for a wireless charging solution, as Steve Roth explains
problematic for the sensitive audio circuitry.

A rechargeable NiMH powered solution offers the best of both worlds. The NiMH cell has nearly identical voltage output to the Zn-Air cells (therefore no additional step-down regulator is necessary), is rechargeable and available in form factors that are the same as those of the standard Zn-Air battery, allowing for a small overall hearing aid unit, making it a very compelling choice.

Why is it then, that a wireless charger is needed? The answer is clear; recharging a battery removes the need for frequently swapping out battery cells; as already mentioned this is very beneficial for the manual dexterity challenge. Combining a wireless charging method with a NiMH battery cell can provide a robust and convenient charging solution. This allows the hearing aid to be sealed and waterproof, thereby reducing the need to open the unit while also protecting it at the same time, thereby increasing reliability and longevity.

**Wireless Power Transfer (WPT)**

An inductive WPT system (as shown in Figure 1) consists of transmitter electronics, a transmit coil, a receive coil, and receiver electronics. Received power depends on many factors: transmit power, coupling between the transmit (Tx) Coil & receive (Rx) coils (distance, alignment, physical properties, ferrites), nearby unrelated metal, as well as component tolerances. In a wireless power transfer system, power is transmitted using an alternating magnetic field. An AC current in the transmit coil generates a magnetic field. When the receive coil is placed in this field, an AC current is induced in the receive coil. The AC current induced at the receive coil is a function of the applied AC current at the transmitter and the coupling between the transmit and receive coils. The power transmission range across the air gap can be improved using resonance by connecting a resonant capacitor to the receiver coil to create an LC tank tuned to the same frequency as the transmit coil AC current frequency.

Historically, to build a WPT charging system required a complex solution: a battery charger, switching buck regulator and WPT circuitry. This complex solution tends to be large and difficult to design.

A wireless power receiver and charger solution which solves the issues outlined requires the following attributes:

- **Wireless charging** – removes the need for frequently swapping of the battery, and allows for a sealed, waterproof, more robust hearing aid.
- **Monolithic solution** – small integrated receiver and WPT circuitry all in 1 IC
- **Temperature compensated charging** – allows for safe charging of the NiMH battery
- **Zn-Air battery detection** – the hearing aid may function with either NiMH or Zn-Air batteries. A rechargeable NiMH cell is for normal use, but in an emergency when the user may have forgotten to charge the NiMH cell, a non-rechargeable Zn-Air battery cell can be safely inserted and the LTC4123 will ensure that it does not charge it (therefore not damaging it).
- **Reverse polarity detection** – stops charging in case batteries inserted backward
- **Charge status indication** – so the user knows when to recharge the battery
- **Charging safety timer** – safety and protection for the battery
- **Hot/Cold detection** – pauses charging if the battery temperature goes to extremes
- **Overall tiny solution size**

To address these specific needs, Linear has introduced the LTC4123. It is a 30mW wireless receiver with a constant-current/constant-voltage linear charger for NiMH batteries. An external resonant LC tank connected to the device enables the IC to receive power wirelessly from an alternating magnetic field generated by a transmit coil. Integrated power management circuitry converts the coupled AC current into the DC current required to charge the battery. Wireless charging allows for a completely sealed product and eliminates the need to constantly replace Zn-Air primary batteries.
However, for products that demand the flexibility of operating from multiple battery chemistries, the Zn-Air detection feature in LTC4123 allows the same application circuit to work interchangeably with both rechargeable NiMH batteries and primary Zn-Air batteries. Both battery types can directly power a hearing aid ASIC without the need for additional voltage conversion. By contrast, a 3.7V Li-Ion battery requires a step-down regulator in addition to wireless battery charging functionality to power the ASIC.

The LTC4123 rectifies AC power from the receive coil and can also accept a 2.2V to 5V input to power a full-featured constant-current/constant-voltage battery charger. Features of the charger include programmable charge current up to 25mA, a temperature compensated single-cell 1.5V battery charge voltage with ±1% accuracy, charge status indication and an onboard safety charge termination timer. The temperature-compensated charge voltage protects the NiMH battery and prevents overcharging. It prevents charging when batteries are inserted with reverse polarity and pauses charging if the temperature becomes too hot or too cold.

An inductive wireless power system consists of transmitter electronics, transmit coil, receiver electronics and a receive coil. The LTC4123 forms the basis for the receiver electronics in such a system. The receive coil can be integrated into the receiver electronics printed circuit board (PCB). An external resonant LC tank connected to the ACIN pin allows the device to receive power wirelessly from an alternating magnetic field generated by a transmit coil. An LTC6990 TimerBlox Voltage Controlled Silicon Oscillator can be used as a transmitter.

**Architecture advantages**

The LTC4123 solution has the following architecture advantages compared to a Li-Ion + step-down regulator based multi-chip approach:

1. Single-cell NiMH rechargeable batteries are a drop-in replacement for the standard hearing aid application Zinc-Air (Zn-Air) primary cells
2. NiMH may not provide as much runtime as a Li-Ion solution for a given battery size, however its runtime is adequate for the application.
3. No need for an additional step-down voltage regulation stage, thus reducing solution size, complexity and cost without concern for EMI/EMC switching frequency noise interfering with the audio quality.
4. Very simple one-chip wireless charging solution for NiMH battery chemistries.

The LTC4123-based rechargeable NiMH powered solution offers hearing aid designers excellent features and ease of implementation. The NiMH cell has nearly identical voltage output to the Zn-Air cells, is rechargeable and has form factors that are virtually the same as those of the standard Zn-Air battery. The LTC4123 adds wireless rechargability and extensive protection features to a hearing aid or other wearable devices with very little change to the system.
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