# 1 Intel Atom - Enabling the Next Generation of Embedded Modules

The worldwide acceptance of IEC 61850 and the trends in the development of different distributed applications based on the station and process bus communications defined in the standard are pushing the protection, automation and control industry towards development of a new generation of devices that can meet new design criteria. It appears that just in time Intel has introduced a new generation of processors that can help in meeting the new requirements.

As Intel's Executive Vice-President Sean Maloney said: "*This is our smallest processor built with the world's smallest transistors. The Intel® Atom™ processor is based on an entirely new design, built for low power and designed specifically for a new wave of Mobile Internet Devices and simple, low-cost PC's. This small wonder is a fundamental new shift in design, small yet powerful enough to enable a big Internet experience on these new devices. We believe it will unleash new innovation across the industry.*"

The Intel Atom processor is based on a new micro-architecture implemented on a chip that is less than 25 mm². It uses the smallest transistors with excellent performance enabled by all new hafnium-infused 45nm high-k silicon technology that allows it to pack 47 million transistors.

The chips have a thermal design power (TDP) specification in 0.6-2.5 watt range and depending on customer need scale up to 0.8 to 1.8GHz speeds. By comparison, today's mainstream mobile Core 2 Duo processors have a TDP in the 35-watt range.

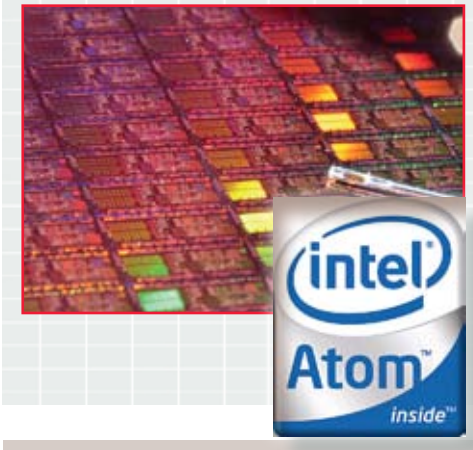
Using lead-free and halogen-free manufacturing, the Intel Atom processor is the first in Intel's lineup to eliminate halogen and lead products altogether. It is designed specifically for small devices and low power, while maintaining the Intel® Core™ 2 Duo instruction set compatibility.

The design also includes support for multiple threads for better performance and increased system responsiveness. Up to 11 Intel Atom processor can fit in an area the size of an American penny. It enables a new generation of powerful and energy-efficient Mobile Internet Devices (MIDs) and a new category of simple devices for the internet called netbooks and nettops that will be available at affordable prices.

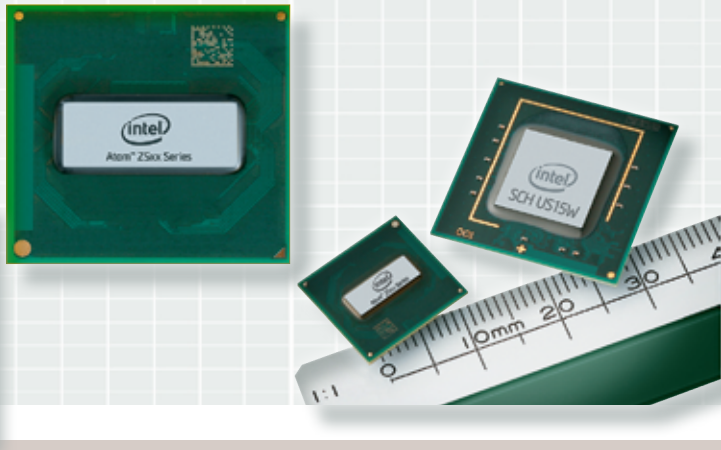
**More information can be found at**:
http://www.intel.com/technology/atom/index.htm. ■

*Images courtesy of Intel*

The Intel Atom processor allows the design of small, lightweight, thermally constrained, fanless embedded applications.




**Intel Atom Logo**

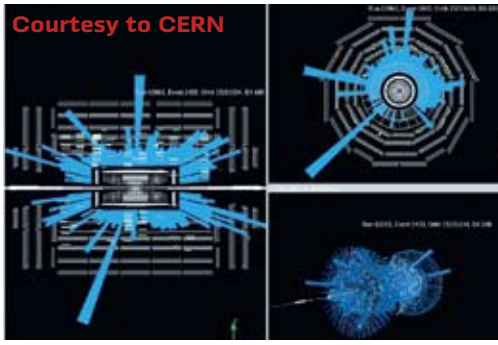



**Intel's smallest processor is less than 25 mm²**

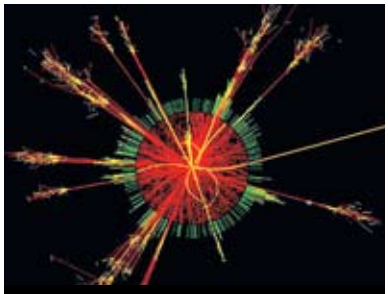
# 2 The Large Hadron Collider
## LHC - The Biggest Toy in the World

**The biggest toy in the world** was delivered to physicists at 10:28 in the morning on 10 September 2008. The first beam in the Large Hadron Collider (LHC) at CERN (the European Organization for Nuclear Research) was successfully steered around the full 27 kilometers of the world's most powerful particle accelerator on the Swiss/French border.
It is expected that the huge and extremely complex machine will allow scientist to reproduce the conditions following the Big Bang and improve their understanding of subatomic particles.
Deciphering the name, it is clear why it is called Large. Hadron is used in the name because it accelerates hadrons – in this case protons. Since the function of the machine is to accelerate two beams of particles traveling in opposite directions, which collide at four points where the two rings intersect – it is a collider. There is a lot that can be learned from working on a large particle accelerator. The complete system includes thousands of individual elements that have to be synchronized to under a billionth of a second, and beams finer than a human hair have to be brought into head-on collision.
To get an idea of the LHC, we need to consider the fact that there are a total of 9300 magnets inside, cooled down to -271.3°C (1.9 K) by the largest cryogenic system in the world. At full power, trillions of protons will race around the ring 11245 times/second, traveling at 0.999999991 times the speed of light. Two beams of protons will each travel at a maximum energy of 7 TeV (tera-electronvolt), corresponding to head-to-head collisions of 14 TeV. To produce all that, the LHC consumes a total of 120 MW electric power provided primarily by the French company EDF.
When two beams of protons collide, they will generate temperatures more than 100000 times hotter than the heart of the Sun, concentrated within a minuscule space. To sample and record the results of up to 600 million proton collisions/sec, engineers have built gigantic devices that measure particles with micron precision. The trigger system registers the location of the particles to millionths of a meter. Six experiments are installed at the LHC:
A Large Ion Collider Experiment (ALICE), ATLAS, the Compact Muon Solenoid (CMS), the Large Hadron Collider beauty (LHCb) experiment, the Large Hadron Collider forward (LHCf) experiment and the TOTal Elastic and diffractive cross section Measurement (TOTEM) experiment.
The data recorded by the experiments at LHC is expected to be about 15 petabytes (15 million gigabytes) of data annually – enough to fill more than 1.7 million dual-layer DVDs. The data analysis will be performed by the Grid - tens of thousands of computers located around the world being used in a distributed computing network.
The LHC will recreate the natural phenomena of cosmic rays and is expected to produce microscopic black holes, as well as different hypothetical particles. The unknowns related to the behavior of the black holes have raised concerns about the safety of the project.
Further information on these issues can be found in the Legal Issues section on page 53. ■

**Images:** Courtesy to CERN



**Tungsteen block at point 5:** **The debris of particles picked up in the detector´s calorimeters and muon chambers.**

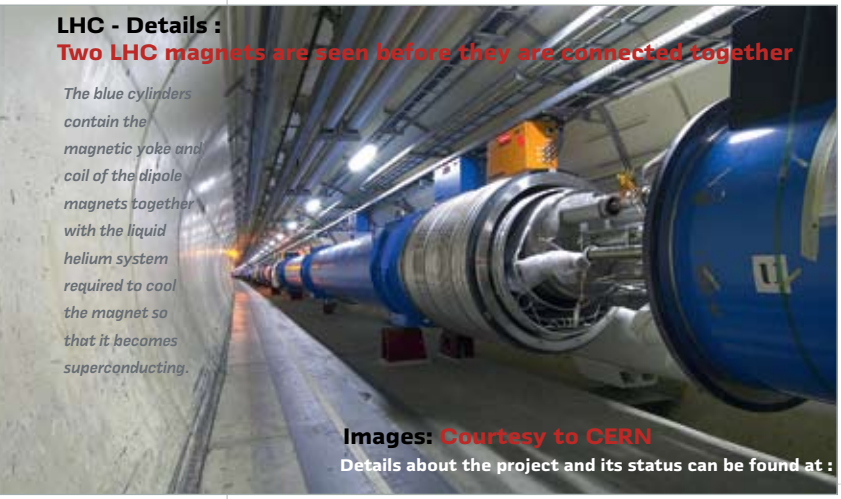


**Simulated black hole in ATLAS:**

**Such a small black hole would decay instantly via a process known as Hawking radiation.**

**LHC - Details :**
**Two LHC magnets are seen before they are connected together**

*The blue cylinders contain the magnetic yoke and coil of the dipole magnets together with the liquid helium system required to cool the magnet so that it becomes superconducting.*



**Images:** Courtesy to CERN

**Details about the project and its status can be found at :**
**http://public.web.cern.ch/public/en/LHC/LHC-en.html**

# 3 Tesla Roadster energy solutions

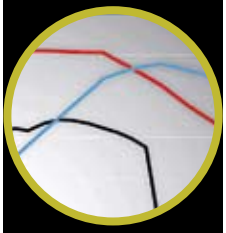
*Tesla Roadster - the first electric sports car*

THE DRAMATIC INCREASE OF OIL PRICES during the first three quarters of 2008 has resulted in a significant increase of alternative vehicles. Many of the established car manufacturers have announced their intentions to deliver electric cars to the market – some later next year, with others following in 2010. In the meantime, there are several low-end electric vehicles that can be seen on the streets of many cities around the world. However, they can not be registered as cars, but something else, depending on the country. This is not the case with the Tesla Roadster – a really exciting vehicle that is already in production in California, USA.

The lightweight two-seat sports car has a 248 hp (185 kW) electric motor, a 220 mi (350 km) range and 3.9 sec 0 to 60 mph (96 kmph) acceleration - a real low-emissions alternative to Ferrari and Porsche.

Tesla first began building the Roadster in March 2008. After some power train issues have been resolved, the company plans to produce twenty cars per week by December 2008. A maximum output of forty cars per week should be reached by March 2009. The price of almost 100 K USD will make it hard for PAC engineers to get one, but there are many more affordable electric vehicles on their way, as demonstrated in the Paris auto-show. We will talk about them in the next issue of PAC World.

Steering wheel and dash-board



Tesla Torque curve
Tesla Power curve
4-cylinder high-performance engine Torque curve

The design of the Tesla Roadster includes many multi-use components, such as a high-performance AC motor that can run forwards and backwards, the battery box, and air ducts that double as energy-absorbing zones. The Power Electronics Module (PEM) performs motor torque control, regenerative braking control and charging. The 375 volt AC induction electric motor is air-cooled and with a variable frequency drive. The power train is a single-speed unit.

More information can be found at: http://www.teslamotors.com/ ■

**Tesla is a startup company located in San Carlos, California, USA.**