

## Network-on-Chip Interconnect Semiconductor IP for System on Chip Makers



**Charles Janac**  
President & CEO

### About Arteris

Arteris provides Network-on-Chip (NoC) interconnect semiconductor intellectual property (IP) to System on Chip (SoC) makers so they can reduce cycle time, increase margins, and easily add functionality. Arteris invented the industry's first commercial network on chip (NoC) SoC interconnect IP solutions and is the industry leader. Unlike traditional solutions, Arteris interconnect plug-and-play technology is flexible and efficient, allowing designers to optimize for throughput, low power, latency and floorplan.

Arteris is different because we were founded by networking experts who applied their knowledge to the problems of SoC development. As SoC makers added more IP blocks to chips, traditional bus and crossbar means to communication became very inefficient, resulting in serious pain to architects, designers, and integrators: Massive numbers of wires, failed timing closure, increased heat and power consumption, and spaghetti-like routing congestion lead to increased die area as well as costly schedule delays. These problems were compounded when there were IP changes late in the design cycle or when management expected the next derivative version of the chip to be on time and risk free because only a few IP blocks were changed.

**Interview conducted by: Lynn Fosse, Senior Editor, CEOCFO Magazine**

**CEOCFO: Mr. Janac, your website indicates Arteris is the Network-on-Chip Interconnect IP company. How so?**

**Mr. Janac:** We make networks that operate inside semiconductor chips. Arteris pioneered the idea that instead of sending just basic electrical signals between the various blocks of a semiconductor chip, you convert all the signals to packets, allowing you to have lower power, fewer wires, and fewer transistor gates inside a chip. This technology has become so extensively deployed in multiple semiconductor systems that it is now to the point where nearly all of the new cell phones that you can buy, the most modern ones, have some Arteris interconnect inside.

**CEOCFO: How are you able to develop something that clearly others have not?**

**Mr. Janac:** It is actually a simple idea. However, at ground level it is very technical. Networking in the office environment with routers, switches, and buffers has been around since the 80s. We scaled down and adapted networking technology from the macro-space to the point where it became effective to use inside of a chip. What drove the adoption was that the chips had become very complex and instead of everyone building their own pieces of the chip or every last piece of the chip internally, they started licensing commercial IP blocks from other sources. Companies such as ARM and Synopsys basically wound up selling a prepackaged IP or configurable IP to the semiconductor manufacturers and we wound up connecting all of that IP based on the customer's own architecture in a more efficient manner than it was possible to do in any other way. You have issues of dealing with a huge number of blocks, I/Os and wires; when dealing with chip complexity and IP blocks coming from multiple sources, packets are better than just ordinary electrical signals.

**CEOCFO: Are you working with an individual company? Would any one of these companies come to you for a custom solution or do you have a set group of products?**

**Mr. Janac:** We have tried very hard to have one product that satisfies the requirements of multiple companies. If you allow your product to have custom versions, you then wind up having to verify the quality of too many products and versions. We very much tried to keep down to a single main product that has some options. The product has an architecture where we can add small pieces specific to an individual customer, and then either keep the feature proprietary to the customer with keys or make it available to the entire market.

**CEOCFO: You have figured it out!**

**Mr. Janac:** It is an elegant architecture that allows for customization without breaking the product into pieces. If you think about it, there are only three viable business strategies out there. You have innovation strategies, which means you always have to be technically ahead of everyone else. You can have an operationally efficient strategy where you can

have it any color as long as it is black, as Henry Ford used to say. The product is very cost effective, high quality and your job is to get everyone to buy the product as-is. When customers want customizations, you say “no,” otherwise it would destroy the operational efficiency. Arteris pursues a customer intimacy strategy where we are following what the customer needs to get done, and our job is to say yes to the customer, but in a very smart and efficient way so we are able to deliver without breaking the product into unsustainable pieces.

**CEOCFO: *How does an engagement work when a company comes to you? How much is it back and forth to add on what they need and do they know what they need and want?***

**Mr. Janac:** There is a negotiation that takes place between what the customer needs and what we are able to deliver within a specified time frame. There is a discussion between our application engineers and the customer’s technical people, typically. When we were young, and we have been shipping since 2006, the requests for the customizations were fairly numerous and extensive. We now have a pretty mature technology, mature product and mature customer relationships. Those requests are not very numerous. We pretty much have most of what the market requires that has been built up over the last seven years that we have been shipping the product.

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**CEOCFO: *What about new technologies and concepts? How are you staying ahead and do you worry at all that someone will come up with a concept that people will think is better?***

**Mr. Janac:** Yes, you always worry. One of the hardest parts about this business is that it is never static because our customers’ chips are increasing in complexity. They are going down the process curve. When we started, state of the art was 90-micron geometries, and 130-micron geometries were considered mainstream. Now most of the designs take place in 28- or 20-nanometer processes, even down to 16-nanometer geometries. People are talking about ten nanometers, which I think is about twenty atoms wide or something. This causes tremendous technological changes. There is going to be a forced migration for chips to become three dimensional because it will only make sense to put the big digital dies on these latest digital processes, and put the analog functions and memories in a separate, stacked dies. Not only will you be communicating in two dimensions but you will also be communicating in three dimensions. There are issues that some electronics have become disposable, so you need to be very low cost. There are some semiconductors where there is an increased emphasis on mission criticality. Tesla, BMW and others are talking about autopilots for self-driving cars, so some of these electronics have to be made mission critical, with redundancy, fault tolerance and other safety features. The changes are always constant and this is why you have to have a customer intimacy strategy. Our job is to follow the customer, give them what they need while every five or six years introducing very major pieces of innovation that Arteris created. This is a dynamic market.

**CEOCFO: *What are you working on now?***

**Mr. Janac:** We just shipped something called a resilient network on chip, which is targeted at mission critical electronics: Automotive, medical, avionics, robotics, industrial, automation and those types of markets. In these resilience features, every piece of our interconnect that transforms a packet is duplicated so that you can compare the functional signal against the reference signal, which is typically delayed by one or two cycles. When they agree, you know that you have a good signal. If they do not agree, you generate a fault and you report it to the higher-level software. That is a basic description of the resilience features we are shipping that out this month. We are constantly working on new interconnect technologies and will be announcing some major products next year.

**CEOCFO: *Do you work directly with companies? Do people purchase through distributors?***

**Mr. Janac:** We learned that our products were too technical and difficult to sell through distributors. We found that both our customers and we are best served with direct engagement and communication with our highly technical sales people and application engineers, and in some cases even our engineering folks, so that we can thoroughly understand the customer requirements and deliver what is needed. We license a high-touch product.

**CEOCFO: *What did you learn from your undergraduate in organic chemistry that has helped you in the business world?***

**Mr. Janac:** I learned that I did not want to spend my life synthesizing organic molecules!

**CEOCFO: *What have you taken from the MBA training that has been relevant in the real world or do you find that it was not as important as you or Stanford might have thought when you were going?***

**Mr. Janac:** Everyone’s story is different. For me, particularly, going through the Stanford MBA program was absolutely eye opening and life-changing because I come from a family of scientists and engineers, where business was just not

discussed. Learning about the impacts of finance, investments and sales management were very eye opening. I loved it and I use the concepts pretty much every day. I wished that I had spent even more time there and paid even closer attention to some of the courses. I have learned a lot there. One of the most important courses was a course at the end of the MBA program where you look at a company from the eyes of a CEO and where you have to try to put all the different pieces of an organization together and make it play together. That was very useful in later years.

**CEOFO: *How is business today?***

**Mr. Janac:** Business is good. Last year we did a transaction where we sold certain technology assets to Qualcomm so we have been busily rebuilding that part of the organization. Semiconductor IP is the foundation of many of these new electronic systems such as mobile phones, electronic watches and automobile subsystems. Our business is quite strong and our strategy is to grow at a moderate rate while never losing a customer and acquiring 8-10 new customers per year. Our goal is being the number one player in this relatively narrow but important market.

**CEOFO: *Why does Arteris stand out?***

**Mr. Janac:** We have had the vision that the SoC interconnect was going to become an increasing part of how all the major semiconductor chips in the world are assembled. We built a technology that met the customers' requirements in terms of technology features and quality and built an organization that is able to support our products on a worldwide basis. We win pretty much every benchmark as long as the chip is complex enough. We not only license our network-on-chip IP to customers but we also help them get their chips out. That combination has served us well.

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**BIO:** Mr. Janac is President and CEO of Arteris where he is responsible for growing and establishing a strong global presence for the company that is pioneering the concept of NoC technology. Charlie's career spans 20 years and multiple industries including electronic design automation, semiconductor capital equipment, nanotechnology and venture capital.

In the first decade of his career, he held various marketing and sales positions at Cadence Design Systems (NYSE: CDN) where he helped build it into one of the ten largest software companies in the world. He joined HLD Systems as president, shifting the company's focus from consulting services to IC floor planning software and building the management, distribution and customer support organizations. He then formed Smart Machines, manufacturer of semiconductor automation equipment and sold it to Brooks Automation (NASDAQ: BRKS). After a year as Entrepreneur-in-Residence at Infinity Capital, a leading early-stage Venture Capital firm, where he consulted on Information Technology investment opportunities, he joined Nanomix as president and CEO helping build this start-up nano-technology company.

Mr. Janac holds a B.S. and M.S. degree in Organic Chemistry from Tufts University and an M.B.A from Stanford Graduate School of Business.

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**THE NETWORK-ON-CHIP COMPANY**

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