



# Research Brief

## Powerful Partners Helping Drive FPGA System Supplier Nallatech's Success

### *Executive Summary*

Nallatech is an industry-leading supplier of field programmable gate array-based (FPGA-based) systems and enabling tools software — as well as a provider of FPGA-design services. The products that it builds are targeted to serve specialized computing needs in the defense and high-performance computing (HPC) markets. And these products are best known for their ease-of-use, quickness to deploy, COTS (commercial off-the-shelf) design, and high performance density.

In the defense marketplace Nallatech has found a home for its systems in the areas of signal intelligence processing; software defined radio; command, control, communications, computers, intelligence, surveillance and reconnaissance (C4ISR). And in the HPC marketplace, Nallatech products are used for computational fluid dynamics; oil and gas exploration; DNA research; and other computational-heavy applications.

From a business perspective, Nallatech is seeking to grow its marketshare in its traditional FPGA markets while finding ways to expand into new markets. And, in order to expand into new markets, Nallatech has structured almost a dozen business partnerships with several HPC hardware and software suppliers/integrators — the most notable of which are IBM and Intel.

- The Nallatech/IBM relationship enables Nallatech to use IBM BladeCenter chassis as its core system design (the BladeCenter holds power supplies, a networking backplane, storage, memory, fans, and other components — Nallatech builds FPGA motherboards that can exploit this design). By using IBM's BladeCenter chassis, Nallatech does not have to design and manufacture entire blade systems designs, the company needs only to build the core FPGA systems boards that drive the blade design. Accordingly, Nallatech saves development and support time/effort/money — while IBM is able to expand its BladeCenter ecosystem offerings.
- The recently announced Nallatech/Intel relationship positions Nallatech as a co-designer of FPGA accelerators and high level design tools that can be used to accelerate the performance of computationally intensive algorithms. For Nallatech, this relationship helps build advanced accelerator expertise while improving its FPGA tool offerings; for Intel, the jointly developed accelerators will help accelerate Intel's QuickAssist Technology strategy.

In this *Research Brief*, *Clabby Analytics* takes a closer look at Nallatech. We examine the evolving HPC marketplace; the role Nallatech is uniquely positioned to play in HPC; the company's product line; and its strategic partnerships. And, after researching this company, its target markets, its key partner relationships, and its business plan, we believe that Nallatech is very well positioned for expansion — especially into new and evolving commercial HPC markets.

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### *Toward Understanding the HPC Marketplace*

In days gone by, the HPC market comprised of large, scaled-up, clustered systems that focused primarily on solving computationally-heavy scientific or complex financial problems. These monoliths or tightly-coupled clusters were large, power-hungry, expensive, and unwieldy — often requiring expansive datacenters with extensive power and cooling systems in order to operate. These systems still play a vital role in the HPC market — there are some visualization applications, for instance, that are best served by this type of architecture. But over the last three years, the market share of monolithic clusters has shrunk dramatically — replaced by low-cost, powerful, multi-core, x86-based commodity servers that can be linked together to create distributed, large-scale, loosely-coupled supercomputers.

These low-cost, distributed, commodity-based supercomputer configurations are opening up new supercomputing market opportunities as supercomputing is now becoming affordable even at the department level. But these new HPC configurations still require a lot of real estate (space); they are still power-hungry; they are complex, costly, and time consuming to deploy; and models and components in these environments are subject to obsolescence in eighteen month (or less) time cycles. Due to these inhibitors, some segments of the HPC market cannot be served by industry-standard, commodity-based HPC configurations.

These segments include the defense industry, as well as commercial environments that are faced with special real estate and mobile requirements. These segments require systems that offer:

- Extremely high performance;
- Low energy consumption;
- Reduced size and weight (as compared with mass-market, general purpose commercial systems);
- Fast deployment/implementation, often in ruggedized mobile environments; and,
- Reduced exposure to obsolescence.

To meet these special requirements, defense and HPC buyers often turn to alternative embedded, commercial off-the-shelf (COTS) solutions from suppliers of general purpose pre-processors (GPPs), digital signal processors (DSPs), or application-specific integrated circuits (ASICs) — or suppliers of systems based on field programmable gate arrays. All of these solutions offer HPC buyers the opportunity to meet their HPC requirements using less real estate within low-power envelopes.

### *Why Choose an FPGA-based Solution?*

What are the trade-offs when evaluating GPP vs. DSP vs. ASIC vs. FPGA solutions? When evaluating these technologies potential buyers should evaluate each device's performance characteristics; size, weight, and power (SWAP) characteristics; implementation cost and risk (due to obsolescence); and total cost of ownership. Comparisons along these lines will show:

- 1) ASICs are strong performers, followed closely by FPGAs;**
- 2) ASIC SWAP characteristics also slightly edge-out FPGAs; and,**

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- 3) FPGAs are significantly more cost effective (especially when considering programming costs and functional flexibility); and,**
- 4) FPGAs are lower risk than GPP, DSP, and ASIC solutions.**

Nallatech would argue that there are several other reasons to choose its products over these alternative approaches. Nallatech claims it offers products and services that are the:

- Easiest to use;
- Quickest;
- Lowest risk;
- Highest performance density;
- Broadest breadth of product range;
- Access to FPGA experts; and,
- Provide XTended COTS support.

But perhaps another way of looking at why an FPGA solution should be chosen is to look closely at FPGA SWAP, implementation, performance and obsolescence claims:

- With respect to performance, Nallatech's FPGA systems have been designed to scale for multiple, concurrent FPGA processing — and these systems feature a high-bandwidth inter-FPGA communications fabric. Fast switching and multiprocessor scalability speak well for Nallatech's claim to be the "quickest" in terms of overall performance.
- With respect to SWAP and particularly power consumption, it can be successfully argued that FPGAs offer greater performance per device; and that they offer reduced power consumption relative to performance.
- With respect to implementation claims — Nallatech offers several programming products and design tools that simplify design and deployment on FPGA-based systems. Nallatech has partnerships with all of the leading suppliers of FPGA compiler tools. Graphical user interfaces and widespread operating environment support help bolster Nallatech's argument that its products are straightforward to implement and comparatively easy to use. And,
- With regard to obsolescence protection, Nallatech protects its customer's investments by ensuring code compatibility between FPGA generations. Further, FPGA code is software — whereas ASIC modifications are often made in hardware (hardware changes and modifications are not a good way to protect against obsolescence). And finally, new FPGA features are evolutionary — they create a superset but don't disable a subset of features that a customer has already been using. All of these features speak strongly in favor of Nallatech's claim that its products help protect against obsolescence.

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### *How Are FPGA Solutions Being Used?*

FPGAs are ideally suited to attack complex floating point problems using advanced algorithms. And some of the most challenging and interesting uses for embedded FPGA systems can be found in the defense industry where FPGA-based systems are being used for C4ISR, software defined radio, and signal intelligence applications. Battle cruisers, destroyers, and submarines have strong needs for FPGA-based systems due to high performance computing requirements (such as targeting and identification) in cramped quarters with real estate restrictions; stealthy unmanned aerial vehicles (UAVs) use FPGA-based systems for communications and signal processing as well as to analyze sensory data. Software defined radio is used to solve problems related to signal compatibility and spectrum usage (the defense industry has the need to support many waveform types while ensuring compatibility across a wide range of devices).

*One Nallatech customer (a U.S. department of defense contractor) that specializes in developing image processing capabilities for UAVs uses Nallatech FPGA-based solutions to provide "see and avoid" technology that is used in helping UAVs avoid being detected and destroyed. These UAVs are compact aircraft — so real estate is precious on board a UAV. And processing sensory data using requires a lot of processing capability in environment where power is at a premium. FPGA-based systems have proven to be ideal for this type of application environment.*

### *Nallatech's FPGA Product Offerings*

Nallatech's solution offerings fall into four categories:

1. Commercial, off-the-shelf FPGA-based hardware motherboards;
2. COTS FPGA-based computing modules;
3. System software/application development tools, libraries, and a function generator; and,
4. HPC products (accelerator cards, blade products, system solutions, HPC design flow solutions).

Each of these categories are examined more closely in the following subsections. Further product details can be found on [http://www.nallatech.com/?node\\_id=1.2](http://www.nallatech.com/?node_id=1.2) (Nallatech's website).

#### *Nallatech COTS Motherboards and Modules*

Nallatech's hardware line is known as Dime II (DIME means DSP and Image Processing Module for Enhanced FPGAs). This line consists of a variety of FPGA-based offerings including FPGA-based motherboards, several FPGA modular solutions, and FPGA-based carrier cards — all of which can connect to industry standard chassis through one or a variety of the following interconnects: cPCI, VME, PCI and PCI-X, as well as PCI-104.

The company's FPGA modules include FPGA/Digital IO cards, single and dual FPGA cards, and an FPGA/Analog IO series of devices. And Nallatech's carrier card (BenNUEY-VME).

Nallatech's hardware offerings are illustrated in Figure 1 (next page).

**Figure 1: Nallatech Hardware Offerings**



Blade Chassis



FPGA Computing Motherboards



Blade



BenNUEY

*Source: Nallatech — June, 2007*

*Nallatech Software and IP Cores*

To help build software for its FPGA-centric products, Nallatech offers an FPGA Computing Design Toolkit known as DIMETalk. The company also provides its own systems development software (known as FUSE), as well as a MATLAB toolbox (known as FUSE Toolbox for MATLAB):

- DIMETalk 3 abstracts the features of the Nallatech's hardware platforms to provide an easy to use development environment for implementing applications on multi-FPGA systems. This graphical user interface (GUI) environment enables users to develop complex high performance FPGA computing applications more easily, reducing risk, cost and shortening time to market.
- FUSE system software is fundamental to the operation of Nallatech hardware platforms in that it provides configuration, control and communications functionality between host systems and Nallatech FPGA computing hardware. FUSE provides application program interfaces (APIs) that enable programmers to get up and running quickly when communicating with a host PC, server, or single-board computer (SBC). FUSE supports several operating systems and

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programming languages, enabling low risk and straightforward system integration/in-field deployment.

- The FUSE Toolbox for MATLAB facilitates the configuration and control of Nallatech FPGA based computer systems, including data communications, directly from MATLAB, using a provided library of functions. MATLAB is a high-level language/interactive environment that is used by programmers to perform compute-intensive tasks faster than using traditional programming languages and approaches.

### *HPC Products*

Nallatech's HPC product set consists of a variety of products that include an FPGA Accelerator Card (a single, high-performance FPGA compute node); an IBM BladeCenter Expansion Blade (a dual high performance FPGA compute node); two different BladeCenter chassis; and an HPC Software Toolkit to assist in software development on blade systems.

*Clabby Analytics especially likes the fact that Nallatech is using IBM's BladeCenter enclosure as the basis upon which to deploy its FPGA (field programmable gate array) blades. By so doing, NALLATECH does not have to build a complete system in order to bring its products to market. It can rely on IBM to build and test its own enclosure, power and cool that enclosure, and innovate in network design and storage integration within that enclosure. NALLATECH needs only to build what it is good at — FPGAs on a board. Accordingly, NALLATECH doesn't have to spend tons of research and development Euros building and testing a complete system. And because IBM's BladeCenter sells in large volumes, NALLATECH can take advantage of BladeCenter economies of scale which translate into lower build costs for a complete system (and lower purchase prices, therefore, for NALLATECH customers).*

### *Partnerships: The Ultimate Key to Nallatech's Growth*

In reality, Nallatech has three strategic relationships: the aforeto mentioned IBM and Intel relationships, as well as a strong and solid relationship with Xilinx. Xilinx is Nallatech's exclusive supplier of FPGAs — which gives Nallatech early access to any advances in the Xilinx FPGA line. Xilinx is also a Nallatech competitor as it, too, builds FPGA-based systems and components. So far, Nallatech has been able to balance this relationship — working in favor of both companies. Still, working with a competitor can also be seen as an exposure — one that Nallatech will have to carefully manage over time.

Nallatech also has close relationships with several systems integrators as well as other component suppliers. These integrators and component makers include ACT/Technico, AES, Mantaro, RAVE Computing Solutions and RTD,

A closer look at these relationships (as well as the relationships with IBM and Intel) shows a recurring theme — Nallatech does not believe that it has to develop all of its solutions in-house. It turns to IBM for systems, to RTD for ruggedized enclosures and heat-pipe technology,. Companies that try and build it all themselves often find themselves at a disadvantage in HPC. Nallatech is a strong believer in partnering — a sign that bodes well for Nallatech's future.

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### *Summary Observations*

Nallatech is an FPGA-centric supplier of COTS high-performance computing solutions that include FPGA hardware systems, FPGA software development environments, and related design services. Its hardware features integrated, embedded FPGA processors designed to attach to a variety of off-the-shelf or custom-designed computer systems using a variety of industry standard interfaces.

What Nallatech is not, however, is an FPGA vendor (Nallatech makes FPGA-centric systems, not FPGAs); it's not a systems integrator (although it works closely with several systems integrators); and it's not a custom system design services company. Nallatech designs and builds FPGA-centric hardware and software — and provides design assistance — period.

To date, Nallatech has been highly successful in the high-performance embedded computing marketplace believes that Nallatech's designs are also well suited for the general HPC marketplace — especially when high performance, low cost, ease of implementation, SWAP, and reduced exposure to obsolescence are key requirements. Costs in the HPC market (which includes scientific, engineering, financial systems, digital content creation, and other compute intensive applications) are coming down as powerful, commodity-based distributed systems are replacing monolithic supercomputers. We believe that Nallatech is well positioned to capitalize on this move to HPC systems — especially due to its packaging within IBM BladeCenter chassis. The combination of Nallatech's FPGA blades and IBM systems architecture should open numerous new opportunities for Nallatech to gain momentum in traditional HPC markets over the next few years.

In addition to the IBM relationship, Nallatech's relationship with Intel should help the company build additional FPGA programming expertise — as well as help it build more simplified tools for accelerating application development on FPGAs. And the old axiom in computing is "the more applications available on your platform, the greater chances you have to make the sale" applies here. The Nallatech/Intel relationship should help bring applications to each vendors' systems lines — increase sales opportunities.

Ultimately, to open new markets in HPC, Nallatech will need to expand its application base and increase the number of feet it has on the street (sales people). The recent partnerships with IBM and Intel are clearly steps in the right direction. Nallatech will need even more of these types of relationships if it wishes to grow its HPC business in the near term.

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