ADLINK
Leading EDGE COMPUTING

Industrial Grade Computer-on-Modules and
Single Board Computers in Edge Computing

ADLINK Building Blocks Enable Edge Computing

COM Express
SMARC
Qseven
ETX
Mini-ITX
PC/104
ATX
PICMG 1.0
PICMG 1.3



www.adlinktech.com
2017

Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

ADLINK, the IoT, and Computer-on-Module-Enabled Edge Computing

Impact of IoT

By 2020, Gartner predicts that 20.8 billion connected devices will be in use. Nearly one in every three of them will be business-related. This expected growth illustrates the impact that the Internet of Things (IoT) will have on connected industries. Communications between IoT devices – everything from sensors to security systems to vending machines – and their on-premise hubs will constantly interconnect with other systems, continuously collecting or generating data and relaying it to remote data centers for processing. When properly analyzed, this information can transform into useful reports and actionable results for business decision-makers.

The **Internet of Things** is a collection of connected devices, systems, and networking resources (both wired and wireless) situated on public and private networks.



As a growing ecosystem, the IoT offers significant benefits for businesses that can take advantage of it. Sensors deployed into nooks and crannies at the network's edges gather more usable information than a centrally located sensor ever could. These strategically placed IoT devices collect information at faster rates than single sensors, enabling business intelligence and productivity increases that organizations lacking an IoT strategy can't match – at least not without disproportionately larger and less efficient investments in legacy technologies.

Computer-on-modules, or COMs, are one of many IoT building blocks that companies and manufacturers use to develop IoT solutions. Even though COMs are much smaller than common desktop computers, they can incorporate a processor, memory, flash storage, power management, USB, Gigabit Ethernet, and a host of other components able to handle demanding, data-heavy applications. COMs tend to be scalable, cost-effective, and impressively "dense," yielding high computing output from a small physical footprint.

Edge computing is the use of embedded compute devices deployed at the periphery of a network.

Working on The Edge

IT's most effective utilization of the IoT occurs on the outskirts of the network, and in many cases, beyond a company's normal infrastructure. These small computers process incoming data at the source and send refined results back to either an on- or off-premises data center. By decentralizing computation, workloads get distributed and lessen the burden experienced by most other data center infrastructures. This distribution of work at the edge has several advantages:

- **Server Load Reduction:** As computational horsepower off-loads onto remote IoT devices, server hardware gets a smaller footprint on the data center floor. Not only does this reclaim physical space, but transactional workloads will place less burden on local cloud infrastructure, freeing up resources for other projects and processes. Also, data produced on IoT devices will be real-time, eliminating lag caused by transmission delays.
- **Network Load Reduction:** As noted, data processed at the edge is refined and sent back to the data center for further processing and analysis. As opposed to sending raw data that hasn't been processed yet, the IoT model carries the advantage of reducing the amount of network traffic, freeing up bandwidth that can be allocated for other tasks.
- **Geographical Advantages:** A centrally-based operation can directly monitor and process data from a remote facility, but, in the case of sensor-based data collection, it's better to have a distributed collection of sensors physically placed on-site. IoT devices collect data directly at the source, process the information, and send it "home." Processed data becomes streamlined, enabling faster transmission while providing accurate information about monitored objects or environments.
- **Feature Support:** IoT devices are customizable and designed to perform specific tasks or operations. COMs function just like traditional computers with operating systems running specific applications that may not be available on data center servers. For example, operations like clustering and load balancing could be configurable outside the data center. Apps with urgent demands can be deployed more quickly at the network edge, especially when dealing with rapidly changing, up-and-coming technologies, such as ultra-mobility and virtual reality.
- **Security:** Remote processing means that less data transmits over-the-wire, giving malicious entities a smaller target to attack while making the data stream easier to encrypt and protect. Moreover, if an IoT device becomes compromised, it can help compartmentalize the attack so that the exploit doesn't spread to other areas of the network from the remote site.

Of course, deploying IoT into an enterprise environment can be challenging. Problem areas to avoid or mitigate can include:

- **Complex Configurations:** A company can "bite off more than it can chew," especially if unprepared to manage deployed IoT devices. Proper management requires planning, automation, and well-monitored environments. Anything short of a fast, vetted deployment process can consume engineering time and resources.
- **Hacking Vector Increase:** As devices proliferate around a remote location, the chances that one or several IoT devices will be tampered with increases due to the possibility that malicious hackers can find them and overcome their security. Also, if multiple devices are compromised, botnet-like attacks can be used to attack the local network or a company's environment.
- **Data Storms:** Attacks from IoT devices won't always originate maliciously. Misconfigured devices, broken patches, or a weak infrastructure can fall victim, too. Proper safeguards and testing updates before deployment can help protect vulnerable environments.
- **Licensing/Operational Costs:** Costs of IoT device upkeep and maintenance beyond the initial purchase need to be considered. Though devices like COMs are easily upgradeable, when done en masse, these changes require licensing and staff time. Additionally, in the case of custom-built applications, a development team will need to be employed to keep the applications going.
- **Infrastructure Requirements:** Deploying IoT may not be simple. Having the right infrastructure to support hundreds or even thousands of IoT devices requires sufficient bandwidth, the right software to interpret the incoming data flood, and the right kind of computer/cloud hardware to run operations effectively. Careful planning and good foresight should alleviate or eliminate potential problems.

Ultimately, edge computing is a foundation for several other emerging technologies and services that rely on decentralized architecture. Each service, on its own, takes advantage of off-site computing, yet still reports into the larger infrastructure. A sampling of these services include:

- **Grid Computing:** Conceptually, grid computing employs multiple orchestrated IoT devices that share the same end goal. These distributed computers don't need to be geographically close, nor do they have to be of similar design. Rather, grid computing's critical ingredient is that systems can provide the necessary horsepower to complete tasks that a single computer cannot efficiently perform.
- **Fog Computing:** Traditional cloud computing environments run from a centralized location with client endpoints accessing them remotely. Fog computing differs from cloud computing in that a local cloud, or fog, is built where the connecting clients sit at the edge of the network. By being able to provide a shorter connection, fog computing clients get faster response times, as dependencies on distant cloud computing environments are eliminated.
- **Mobile Edge Computing:** To improve on cellular performance, networks can employ a version of edge computing specifically for cellular services. Mobile edge computing, or MEC, takes IoT-based hardware and places it closer to where you would find phones, tablets, and other devices that rely on a cellular signal. Like other edge computing services, MEC helps cut down on network congestion, letting mobile devices transfer data with minimal latency – a key advantage in today's world where cellular data transmission is in such high demand.

Across many different industries, the application of edge computing has produced a mix of results and solutions.

- Local governments adopt the IoT and edge computing to help manage traffic on city streets. By integrating smart devices and public works devices, life can become easier. For example, public works projects, such as parking space sensors, reduce the time needed to find somewhere to park, and smart traffic signals prevent longer than necessary waits at traffic stops.
- Research institutions collect data from remote locations through edge computing. Moreover, multiple participating computers can share data processing, economizing and taking advantage of available CPU cycles across a grid's membership.
- For IT departments, concerns over latency and productivity can spur finding better solutions for running operations at the network edge. Fog computing provides remote offices with a local cloud environment that isn't operating only as a network endpoint. IoT devices, like sensors, security systems, and office automation products can take advantage of the fog.
- For sports and entertainment, MEC is deployed to help broadcast events at large stadiums where cellular devices are widely used throughout the event. Ruggedized wireless cells installed around the stadium help transmit video feeds throughout a venue with minimal lag and stutter.

ADLINK Leads the Way in Edge Computing

ADLINK provides its customers with a wide variety of IoT solutions to help facilitate the move to edge computing. With a company tag line of "Leading EDGE COMPUTING," ADLINK sits in the industrial forefront of designing and manufacturing embedded devices as well as testing, measurement, and automation products. Among its vast inventory, ADLINK has a wide assortment of COMs, computers, and systems that help companies move pertinent services and processes to an edge computing environment. However, before any company can even consider moving to the edge, it should grasp the importance of edge computing.

Performance is paramount. By processing information at the edge, valuable time and resources at an on-premise data center won't be expended by overburdened servers and networking equipment. With these faster results, companies can quickly respond to critical business information with little to no delay. Remote offices and facilities also benefit from closer proximity to data-gathering IoT devices, accelerating local decision making.

Businesses must consider what is needed to build and deploy IoT-based solutions for effective results:

- **Centralized Management:** IoT infrastructure can scale more easily and efficiently when managed from a central location. For admins, not having to jump from system to system is a definite plus, especially if a single console can control multiple devices out at the edge.
- **Interoperability:** Hardware and software used to run an edge computing environment need to be compatible with on-premises data center systems. Having the wrong networking infrastructure, or outdated methodologies can delay a project's deployment.

- **APIs:** Application program interfaces (APIs) help dictate how systems interact with each other. Whether they're written in-house or come packaged with other products, APIs are necessary for developers to build important software gateways that let commands and calls communicate and control edge computing devices.
- **Environmental Reliability:** Another thing to consider is the environmental soundness of your IoT device location. Ruggedized equipment can deliver more reliability in more strenuous or risky settings, but at an additional cost. Evaluating a location and determining if it's hostile or safe enough to run unprotected hardware can prevent loss due to damaged, stolen, or disabled devices.
- **In-house Support:** As with most emerging technologies, having a good support structure is important. Relying on vendor support can delay the expediency that edge computing provides. Experienced staff and a functional support structure should never be overlooked.



Once businesses successfully determine their readiness for edge computing, they can develop and deploy their own IoT solutions with ADLINK's catalog of embedded solutions. Several ADLINK product families specifically target edge-type applications by delivering an optimized mix of high performance and feature breadth with small form factor and extreme durability. They are built to accommodate tomorrow's edge computing applications but with a design robustness that's ready for any environment.

These components interoperate as seamless solutions and are categorized as follows:

- **Computer-on-modules** are considered IoT building blocks. These small modules are fully operational computers when mounted on custom carrier boards designed to meet the application's functionality and I/O requirements.

  ADLINK has a variety of COMs available, with each model targeting specific enterprise needs:

  » **COM Express** – A variety of modules that support processors ranging from Intel® Atom™ to Xeon®, as well as select AMD CPUs. ADLINK COM Express Type 7 platforms are particularly suited to small footprint and/or highly dense server applications requiring 10Gbit bandwidth.

  » **SMARC** – Low-powered modules, typically running under 6W, that target mobile applications and support alternate low-power SOCs and CPUs, including Intel® Atom™, Celeron®, and Pentium® processors, and FreeScale CPUs. The new SMARC 2.0 standard significantly enhances features such as display flexibility (accommodating up to four digital displays, including dual-mode DisplayPort) and higher-performance I/O (two GbE ports, eight USB ports, and more).

  » **Qseven** – Mid-range modules available in a standardized form factor that support Intel® Pentium®, Celeron®, and Atom™ processors.

  » **ETX** – A legacy COM specification with support for graphics, networking, USB, PATA, and PCI/ISA buses. Support for this legacy form factor remains relevant for many customers, even in the era of edge computing, especially in applications requiring more local than cloud processing.



COM Express



SMARC



Qseven



ETX

- **Mini-ITX embedded boards** are a trusted, industrial-grade solution built on an industry standard small form factor. ADLINK's supported range of CPUs within its Mini-ITX line includes Intel® Core™, Pentium®, Celeron®, and Atom™ processors, as well as AMD Embedded R-Series APUs. Mini-ITX embedded boards provide a quick, convenient way to create industrial computing solutions. This small form factor option serves well in a variety of applications, including industrial automation, digital signage, retail, gaming, and medical.
- **ATX industrial motherboards** offer the same range of processors supported by their Mini-ITX siblings. However, these larger motherboards include additional offerings, such as more PCI Express and PCI expansion slots, more memory, and other features that will support more robust applications than many Mini-ITX counterparts. Additionally, ADLINK ATX's all-in-one PCBA design makes for one of the most durable and reliable options when balancing performance and expandability in difficult environments.



Mini-ITX



ATX

The latest ADLINK ATX product is the IMB-M43, an industrial ATX motherboard with 6th generation Intel® Core™ i7/i5/i3 processor.

- **PCI/104-Express** products bring PCI Express performance and versatility to the PC/104 family for today's demanding embedded applications. With features such as conformal coating, fanless operation even under extreme



temperatures, and adherence to ADLINK's stringent Extreme Rugged qualifications, PCI/104-Express provides reliability and a small footprint to a broad range of IoT-era settings.

- **IoT gateways** are edge devices that sit between IoT systems



and the cloud while providing security, translation services for protocols, and data management (storage, filtering, and processing). Available in several models, ADLINK's IoT gateways support Intel processors ranging from Quark™ to Core™ i7.

- **SEMA (Smart Embedded Management Agent)** is ADLINK'S middleware tool that monitors system performance and status, including specific characteristics of the CPU, memory, network information, GPIO control, sleep states, and other board-related information. SEMA middleware communicates with a built-in board

management controller (BMC) installed on every ADLINK COM, SBC, and Mini-ITX product to collect the latest system information. SEMA is a board-level functionality that, when combined with ADLINK's SEMA Cloud solution, turns fleets of edge computing devices into a remotely manageable, data-driven hardware collective.

ADLINK has added to its IoT portfolio with software solutions that enable easy system connectivity and help reduce the complexity of building IIoT applications. Using the Data Distribution Service (DDS) middleware standard to enable scalable, real-time, dependable, high-performance and interoperable data exchanges, ADLINK has moved closer to our goal of providing complete application-ready, generic and domain-specific platforms.

ADLINK and the Building Blocks for Edge Computing

ADLINK presents its customers with the capability to build out their own customized corner of the Internet of Things, and gives companies the opportunity to choose from a variety of deployable hardware solutions while helping to promote innovation, performance, and control. Investment in embedded hardware designs and software targeted at edge computing can help any enterprise fine-tune the critical workflows and processes it needs to stay ahead of the competition.

To see more of what ADLINK has to offer, or to learn more about the company's edge computing services and products, visit the ADLINK website at www.adlinktech.com.

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