

A graphic with a light blue background and a network of white dots and lines. It contains several circular inset images: a doctor at a computer, a person with a stethoscope, a hand holding a tablet with an X-ray, a DNA double helix, and a person's face. A semi-transparent purple box is overlaid on the right side of the graphic.

**Case Study:**  
**Data Acceleration Solution for**  
**Next Generation Sequencing**  
*(Axiomtek's Intelligent Medical Solution)*

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## DNA Sequencing for the Human Genome

DNA sequencing is the technology of determining the order of the base pairs in a DNA segment, which carries genetic information that can be used to understand why and how a disease develops. Discovering the sequence of an entire human genome (the complete set of a human's DNA) makes it possible to administer personalized treatment and medical care according to an individual patient's health, allowing medical experts to apply precision medicine to the diagnosis and treatment of cancer and other genetic diseases, and to ultimately prevent them from developing.

Unlike traditional genome sequencing in the past that required tremendous time to accomplish, sequencing a complete human genome today is much faster, thanks to the adoption of next-generation sequencing (NGS), a highly parallel technique capable of analyzing millions of DNA segments simultaneously, as well as the advanced sequencing machines providing massive storage and powerful computing performance to boost processing speed. An entire genomic sequence of more than three billion DNA strands that once took years to decipher can now be mapped out within a single week. These genomic data, after being further analyzed and structured using AI-driven technologies such as deep learning, can generate accurate clinical models and biological insights to assist physicians in disease prediction and drug selection, enabling customized treatments and health care options that are most appropriate for each patient.

### Challenges for Building Next-Generation Sequencing Systems

Since next-generation sequencing (NGS) relies on enormous computing power to sequence millions of DNA fragments in parallel, CPU performance is a primary concern for manufacturers when building a modern DNA-sequencing system. Other essentials include fast memory access, reliability of reading and writing large datasets, as well as excellent thermal dissipation capability and low-noise operation. Meanwhile, for a sequencing system to be deployed in a lab's or hospital's server room as an auxiliary sequencing machine, the expandability of data acceleration capability should be considered as well.

### Main Requirements

- High-performance CPUs
- High-capacity memories with fast access speed
- High speed and reliable storage, with long-lasting DWPD (Drive Writes Per Day) endurance
- Adaptable and scalable system for complex project needs
- Highly customized service solutions, especially thermal and low-noise design

## Axiomtek's Solutions

Axiomtek provides a wide range of fully customizable embedded solutions, from dual CPU server boards to edge server products, for manufacturers to build DNA-sequencing machines with mega processing power to enhance sequence throughput and algorithm programming, helping genetic scientists achieve fast and accurate DNA analysis in next-generation sequencing research. Axiomtek's dual CPU server board, for instance, is designed with dual Intel® Xeon® CPU architecture to deliver optimal computing performance. It can be customized to adopt two multi-core Intel® Xeon® CPUs, each supporting 12 cores to give the board up to 24 cores of computing power. The server board also has 12 slots of DDR4-2933 ECC DIMM memory with up to 288GB (16GB x 6 + 32GB x 6) capacity, along with 4TB U.2 SSD providing 3G/2.9G RW performance. To accelerate data processing speed and enables simultaneous multitasking, its expansion interface is equipped with 2 riser cards providing 2 PCIe x 16 Gen 3.0 slots for adding data acceleration cards and camera interface boards. This highly customizable server board can further meet the complex requirements of DNA sequencing by including such features as multiple LAN and USB ports, SATA and NVMe interfaces for extensive storage of massive DNA sequencing data, as well as PCIe lanes and expansion interfaces for the integration of data acceleration peripheral cards.

## Axiomtek's Design-In Services

Tailored to the needs of DNA sequencing, Axiomtek's embedded boards and specialized systems are built with a highly adaptable design concept in mind. Axiomtek's design-in services provide crucial help for the customer throughout the entire development process, leading to the creation of a fully customized sequencing system that can perfectly fit individual application demands.

### Benefits of Axiomtek's Design-In Services

**Shortened Development Cycle**



**Fast Time to Market**



**Cost Savings**



**Reduced Design Effort**



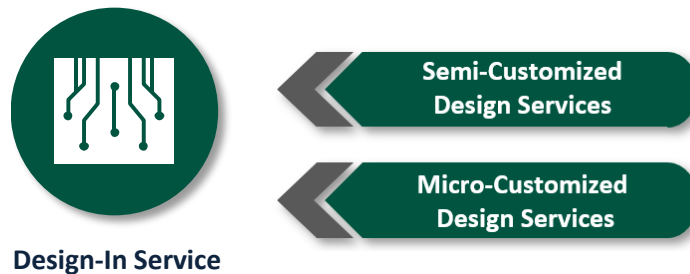
## Design-In Service Process

From conceptual planning, design, testing and validation down to the final shipping and deployment stage, Axiomtek's design-in services offer key assistance in all facets of customization to ensure that the final product will work reliably in mission critical environments. While building a prototype for the customer, Axiomtek takes every critical factor into account through meticulous research and design: whether it is processing speed, storage capacity, noise reduction, heat dissipation, data acceleration, or even peripheral integration, all elements will be carefully thought out, tested, and executed.



## Adjustable Assistance

Aside from fully customizable design, Axiomtek's design-in services are known for their high flexibility. Customers can choose the level of involvement, i.e., semi-customized design services or micro-customized design services, which scales down the amount of assistance Axiomtek provides based on the actual needs of each project. This is made available for customers who desire to do most of their own designs or need help only for specific areas, i.e., re-configuring minor changes on a motherboard. A lower TCO (total cost of ownership) can therefore be achieved.



## Comprehensive Software Support

Going beyond physical services, our design-in services also provide customers with software services, including embedded OS development, software API utility and driver support, as well as BIOS customization. Specifically, the next generation sequencing technology company can utilize our BIOS customization service to personalize their product's boot-up screen and request that each board come pre-installed with an embedded version of Windows OS in order to provide users with an easy-to-use interface.

### Embedded OS Development



### Software API Utility



### Driver Support



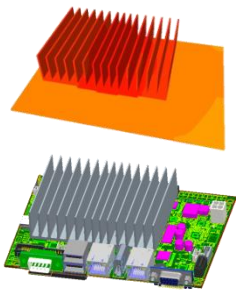
### BIOS Customization



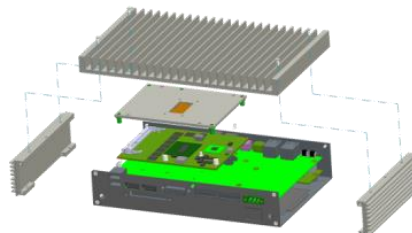
## Thermal Solution

The customer can rely on Axiomtek's thermal solution service to ensure that their embedded boards or system products, despite operating in extreme temperature conditions, have an efficient thermal mechanism to deliver consistently reliable performance with failure prevention. The service includes proven thermal module and enclosure design as well as customizable thermal solution and design support, which guarantee Axiomtek's products are robust enough to operate under harsh circumstances with extreme temperatures.

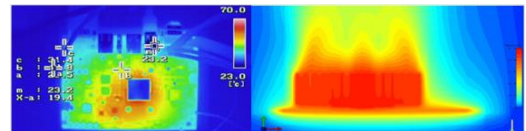
### Proven Thermal Module



### Customized Thermal Solution



### Design Support for Customers



## About Axiomtek Co., Ltd.

Axiomtek has experienced extraordinary growth in the past 30 years because of our people, our years of learning which resulted in our tremendous industry experience, and our desire to deliver well-rounded, easy-to-integrate solutions to our customers. These factors have influenced us to invest in a growing team of engineers including software, hardware, firmware and application engineers. For the next few decades, our success will be determined by our ability to lead with unique technologies for AIoT and serve our key markets with innovatively-designed solution packages of hardware and software – coupled with unmatched engineering and value-added services that will help lessen the challenges faced by our systems integrator, OEM and ODM customers and prospects alike. We will continue to enlist more technology partners and increase collaborations with our growing ecosystem who are leaders in their fields. With such alliances, we will create synergy and better deliver solutions, value and the expertise our customers need.

Axiomtek is a Member of the Intel IoT® Solutions Alliance. A global ecosystem of more than 800 industry leaders, the Alliance offers its Members unique access to Intel technology, expertise, and go-to-market support—accelerating deployment of best-in-class solutions.