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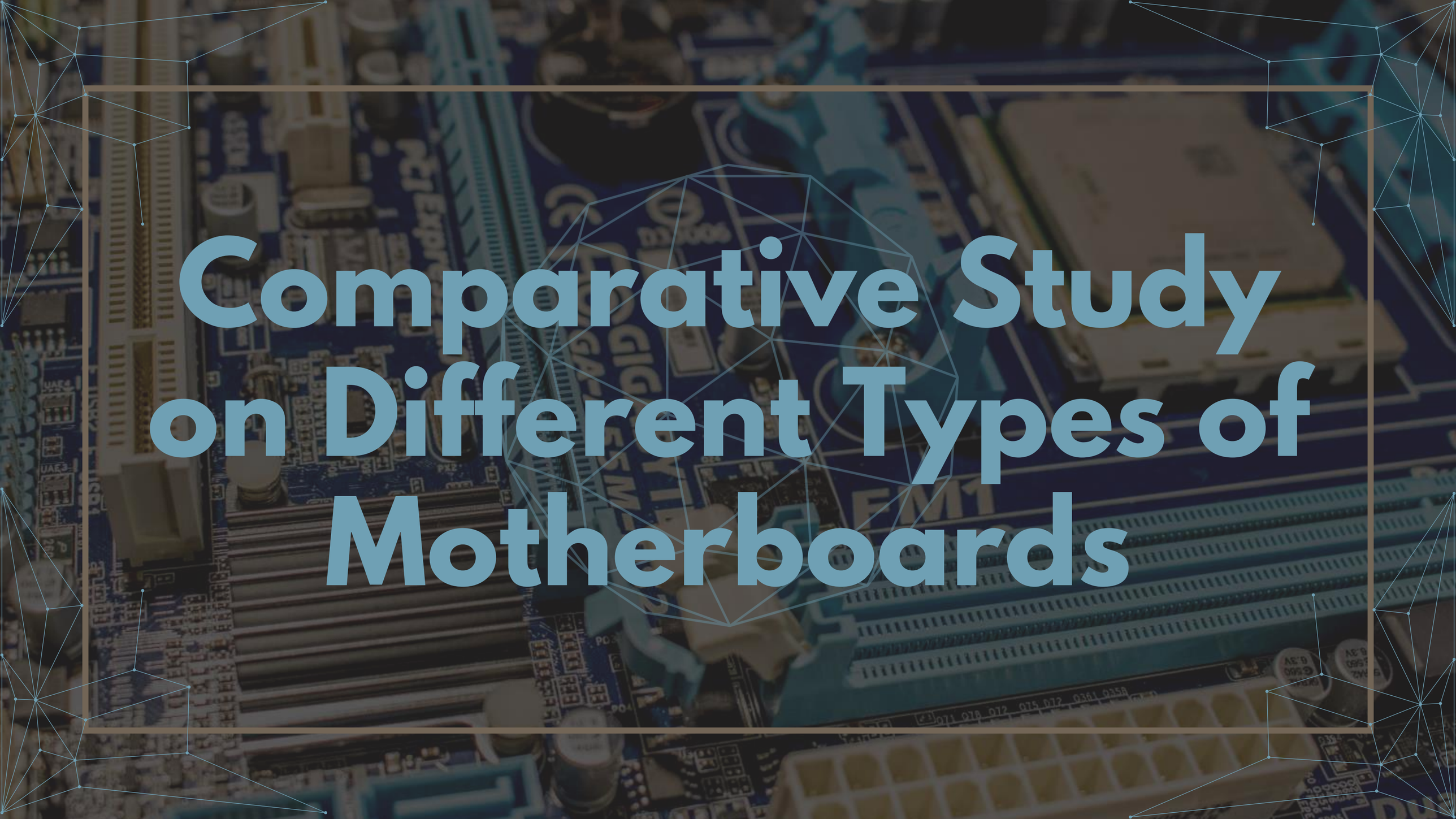
PORTFOLIO #5



Comparative Study on Different Types of Motherboards

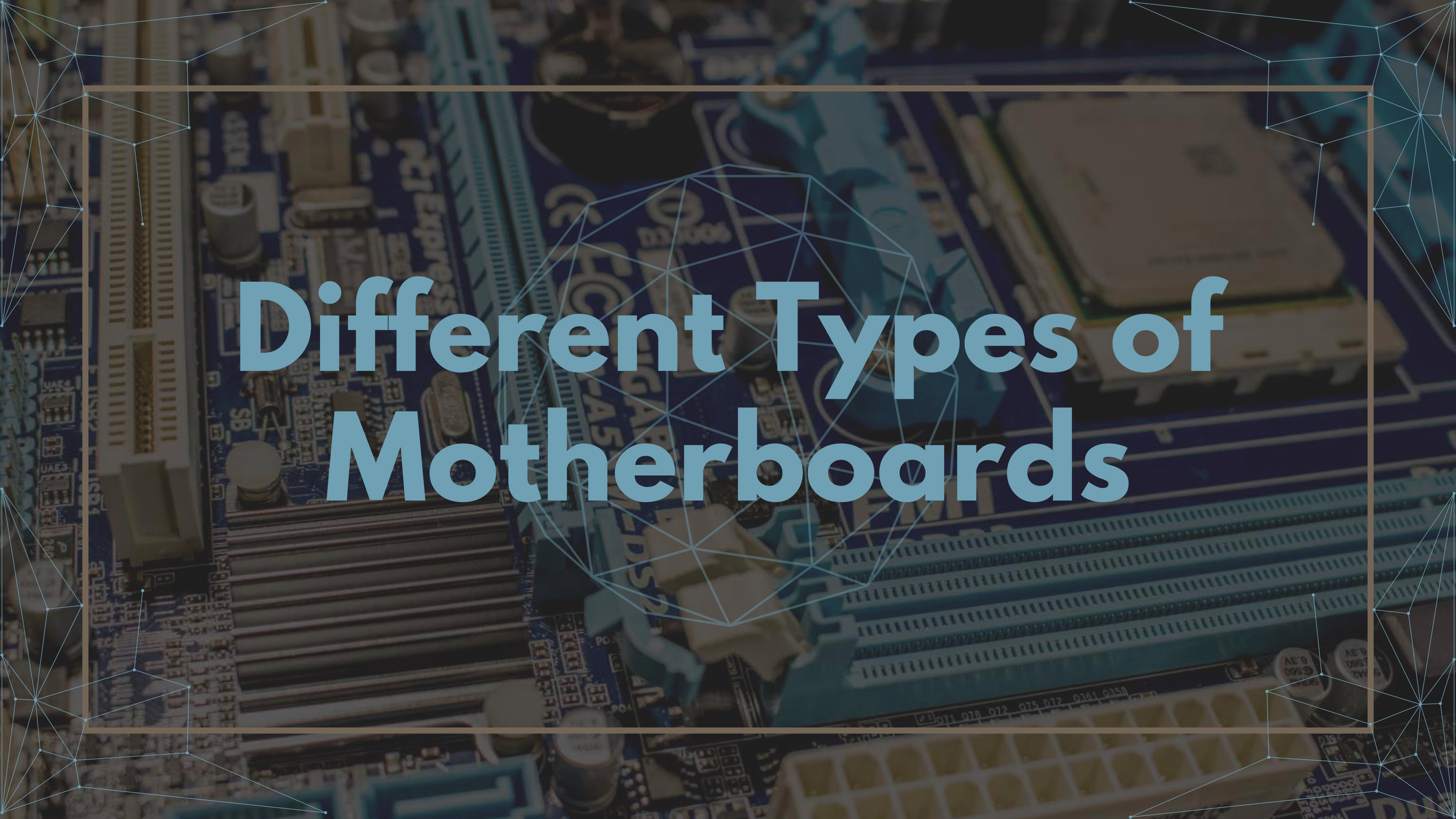
What is a Motherboard?

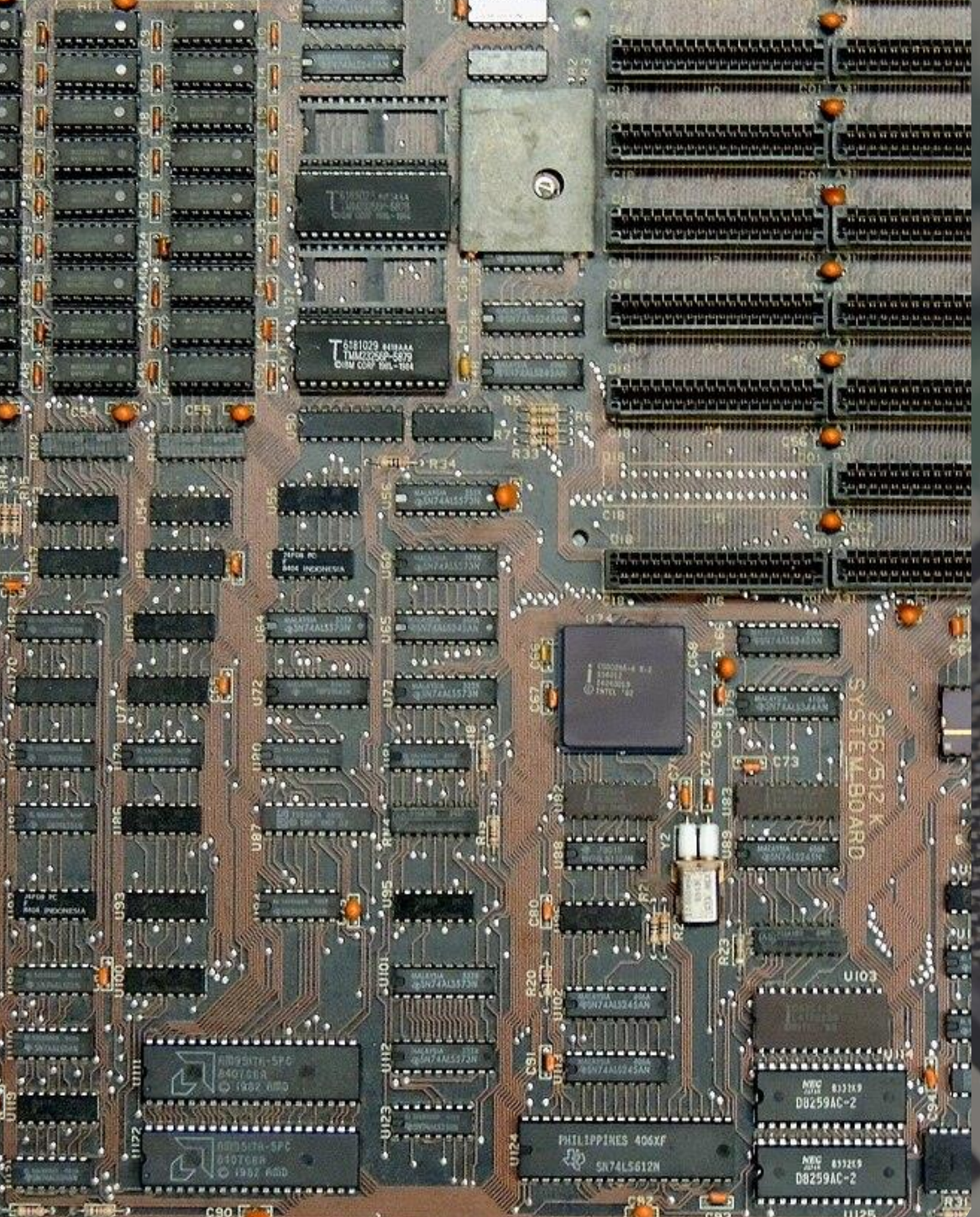
The motherboard, often referred to as the "mainboard" or "system board," is the primary circuit board in a computer. It serves as the central hub connecting all the critical components such as the CPU (Central Processing Unit), RAM (Random Access Memory), GPU (Graphics Processing Unit), storage devices, and peripheral devices.

The type of motherboard used in a computer significantly influences its performance, expansion capabilities, and overall system reliability. This study aims to provide a comparative analysis of different types of motherboards, focusing on their form factors, features, and suitability for various use cases.

Functions of a Motherboard

- **Power Distribution**: Distributes power from the PSU to the components.
- **Processor Interface**: Connects and allows communication with the CPU.
- **Memory Interface**: Manages and connects the system RAM.
- **Data Communication**: Facilitates communication through buses and the chipset.
- **Storage Interface**: Connects and manages data transfer with storage devices.
- **Peripheral Interface**: Provides ports for connecting external devices.
- **Expansion Slots**: Allows additional hardware to be added (e.g., GPUs, sound cards).
- **Audio/Video Interface**: Manages integrated and dedicated audio/video hardware.
- **Networking Interface**: Provides Ethernet, Wi-Fi, and Bluetooth support.
- **Cooling and Heat Management**: Controls and monitors system cooling.
- **BIOS/UEFI Firmware**: Manages system startup and hardware settings.
- **System Clock**: Synchronizes the timing and operations of system components.
- **Security Features**: Implements security mechanisms for the system.


Different Types of
Motherboards



AT Motherboard (1983)

Introduced with the IBM PC/AT, the AT motherboard was one of the first standard motherboards that featured expansion slots and a standard power supply connector.

The AT motherboard was the standard form factor in the 1980s and early 1990s. It was the predecessor to the ATX form factor.

Pros: Large size for expansion and cooling.

Cons: Outdated, inefficient cooling, and large physical dimensions that are no longer suitable for modern builds.

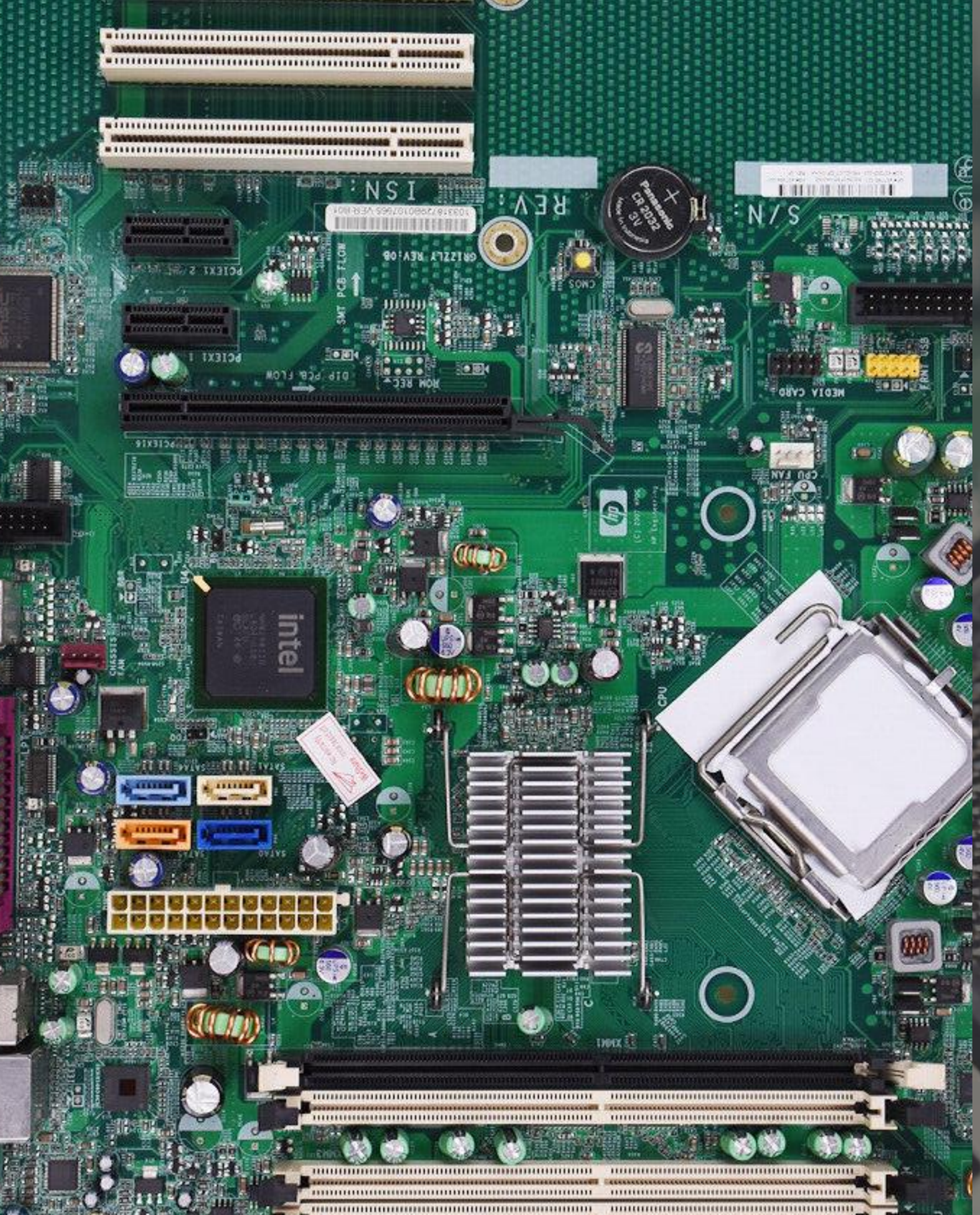
ATX Motherboard (1995)

Introduced by Intel, the ATX motherboard replaced the older AT standard and became the dominant motherboard form factor. It introduced better power management and more room for components and cooling.

ATX motherboards have been the standard for mainstream desktop computers for many years. They are widely used in home, office, and gaming systems.

Pros: Versatile, lots of expansion slots, excellent cooling, and wide compatibility with cases and other components.

Cons: Requires larger cases and power supplies. Can be bulky for smaller or compact builds.



BTX Motherboard (2004)

Developed by Intel to improve thermal management with a better airflow design. However, it did not gain widespread adoption.

BTX was introduced as an alternative to ATX, with the goal of improving cooling. It rotates the motherboard to allow for better airflow.

Pros: Better thermal management and airflow than ATX due to its design. Components are oriented for better cooling.

Cons: Limited adoption and fewer case options, which led to the decline of this form factor.

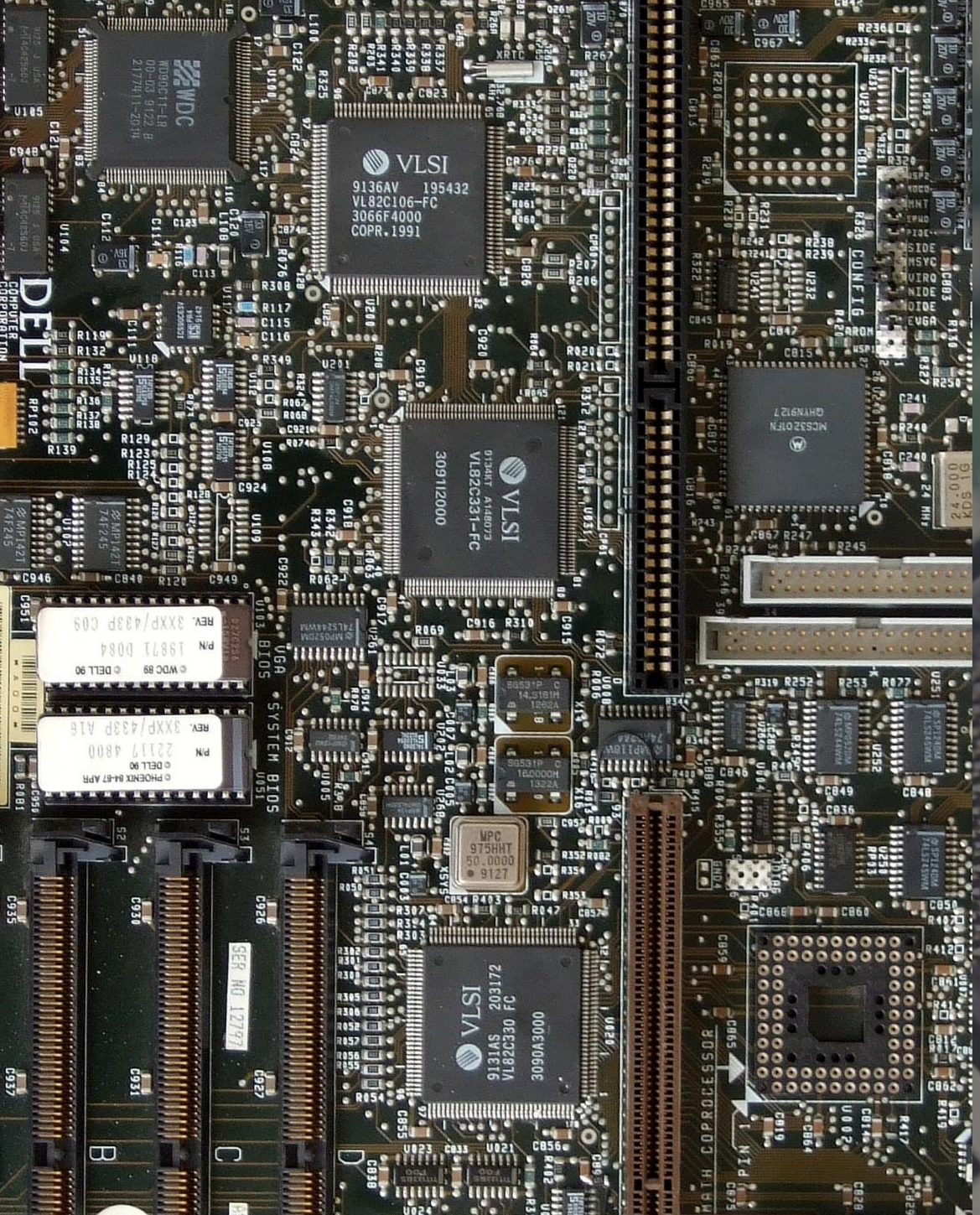
Extended ATX (1996)

A larger version of the ATX motherboard designed for high-end servers and workstations, offering more space for additional components and cooling.

E-ATX is an extension of the ATX standard, designed for high-end systems that need extra space for additional components like multiple GPUs and more RAM.

Pros: Offers more expansion slots, more room for cooling, and is suitable for professional workstations and servers.

Cons: Requires very large cases and high-power supplies, not ideal for compact systems.



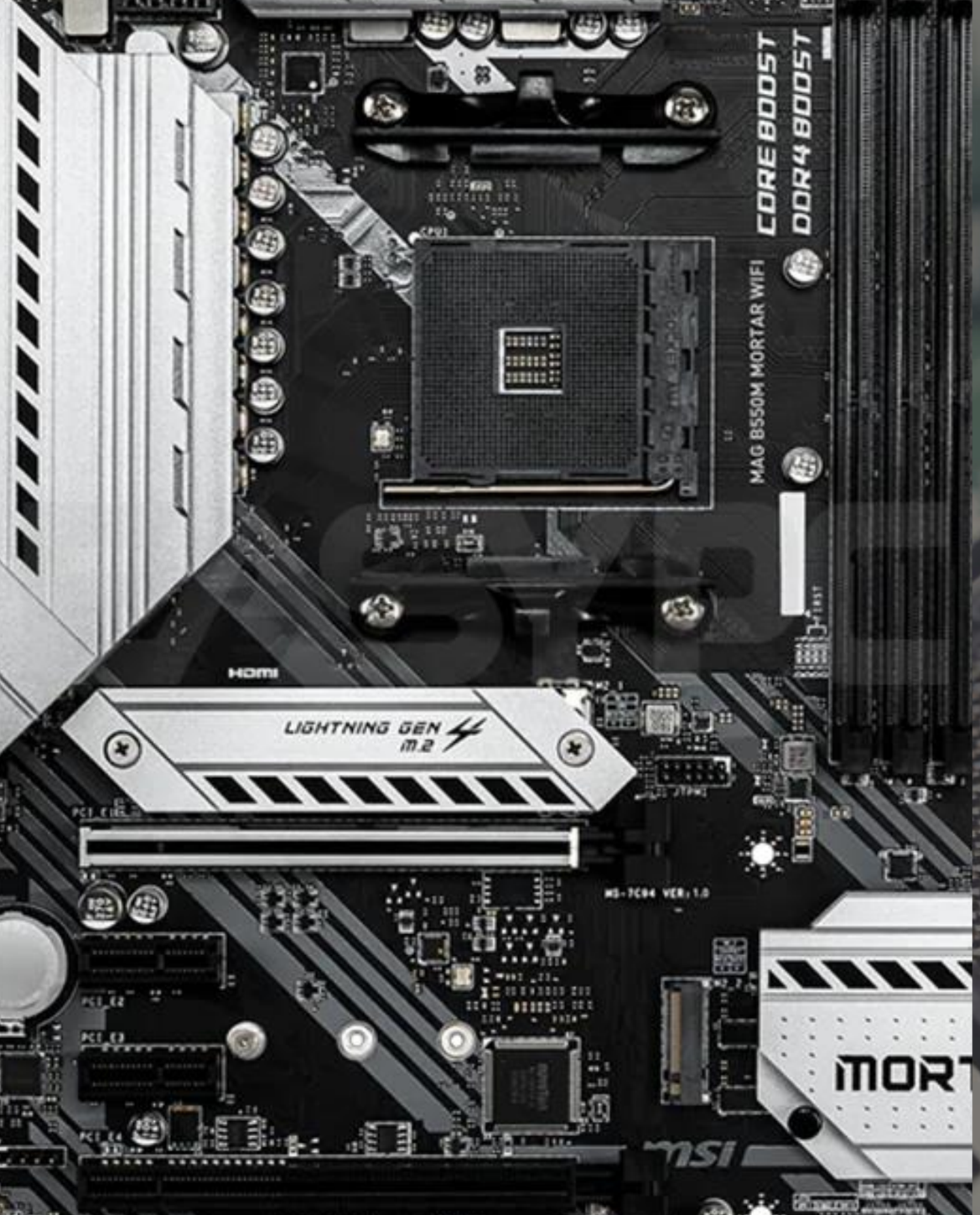
LPX Motherboard (1987)

A larger version of the ATX motherboard designed for high-end servers and workstations, offering more space for additional components and cooling.

LPX was designed as a low-profile form factor for compact desktop systems. It often uses riser cards for expansion slots.

Pros: Compact and energy-efficient.

Cons: Very limited expansion slots and obsolete in most modern computing.



Micro-ATX Motherboard (1997)

Introduced by Intel as a smaller alternative to the ATX motherboard, designed for budget systems and compact cases while retaining expansion options.

Micro-ATX motherboards offer a more compact size than standard ATX while still providing decent expansion options for mainstream systems.

Pros: Affordable, compact, and suitable for budget builds. Offers good performance with some expansion flexibility.

Cons: Limited number of expansion slots compared to ATX, can feel restrictive for high-performance systems.

Mini ITX Motherboard (2001)

Created by VIA Technologies, Mini-ITX is an ultra-compact motherboard form factor designed for low-power, space-efficient systems, often used in home theater PCs (HTPCs) and embedded devices.

Mini-ITX is the smallest mainstream motherboard form factor, ideal for ultra-compact systems like home theater PCs (HTPC) or small office setups.

Pros: Extremely small, low power consumption, and quiet operation.

Cons: Very limited expansion capabilities (typically just one PCIe slot), usually integrated graphics.

Mini ATX Motherboard (1995-2000)

A rare, smaller version of the ATX, typically used for compact desktop builds but not as widely adopted as Micro-ATX or Mini-ITX.

Mini-ATX is a somewhat rare and smaller version of the ATX, offering some benefits of ATX but at a more compact size.

Pros: More compact than standard ATX, still offers a decent number of expansion slots.

Cons: Not as widely supported as microATX and ATX, limited in terms of upgradability.

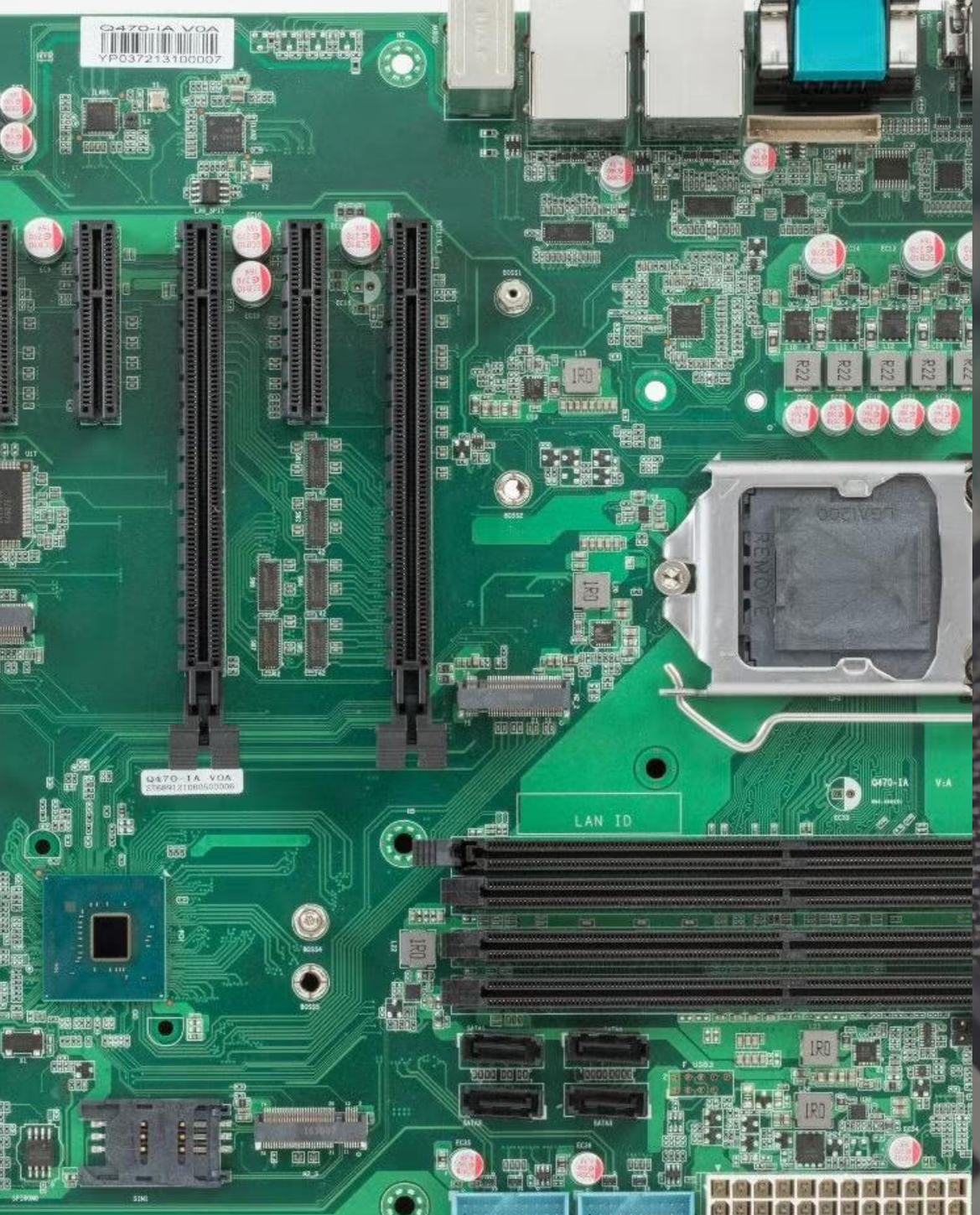
Pico BTX Motherboard (2005)

A very small motherboard format used primarily for ultra-compact systems, it was designed to work with BTX cases to improve thermal performance in small devices.

Pico BTX is one of the smallest motherboard formats, mainly used for ultra-compact systems with minimal expansion requirements.

Pros: Extremely compact size, very low power usage.

Cons: Very few expansion slots, not suited for high-performance systems.



Standard ATX Motherboard (1995)

Same as the ATX motherboard, "Standard ATX" refers to the original ATX form factor that set the standard for desktop computers. It’s essentially the same as the regular ATX introduced by Intel in 1995.

This is the same as the ATX, often referred to as "Standard ATX" to differentiate it from other extended or mini versions.

Pros: Same advantages as the ATX motherboard: flexibility, great expansion potential, and good cooling.

Cons: Larger size, which may not be necessary for all users.

Conclusion

ATX, Extended-ATX, and Standard-ATX motherboards are the go-to choices for users who need full-size desktop PCs with significant expansion capabilities for gaming, professional, or server use.

Micro-ATX and Mini-ATX offer a more compact solution for budget-conscious users or those building in smaller form factors but still require some expansion flexibility.

LPX and BTX represent older or niche form factors that were designed with.

Mini-ITX and Pico BTX are suitable for ultra-compact, low-power systems but have very limited expansion and upgrade options.

Motherboards themselves have historically followed in the lines of computer development: from very large complex systems with separable parts to highly integrated, compact boards able to fit all sorts of peripherals and devices.

Moving away from expandable modular systems like the AT and the ATX form factor to smaller and even more specific form factors, such as Mini-ITX and Pico-ITX, reflects the requirement for much more efficient, high-performance computing based on increasingly smaller, more energy-efficient designs.

Table:

Form Factor	Build	CPU Slots	Memory Slots	Chipsets	BIOS	PCI Slots	SATA	Builtin Features
AT Motherboard	Large, bulky	1-2 (Socketed)	2-4	Older chipsets (e.g., Intel 386/486)	Legacy BIOS (non-UEFI)	3-4 (ISA, PCI)	1-2	Limited expansion, no integrated graphics or modern features
ATX Motherboard	Standard desktop	1 (Socketed)	2-4	Intel chipset, others (e.g., VIA, AMD)	Legacy BIOS or UEFI	Legacy BIOS or UEFI	4-6	Integrated graphics, USB, Audio, Ethernet
BTX Motherboard	Medium-sized	1 (Socketed)	2-4	Intel chipsets	Legacy BIOS or UEFI	Legacy BIOS or UEFI	2-4	Optimized airflow, better thermal management
Extended-ATX Motherboard	Larger, heavy-duty	1 (Socketed)	4-8	Intel chipset, others	UEFI	7-8 (PCIe)	6-8	Multiple GPU support, large RAM capacity, server features
LPX Motherboard	Compact, low-profile	1-2 (Socketed)	2-3	VIA chipsets	Legacy BIOS	2-3 (PCI)	1-2	Low-profile design, limited expandability
Micro-ATX Motherboard	Compact desktop	1 (Socketed)	2-4	Intel, AMD chipsets	UEFI	4-5 (PCI, PCIe)	4	Integrated graphics, USB 3.0, Audio, Ethernet
Mini ITX Motherboard	Ultra-compact	1 (Socketed)	1-2	VIA, Intel chipsets	UEFI	1-2 (PCIe)	2	Low power consumption, HDMI, Wi-Fi, Bluetooth
Mini-ATX Motherboard	Compact desktop	1 (Socketed)	2-4	Various chipsets	Legacy BIOS or UEFI	3-4 (PCIe)	2-3	Similar to Micro-ATX, but less common
Pico BTX Motherboard	Ultra-compact	1 (Socketed)	2	Intel chipsets	Legacy BIOS	1-2 (PCIe)	2	Ultra-small, low power, limited I/O and expansion
Standard-ATX Motherboard	Standard desktop	1 (Socketed)	2-4	Intel, AMD chipsets	Legacy BIOS or UEFI	5-7 (PCI, PCIe)	4-6	Integrated graphics, USB, Ethernet, Audio

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Thank You!