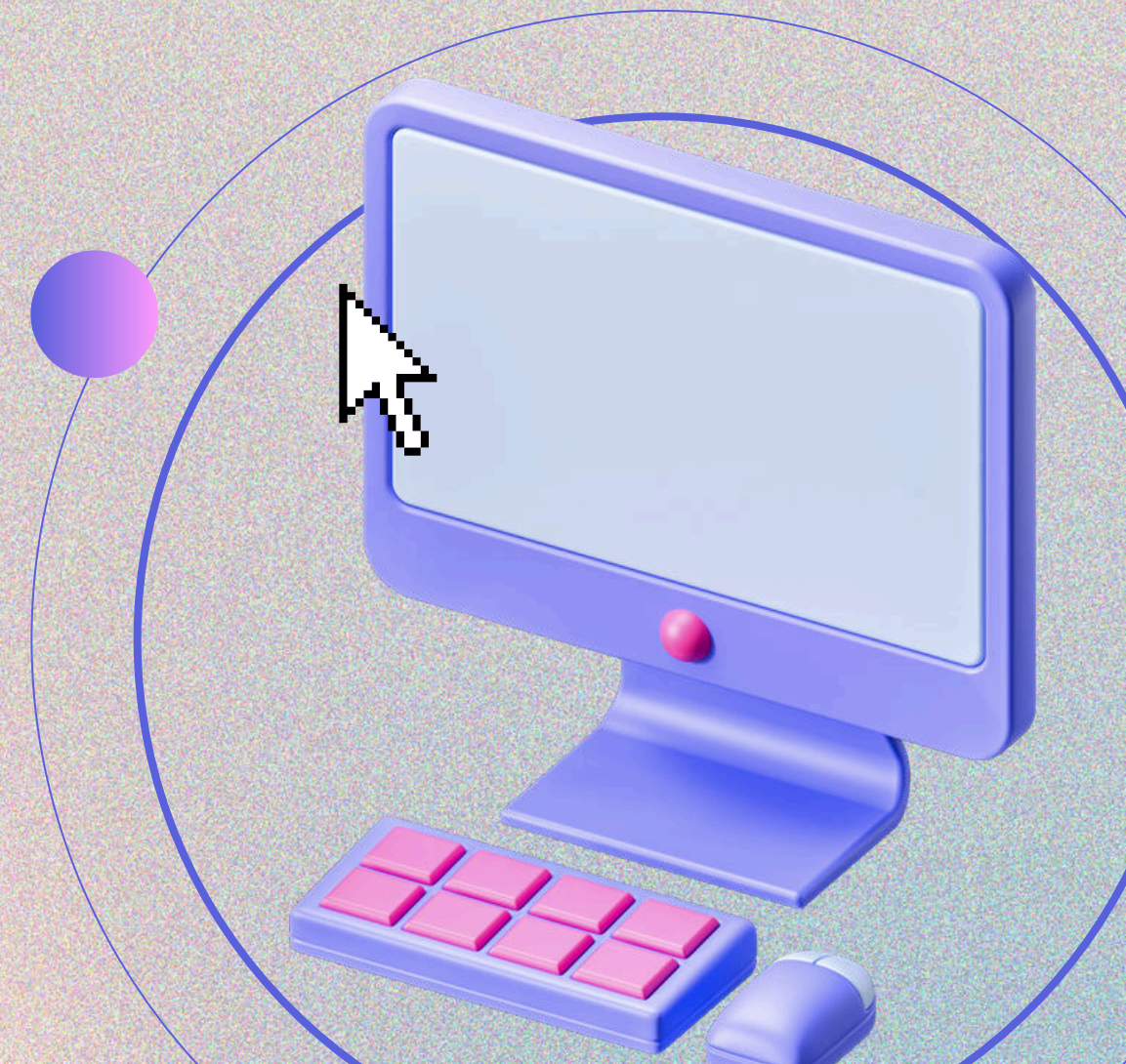
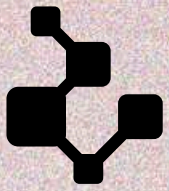




THE FIVE GENERATIONS OF COMPUTERS

CHAPTER 2





GENERATIONS OF COMPUTER

- The computer has evolved from a large-sized simple calculating machine to a smaller but much more powerful machine.
- The evolution of computers to their current condition is characterized by the generations of computing technology.
- Each generation of computer is developed based on a new technical advancement, resulting in better, cheaper and smaller computers that are more powerful, faster and efficient than their predecessors.

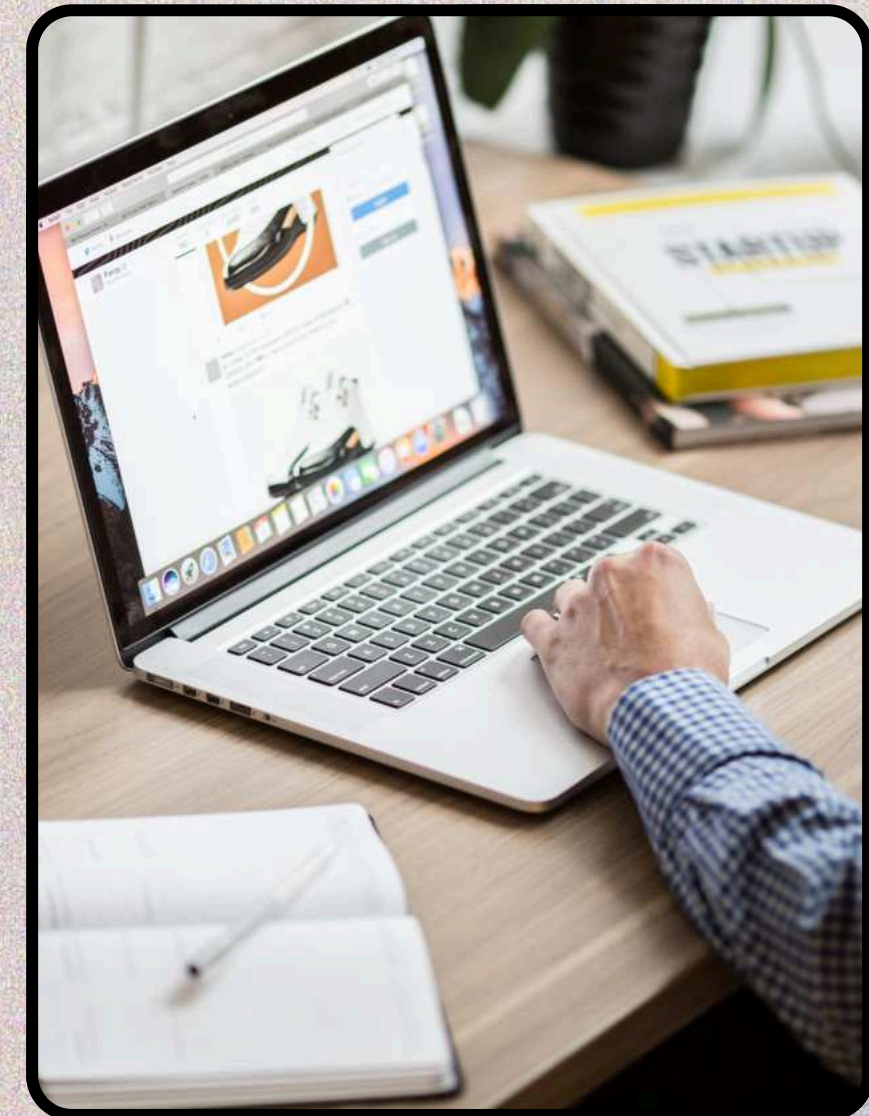


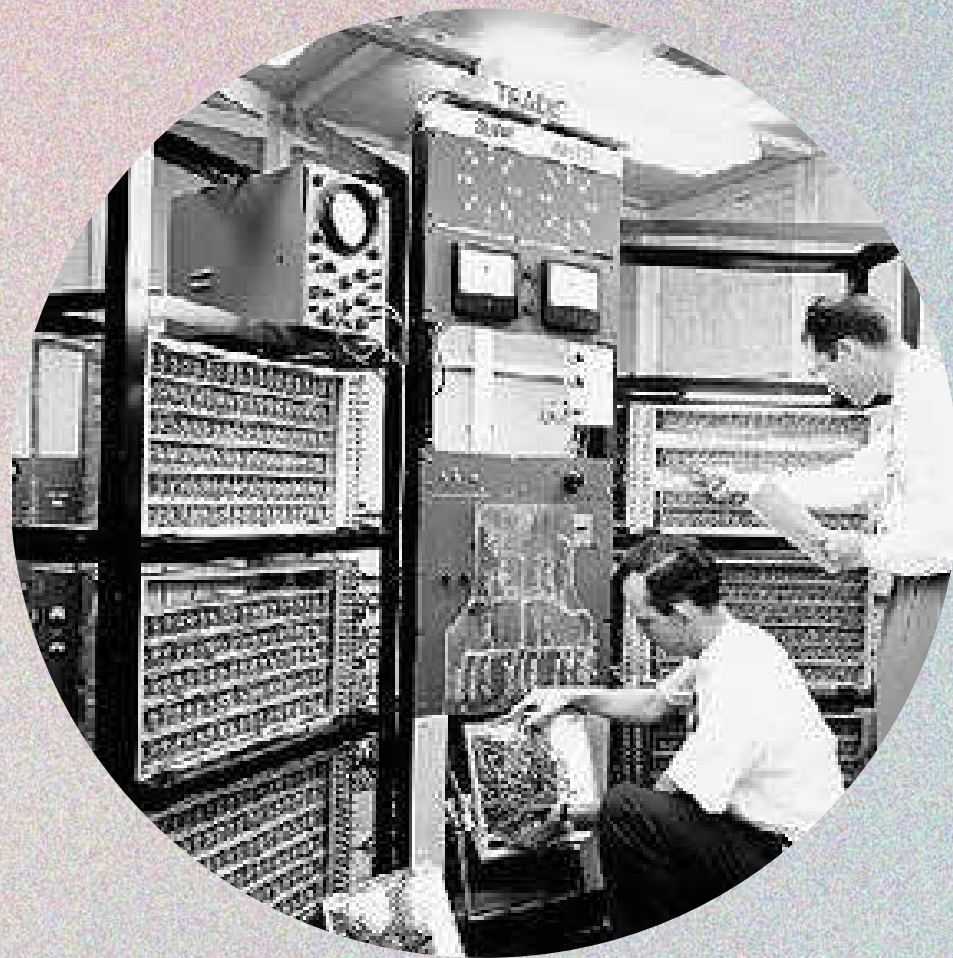
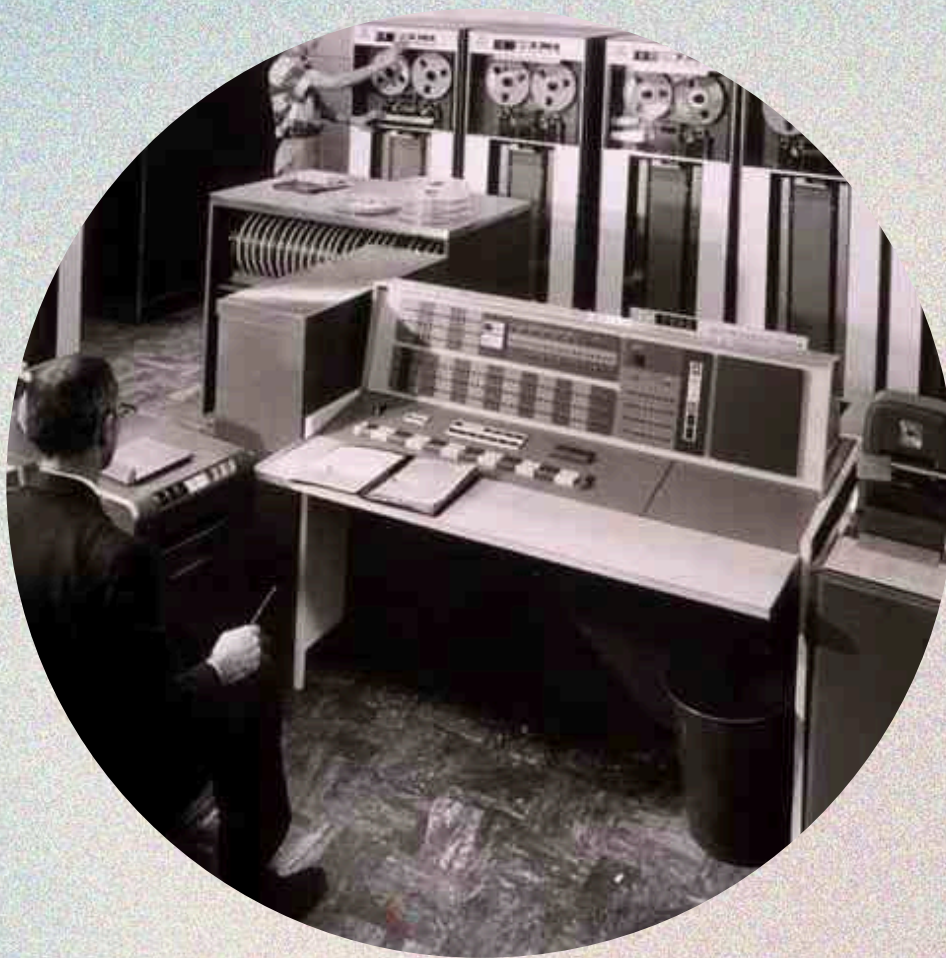


studio shodwe

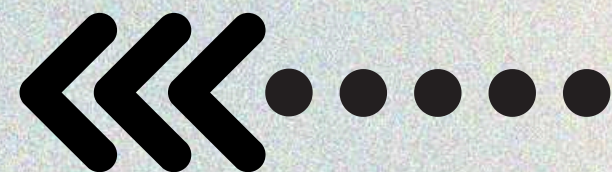
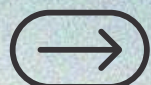
GENERATIONS OF COMPUTER

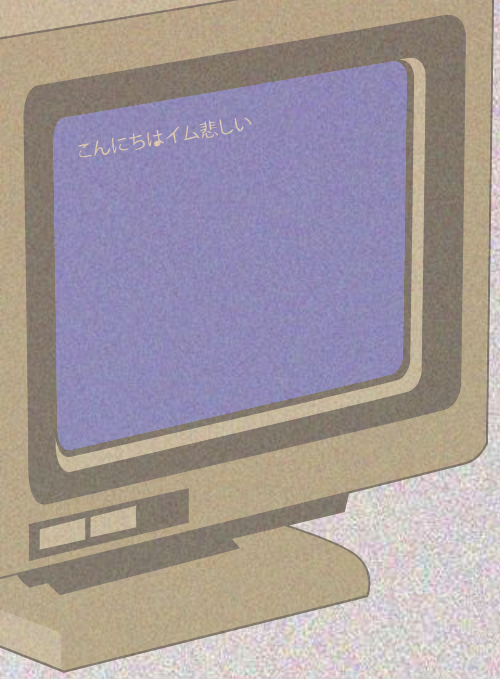
Currently, there are five generations of computer. In the following subsections, we will discuss the generations of computer in terms of the technology used by them (hardware and software), computing characteristics (speed, i.e., number of instructions executed per second), physical appearance, and their applications.





THE FIVE GENERATIONS OF COMPUTERS





First Generation Computers

(1940-1956)

VACUUM TUBES



Technology: First-generation computers utilized vacuum tubes, substantial electronic components employed for the switching and amplification of electronic signals.

Characteristics:

- Huge size and consumed a lot of power.
- Slow processing speed.
- Limited memory storage and high failure rates.
- They were prohibitively costly to operate and, in addition to consuming substantial electricity, produced significant heat, frequently resulting in problems.
- Programmed in machine language (binary).
- Used for simple calculations, such as military and scientific applications (e.g., ENIAC, UNIVAC).

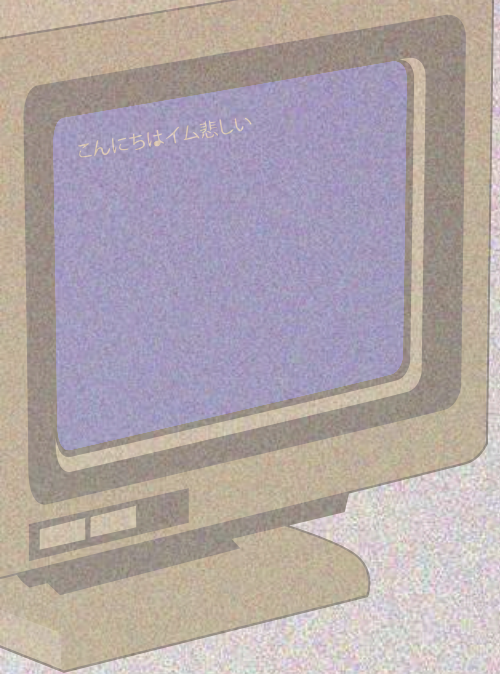


VACUUM TUBES



ADVANTAGES:

- The invention of electronic computers was a major breakthrough, allowing for faster and more precise calculations than manual methods.
- Although slow by modern standards, these early computers outperformed earlier mechanical calculating equipment.
- First-generation computers set the groundwork for the evolution of contemporary computing technologies and programming languages.



VACUUM TUBES

DISADVANTAGES:

- Size: First-generation computers were enormous and could occupy entire rooms, making them impractical for widespread use.
- Excessive Heat Generation: The vacuum tubes generated a lot of heat, which could cause systems to overheat and malfunction without proper cooling.
- Slow Speed: These computers had extremely slow processing speeds compared to modern computers, limiting their effectiveness in handling large-scale tasks.
- Limited Memory: Memory storage was limited, which restricted the size and complexity of programs that could be run on these computers.

Second Generation (1956 – 1963)

TRANSISTOR REVOLUTION



Technology: The vacuum tubes were replaced by transistors, which were smaller, more reliable, and consumed less power.

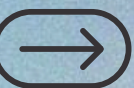
Characteristics:

- Smaller in size compared to the first generation.
- More reliable and faster than first-generation machines.
- Used for commercial applications like business data processing.
- Second-generation computers transitioned from obscure binary machine language to symbolic representation.
- During this period, high-level programming languages, including early iterations of COBOL and FORTRAN, were also being developed.
- These were the first computers that retained their instructions in memory.

TRANSISTOR REVOLUTION

ADVANTAGES:

- **Smaller Size:** Transistors were much smaller and more compact than vacuum tubes, allowing computers to shrink in size significantly.
- **Greater Reliability:** Transistors were much more reliable than vacuum tubes and less prone to failure.
- **Faster Performance:** Transistors offered much faster processing speeds compared to vacuum tubes, allowing computers to handle more complex tasks.
- **Introduction of High-Level Programming:** The development of assembly language and higher-level programming languages made programming easier and more accessible.

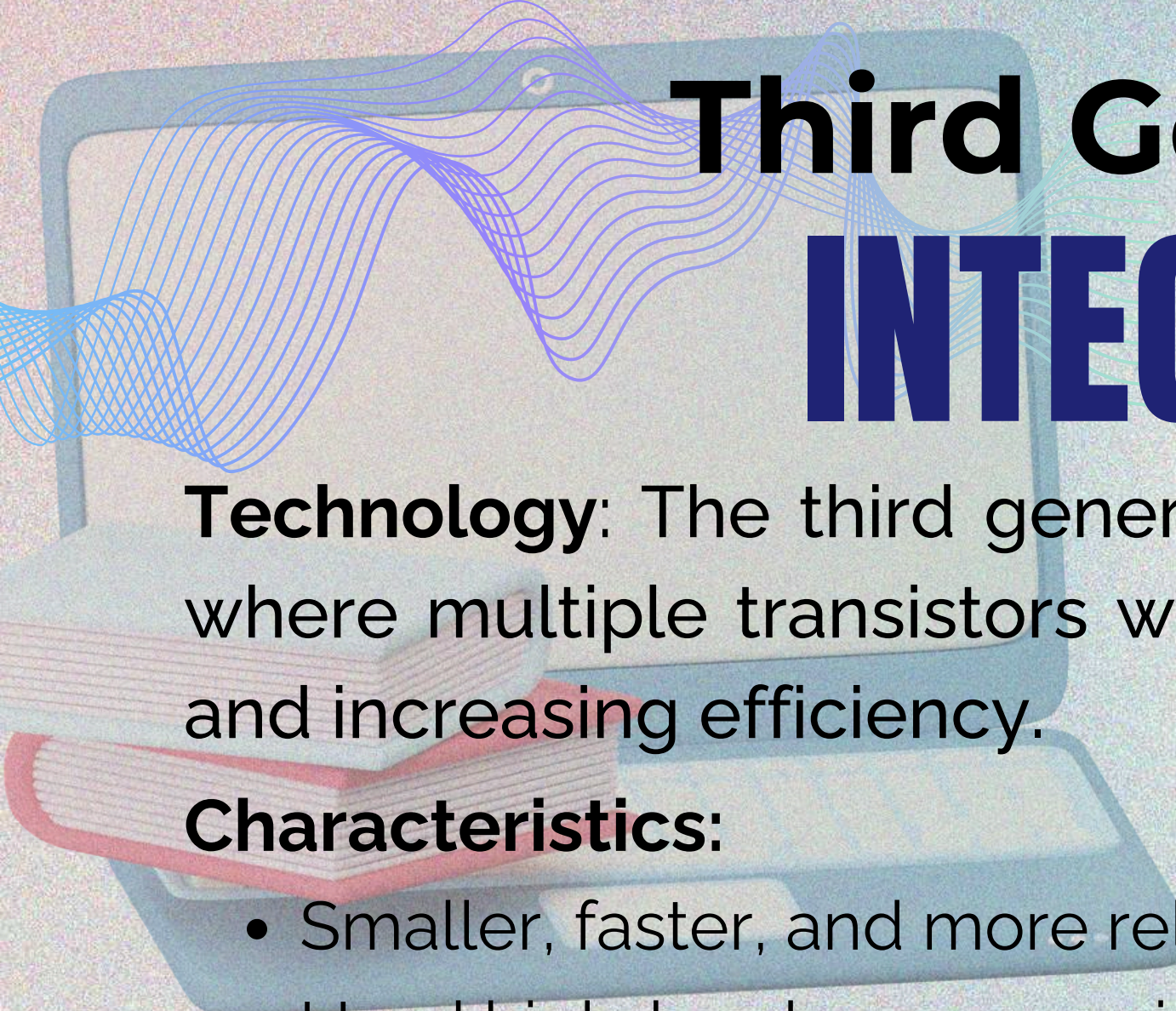


TRANSISTOR REVOLUTION

DISADVANTAGES:

- Limited Memory: Although memory technology improved, the memory capacity was still limited compared to modern standards, constraining the performance and capabilities of these systems.
- Complexity of Programming: While assembly language simplified programming somewhat, it was still complex compared to modern high-level languages, and required specialized knowledge to use.
- Reliability Issues: Though more reliable than vacuum tubes, transistors were still susceptible to failure under certain conditions.
- High Maintenance: These systems still required considerable maintenance and repair, especially in large installations, as they were not yet fully self-sustaining.





Third Generation (1964-1971)

INTEGRATED CIRCUITS

Technology: The third generation saw the introduction of integrated circuits (ICs), where multiple transistors were placed on a single chip, further reducing the size and increasing efficiency.

Characteristics:

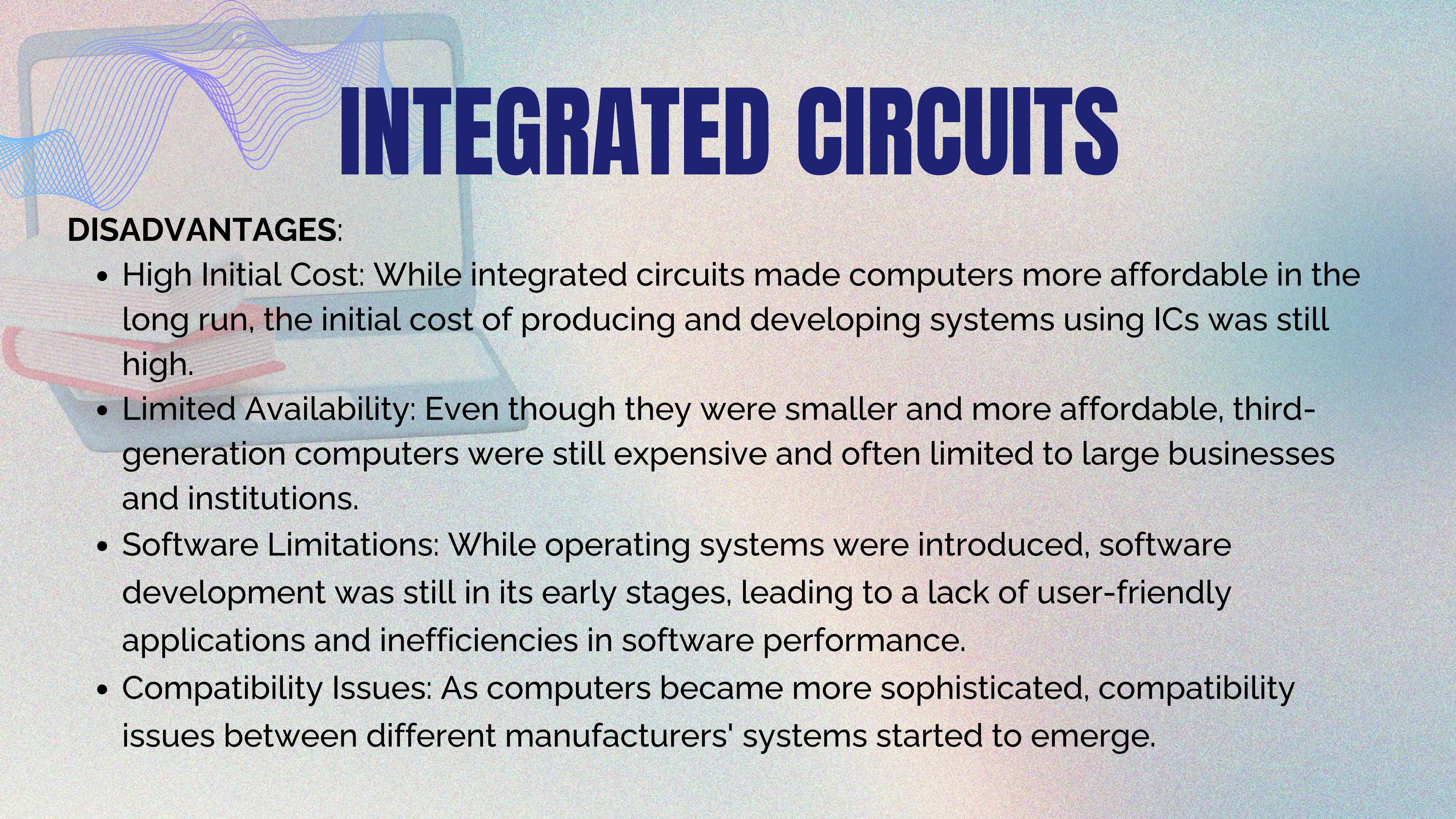
- Smaller, faster, and more reliable than previous generations.
- Used high-level programming languages like FORTRAN, COBOL, and BASIC.
- Introduction of operating systems (OS) to manage hardware and software.
- Transistors were downsized and integrated into silicon chips, known as semiconductor integrated circuits (ICs), facilitating shrinking and decreasing the size and cost of computers.
- Instead of punch cards and printouts, users interacted with third-generation computers using keyboards and monitors to connect with an operating system.
- Allowed the device to run numerous apps at the same time.



INTEGRATED CIRCUITS

ADVANTAGES:

- Miniaturization: Integrated circuits allowed for even greater miniaturization of computers, leading to more compact and portable systems.
- Increased Reliability: ICs were even more reliable than transistors, reducing the risk of hardware failure.
- Improved Processing Power: ICs contained multiple transistors on a single chip, significantly increasing the processing power and speed of computers.
- Better Memory and Storage: The development of memory chips led to better storage capacity and faster retrieval of data.



INTEGRATED CIRCUITS

DISADVANTAGES:

- **High Initial Cost:** While integrated circuits made computers more affordable in the long run, the initial cost of producing and developing systems using ICs was still high.
- **Limited Availability:** Even though they were smaller and more affordable, third-generation computers were still expensive and often limited to large businesses and institutions.
- **Software Limitations:** While operating systems were introduced, software development was still in its early stages, leading to a lack of user-friendly applications and inefficiencies in software performance.
- **Compatibility Issues:** As computers became more sophisticated, compatibility issues between different manufacturers' systems started to emerge.



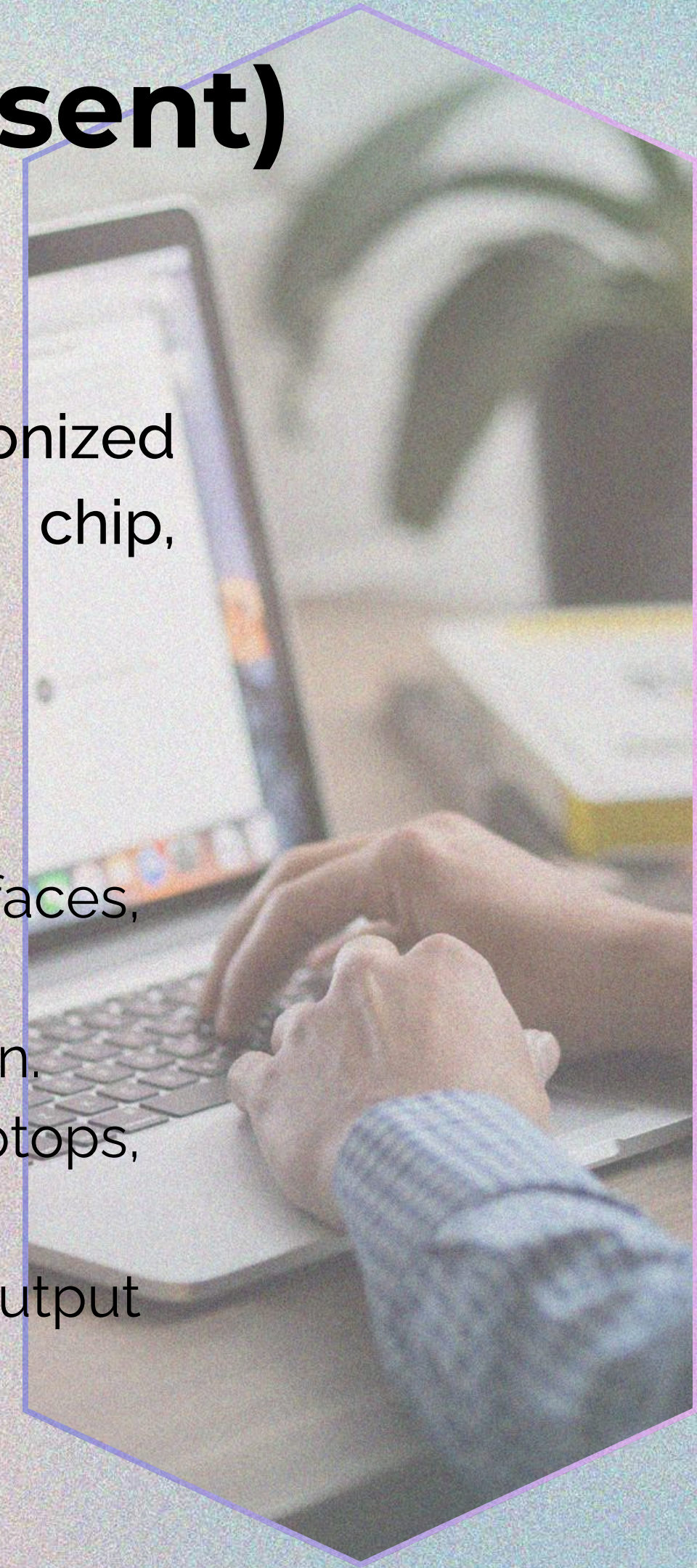
Fourth Generation (1971-present)

MICROPROCESSORS

Technology: The development of the microprocessor revolutionized computers by placing the entire processor onto a single chip, dramatically increasing computing power.

Characteristics:

- Personal computers (PCs) became more common and affordable.
- Increased focus on user-friendly interfaces (e.g., graphical user interfaces, GUIs).
- Significant advancements in storage, networking, and communication.
- Development of more compact and powerful devices like laptops, tablets, and smartphones.
- From the central processor unit and memory to the input/output controls, everything is on one chip.

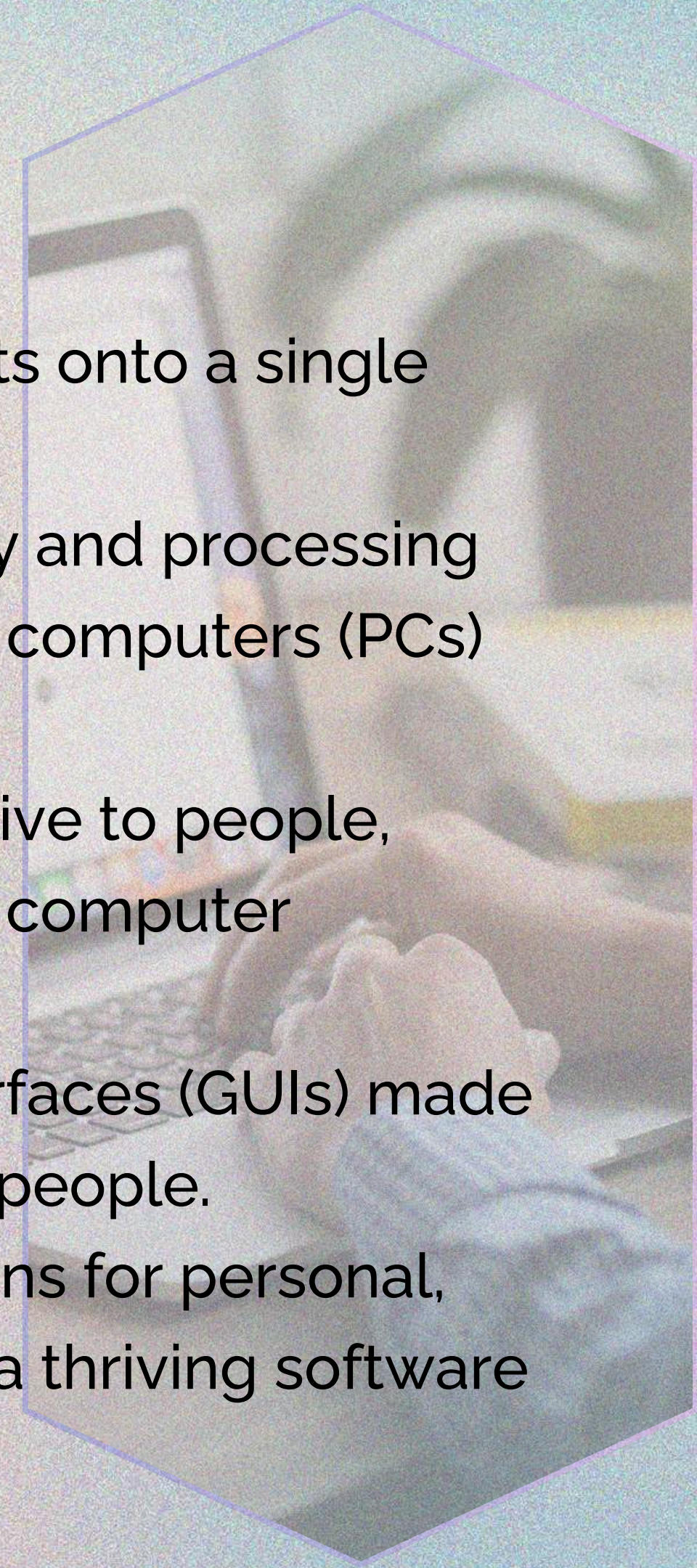




MICROPROCESSORS

ADVANTAGES:

- Microprocessors combined all of a computer's CPU components onto a single chip, allowing for extremely tiny and portable computers.
- Microprocessors significantly increased the computing capacity and processing speed of computers, allowing for the development of personal computers (PCs) and more complicated software applications.
- Affordability: Microprocessors made computers more inexpensive to people, corporations, and educational institutions, igniting the personal computer revolution.
- User-Friendly Software: The introduction of graphical user interfaces (GUIs) made personal computers easier to use, especially for non-technical people.
- Software Development: The proliferation of software applications for personal, educational, business, and entertainment purposes resulted in a thriving software industry.

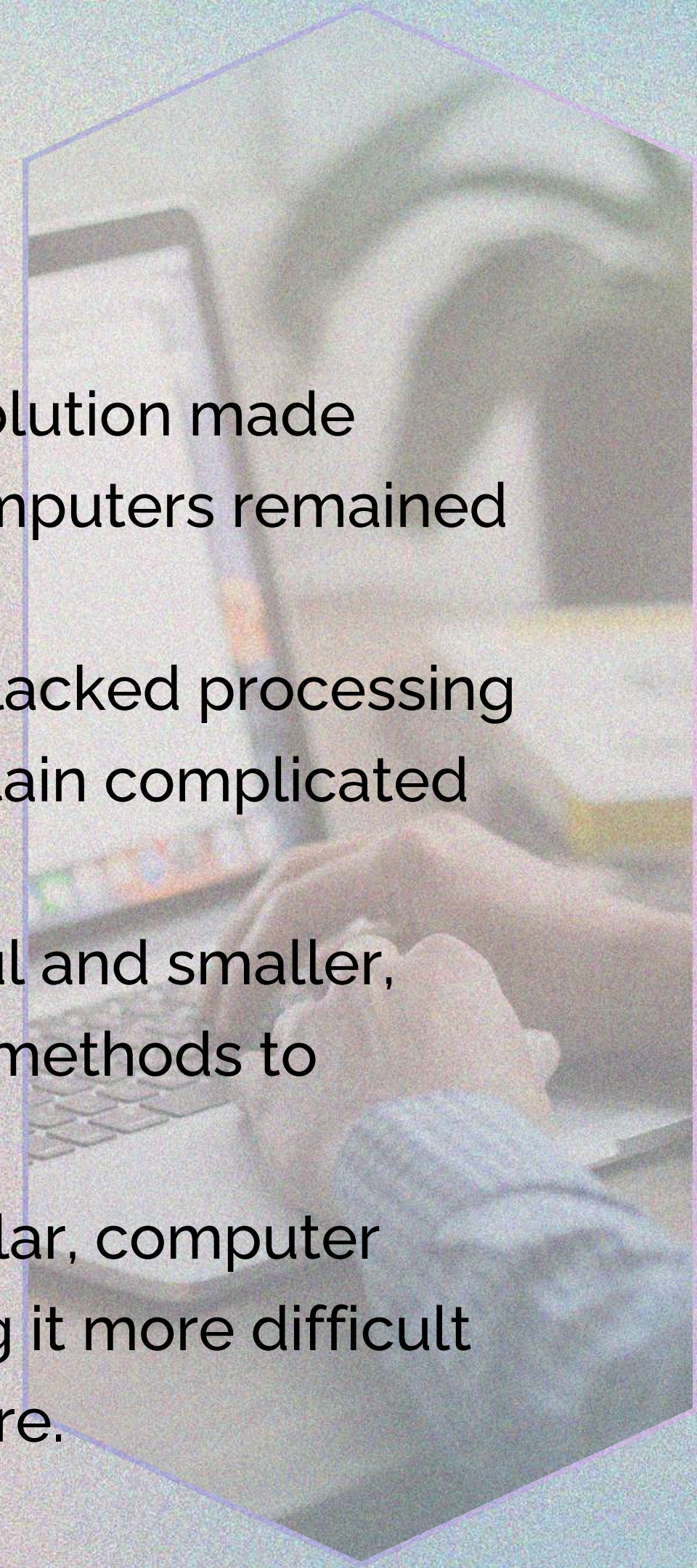




MICROPROCESSORS

DISADVANTAGES:

- Early Affordability Issues: Even though the microprocessor revolution made computers more inexpensive, the original costs of personal computers remained excessive for some consumers, notably in the early 1980s.
- Limited Storage and Processing Power: Early microprocessors lacked processing speed and storage capacity, rendering them unsuitable for certain complicated activities and applications.
- Overheating and Cooling: As computers became more powerful and smaller, problems with overheating arose, necessitating better cooling methods to preserve system stability.
- Security Concerns: As personal computing became more popular, computer viruses, hackers, and other security concerns increased, making it more difficult to manage due to a lack of early security standards and software.



Fifth Generation (1990s - Present)

ARTIFICIAL INTELLIGENCE (AI),

QUANTUM COMPUTING (EMERGING)

Characteristics:

- AI and Parallel Processing: Computers are designed to handle massive data processing tasks and learn from experience.
- Quantum Computing: The development of quantum computers promises to revolutionize computation, enabling solutions to problems previously thought impossible.
- Connectivity: The proliferation of cloud computing and internet of things (IoT) is increasing the capability of computers.
- Parallel processing and superconductors are helping to bring artificial intelligence to life.
- The goal of fifth-generation computing is to create machines that respond to natural language input and can learn and self-organize.



ARTIFICIAL INTELLIGENCE (AI), QUANTUM COMPUTING (EMERGING)

ADVANTAGES:

- Artificial intelligence (AI) enables computers to accomplish activities that traditionally needed human intelligence, such as natural language processing, image identification, and decision making. This promotes advancements in fields such as automation, robotics, and healthcare.
- Machine learning techniques allow computers to learn from data and improve over time, resulting in smarter systems that can adapt to new situations without requiring explicit programming.
- Advanced Data Analysis: AI and big data tools enable computers to handle and analyze massive volumes of data, offering insights that were previously impossible or prohibitively expensive to access.
- Increased Automation: AI-powered automation is transforming industries such as manufacturing, healthcare, finance, and customer service, resulting in more efficiency, cost savings, and innovation.



SUMMARY OF KEY DEVELOPMENTS IN EACH GENERATION:

- **FIRST GENERATION: VACUUM TUBES.**
- **SECOND GENERATION: TRANSISTORS.**
- **THIRD GENERATION: INTEGRATED CIRCUITS (ICS).**
- **FOURTH GENERATION: MICROPROCESSORS.**
- **FIFTH GENERATION: ARTIFICIAL INTELLIGENCE, QUANTUM COMPUTING.**

Each generation of computers represents a leap forward in technology, contributing to the rapid advancements that have led to the powerful, interconnected systems we use today.

CONCLUSION

The evolution of computers through five generations represents a journey of remarkable technological advancements that have drastically transformed industries, economies, and daily life. Each generation has contributed to the development of faster, more efficient, and more accessible systems, paving the way for the modern computing era.

