

Introduction

Most of the development in generative AI, so far, has been in the Cloud with hyperscalers like Amazon Web Services (AWS), Microsoft (MSFT) and Alphabet (GOOG) leading the way. A key advantage of these hyperscalers is to provide the scale needed for adoption of AI in enterprise computing. However, in an effort to increase response time, there is now an emergence of Edge AI, for integrating AI in edge computing.

Edge AI

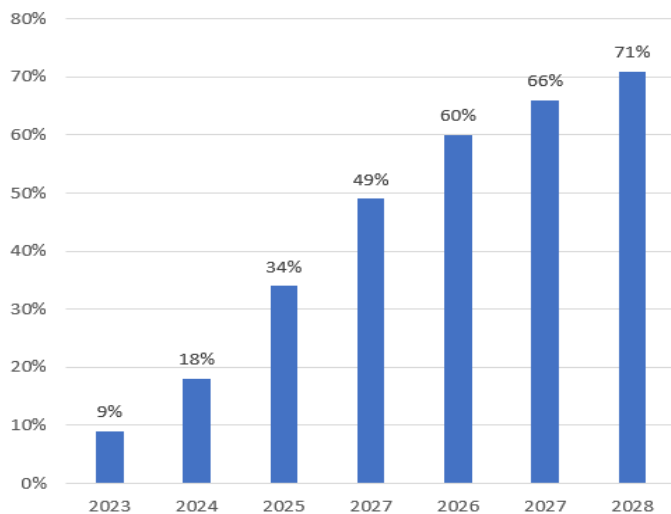
Edge computing is the process of storing and analyzing data close to the devices that produce the data and users who consume it. Edge computing provides some advantages over Cloud computing.

1. *Minimal Latency:* Latency is the time it takes for data to travel between two points in a network. If data analysis and AI is done in the Cloud, data has to travel from the point of generation, which is at the edge, to large data centers in the Cloud. This can take time. In Edge computing, data analysis is done close to where it is generated. Thus, latency is minimal.
2. *Data security:* While most hyperscalers provide data security, data breaches do occur occasionally. These breaches generally occur when data leaves the edge and travels to the Cloud. By computing at the edge, data can be analyzed and stored within local area networks (LAN) and behind company firewalls, thus reducing chances of data breach.
3. *Energy Efficiency:* Since Edge AI processing is done locally, there is no need to transport and process vast amounts of data to centralized data centers. This reduces energy consumption.
4. *Customization:* On device processing allows companies to build AI models specific to their needs on LANs.

Global market for edge AI is expected to grow from about \$19B in 2023 to \$144B by 2033 for a CAGR of 26% over that time period¹. The roll out of 5G networks along with the development of new chips is expected to stimulate this growth. Development of apps is expected to further fuel this growth. Edge AI allows for real time decision making, which is critical to many industries. For example, in manufacturing, predictive maintenance is crucial for minimizing down time. Edge AI allows for real time monitoring of systems to optimize production. In the automotive sector, Edge AI is important for driverless cars, where processing data from various inputs in real time is crucial for safety. In healthcare, it allows for monitoring of remote patients in real time for immediate medical interventions. In the energy and utility sectors, Edge AI can optimize energy distribution by analyzing usage data in real time. Smart phones, personal computers (PCs), sensors, and smart cameras are just some examples of devices that can be used for Edge AI².

Investment Case

An AI PC is a personal computer which can run AI software and applications locally, i.e., without connecting to the Cloud. AI PCs need significant processing power to run AI operations. Thus, in addition to Central Processing units (CPUs), these need Graphic Processing Units (GPUs) and Neural Processing Units (NPUs). The number of TOPs (trillion operations per second) of NPUs determine the performance of AI PCs. Microsoft recently suggested that a minimum of 40TOPs for AI PCs. The initial AI PCs are expected to have TOPs of about 40 while, those shipped after 2024 are expected to have TOPs greater than 40. Analysts expect AI PCs market share to increase from about 18% of total PC shipments in 2024 to more than 70% of total PC shipments in 2028, for a CAGR of almost 44% (Figure 1)³.

Figure 1: Marketshare Estimate of AI PCs³

Also, due to productivity gains, early adoption, between 2024 through 2025 is expected to be in the commercial market followed by the consumer market. There are several companies that have developed or are developing chips for AI PCs. Qualcomm (QCOM), Apple (AAPL), Intel (INTC) and Advanced Micro Devices (AMD) are currently producing or developing chips that run near 40 TOPS (Table 1). To date, the most advanced AI PC app is MSFT's Copilot, which can help with various tasks such as creating documents, searching the web, and managing files. MSFT recently announced its **Microsoft Surface**® laptop and **Surface Pro**® tablet, its Copilot + PCs using QCOM's AI chipset, **Snapdragon X Elite**™. Other PC makers are also launching similar AI PCs using QCOM's **Snapdragon**™ chipset. NVDA does not have a NPU chipset yet, however, its **GeForce RTX**® offers more than 1300 TOPS performance.

Source: State of the union: ARM MU well placed as AI expands on-device to Phones and PCs – Bank of America, June 17, 2024.

Reprinted by permission. Copyright © 2024 Bank of America Corporation ("BAC"). The use of the above in no way implies that BAC or any of its affiliates endorses the views or interpretation or the use of such information or acts as any endorsement of the use of such information. The information is provided "as is" and none of BAC or any of its affiliates warrants the accuracy or completeness of the information.

Table 1: AI PCs Chips⁵

| Company | Chipset | TOPS |
|---------|------------------------------|------|
| QCOM | Snapdragon X Elite ™ | 45 |
| AMD | Ryzen AI 300 series ™ | 50 |
| INTC | Lunar Lake | 48 |
| AAPL | M4 | 38 |
| NVDA | GeForce RTX ® | 1300 |

Source: Company Sources

SourcesSmart phones are another device for Edge AI. AI smart phone market share of about 3% in 2023 is expected to increase to about 8% in 2024 and about 40% in 2027 for a CAGR of 83%⁴. Integrating AI features in a smart phone will allow users to edit photos as well as generate new images. It will also allow for editing text and be able to do live translation. There are several AI smartphones on the market including, **Google Pixel 8 Pro**™, and **Samsung Galaxy**®. APPL recently announced that its **iPhone 15 PRO**® and **iPhone 15PRO Max**®, which will be launched in October 2024, will have AI features.

QCOM is the leading producer of mobile chips. Most mobile chips are based of chip architecture designed by ARM PLC (ARM). ARM architecture allows for more efficient processing while lowering energy consumption. ARM licenses its architecture to semiconductor companies developing CPUs. For example, QCOM, AAPL and Samsung license ARM architecture to develop their AI chips. ARM licensing royalties for AI chips is higher than royalties on non-AI chips.

Summary

Edge computing reduces latency and energy consumption. It allows for AI customization while improving data security. As a result, Edge AI is expected to be the next frontier in the build out of AI infrastructure. Global market for edge AI is expected to grow from about \$19B in 2023 to \$144B by 2033 for a CAGR of 26% over that time period¹. AI PCs and AI smartphones require specialized chips, which contain CPUs, GPUs and NPUs, to run AI algorithms. Companies developing these chips are expected to benefit from the growth in Edge AI.

References:

1. <https://scoop.market.us/edge-ai-market-new/>
2. <https://stlparkers.com/articles/edge-computing/edge-computing-devices/>
3. State of the union: ARM MU well placed as AI expands on-device to Phones and PCs – Bank of America, June 17, 2024
4. <https://www.counterpointresearch.com/insights/over-1-billion-generative-ai-smartphones-to-be-shipped-cumulatively-during-cy-2024-2027/>
5. Company Sources: <https://www.qualcomm.com/products/mobile/snapdragon/laptops-and-tablets/snapdragon-x-elite>, <https://www.amd.com/en/partner/articles/ryzen-ai-300-series-processors.html>, <https://www.intel.com/content/www/us/en/newsroom/news/intels-lunar-lake-processors-arriving-q3-2024.html>, <https://www.apple.com/newsroom/2024/05/apple-introduces-m4-chip/>, <https://www.nvidia.com/en-us/geforce/rtx/>

© Regions Bank, Member FDIC. This publication has been prepared by Regions Investment Management, Inc. (RIM) for Regions Bank for distribution to, among others, Regions Wealth Management clients. RIM is an Investment Adviser registered with the U.S. Securities & Exchange Commission pursuant to the Investment Advisers Act of 1940. RIM is a wholly owned subsidiary of Regions Bank, which in turn, is a wholly owned subsidiary of Regions Financial Corporation. While the commentary accurately reflects the opinions of the Analyst by whom it is written, it does not necessarily reflect those of Regions Bank or RIM. This publication is solely for information and educational purposes and nothing contained in this publication constitutes an offer or solicitation to purchase any security, the recommendation of any particular security or strategy or a complete analysis of any security, company or industry or constitutes tax, accounting or legal advice.

Information is based on sources believed by RIM to be reliable but is not guaranteed as to accuracy by Regions Bank, RIM or any of their affiliates. Commentary and opinions provided in this publication reflect the judgment of the authors as of the date of this publication and are subject to change without notice. Certain sections of this publication contain forward looking statements that are based on the reasonable expectations, estimates, projections and assumptions of the authors, but forward-looking statements are not guarantees of future performance and involve risks and uncertainties, which are difficult to predict. Investment ideas and strategies presented may not be suitable for all investors. No responsibility or liability is assumed by Regions Bank, RIM or their affiliates for any loss that may directly or indirectly result from use of information, commentary or opinions in this publication by you or any other person. Trust and investment management services are offered through Regions Wealth Management, a business group within Regions Bank. Investment advisory services are offered through RIM. Employees of RIM may have positions in securities or their derivatives that may be mentioned in this report or in their personal accounts. There could also be times that some securities mentioned in this report are held in a RIM model portfolio. The companies mentioned specifically are sample companies, noted for illustrative purposes only. The mention of the companies should not be construed as a recommendation to buy, hold or sell positions in your investment portfolio.

In some cases, RIM's investment management services and/or strategies will be utilized by Regions Wealth Management for its trust and investment management clients. RIM receives compensation from Regions Bank for providing certain services, including market commentary. When applicable, RIM receives additional compensation based upon the assets in Regions Wealth Management client accounts managed according to RIM's strategies. For additional information concerning RIM or its strategies, please see RIM's Form ADV Part 2A, which is available by calling 205-264-6735. Neither Regions Bank, nor Regions Asset Management (collectively, "Regions") nor the Regions Bank subsidiary, Regions Investment Management, Inc. (RIM), are registered municipal advisors, nor provide advice to municipal entities or obligated persons with respect to municipal financial products or the issuance of municipal securities (including regarding the structure, timing, terms and similar matters concerning municipal financial products or municipal securities issuances) or engage in the solicitation of municipal entities or obligated persons for such services. With respect to this presentation and any other information, materials or communications provided by Regions or RIM, (a) Regions and RIM are not recommending an action to any municipal entity or obligated person, (b) Regions and RIM are not acting as an advisor to any municipal entity or obligated person and do not owe a fiduciary duty pursuant to Section 15B of the Securities Exchange Act of 1934 to any municipal entity or obligated person with respect to such presentation, information, materials or communications, (c) Regions and RIM are acting for their own interests, and (d) you should discuss this presentation and any such other information, materials or communications with any and all internal and external advisors and experts that you deem appropriate before acting on this presentation or any such other information, materials or communications.

| |
|--|
| Investment, Insurance and Annuity Products |
| Are Not FDIC-Insured Are Not Bank Guaranteed May Lose Value Are Not Deposits |
| Are Not Insured by Any Federal Government Entity Are Not a Condition of Any Banking Activity |