



# Strategic Pivot of Long-Standing x86 Rivals

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On 15 October 2024, AMD and Intel—the two titans of the global microprocessor industry—made an unprecedented move by announcing the formation of an “x86 ecosystem advisory group.” When I shared the picture on social media of AMD CEO Lisa Su standing next to Intel CEO Pat Gelsinger following the announcement, a response from my friend said, “Was this picture created by GenAI?” It feels so unreal. Against all odds, this partnership is officially aimed at accelerating innovation for developers and customers. Bystanders could easily conclude that this surprising partnership is driven largely by the looming challenges posed by ARM architecture, which is no longer just dominating the mobile/client computing space including the emerging artificial intelligence (AI) PC, but also attempting to grab market shares of data center servers by its low power reputation. Moreover, the RISC-V camp is also closely observing from a distance, further complicating an already-intense battleground. These highly competitive alternatives in both PC/notebook and data center server segments could be game-changers, which can potentially reshape the landscape that is dominated by x86 architecture in general-purpose computing of the past four decades.

Despite being historically relentless rivals, the rise (again) of ARM and RISC-V could threaten AMD and Intel’s collective x86 market shares, thus creating an existential crisis for both. Many questions remain: To what extent will this collaboration cover, and how long can this relationship be sustained? Based on the *x86 Ecosystem Advisory Group* name, it seems likely that their collaboration will focus on simplifying and unifying the future development of the x86 instruction set extensions, increasing standardization of hardware–software interfaces, minimizing respective development effort, and enhancing the interoperability of system and application software that run on both AMD and Intel platforms. By doing so, they could provide a

huge incentive for their common original equipment manufacturer (OEM) vendors as well as software developers in the ecosystem.

For such a partnership to be effective and succeed, I cannot help but draw similarities to the lessons that we learned from classic game theories. I had an engaging discussion with my fellow friends—Edgar Barua, Charles Coutu-Nadeau, and Vijay Anand Devanathan—from the MIT Sloan School of Management about if Intel CEO Pat Gelsinger was consulting us, what would be our recommended actions necessary to achieve his intended goals of value creation and value capture throughout this alliance.

AMD and Intel indeed have strong motivations to form this advisory group, yet both companies may also harbor their own hidden agenda. By collaborating with AMD on standardization and promoting the x86 architecture, Intel could potentially garner more market share given their long-established brand name in the space. On the other hand, AMD may find greater incentives to collaborate with Intel for several reasons. First, they will be able to deliver a compatible x86 solution simultaneously, avoiding delays of their x86 products. A recent case in point is the latest AMX instruction extension that was originally introduced by Intel’s 4th Xeon Scalable processor, codenamed *Sapphire Rapids*. It is not clear whether AMD will extend their x86 implementation with AMX for compatibility. Second, in reality, AMD is currently in the number two position in the competition (although they have caught up rapidly in recent quarters) and thus appears more vulnerable to the growing threats from non-x86 architectures. This situation is reminiscent of the “prisoner’s dilemma” from game theory. If either company chooses to defect and prioritizes its own interests over the collaboration, the advisory group will be destined to fail. Conversely, if the announcement is merely symbolic, with no actionable plan, their combined x86 market will be eroded and gradually replaced by non-x86 alternatives. Success will only be possible if both companies align their common objectives and collaborate under a framework similar to a “formal relational contract”<sup>1</sup> guided by principles such as reciprocity, honesty, equity, and

## APPENDIX: RELATED ARTICLES

- A1. J. B. Carter, "Special issue on Contemporary Industry Products 2024," *IEEE Micro*, vol. 44, no. 6, pp. 6–7, Nov./Dec. 2024, doi: [10.1109/MM.2024.3503212](https://doi.org/10.1109/MM.2024.3503212).
- A2. J. J. Yi, "A review of *Wisconsin Alumni Research Foundation v. Apple*—Part I," *IEEE Micro*, vol. 44, no. 6, pp. 92–96, Nov./Dec. 2024, doi: [10.1109/MM.2024.3504881](https://doi.org/10.1109/MM.2024.3504881).
- A3. S. Greenstein, "Unpriced and crucial," *IEEE Micro*, vol. 44, no. 6, pp. 100–102, Nov./Dec. 2024, doi: [10.1109/MM.2024.3478428](https://doi.org/10.1109/MM.2024.3478428).

integrity. This approach would allow for standardized x86 extension, interface design, and software, which would expedite the time to market by leveraging talents from both companies and reduce development costs for their ecosystem partners, such as OEMs and software developers. Ultimately, it benefits the final customers: cloud service providers, enterprise, and individual end users.

It is eye-opening to see how the evolution of the processor architecture market has brought together two long-standing rivals. However, key questions remain: Should a third-party governance body be introduced to oversee, moderate, and keep their collaboration efforts on course? Do all stakeholders welcome this partnership and wish for their success? Only time will tell.

This Special Issue on Contemporary Industry Products 2024 includes seven articles that were selected by the program committee (PC) of the Industry Track submitted to the 51st ACM/IEEE International Symposium on Computer Architecture (ISCA), held in Buenos Aires, Argentina, in June 2024. First, I would like to extend my sincere gratitude to Guest Editor Dr. John B. Carter of IBM Corporation. This special issue has been a regular annual contribution since 2020. The selected articles underwent a rigorous review and selection process that was instituted by the ISCA Industry Track PC. This effort requires extra work for Carter and his PC in identifying valuable and insightful experiences learned from industry designers and having them shared with the computer architecture community through the *IEEE Micro* venue. Carter did an outstanding job of leading his ISCA Industry Track PC, which diligently selected eight remarkable articles that showcased recent industry's product designs from companies such as AMD, ARM, Efficient Computer Company, HyperAccel, IBM, and SambaNova Systems. For a preview of these articles, please read the Guest Editorial message by Carter.<sup>A1</sup>

In addition to the industry product articles, the regular *Micro Law* column features Dr. Joshua Yi,<sup>A2</sup> who started a new series to analyze the subtle, intricate research relationship between academia and industry in terms of intellectual property (IP). When a university receives a gift to conduct research with no strings attached, a key question arises: how should the IP that is generated from this research gift be handled? Should the university publish their findings openly, without claiming IP ownership? The first of this series reviews the case of *Wisconsin Alumni Research Foundation versus Apple* on a computer architecture patent. In the *Micro Economics* column, Prof. Shane Greenstein<sup>A3</sup> discusses an intriguing economics phenomena in the digital services world—*crucial inputs that cost nothing*, in other words, free to users. Examples include platforms like Wikipedia, GitHub, Hugging Face, and so on as well as popular AI frameworks such as PyTorch or TensorFlow. What we take for granted today has far-reaching consequences for how modern businesses are established and evolve.

This is the final issue of *IEEE Micro* for 2024. It has been a year since I began serving as your editor-in-chief, and time really flies! I hope you have found the articles we selected and published to be of great value and filled with innovations to meet your interests. I wish everyone a wonderful holiday season and look forward to serving you more in 2025.

## REFERENCE

1. D. Frydinger, O. Hart, and K. Vitasek, "A new approach to contracts," *Harvard Bus. Rev.*, vol. 97, no. 5, pp. 116–125, 2019.

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