

# Outlook: Forward Thinking for 2022

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*Each January issue of Computer is devoted to invited articles offering forward-looking ideas. This 2022 issue discusses artificial intelligence hardware concerns, the future of software, the current state of open banking, future obstacles in deploying autonomous machines, ethical dimensions of social media, and a 200-year look back at the invention and contribution made by Charles Babbage.*

**P**redictions are frequently wrong. Regardless, we crave them. Why? Who knows, but it's probably because not all surprises are appreciated.

Each January issue of *Computer* is devoted to invited articles offering forward-looking ideas. Although these articles usually aren't what you might consider to be traditional prediction papers, they offer insights that you might wish to ponder when thinking into 2022 and beyond.

Here, we featured articles whose authors look to evaluate the current state of computing technology or forecast where they think it might or should need to go soon. The landscape to consider is vast, and *Computer* runs numerous special issues that drill deeply into many of the hot technologies of the moment. What we've endeavored to do here is capture a selection of topics we thought are interesting.

VerWey's article "The Other Artificial Intelligence Hardware Problem" is a timely commentary on supply chain vulnerabilities and how one specific company, Taiwan Semiconductor Manufacturing Corporation (TSMC), provides a unique challenge for the field of artificial intelligence (AI). As the author observes, obstacles to innovation in AI hardware design and manufacturing have been masked by terrific advances in AI algorithms. The nature of AI, where data from one country are processed on a machine learning platform executed in a different country and then applied in yet another, highlights the interdependencies enabled by cloud computing and the

global value chain it supports. TSMC's dominance in the semiconductor space presents an interesting set of risks for the AI industry and for the security interests of countries that rely on AI.

Crawford and Sloss's article asks, "Is Expressiveness the Future of Software?" The authors take a look 10 years out to imagine what is constant in the value proposition for advances in software. They conclude that shareable knowledge models where true value is created from the ongoing capture of experiences. As our ability to capture increasingly more complex experiences is enabled, software will commensurately leverage these captured experiences into new knowledge models that provide increasing sophistication. Although no one can predict today exactly where software will be in a decade, the authors are sure that path will be driven by expressiveness in programming environments.

The article from Kassab and Laplante titled "Open Banking: What It Is, Where It's at, and Where It's Going" takes a look at new banking models that are being enabled by significant advances in computing technology. Specifically, open banking, which is essentially "finance as a service," is gaining traction around the globe and may be poised to arrive shortly in the United States. This article is both a primer on open banking and a policy brief on what technical and legal hurdles will need to be overcome for this service to become mainstream. There are also some illuminating comparisons offered that contrast open banking with more conventional financial systems.

"Rise of the Autonomous Machines" sounds like a dystopian movie, but Liu and Gaudiot's article is actually an insightful examination of the obstacles that stand in the way of fully deploying autonomous machines. The authors review decades of technology innovations that are enabling autonomous machines and then detail 10 challenges that will influence product roadmaps as the technologies continue to mature. Eight of the challenges are technological in nature, while one addresses workforce development challenges and the other puts a policy lens on how society might change once autonomous machines are deployed.

The ethical dilemmas brought about by the rise of social media inspired Miller, Johnson, and Drake's introduction of "The ConnectionRoom: A New Analogy for Understanding the Ethical Dimensions of Social Media." Their clever analogy is meant to rationalize the complex and interconnected operating ecosystem of social media. Invoking images of Prof. Xavier's Cerebro machine from Marvel's *X-Men*, the ConnectionRoom emphasizes that social media are now a huge, intimate, and potentially intrusive part of our lives. The authors explore some practical and legal considerations of social media via their ConnectionRoom analogy.

And finally, DeFranco's "From Calculations to Computations: A Look Back at the First Computer" is a tribute to the genius and contributions of Charles Babbage, whose proposal for a computational machine is celebrating its bicentennial in 2022. DeFranco's article historically



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grounds Babbage's difference engines in the pantheon of achievements by Pascal and the Countess of Lovelace. Babbage

was seminal in developing the field of mechanical computation that led to the development of today's computers.

So, in conclusion, will the ideas presented in this issue be "hot topics" in the near future? Who knows? We're not futurists. We offer them only as food for thought.

We hope you enjoy this annual issue. Happy New Year! 📧



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