

Technology Radar

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An LTIMindtree Crystal Report

Foreword



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Innovation in technology is happening at a rapid pace, changing the world in unprecedented ways. The desire to foresee the future was never so strongly expressed.

In the modern era, where speed and efficiency are paramount, cutting-edge technological advancements have taken the forefront. The march of Generative AI is resulting in unbelievable and unimaginable inferences through a plethora of new-age algorithms. Leveraging complex AI models and superior computing capabilities, it is paving the way to a very futuristic outlook. Artificial Intelligence (AI), the Internet of Things (IoT), Decentralization, and Augmented Reality (AR) are leading the way in transforming industries. Automating tasks, predicting patterns, and building new ways of user experience and security are collectively pushing us towards a more innovative and connected world. Furthermore, we are witnessing concerted investments and efforts to integrate AI with the emerging paradigm of Quantum Computing. Enterprises are also becoming increasingly purpose-driven by prioritizing their commitments to environmental, social, and governance (ESG) principles, where a lot of investments are flowing in.

In 2023, AI assistance for application development, automation, data analysis, customer services, and other AI-related topics were the most common subjects of conversation. For example, GitHub Copilot, AWS CodeWhisperer, Jasper, and others are driving the change in how we use tools with the help of Large Language Models. We are all excited about the possibility of using them to write user stories, create test cases, and even carry out deployments. Considering ethics, privacy, security, trust, sustainability, decentralization, task specialization, propriety, and regulation, we have a strong case for developing smaller, bespoke, explainable, and concise Large Language Models.

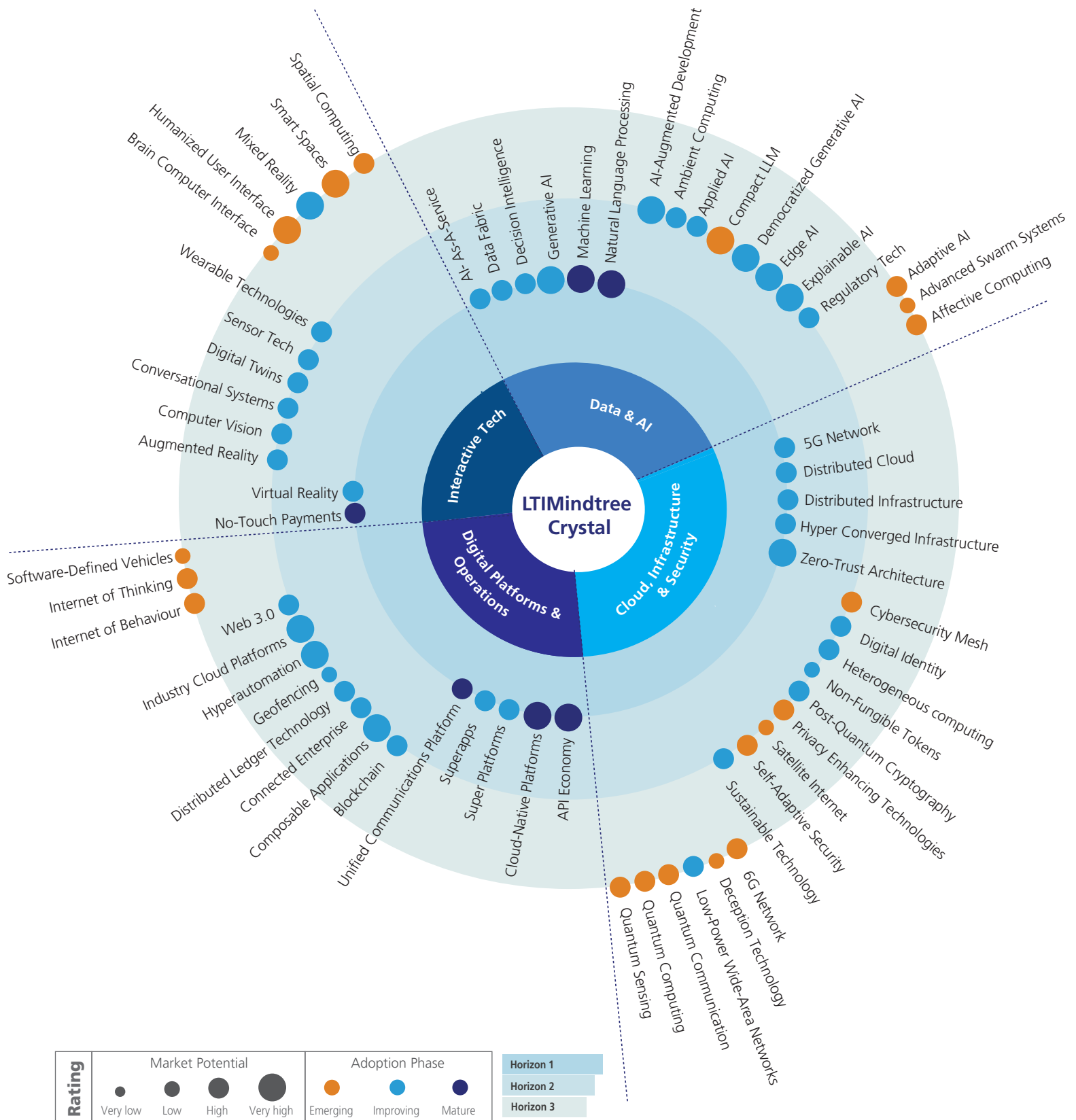
The recent trend of combining Augmented Reality and Spatial Technologies has revived and reiterated the potential of bringing together virtual and physical to a mixed world. It has provided abundant possibilities and opportunities for humans to interact with the physical world virtually. The allure of the cloud is fueling the adoption of composable architecture principles for agility, technology ROI, and TTM, bringing in a renewed focus on platform engineering at the forefront.

So, what will 2024 look like? What emerging technologies will shape our lives, societies, and business ways and influence entire economies? It is a world where AI, computing power, smarter devices, security, and data all come together to create today's engines to enable the technologies of tomorrow.

This edition of the LTIMindtree Crystal Technology Radar 2024 provides a peek into the world of tomorrow. This perspective shows how disruptive factors that we call "trends" are changing the future, highlighting their technology maturity, interdependence across segments, and market potential.

As a community, we are committed to spreading awareness on how these technologies can help us prepare for the opportunities and challenges ahead and create a bright, green, and sustainable future.

LTIMindtree Crystal – Technology Radar 2024



Navigating The Radar

The technology trends listed below are arranged according to their corresponding horizon and grouped by their technology segment

	Horizon 1	Horizon 2	Horizon 3
Interactive Tech	<ul style="list-style-type: none"> No-Touch Payments Virtual Reality 	<ul style="list-style-type: none"> Augmented Reality Computer Vision Conversational Systems Digital Twins Sensor Tech Wearable Technologies 	<ul style="list-style-type: none"> Brain Computer Interface Humanized User Interface Mixed Reality Smart Spaces Spatial Computing
Data & AI	<ul style="list-style-type: none"> AI As-A-Service Data Fabric Decision Intelligence Generative AI Machine Learning Natural Language Processing 	<ul style="list-style-type: none"> AI-Augmented Development Ambient Computing Applied AI Compact LLM Democratized Generative AI Edge AI Explainable AI Regulatory Tech 	<ul style="list-style-type: none"> Adaptive AI Advanced Swarm Systems Affective Computing
Cloud, Infrastructure & Security	<ul style="list-style-type: none"> 5G Network Distributed Cloud Distributed Infrastructure Hyper Converged Infrastructure Zero-Trust Architecture 	<ul style="list-style-type: none"> Cybersecurity Mesh Digital Identity Heterogeneous computing Non-Fungible Tokens Post-Quantum Cryptography Privacy Enhancing Technologies Satellite Internet Self-Adaptive Security Sustainable Technology 	<ul style="list-style-type: none"> 6G Network Deception Technology Low-Power Wide-Area Networks Quantum Communication Quantum Computing Quantum Sensing
Digital Platforms & Operations	<ul style="list-style-type: none"> API Economy Cloud-Native Platforms Super Platforms Superapps Unified Communications Platform 	<ul style="list-style-type: none"> Blockchain Composable Applications Connected Enterprise Distributed Ledger Technology Geofencing Hyperautomation Industry Cloud Platforms Web 3.0 	<ul style="list-style-type: none"> Internet of Behaviour Internet of Thinking Software-Defined Vehicles

Top 8 Technologies of 2024

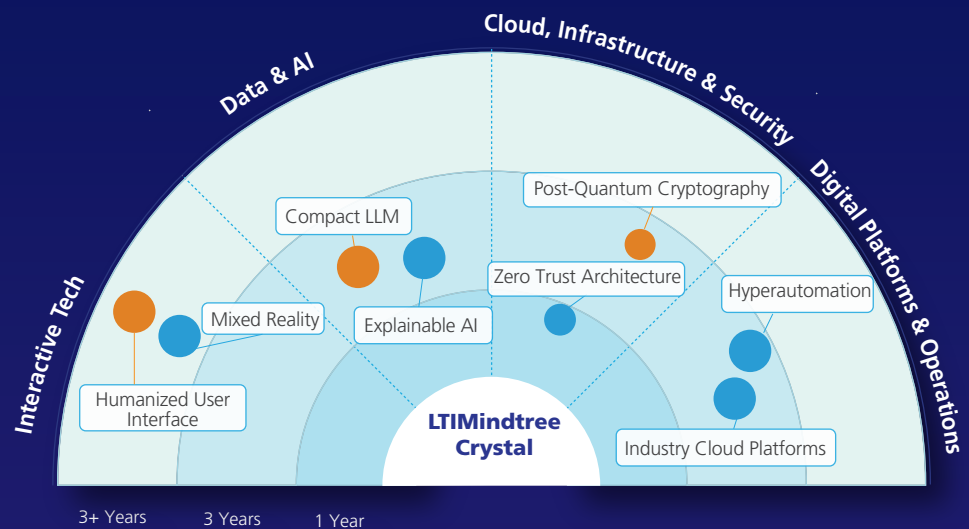


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As we embrace the relentless acceleration of innovation, staying ahead of the curve has become imperative. At LTIMindtree, we foster a collaborative world where diverse perspectives spark transformative solutions. We are committed to not just adopting the technologies of tomorrow but also actively shaping the future powered by them.

LTIMindtree Crystal Technology Radar 2024 continues to serve as a powerful tool guiding us on this journey. Its comprehensive coverage of 66 innovative technologies across four distinct segments (Interactive Tech, Data & AI, Cloud, Infrastructure, & Security and Digital Platforms & Operations) offers a radial view of technologies positioned according to their maturity and adoption stages. These attributes enable us to strategically navigate the technological landscape and identify the trends with the most significant potential. From nascent concepts on the horizon to near-realization, these technologies paint a picture of exciting possibilities and challenges that demand proactive exploration.

However, not all opportunities are created equal. Within this expansive map of innovation, we have handpicked eight technology trends that exhibit exceptional potential to transform industries and unlock remarkable value. While the future undoubtedly holds exciting prospects, these opportunity areas are where we anticipate focused efforts from enterprises and CXOs to build resilient and future-proof businesses capable of thriving in the face of rapid change.



This preface marks the starting point of our exploration into these "Technologies for Tomorrow", as we delve deeper into each trend, examining their potential impact, key considerations for implementation, and how they can be harnessed to shape a brighter future for all.

Interactive Tech



Humanized User Interface

Usability stands as the guiding principle for a humanized user interface. Its market growth is driven by the need for interfaces to adapt dynamically to contexts and environments. Enterprises are strategically investing in cultivating trust and acceptance of hyper-personalized systems. Capabilities focusing on natural interfaces like voice, gesture, and emotion recognition to deliver humanized user interfaces enable the user to gain focused insights quickly, improving decision velocity. IDC expects that by the end of 2025, 30% of Asia-Pacific (excluding Japan) organizations will take advantage of humanlike interfaces in their enterprise applications.

The market is proliferating with devices and sensors to ensure humanized interfaces that will unfold new-age, immersive, and frictionless experiences. It will promote user satisfaction and operational efficiency, leading to an always-optimal experience.



Mixed Reality

Leading tech players are pushing the limits of new-age immersive experiences with MR headsets. Apple's entry into the MR market marks a significant step towards mainstream adoption. Computationally heavy spatial algorithms enhance object recognition and real-time interactions in MR experiences. Sales, maintenance, and warehousing operations are evolving with interactive demos, remote assistance for repairs, and intuitive navigation features. IDC forecasts that combined shipments of AR, VR, and MR devices will skyrocket to 97 million units between 2023 and 2027, generating an estimated revenue of USD 49 billion.

Lighter and more accessible MR experiences that work seamlessly across different hardware platforms have the potential to unlock a future where users can enjoy consistent experiences regardless of their device or even without it.

Data & AI



Compact LLM

Contextualized large language models trained specifically for business functions are ushering in a new era of intelligent applications. Hyperscalers like AWS and Azure provide access to compact models as hosted APIs. Traditional and popular cloud-based LLMs lack customization and may carry bias risks. Inaccuracy, cybersecurity, and intellectual property infringement are the most-cited risks of LLM adoption, according to a 2023 McKinsey Report. This has paved the way for a democratized approach, where deploying compact LLMs offers comparable computational power in a cost-effective, efficient, and transparent manner.

Although compact LLMs may not match the effectiveness of their larger counterparts, they ensure user data protection by eliminating the need to transmit data to centralized servers and reducing hallucinations. These models balance performance and practicality, with reduced capital-intensive investments offering benefits such as exclusive access, rapid performance, and enhanced privacy protection.



Explainable AI

Enterprises venturing into the development of intelligent applications grapple with the challenge of inconsistent outcomes, inaccuracies, and biases. The lack of understanding regarding how AI systems arrive at decisions heightens concerns about the reliability of these applications. Explainable Artificial Intelligence (XAI) emerges as a promising solution, uncovering hidden biases or errors in data or models and enhancing the precision of outcomes. Explainability fosters trust and ensures AI systems' reliability, consistency, and accuracy. What distinguishes XAI is its capacity to unravel the complex mechanisms of neural networks and present them in understandable terms for humans.

This breakthrough unlocks numerous possibilities, prompting researchers to explore innovative methods for visualizing and communicating computational outcomes. The increased investment from industry giants underscores the growing significance of interactive interfaces and customized explanations for diverse audiences. Notably, IBM's XAI tool for AI monitoring has demonstrated remarkable results, reducing monitoring efforts, increasing model production, and improving model accuracy. This success has translated into substantial profits ranging from USD 4.1 to 15.6 million.

Cloud, Infrastructure & Security



Post-Quantum Cryptography

Companies like IBM and Xanadu are continually advancing their processing capabilities, promising a post-quantum world by 2030. Superior computing power entails significant risks in securing sensitive data across the digital landscape, especially for compliance-driven industries like finance and insurance. The emergence of quantum computers has prompted significant investment and innovation in Post-Quantum Cryptography (PQC). As a result, companies and organizations worldwide are now faced with the imperative to transition their multi-cloud environments, global networks, and software to PQC solutions.

The US government is pushing for a switch to quantum-resistant cryptography. A White House memo mandates this shift for federal agencies, and Congress is backing it with USD 100 billion in funding through the Endless Frontiers Act. The National Institute of Standards and Technology (NIST) is leading the charge in developing and standardizing PQC based on advanced mathematical techniques like code-based and lattice-based approaches. This fusion of cryptography and mathematics is emerging as a critical area of cybersecurity.



Zero Trust Architecture

Zero-trust principles are actively used to plan industrial and enterprise infrastructure and workflows. Gartner highlights zero trust as a key focus, projecting that by 2025, approximately 60% of enterprises will opt for zero trust solutions over virtual private networks. In 2021, President Biden directed US federal agencies to advance toward zero-trust architectures for their enterprise networks. The Office of Management and Budget recently issued a memorandum mandating a federal ZTA strategy, requiring agencies to adhere to cybersecurity standards by fiscal year 2024. Innovations in zero trust architecture are exemplified by “least privilege access” and network segmentation, which hinder cyber threats by isolating them and impeding lateral movement.

Micro-segmentation offers adaptability to address evolving threats and business needs while emphasizing continuous monitoring for rapid threat detection and response. Organizations increasingly prioritize risk mitigation, transitioning to zero trust security architecture for enhanced network security.

Digital Platforms & Operations



Hyperautomation

Hyperautomation elevates IT operations by replacing complex manual tasks with intelligent self-optimizing machines. According to Gartner, by 2025, more than 20% of products will undergo fully automated manufacturing, packaging, shipping, and delivery processes, remaining untouched until purchased. Furthermore, by 2024, companies are projected to slash operational expenses by 30% by integrating hyperautomation technologies into redesigned operational frameworks. As AIOps evolves, hyperautomation creates a digital model of IT assets and processes, delivering real-time insights for improved performance and agility. This approach expedites processes such as asset management, patching, and incident response, resulting in cost savings, and uncovers latent improvement opportunities through interconnected intelligence.

IT firms are making substantial investments in hyperautomation to help clients achieve flexibility and aiming to provide end-to-end hyperautomation platforms with advanced capabilities. This automated value chain, powered by hyperautomation, consolidates tasks into streamlined, scalable, and adaptable end-to-end super platforms.



Industry Cloud Platform (ICP)

Industry Cloud Platforms (ICPs) have emerged as game changers, rapidly accelerating the digital transformation journey for businesses across diverse sectors. ICPs combine the power of SaaS, PaaS, and IaaS to help build industry-relevant, on-demand solutions into a whole product offering with composable capabilities. ICP acts like an expert industry consultant embedded within your cloud environment, offering pre-built solutions and automation tailored to your needs. That's the power of ICPs; they provide deep industry expertise, pre-configured solutions, and industry-specific data models with plug-and-play features for cloud adoption. The market potential is massive, with predictions from Deloitte suggesting a USD 640 billion market size and Gartner predicting over 70% enterprise adoption by 2027. Early adopters are already reaping the rewards with faster time-to-market, streamlined operations, and solutions that directly address their industry challenges. From Google Cloud's Recommendations AI API to Goldman Sachs' Financial Cloud for Data platform, industry-specific offerings are gaining traction, pushing cloud adoption beyond its early stages.

About LTIMindtree Crystal

LTIMindtree Crystal brings “Beyond-The-Horizon” technologies to cross-industry enterprises. It presents exciting opportunities in terms of foresight to future-ready businesses keen to make faster and smarter decisions on existing and emerging technology trends. The LTIMindtree Crystal is an output of rigorous research by our team of next-gen technology experts and meticulously rated by our Technology Council across a set of parameters.

We want to thank our Technology Council members for their passion and support in sharing their ratings and feedback. We hope you enjoyed reading the Technology Radar Report 2024!

For any queries and suggestions, please write to Crystal@LTIMindtree.com

LTIMindtree is a global technology consulting and digital solutions company that enables enterprises across industries to reimagine business models, accelerate innovation, and maximize growth by harnessing digital technologies. As a digital transformation partner to more than 700 clients, LTIMindtree brings extensive domain and technology expertise to help drive superior competitive differentiation, customer experiences, and business outcomes in a converging world. Powered by 82,000+ talented and entrepreneurial professionals across more than 30 countries, LTIMindtree — a Larsen & Toubro Group company — combines the industry-acclaimed strengths of erstwhile Larsen and Toubro Infotech and Mindtree in solving the most complex business challenges and delivering transformation at scale.

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