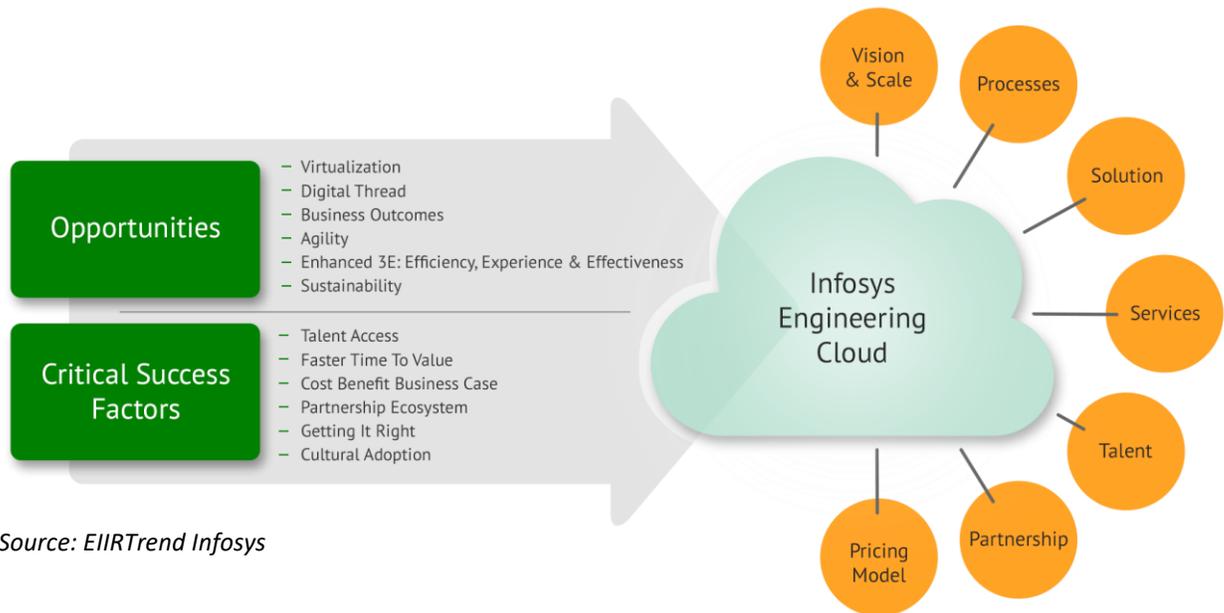


The Engineering Cloud: An Idea Whose Time Has Come

Author: Pareekh Jain, CEO EIIRtrend

The engineering cloud is an emerging trend across engineering enterprises. As enterprises embrace virtualization and cloud-enabled digital transformation, they also have an opportunity to transform the performance of their engineering operations with the engineering cloud. The engineering cloud (meaning cloud for engineering functions/solutions/products/processes) is different from cloud engineering, which pertains to the engineering of the cloud infrastructure and tech stack. This PoV defines the engineering cloud and discusses its significance for enterprises and the success factors for implementation. It also discusses [Infosys](#)' comprehensive approach to the engineering cloud driven by its Cobalt suite of services, solutions, platforms, tools, and knowledge artifacts.

Exhibit 1: The Engineering Cloud: Opportunities, Critical Success Factors, and the Infosys Approach

Source: EIIRTrend Infosys

Defining the Engineering Cloud

Abhishek believes that Enterprises are looking at Cloud coupled with other digital technologies like AR/VR/AI/ML/Autonomous, not just for enabling their IT Operations but even for orchestrating their Core Engineering Functions like Design, PLM, Manufacturing, Networking both at a product and process level. This will be the new frontier for accelerating Engineering and R&D. Thus cloud is an enabler in transforming engineering products, processes, and business models.

“The engineering cloud is defined as all engineering activities on the cloud that help to connect engineering products, optimize engineering processes, and servitize engineering business models.”

- **Abhishek Goyal**, VP Engineering and IOT at Infosys.

The engineering cloud is different from cloud engineering, as shown in the exhibit below.

Exhibit 2: The Engineering Cloud vs. Cloud Engineering

Engineering Cloud	Cloud Engineering
<p>On the Cloud</p> <ul style="list-style-type: none"> • Connecting engineering product • Digital design engineering • Digital manufacturing • Digital integration across the industrial automation and control systems stack • Engineering data management • Optimizing engineering processes • Servitizing engineering business models 	<ul style="list-style-type: none"> • Tech stack for the cloud • Software engineering for cloud-enabling applications • Cloudifying on-premise applications

Source: EIIRTrend, Infosys

Why is the Engineering Cloud Important and Why Now?

The engineering cloud creates an environment for enterprises to transform and thrive. Six specific value propositions of the engineering cloud are:

- **Virtualization:** The cloud enables physical processes to perform virtually. It is especially important when physical access or collaboration is not possible. It also helps reduce cost and time. Even if the whole process cannot be performed virtually, some degree of virtualization helps in better process performance and management. In engineering, processes such as design and testing can be done on the engineering cloud. Even some activities in manufacturing, operations, and after-sales can be improved on the engineering cloud.

Example: Core engineering applications in the design phase around CAE, CAD, and CAX including compute-heavy applications like simulations are being hosted on a virtualized environment either in enterprise data centers or the public cloud. This provides flexibility of scale as you grow and high availability of more clusters for those critical applications. Also, it is easy to deploy and manage.

- **Digital Engineering or Digital Thread:** The engineering cloud can help to transform engineering enterprises digitally like digital natives. Times are changing, and processes need to be transformed along with the changing times and emerging technologies. A procurement process that relies on historical data to plan orders should be digitally transformed to track real-time equipment failures using IoT and analytics, and then plan orders. Similarly, many processes can be improved by leveraging AI, automation, and analytics. Products can be transformed by making them connected. Business models can be transformed by servitization and closed-loop product lifecycle. All these and many more capabilities are possible on the engineering cloud. Manufacturing and engineering applications on the cloud enable collaborative design with distributed teams and remote operations of production and operations. The full potential of digital transformation will be realized when enterprises move the bulk of their engineering processes and applications to the cloud, make their products connected, and leverage new business models.

Example: A large industrial motor manufacturing client transformed its manufacturing process from Engineered to Order (ETO) to Configured to Order (CTO). This shift was made possible by integrated data from design, engineering, and manufacturing and then to service. Setting this up on the cloud enabled faster collaboration, which in turn, enabled a responsive supply chain by connecting engineering data with the suppliers in real-time.

- **Business Outcomes:** Achieving a step-change in business performance in efficiency, growth, productivity, quality, and flexibility for an engineering enterprise is possible with the engineering cloud. Some of the business outcomes are productivity and cost improvement, reduction in product and services cost, reduction in wastage, reduction in time to market, traceability, and reduction in

time to quote. The engineering cloud enables smart connected products and smart connected services leading to an as-a-service model of product offering.

Example: A large industrial equipment manufacturer designed smart connected forklifts. This has enabled the client to monitor the usage and the condition of the forklifts remotely in real time 24X7. It is helping the client improve utilization, reduce downtime, and improve MTTR and MTBF.

- **Agility:** It involves making engineering organizations agile with lean and digital engineering processes so they can capitalize on opportunities much faster and be able to respond effectively to disruption and challenges. As we have seen in the pandemic, disruptions can come from anywhere, and enterprises that are agile and can respond to disruptions survive. Also, rapid innovation is required to win in a hypercompetitive market. The engineering cloud helps develop a flexible technical stack for the enterprise, which enables rapid change and experimentation. This flexibility enables an engineering organization to design and deliver quickly, efficiently, and effectively.

Example: A digital supply chain enabled through cloud-based collaboration platforms connecting all the key suppliers helped improve responsiveness and reduced sourcing lead times. It also helped build resiliency in the pandemic by rerouting supplies.

- **Enhanced 3E – Efficiency, Experience, and Effectiveness:** Digital engineering improves the visibility of information with data. When enhanced with AI and ML, the bottlenecks in the system—process or machines—are visible. This helps improve efficiency across the process. The responsiveness of the whole system is improved due to real-time data-driven insights and actions. Right first-time responses improve. Finally, with persona-based and experience-based design, the overall experience of every persona is addressed.

Example: Manufacturing organizations use machine data to monitor the condition and state of the machine to bring in predictive maintenance. Use the machine-state data to predict the impact on product quality. Having the right information relevant to the person whether it is the operator, technician, supervisor, or supplier improves the work experience.

- **Sustainability:** With circular economy concepts, the design of the products now has to consider the end of life and disposal of the product for sustainability. Manufacturing and engineering organizations are measuring the energy consumed per product and the waste generated per product. These KPIs are becoming the corporate mandate and are appearing as disclosures in the financial reports. With cloud engineering and digital thread, product life cycle process handling becomes simplified as the data is integrated on a common platform, and through the cloud, it is visible to all the stakeholders. The engineering cloud journey also helps enterprises in their sustainability outcomes and their net-zero pledges to obtain measurable savings in energy.

Example: A power generation company developed a real-time monitoring solution to manage hazardous material handling and dispatching. With real-time visibility on the cloud, tracking and tracing of the material throughout the life cycle ensured compliance with the process.

Now, after the pandemic, there is a greater push on all the above. Enterprises want capabilities to operate virtually if needed. Engineering enterprises are adopting agile product engineering to respond faster to the customer and the market demand of customized products and reduce time to market of new products. To survive competition, enterprises need to transform, become more agile, and deliver business outcomes. Enterprises also need to work on efficiency, experience, effectiveness, and sustainability.

Key Success Factors in the Engineering Cloud

Many enterprises have a strong desire to move their engineering products, processes, and business models to the engineering cloud. They often face challenges in execution. They need to consider some critical factors to get the engineering cloud right in terms of execution and value creation.

- **Talent Access:** The engineering cloud requires talent with strong skill sets in advanced technologies. Talent or skill shortage becomes a bottleneck because many of these engineering cloud skills are hard to find for enterprises. They are available at a premium in the market. Specialist engineering cloud service providers can provide these skills on demand. Having multi-dimensional talent in the engineering domain and cloud technologies is an advantage.

Example: Deploying engineering applications on the cloud requires cross-functional skills: cloud infrastructure skills to ensure the right infrastructure, security, and scaling, and engineering application skills to define the functional and non-functional requirements. E.g., impact latency, delay, and user experience. The cloud engineering team can design the infrastructure accordingly.

- **Faster Time to Value:** In some cases, the engineering cloud journey may require a lot of time. To compete effectively in the market and for any internal transformation, time is of the essence. Faster time to value is critical for engineering enterprises in their engineering cloud journey. Enterprises shouldn't have to reinvent the wheel. Engineering cloud specialists should be able to accelerate time to value with solutions, IPs, and accelerators.

Example: Time to set up the engineering application, time to scale up or down based on the need, and establish integrations with suppliers and partners.

- **Cost-Benefit Business Case:** The engineering cloud should deliver the business case with significant improvement in business and operational metrics. It is essential for enterprises to work according to the business case, which may require the alignment of cost commitments with expected benefit realization promptly. Some enterprises prefer a lower initial commitment in their engineering cloud journey and self-funded later with the savings realized. Overall, TCO should decrease as well.
Example: The cost of the infrastructure compared to an on-premise data center deployment. The overall cost in terms of time taken to deploy on the cloud vs on-premise. OPEX cost as well as CAPEX cost benefit compared to on-premise.
- **Partnership Ecosystem.** The engineering cloud requires an ecosystem of partners to stitch a complete solution. Enterprises should be well versed with the partner ecosystem to make the engineering cloud a success. Sometimes, it is practically difficult and time-consuming for enterprises to figure out all the partnerships themselves. In such cases, it is advisable that enterprises work with a few key partners and take their help in bringing a larger partnership ecosystem.
Example: Hyperscalers (AWS, Azure, GCP), product vendors like engineering application vendors of CAD, PLM, MES, SCADA, HISTORIAN, and so on. A system integrator who can assemble the disparate technology stack and create a purpose-built solution will be a key differentiator.
- **Getting it Right (Complexity & Risk Management).** A lot of things can go wrong in the engineering cloud journey in both strategy and execution. The engineering cloud is a complex system of systems and requires a lot of technical dependency on different products and processes both inside the enterprise and across the extended enterprise with suppliers and customers. There are different security, data protection, and resiliency requirements. Also, the engineering workflow becomes very complex. The cloud journey should be planned with a simplification and risk management approach along with partners who can help in getting this right, enabling seamless collaboration across the extended enterprise.
Example: When setting up PLM on the cloud, getting the right solution architecture and design is key for a successful deployment. It is also important to build an operations management solution for agility in the changing requirements of the cloud deployment.
- **Cultural Adoption.** Engineering enterprises have a huge legacy in terms of not only technology but also process and culture. Teams have to undergo a lot of unlearning and re-learning. This change management is critical for enterprises to think natively digital and cloud.
Example: Thinking natively cloud and digital, understanding the virtual infrastructure, mindset on the team in pursuing a physical infrastructure-based solution.

Enterprises should work with partners who are experts in the engineering cloud and have done it successfully with other enterprises. Service providers should have access to talent and a thriving partnership ecosystem. They should offer faster time to value with predefined solutions, IPs, accelerators, and solutions. Also, with innovative pricing models, they should deliver on cost-benefit business cases.

Infosys' Comprehensive Engineering Cloud Approach

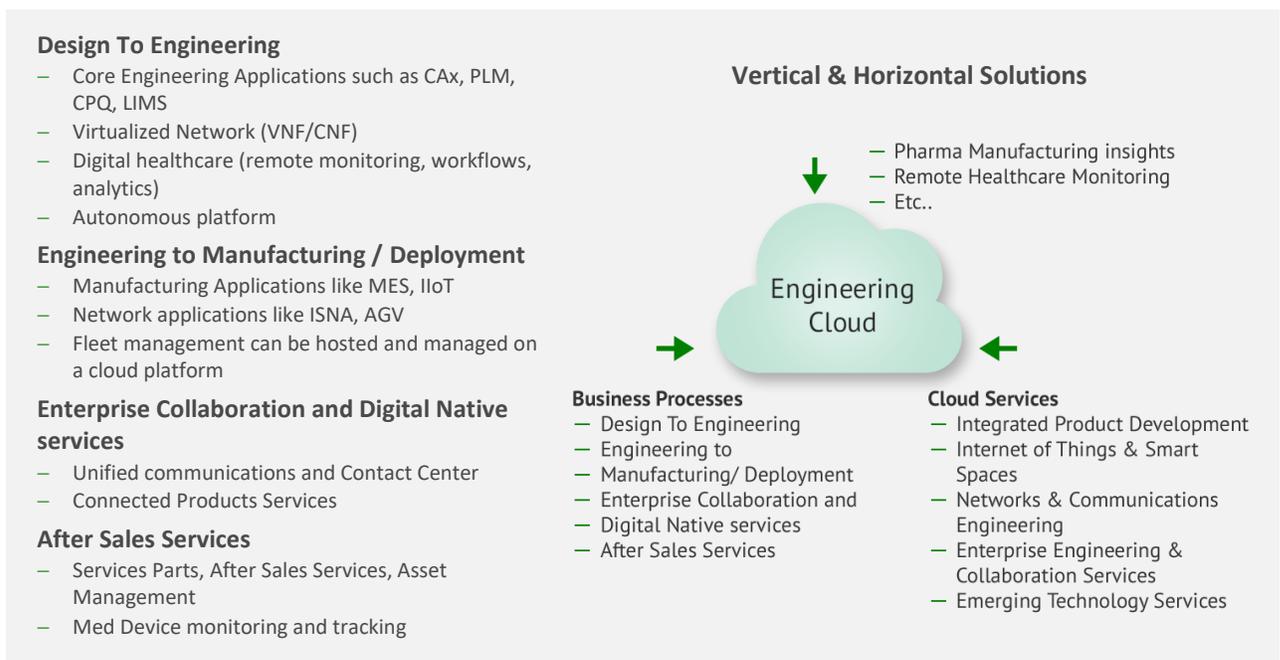
Infosys' Engineering Cloud is part of Infosys Cobalt, a comprehensive offering from Infosys to accelerate the enterprise cloud journey. This offering is driven by engineering services. After nearly 30 years of working with engineering enterprises, a deep understanding of the challenges in the adoption of the engineering cloud has helped provide the right approach for the engineering cloud. Infosys Engineering Cloud is the cloud offering suite from Infosys for engineering services, solutions, platforms, and knowledge management (KM) artifacts.

Infosys Engineering Cloud is driving the transformation of engineering enterprises in their core business areas of engineering design, manufacturing, after-sales, and innovation for enterprises through the cloud. Engineering cloud offering has two dimensions: process-centric and industry-centric.

- **The process-centric** engineering cloud offering cloudifies the engineering process across the design, engineering, manufacturing, and after-sales. E.g., digital thread, connected operations on the cloud, engineering data management on the cloud.
- **The industry-centric** offering provides a verticalized engineering cloud for the business processes specific to the industry domain. E.g., digital manufacturing, digital mines, smart farms, and so on.

The three tenets of Infosys' Engineering Cloud are shown in the exhibit below.

Exhibit 3: The Three Tenets of the Infosys Cloud



Design Engineering Cloud	Manufacturing Cloud	Collaboration Cloud	Connected Products Cloud	Network/ Telecom Cloud	After Sales Cloud	Smart Infrastructure Cloud	Media Cloud
<ul style="list-style-type: none"> PLM CAD/CAE CPQ Embedded System 	<ul style="list-style-type: none"> Connected Operations MES/MOM/ MPS PLM Prototype 	<ul style="list-style-type: none"> Enterprise Collaboration Unified Communication Virtual Desktops Contact Center 	<ul style="list-style-type: none"> Telematics Infotainment Autonomous, CV & Robotics Remotely Guided Mobility Fleet Management system 	<ul style="list-style-type: none"> 5G/MEC/O-RAN Virtualized access/SASE Network Systems 	<ul style="list-style-type: none"> Product configuration and monitoring Preventive Maintenance Usage and Field failure tracking Contact Center 	<ul style="list-style-type: none"> Remote Building Operations Energy & Sustainability Occupant Experience Intelligent Workplace Platform 	<ul style="list-style-type: none"> Content processing Headless CMS Metadata services

Source: Infosys, EIIRTrend

The Infosys Engineering Cloud has a strong value proposition for enterprises. Its vision, scale, processes, services, solutions, talent, partnerships, and pricing models are creating value for engineering enterprises in their cloud journey, as discussed in the exhibit below.

Exhibit 4: The Infosys Engineering Cloud Value Proposition

Segment	Infosys Approach	Value to Engineering Enterprise in Cloud Journey
Vision & Scale	Ambitious vision <ul style="list-style-type: none"> Focus on cloud enablement of team - 90% cloud skilled. More than 60% of the engineering revenue to come from cloud-based solutions over the next 2 years. Migrate/build all Infosys IP solutions on the cloud 	<ul style="list-style-type: none"> Ensures steady investment in talent, solutions, and ecosystem for long-term success Experience of transforming through modernization of legacy engineering enterprises
Processes	Process Digitalization (Details Exhibit 3) <ul style="list-style-type: none"> Design to engineering Engineering to manufacturing and deployment Enterprise collaboration and digital native services Operations/After-sales service 	<ul style="list-style-type: none"> Completeness of offerings across engineering processes helps enterprises leverage the cloud as a process transformation lever across the digital thread. That way, enterprises can scale their engineering cloud journey across the value chain

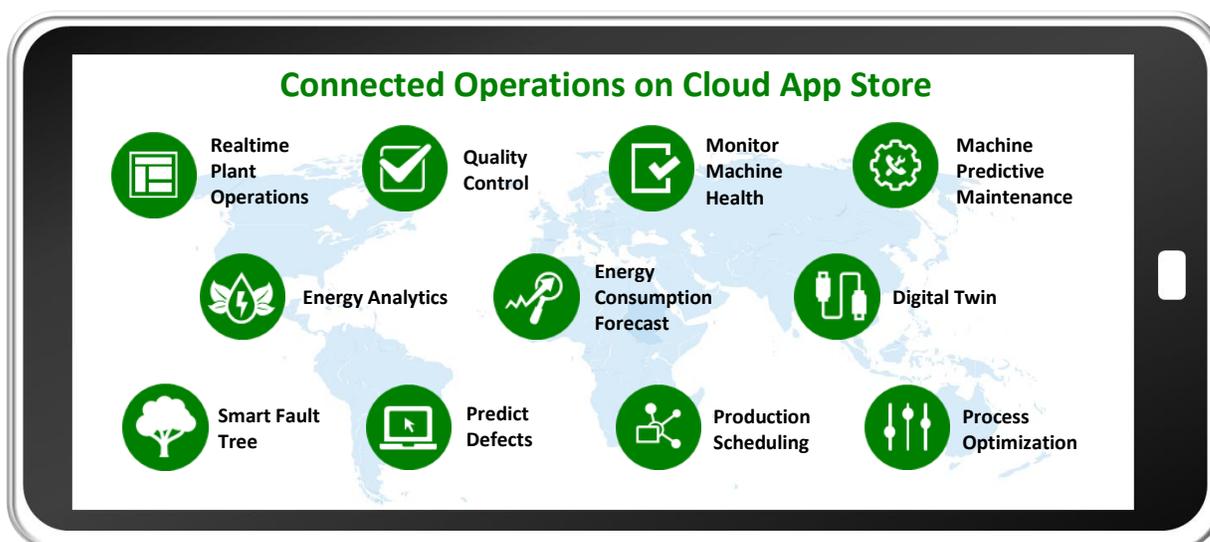
Segment	Infosys Approach	Value to Engineering Enterprise in Cloud Journey
Solution	<p>Fast-growing portfolio with existing 50+ solutions, IPs, value accelerators. (Details Exhibit 3). Some of the solutions are</p> <ul style="list-style-type: none"> • Intelligent and safe workplace • Autonomous platform, computer vision for airports, malls • 5G network assurance • Digital maturity of manufacturing plants • Connected operations on the cloud 	<ul style="list-style-type: none"> • Ensures enterprises don't need to start from scratch or reinvent the wheel. Solutions increase speed to market while saving on cost. • Reduces the time to launch new products/systems by providing a pre-configured cloud application playground
Services	<p>A comprehensive suite of engineering cloud offerings (Details Exhibit 3). Some engineering cloud services are</p> <ul style="list-style-type: none"> • Design engineering cloud • Manufacturing cloud • Collaboration cloud • Connected products cloud 	<ul style="list-style-type: none"> • Depth and breadth of offerings across horizontals and verticals help serving specific needs of different enterprises and get it right in a quick timeframe. Also, enterprises need not look for different partners for different requirements.
Talent	<p>Engineering cloud talent planning supported by a well-structured digital training, certifications, and incentives approach.</p> <ul style="list-style-type: none"> • Focus on cloud enablement of the team, 90% cloud-skilled • Cloud certifications on hyper scalars • Digital tags for employees 	<ul style="list-style-type: none"> • A structured approach ensures sustainability and scalability of talent for enterprise projects.
Partnership	<p>Partnership ecosystem to support the entire value chain</p> <ul style="list-style-type: none"> • Highest levels of partnership with top hyperscalars, software, hardware, academia partners. Extended partner ecosystem for security with key partners such as IBM, RSA, and Symantec 	<ul style="list-style-type: none"> • Helping leverage the partnership ecosystem for a complete solution according to the enterprise technology landscape and roadmap • Integration with partners is smooth without vendor-locking
Pricing Model	<p>Different pricing models for the engineering cloud</p> <ul style="list-style-type: none"> • Outcome-based engagement for consumption load • Gain share/self-funded model • As-a-service model • Bundled engagement model 	<ul style="list-style-type: none"> • Multiple pricing models ensure enterprises can align cost with their budget and cash flow requirements • Reduces total cost of ownership (TCO)

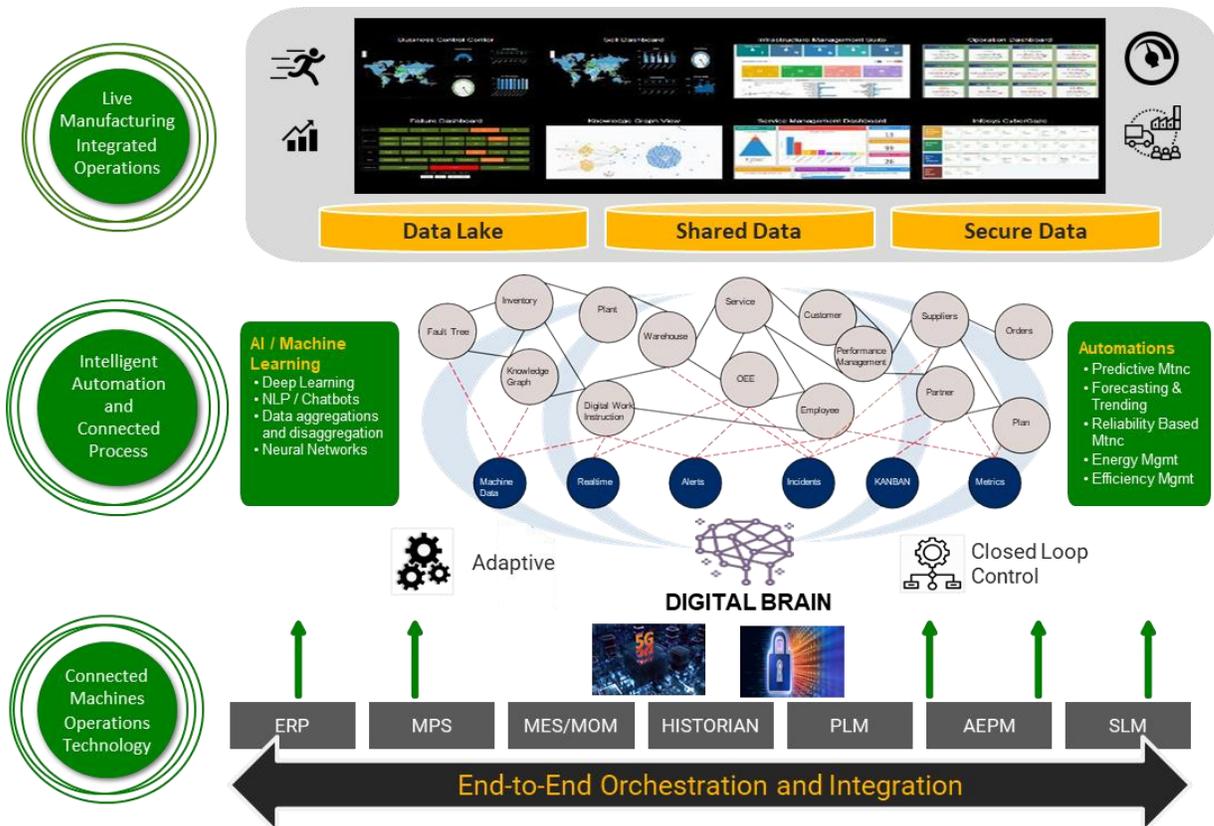
Source: EIIRTrend, Infosys

Infosys continuously invested in developing engineering cloud assets in the process and industry category, enabling its clients to achieve faster time to value and proven technology. A sample of Infosys' engineering cloud assets is explained below.

- **Connected operations on the cloud:** Plug-and-play consumable micro apps/consumption workloads, end-to-end domain-specific solutions and artifacts, pre-defined frameworks, and pre-built tools and accelerators. Real-time data acquisition from machines, hybrid edge/cloud architecture, AI/ ML-powered automation for predictability, bidirectional closed-loop operations. Connected operations solution is based on Infosys' Live Enterprise concept of a sentient-based enterprise. Decision-making powered by Infosys' digital brain with AI/ML.

Exhibit 5: Infosys' Connected Operations on the Cloud





Source: Infosys, EIIRTrend

Infosys Engineering has helped many clients in their engineering cloud journey, recently delivering tangible value. These examples are in different industries across the value chain.

Exhibit 6: Infosys’ Engineering Cloud Customer Examples

Customer	Value Chain	Infosys Engineering Cloud Offering/ Solution	Business Impact Delivered
A Leading US-based Real Estate Firm	<ul style="list-style-type: none"> Operations/Aft er-sales service 	<ul style="list-style-type: none"> Health and wellness solution Monitoring and managing energy consumption and operational efficiencies of buildings Built on Microsoft Azure’s IoT technology stack 	<ul style="list-style-type: none"> 15% - 20% improvement in operational efficiencies 10% - 30% reduction in energy consumption

Customer	Value Chain	Infosys Engineering Cloud Offering/ Solution	Business Impact Delivered
A Leading Network Equipment OEM	<ul style="list-style-type: none"> Design to Engineering 	<ul style="list-style-type: none"> Cloud-native design, development, and testing of 4G and 5G network functions Building the CAAS and orchestration layer for the network workload life cycle management, dynamic scaling, and monitoring 	<ul style="list-style-type: none"> This approach enabled the network OEMs to seamlessly deploy the workloads on any target telco cloud infrastructure and interwork.
A Leading Material Handling Equipment OEM	<ul style="list-style-type: none"> Engineering to Manufacture 	<ul style="list-style-type: none"> Global Telematics Solution (GTS) Azure-based, multi-browser, multi-device solution with Microsoft Connected Vehicle Platform (MCVP) as its core 	<ul style="list-style-type: none"> Delivered 15% velocity improvement, 30% productivity improvement, and 87% reduction in manual intervention
A Leading Diabetes Care Firm	<ul style="list-style-type: none"> Design to Engineering 	<ul style="list-style-type: none"> Patient engagement solution for diabetes management Patients have mobile apps and all data collection and analytics happen on the Azure cloud. 	<ul style="list-style-type: none"> Resulted in better compliance, glucose readings in the right range, improved lifestyle
A Leading Telecom ISV	<ul style="list-style-type: none"> Operations/After-sales service 	<ul style="list-style-type: none"> Using the engineering cloud for network OEM functions like control plane, subscriber management, service provisioning, and fault management 	<ul style="list-style-type: none"> Reducing the tier 2 service providers' network management cost by at least 50% This enabled a new SaaS model for OEM and a marketplace to bring together more network management functions for revenue generation.
A Leading Aero-engine Manufacturer	<ul style="list-style-type: none"> Engineering to manufacture 	<ul style="list-style-type: none"> End-to-end smart factory solution definition and implementation From sensor identification, network setup to implementation of real-time dashboards for condition monitoring, energy, and waste management 	<ul style="list-style-type: none"> An integrated solution covering ERP, MES, and machine data for intelligent scheduling 5% rise in customer delivery adherence 13% increase in OEE in 6 months 10% decrease in waste from machines

Source: EIIRTrend, Infosys

Bottom Line: Engineering enterprises should develop a comprehensive engineering cloud strategy and implementation roadmap with partners

Enterprise shouldn't look at the engineering cloud with a piecemeal or tactical approach. It is an opportunity for transformation and should be looked at comprehensively. Specifically, enterprises should:

- Look for engineering cloud opportunities across products, processes, and business models
- Develop comprehensive engineering cloud strategy and implementation roadmap to capitalize on opportunities
- Select and work with service providers who have comprehensive engineering cloud expertise
- Transform engineering product, processes, and business models with the engineering cloud
- Set up engineering cloud governance. Constantly monitor, improve, and optimize.

The engineering cloud is a transformation journey. Do it right with the right partners.

About the Author



Pareekh Jain

Pareekh Jain is CEO and Lead Analyst of EIIRTrend and Pareekh Consulting.

EIIRTrend is an information platform for discovering engineering, IoT, Industry 4.0 and R&D (EIIR) trends, information, insights, best practices, across 12 industry segments, 24 service segments, 50+ countries and 2000+ providers and buyers.

Pareekh Consulting is a focused analyst and advisory firm for EIIR.

A seasoned EIIR professional, Pareekh has seen the EIIR industry from four perspectives: service provider, sourcing advisor, enterprise buyer, and industry analyst.

He is regularly quoted in media on EIIR trends. Some of the media publications he is quoted in include Harvard Business Review (HBR), NDTV, Times of India, Economic Times, Business Standard, Hindu, Business Line, Livemint, Indian Express, Financial Express, Deccan Herald, Bizzbuzz, Rediff, Voice of America, Moneycontrol, Quartz, and Business Insider.

Pareekh is a thought leader, having authored various publications on topics related to EIIR outsourcing. He loves business fiction writing in his free time, and has authored a novel, Who Is That Lady?

Pareekh received his MBA from the Indian Institute of Management (IIM), Bangalore and his Bachelor of Technology degree from the Indian Institute of Technology (IIT) Delhi.

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