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I am delighted to present to you 'HiTech Insights: Vol 3: Software Product Engineering'. In this edition of our journal, we bring forth our perspective on the impact of key digital themes on software product businesses and discuss their adoption approach to meet today's business demands.

Product companies (ISVs) are leading the adoption of Business 4.0 to create exponential value for their customers. Today, a digital platform led business and 'everything as a service' (XaaS) model are driving widespread development, adoption, and migration to SaaS platforms. New-age software products and platforms are embedded with AI/ML capabilities to make them intelligent and drive better customer experience. Cloud based DevOps is driving scale and agility in product development. Product analytics is delivering excellence in product engineering, operations, and marketing. Hyper-convergence has refined the infrastructure and manageability software market and also brought down infrastructure costs and ensuring cyber security remains a top priority for all ISVs.

With established, emerging, and 'hyper-growth' product players leading the way, the product ecosystem is growing exponentially. We believe that this intensity of growth has to be complemented with design thinking, agility, DevOps, automation, massive scaling, seamless product integrations, and the adoption of next-gen technologies to solve real-world problems.

'SaaSification' of products and platforms is a priority for all ISVs. In doing this, companies must think through revenue realization, costs, culture, infrastructure, backend-IT systems, operations, and support. Intelligent products with embedded AI, ML, and analytics are key differentiators for customer experience. A design thinking approach is imperative to embrace the dynamism to develop disruptive next-generation products. Blockchain offers a multitude of opportunities for ISVs to make solutions more secure, reliable, and trustworthy. Lastly, in their journey of growth and transformation, ISVs cannot ignore the importance of DevOps and automation-led accelerated agile culture, and cost-optimization through hyper-converged infrastructure.

Hope you find this journal an interesting read.

Warm regards,
Nagaraj Ijari
**TCS Named a 'Winner' in Software Product Engineering Services by HFS**

TCS has been positioned in the Winner’s Circle in the first ever HFS Research Software Product Engineering Services Blueprint 2018. TCS' strengths highlighted in the report include its Business 4.0™ framework that leverages digital technologies and location-independent agile delivery to aid transformations, its strong innovation credentials in the software product engineering space, and high number of patents.

“TCS has established itself as a strong software product engineering service provider with an innovation mindset backed by one of the highest number of patents among the service providers evaluated in this Blueprint, and strong customer references. This is helping it pursue its vision of becoming the partner of choice for all existing and new product initiatives,” said Pareekh Jain, Senior Vice President and Managing Director India, HFS.

Click [here](http://example.com) to read the complete report.

**TCS Recognized as a Leader in Software Product Engineering Services by Everest Group**

TCS recognized as a Leader in Everest Group’s Software Product Engineering Services – Market Trends and Service PEAK Matrix™ Assessment 2017. Everest Group Research recognized TCS for its strong Software Product Engineering (SPE) domain expertise and ability to cross leverage best practices across industries, which is greatly valued by clients. It also highlights TCS’ investments as credible and structured in developing IP assets across SPE, data processing, networking, and cyber security.
As a result of rapid digitalization, software products need to be engineered at speed but also with new features and functionality built in. We have assessed TCS as a Leader in our PEAK Matrix™ for Software Product Engineering on account of its vision and ongoing investments in homegrown IP as well as in a broader partner ecosystem,” said Chirajeet Sengupta, Partner, Everest Group.

Click [here](#) to read the complete press release.

**TCS positioned as Leader in Engineering R&D services in Zinnov ER&D Zones**

TCS has been recognized as a leader in Enterprise Software and Computer Peripherals & Storage by Zinnov ER&D Zones in 2017. This leadership is attributed to niche capabilities, formal innovation culture, significant investment in lab infrastructure for go-to-market capabilities and established engagements with leading ISVs.

"TCS' unique combination of next gen technology labs & center of excellences, strong infrastructure facilities and its characteristic strength of deep domain expertise across all verticals help customers to innovate faster with TCS. In an industry that is shifting towards "Software defined everything", TCS' Software Product Engineering services maturity gives them the edge to participate in customers' product transformation journey, adopt agile and bring innovation', said Sidhant Rastogi, Partner & Practice Head, Zinnov.

Click [here](#) to read the complete report.
Redesigning the Value Chain of SaaS Companies

Abstract

Independent software vendors (ISV) are rapidly evolving to adopt Software-as-a-Service (SaaS) as a core product strategy and scale up to meet market demands. This requires them to radically alter their value chains for a smooth transition to the SaaS model.
**SaaS Introduces Fundamental Changes**

The software space has experienced a fundamental change from one-time license pricing to over-a-period deferred spends. As a result, the global SaaS market, which was valued at $23.88 billion in 2014 is expected to reach $164.29 billion by 2022.¹ With SaaS products in areas such as customer relationship management, human resource management, and service management gaining in popularity, traditional ISVs need to reinvent and transform themselves to develop and deliver software as point solutions and services, rather than traditional packaged products.

**How SaaS-enabled ISVs Differ**

The SaaS-based product value chain differs significantly from its typical license-based counterpart.

**Inbound activities**

While inbound activities remain focused on product vision and research, the emphasis is more on selecting the development platforms and software. Products can either be developed on Platform-as-a-Service (PaaS) offerings or built from scratch. Decisions related to infrastructure, platforms, and software tend to vary based on product strategies.

**Operations**

Activities such as product development add a new dimension to preparing the core team for continuous product release and deployments, with Agile and DevOps gaining prominence. Further, since products need to be designed for the SaaS model, there is additional focus on measuring product usage, integration with IT systems, analytics, API architecture, and support and services requirements.
Outbound logistics

The outbound and logistics pillar for the SaaS-based product value chain is the primary differentiator. The type of subscription is a critical factor that enables product functionality access to the end user. Customer onboarding processes play an important role in enterprise product delivery. This pillar also adds activities relevant to platform integration, with IT systems running the business.

Sales and marketing

Instead of retail, online selling is the primary sales channel in the SaaS value chain. Usage-based billing adds additional scenarios to create compelling value propositions for customers since they need not pay for the software as a whole, but only when it is used. Analytics plays a much larger role in the success of the SaaS model. With recurring revenue being their lifeline, customer retention is a critical parameter for SaaS-based product businesses. Analytics techniques are deeply integrated into products to measure and improve customer engagement, product quality, sales and marketing effectiveness, and product support services.

Service

Product service and support in SaaS are tagged to subscriptions and requires additional customer provisioning and onboarding, tenant customization, billing and subscription management, and product function support. The IT function needs to implement new systems or modify existing systems to adapt to changes in licensing, billing, procurement, payments, sales and marketing, and customer relationship management.
<table>
<thead>
<tr>
<th></th>
<th><strong>Traditional ISVs</strong></th>
<th><strong>SaaS ISVs</strong></th>
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<tbody>
<tr>
<td><strong>Product management</strong></td>
<td>- Long-term execution plan&lt;br&gt;- Periodic customer feedback</td>
<td>- Frequent releases&lt;br&gt;- Continuous feedback loop to capture real-time customer sentiments</td>
</tr>
<tr>
<td><strong>Product development and testing</strong></td>
<td>- Agile or Waterfall development models&lt;br&gt;- IT systems independent of product team</td>
<td>- Agile development, continuous integration and release, DevOps methodology&lt;br&gt;- Product and IT teams collaborate</td>
</tr>
<tr>
<td><strong>Software packaging and deployment</strong></td>
<td>Products are packaged as installable modules and are installed by product experts</td>
<td>Products are hosted as solutions on the cloud, with automatic provisioning in real time generally</td>
</tr>
<tr>
<td><strong>Sales and marketing</strong></td>
<td>Through third-party resellers and OEMs or product and channel partners</td>
<td>Through online channels such as e-commerce websites with shorter sales cycle due to lower initial cost of subscription</td>
</tr>
<tr>
<td><strong>Product support and maintenance</strong></td>
<td>- Product support over call, chat, emails, and online forums with defined L1, L2, and L3 support streams&lt;br&gt;- Complex product environments and custom environments make patch releases or custom fixes cumbersome</td>
<td>- Round-the-clock support through online forums and chat clients&lt;br&gt;- Support is more critical and complex&lt;br&gt;- DevOps and other automation practices are a norm</td>
</tr>
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<td><strong>Implementation and customization</strong></td>
<td>Heavy customization</td>
<td>Easy customization</td>
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*Key changes that ISVs need to implement across the value chain in order to successfully adopt the SaaS model.*
**Transformation to next-generation SaaS**

**Key challenges**

The first challenge for companies seeking to transform to a SaaS model is competition from new-age SaaS companies, which do not have legacy products, and are more agile and responsive to market needs.

Secondly, increasing demand of SaaS products poses a challenge due to lack of scale and shortage of talent to develop products. Also, supporting IT systems are not fully geared to manage the rapid growth.

Thirdly, the existing analytics techniques and IT systems of ISVs are not equipped enough to extract insights on customer retention.

**Five key aspects for adopting SaaS model**

To ensure a seamless transition to the SaaS model, companies need to revamp their traditional value chain and reorient software product development, the way the business is run, revenue recognition, financials, sales, marketing, product service, and support.

Five critical steps in the transformation journey are:
1. ‘SaaSifying’ products and tweaking product strategy by hosting products in the cloud, re-architecting for SaaS, and building products from scratch
2. Making IT versatile by changing IT systems that run the business, including customer management, metering, billing, and revenue recognition
3. Dealing with complexities to facilitate seamless onboarding through self-provisioning, continuous support, and customer intelligence
4. Gearing up for ongoing customer relationships instead of one-time sales
5. Preparing for changes in revenue recognition and cash flows by adapting finance systems and overall finance management practices

Conclusion

Increasing SaaS adoption has created a huge growth opportunity for product companies. As companies move to a SaaS model, they need to transform their value chains, which entails altering their product and IT strategies. Fierce competition in the SaaS market has put immense pressure on product companies to launch products using SaaS-enabled models.

SaaS-based subscription models offer opportunities such as anytime-anywhere availability, shorter implementation cycles, greater agility, and competitiveness. SaaS reduces operational hassles and makes for far easier system upgrades.

References


About The Author

Gajanan Kamble

Gajanan Kamble heads the Software Product Engineering Services group of the HiTech business unit at Tata Consultancy Services (TCS). He has been with TCS for 18 years, and has played key roles in product development, presales, business development, and customer relationship management. Kamble works closely with global technology companies in the software product engineering space.
AI-Powered Software Portfolios: A Winning Strategy for Software Companies

Abstract

Digital transformation might be the new normal across industries, but companies now face the challenge of embracing innovation while ensuring business as usual for all processes and functions. Many are leveraging Agile, automation, cloud, and digital marketing solutions to ease this transformation journey. Software being a major enabler, artificial intelligence (AI) is poised to simplify the transition further. More so, as Software-as-a-Service (SaaS) dominates most IT strategies, enterprises now expect all software to be powered by native AI capabilities.

For existing software players, this opens up massive opportunities to help drive a more simplified transformation journey for their customers. While the threat from emerging pure-play native AI firms loom, commercial software companies can consider infusing AI into their existing portfolio offerings. Some independent software vendors (ISVs) are already introducing platform extensions that are powered by AI. This paper highlights how such a portfolio can accelerate digital transformation initiatives—helping enterprises utilize their core systems of record and systems of differentiation effectively.
Embracing the New 'Always Learning' Paradigm

With the advent of As-a-Service approach to software implementation, there rises a need to strike a balance between what the software needs to be and how it can be implemented and configured on enterprise platforms. Needless to say, businesses would want the software's core capabilities to include continuous learning across modules. Ideally, the software should be configured and optimized based on usage.

Here's where the buzz around AI starts making sense. Software vendors will now have to reassess their strategy to rebrand and reposition themselves as AI-powered. As market demands grow and evolve, it will help existing software companies strike the right balance between infusing AI in existing modules and developing independent AI portfolios. This may also solve the issue of defining developer, business user, and executive management personas.

But, first things first, established enterprise software companies will need to accelerate the pace for customers to deploy these innovations in their software which have native machine learning capabilities. Some vendors such as SAP, Oracle, and Infor are already making headway—owing to the extent of business processes covered within enterprise resource planning (ERP) and corporate performance management (CPM). SAP\(^1\) has announced that its new expanded public cloud ERP platform will include machine learning capabilities that go beyond existing systems—ensuring customers stay ahead in the digital transformation curve.

These established players will also need to take note of rapidly emerging pure-play native cloud-driven, self-service business intelligence (BI) platforms. One way to go about it is to infuse AI capabilities to existing platforms that provide governed data discovery. This can, in turn, enhance user experience as well as maximize productivity of BI developers, designers, administrators, analysts, and other relevant users. Software companies with products across multiple categories are

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creating a mesh of AI—interwoven into multiple
Poised to unleash the next wave of digital disruption, AI is
driving software companies to rethink their product portfolios.
products—to deliver more synergies for their customers. Infor’s
new Coleman AI platform, designed for business users,
combines the capabilities of Infor’s cloud software with native
AI trained on industry specific data sets.²

Revisiting Key Software Segments

Taking a leaf out of these recent innovators, software
companies will have to take note of several segments:

1. Data management: When it comes to the software’s data
management components, business and IT functions heavily
rely on data integration, quality, and management tools.
However, this can be extremely effort intensive. As the data
integration market evolves, particularly in terms of the iPaaS,
aPaaS, hybrid cloud data store architecture, infusing AI
becomes all the more essential to minimize the effort
required—from data preparation to quality management.

2. Customer relationship management (CRM) and content
services: Enterprises expect CRM to deliver integrated
customer insights in the omni-channel environment. Processes
within customer service and support, digital commerce,
marketing and sales definitely need AI integrated in the system.
Similarly, content services platforms, which include enterprise
content management (ECM) software, must deliver integrated
services and solutions with inbuilt data management
capabilities. With AI built in, enterprises can rapidly adopt and
leverage these for several business purposes and driving
outcomes. As delivering customer experience ranks high across
industries, software companies like Salesforce’s Einstein³ are
already enhancing core CRM offerings with AI.
3. **Supply chain**: Some emerging players are developing applications which have native AI capabilities for integrated demand management, supply chain management, and integrated business planning. However, to truly enable digital transformation, these companies must frequently interact with stakeholders across the user community. When it comes to adaptive intelligent applications, Oracle has integrated machine learning capabilities into their customer experience cloud offerings.

4. **Security**: This segment is using AI for threat detection, pattern identification, and incident resolution. Companies like Cylance have embedded AI in their security product portfolio to identify potential threats and patterns that could lead to security breaches. Independent AI software and solution providers are already delivering ecosystem capabilities to enhance secure operations centers (SOC) and provide next-generation security solutions through integration with leading SIEM technologies.

**Anatomy and Architecture: Embedding AI**

Software platforms are also deploying machine learning to collect data on customers’ software usage, especially in terms of ensuring higher productivity and delivering business outcomes. To plan both long- and short-term AI embedding and/or interoperability, these players must ask:

- Is the current AI adoption primarily led by independent AI software players? If yes, what is the next growth wave in this area?
- How can we adopt and move beyond chatbots? More precisely, how can we infuse augmented intelligence into existing business processes and applications?
- How can we combine AI-enabled open source tools and services with commercial products? How do we design the reference architecture and which usecase attributes do we incorporate?
- What is the future role of system integrators in terms of realizing business opportunities within the intelligent context-aware software application enabled world?
ISVs too have to plan their products and services, prioritizing AI infusion, keeping in mind certain factors:
• Developer experience for delivering enriched applications on core portfolios
• Leveraging an AI platform on top of the existing platform to address existing business use cases
• Partnerships with independent AI players for rapid alignment to respond to digital transformation opportunities
• Allowing extensions and maintenance of AI capabilities in core modules

The Convergence: Native vs. Interoperable

The current cloud computing world offers several options and reference architectures for businesses to drive agility, automation, and user experience. Figure 1 highlights a possible reference structure for enterprises on the path to digital transformation, specifically for processes which have dependences across multiple layers of commercial enterprise software, integration, data and analytics, and mobile platforms.

Global System integrators are already developing AI Applications and chatbots leveraging industry leading independent AI platforms like IBM Watson, Microsoft Azure, Amazon LEX, Tensorflow, and more. Take for instance a sales AI assistant which can help sales executives with contextual intelligence 'anytime, anywhere' along with correlation and recommendations for new and existing accounts.
**Figure 2** depicts the potential reference architecture components for software, business process, and data platforms with native AI. This might just help existing players offering commercial off-the-shelf (COTS) products natively embed AI as part of their core offerings across dimensions—like transforming the day-in-the-life of business users and developers.
With a support desk virtual agent solution in place, these players can provide a seamless self-service conversation interface to customers—resolving, for instance, common recurring printer-related issues and creating incident tickets in the cloud using natural language processing (NLP) tools.

A product purchase advisory bot can be an intelligent, highly responsive, contextual and advisory virtual assistant to guide users in making product purchase decisions faster—communicating similar to how we converse. This bot can also derive sentiment analysis and user feedback from social media channels.

An IT self-service bot can ensure optimized service management leveraging machine learning. This bot can resolve common support issues faster—setting an example of how service support agents and machines can collaborate effectively.
An HR staffing cognitive bot and analytics solution can accelerate and improve the hiring process wherein candidates can answer questions about the job role, location-wise skills, and so on. This can also provide personalized, contextualized search on job profiles posted by recruiters based on specific filters and parameters.

**Ushering in an AI-Powered Future**

With the aim of delivering consistent compelling customer experience, enterprises will expect partner software companies to integrate the necessary intelligence across product offerings. In terms of gaining a competitive edge, these companies will invest in areas that justify returns on investment (ROI) and meet time-to-market requirements.

Partnering with software companies, enterprises can create enhanced value for their customers in overall business operations by automating key functions intelligently and deriving insights from critical data. Now is the time vendors step up their game and deliver differentiated offerings, and in turn, accelerate AI adoption for enterprises across their business processes and technology dimensions.

Powered by AI, enterprises will stay ahead in terms of reinventing and reimagining their business models—through intelligent and adaptive supply chains, delightful customer experiences, energized human resource management, and highly productive corporate functions like finance, sales, and operations.
About The Author

Spandan Mahapatra

Spandan Mahapatra is part of the leadership team of TCS’ HiTech business unit. He leads the Software Segment business and is the Head of Digital for the unit. Mahapatra also heads the Business Solutions group within TCS’ Alliances and Technology Unit. His team includes a large pool of highly skilled business and technology experts that drive sales, digital solutions development, demand generation for digital business, digital sales, and delivery.

Mahapatra and his leadership team have been instrumental in establishing one of the largest advanced technology innovation platform at the TCS Innovation Lab in Cincinnati on a hybrid cloud—driving interoperability with over 40 technologies across infrastructure and application solutioning layers.
Abstract

As modern users increasingly demand intelligent capabilities from applications, independent software vendors (ISVs) are embracing analytics and machine learning (ML) algorithms to make their products smarter to stay relevant amid increasing competition. Such a move requires ISVs to transform not only their products but also their organizations. This paper discusses the essential transformation ISVs will need to drive in order to fully realize the potential of analytics and ML in delivering to evolving customer demand.
Putting Data to Work: Driving Better User Experience and Faster Time-to-Market

Software products generate a huge amount of data and the resulting goldmine of insights can be used to offer contextual recommendations to enhance user experience. Multiple internal and external data sources exist around software products (see Figure 1).

Product internal data sources (Data captured by software product itself)
- Transaction Data
- User behavior data/Telemetry Data
- Machine/Log/Events Data
- Engineering Data

Product external data sources (Data available around software product)
- Customer/Sales/Marketing/Call Data
- Social Media Data
- Subscription Data
- Infrastructure Data

**Figure 1: Different sources of data available to ISVs**

Product users and product functional teams such as engineering, support, sales, and marketing can benefit from the abundance of data.

Product users are the most important stakeholders in the ecosystem, and user experience directly impacts product revenue. Effective data analysis can improve user experience by:

- Smartly reorganizing UI based on the user’s past behavior
- Providing smart recommendations to the user based on predicted future behavior
- Enabling self-healing capabilities for the product
Similarly, the data can help product functional teams develop the right strategy, positively impacting time-to-market and product quality. Analyzing the data can reveal several correlations for superior decision-making by helping functional teams:

- Accurately predict potential failures or issues in the product
- Understand the co-relation between number of bugs or issues in the product with churn rate
- Understand whether module placements, design elements, and flow have any impact on conversion rate
- Understand the impact of multiple factors like bugs or issues, design elements, and new feature release on market sentiment

The result: ability to positively impact churn rate, conversion rate, and time-to-market.

**Transformation Strategies for Developing Smart Software Products**

Implementing data analytics to help ISVs drive value is not without its share of challenges. The varied data sources are typically owned by different departments and exist in siloes across the organization, or sometimes even with partner companies. Integrating such scattered data poses several hindrances such as the need to invest in skilled resources and technologies, in turn driving costs up.

Here are some transformation strategies that can help ISVs address these challenges.

Transforming a software product into an analytics-driven smart product requires ISVs to drive change across three critical aspects:
Transforming the software product architecture

Many of the existing product architectures were conceived prior to the advent of ML and analytics algorithms, and are incapable of supporting these emerging technologies. Figure 2 highlights one way to build such a capability - wherein analytics-driven smart product architecture leverages an analytics engine and self-service visualization – to enhance user experience, data management, and data security.

**User Experience**

The analytics-driven architecture can help ISVs drastically change user experience by providing smart and relevant visualizations as well as recommendations that guide users in performing further actions. Product analytics helps ISVs improve performance based on usage patterns such as personalized flow and role-based caching rather than generic Least Recently Used (LRU) algorithms or other algorithms. Powered by product feature, usage and failure pattern analysis, ISVs can completely reimagine UX by better understanding user needs, and enabling auto-improvements and adaptive UI. In addition, they can improve simplicity, proactively predict failures, and avert security threats. The outcome: ISVs can create products that are smart enough to self-learn and make decisions without human intervention. For example, products
will move from offering simplified usage to user-centric simplification. If products today are assisting in decisionmaking and self-healing, going forward, they may start making better, informed decisions and proactively take actions to prevent failures.

_data management_

Creating centralized data lakes and deploying the analytics platform on top of that can help ISVs consolidate data scattered across platforms, departments, and verticals.

_data security_

While enterprises are collecting large amounts of data for consumption across multiple devices, security threats are also increasing proportionately. Big Data analytics enables distributed storage and processing of the data on commodity hardware, significantly enhancing security threats.

_restructuring the product organization_

One way to maximize the benefits of data analytics is to create separate organization level data divisions to focus on the following activities:

- Collate all data that is generated and identify the value or insights that can be drawn from such data
- Identify new data that needs to be collected, stored, and analyzed to solve specific business problems
- Guide engineering teams to architect the analytics-driven features in the products

The new data divisions must ideally be supported by new roles based on the needs of the organization such the chief data officer, data architects, data scientists, data curators, and data security experts.
To create synergies between different divisions of the organization while adopting data-centric operations transformation, each of the roles must be part of different teams such as product, IT, sales, and marketing. These roles can help channelize unified analytics approach and data architecture across the organization. However, solving problems at each department must be led by an identical approach – one of identifying the problem and applying analytics to come up with best-fit solutions.

Imbibing data analytics driven engineering culture

Creating an agile culture underpinned by unified analytics requires organizations to bring together key insights across various functions such as sales, operations, product management, and product engineering to drive faster time-to-market and higher quality products.

The blueprint shown in Figure 3 depicts various stages in the product engineering life cycle where data can be captured for relevant analytics. It also depicts how insights generated at various stages can be ingrained in the engineering lifecycle for better outcomes. For example, error log data generated at production can be analyzed for automated problem classification, which can help resolve issues faster and improve overall time-to-market.

*Analytics Driven Product Engineering Blue Print*

*Figure 3: Analytics-driven product engineering cycle*
Separating Winners from the Rest

Going forward, software products will extensively leverage AI and ML capabilities that will enable ISVs to create the high performance, smart applications that modern customers demand. AI-enabled products will reduce the need for human intervention with their self-decisioning capabilities, creating a superior user experience while reducing costs and the overall IT footprint for business users. ISVs that actively infuse a datadriven culture across the organization and allow it to percolate further into their products and services will emerge as winners.

About The Authors

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Ganesh Tonde is a domain expert in the Software Product Engineering group of TCS' HiTech business unit. He has over 19 years of experience and has played several key roles in engineering and high tech domains. Ganesh specializes in enterprise and online platforms and is responsible for digital products and platform engineering solutions. He has a Post Graduate Diploma in Business Analytics from Symbiosis International University, Pune, India, and a Bachelor’s degree in Computer Science and Engineering from the Government College of Engineering, Maharashtra, India.

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Developing Disruptive Software Products with Design Thinking

Abstract

Companies today are aggressively positioning design at the center of the organization to match business practices with the complexities of modern technologies. This is particularly true of the software industry where product lifecycles are shrinking at an incredible rate due to disruptive innovations, and user experience has gained paramount importance. How can software product companies embrace this dynamism to develop next-generation software products that provide superior value to customers?

We believe that customer delight and innovation are the two most important aspects that govern the design thinking approach, and an optimal mix of these two can successfully address the challenges that software companies face in product development. The paper outlines nine design thinking principles to help software companies develop market-disruptive products.
**Introduction**

As technology evolves dynamically and disruptively, product lifecycles in the software industry are shrinking at a rapid pace. With user experience becoming supreme, the parameters of what makes a product successful have changed. Amid intense competition, product companies are striving to ensure that their offerings are more relevant to the consumer and deliver superior value as well. With software and platforms available as services, switching costs are quite low, making it challenging yet essential for these companies to capture the consumer mindshare with next-generation products.

How can product companies keep ahead of the disruption to keep customers happy and acquire a competitive edge? We believe that design thinking is the key to devising winning products that are successful as well as sustainable.

The first step to solving a problem is to knowing the right question, and design thinking helps with just that – asking the relevant questions for developing winning products, such as:

- Who is the target audience for the product?
- Why are we making the product?
- How are we making the product?
- What do we want the product to look like?
- What value will the product give to the end user?

**Design Thinking and Product Development**

In our view, design thinking depends on innovation, which is a function of the feasibility (business aspect) and viability (technology aspect) of a novel idea. Additionally, it requires a strong element of customer delight which would ensure product success. This brings us to what we think should be the guiding 'equation' for employing design thinking in software product development:
Design thinking in products = Customer delight X Innovation

Design thinking takes into account mindsets, principles, practices, and techniques to frame a human-centric approach that goes beyond the product’s outlook. Combining an analytical process with a creative process fosters an environment to experiment, create and prototype models, as well as gather feedback and redesign.

Nine Design Thinking Principles that Software Product Companies Must Follow

Adopting this mindset and creating a cutting edge product isn’t easy. Imbibing design thinking isn’t a one-time activity – it needs to happen throughout the lifecycle of a product. From our extensive work with software product companies and an analysis of current industry trends, we list nine tenets of design thinking that will help software companies navigate the complexities of technology to develop products that will win hearts and disrupt the market.
Principles contributing to customer delight:

Visualize the bigger picture: How can companies strike a balance between the needs of the end user and the synthesized product idea? An integrative thinking with a 360-degree view will enable software developers to provide input at various levels and imagine the end product. Studying the competition, analyzing the end user’s needs, and checking in the findings with all the stakeholders will be important to not lose out on the essence and digress from the core vision of the end product, something that often happens due to delivery timeline pressures.

Be customer-centric: Empathizing with the end user while developing products helps sharpen the competitive advantage. Maslow’s Hierarchy of Needs suggests that people often go for things they need rather than the ones they want. Understanding and applying this principle will need designers and developers to be emotionally intelligent. The customer-centric culture is guided by the end user’s desires, aspirations, engagement, and experience. SAP products used to take months to get deployed in the customer environment. But, after applying design thinking into the product development processes (SAP Rapid Deployment Solution (RDS)), customers received instant access to ensure timely implementation.¹

Adopt a collaborative workstyle: Companies develop products that integrate with multiple environments and data sources. Design thinking suggests using the external environment to bring in newer perspectives to apply to the products. The multidisciplinary teams working on such products must be highly motivated, avid listeners, and risk takers, while being keen to share knowledge, power, and credit.

Be ambidextrous: Successful products are built by companies that exploit and explore opportunities at the same time. They experiment with the current environment even while reimagining the future. The willingness to fail and the courage
to tackle risks need to be industrialized within the product engineering process. The onset of newer technologies and form factors during the development of product and the dynamic environment needs to be tackled well.

**Principles contributing to innovation:**

**Think by doing:** Ditch the conventional, sequential thinking pattern and involve multiple internal and external stakeholders to generate breakthrough ideas. The flow of numerous opinions, and even rejections, only help clarify and validate the thought process, by reducing risks and uncertainties at the early stages of product development. UberEATS, the food delivery service app used rapid field testing wherein the prototypes were taken to restaurants, customers’ homes, and delivery vehicles. This helped the company create a new feature for users who wanted to get their food delivered ‘under 30 minutes.’

**Be creative:** The rapid experimentation process in product development calls for giving a free rein to imagination. As more companies compete to create disruptive products, a higher level of cognition and intuition is required to make a product stick. The concept of abductive reasoning (logical inference to an observation) can help here. In fact, not just creating, even launching products will require an out-of-the-box approach.

**Embrace ambiguity:** Making peace with ambiguity is the key to enduring the speed of change. This becomes even more critical for the software industry. Ambiguity helps tackle situations where user needs are not very concrete or clear, by helping develop product features that are flexible. Ideas can flow from various data sources across organizational boundaries and can be later combined and given shape.
Think generative: Who knows what tomorrow will bring, but a systematic way of thinking can get us closer to it. Generative thinking usually involves imagining or articulating a future customer experience, which triggers innovative product features. Many random ideas could be generated before an acceptable list of features is drawn up. Combining divergent and convergent thinking approaches helps product companies be ‘clairvoyant’. Google has created a linear process of brainstorming new ideas and turning them into products. This process usually starts with knowing the user, improving the idea by ten times (10x), and creating a prototype. This has led to creation of various next generation products.

Always be optimistic: Taking the conventional path to product development is almost history. Trials and errors are usual, and failures frequent, even welcome. In such a situation, it is essential to keep the faith in the end product. Software development teams must learn constructively and continuously from the testing. A positive, receptive, and open mindset never fails.

Scaling Newer Heights in Software Development with Design Thinking

A majority of the software companies today have mastered the art of agility in product development and are keen on developing disruptive, niche products. Design thinking can steer such companies toward breakthrough innovation. Using newer technologies such as machine learning, Big Data science, predictive analytics, cloud technology, artificial intelligence, and so on, deeper customer insights can be procured and applied to develop products that stick. Helping customers make sense of the complexity and making products that are intuitive and simple from the user perspective will require a change in collective attitude to product development.

Embracing design thinking is the way forward. Getting the right balance of customer delight and innovation is crucial to developing design-driven products of the future, which are successful as well as sustainable.
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Blockchain-led Software Development is the Way to Go

Abstract

Blockchain is being seen as a major contributor to emerging computing paradigms. Still in its nascent stage, there is constant demand for new use cases to explore the potential and exponential value that this new technology can generate.

We believe blockchain can bring great value to software companies developing digital products that leverage innovative technologies and are delivered over multiple channels. Its capabilities in enabling secure, real-time sharing of data across entities and automation of transactions and settlements through smart contracts can deliver the enhanced efficiency and security critical to software products today. With adoption of the Software as a Service (SaaS) model and high levels of customizations becoming the norm, implementing blockchain in the products value chain could well become a prerequisite for the software industry.

This paper discusses three use cases for blockchain in the software product industry amid contextualizing specific capabilities of this technology in solving challenges faced by the industry.
Why Blockchain

Blockchain is essentially a decentralized, transparent ledger with transaction records. The database is shared and updated across multiple network nodes (decentralized), monitored by everyone (transparent), and owned or controlled by no one. It can be compared to a gigantic interactive spreadsheet where everyone can access data, view updates, and confirm unique digital transactions. An important difference though is that any update to an existing transaction is added as a new ‘block’; the existing one doesn’t get overwritten! This makes all transactions immutable, bringing a lot of trust to the system. Unique cryptographic coding makes transactions on the blockchain easily traceable and highly secure, while the ability to develop and activate smart contracts across participants makes them automated.

The software product industry is going through rapid technology and operating model changes, with platformization’ or ‘everything as a service’ being the trending theme. Software companies are developing cloud-based Software-as-a-Service (SaaS) products and customers are rapidly migrating to subscription based models. The products being developed have to be customized for varied audiences across channels, such as desktop, laptop, mobile, or wearables. Apart from this, given the deluge of technology advances, software companies need to be able to adapt readily and brace for unforeseen scenarios.

Enabling Continuous Evolution of Software Products

As more and more enterprises adopt blockchain frameworks, software companies will have to make products that are easy to integrate with blockchain solutions.
A typical blockchain stack (see Figure 1) has the following four levels:

- **User Interface**
- **Protocols**
- **Overlay networks**
- **OpenSource blockchains**

The user interface level, which is typically web-based, can be customized for user experience across channels (such as mobile, wearables) depending upon the type of product.

The protocol layer is a software system that transfers over the blockchain ledger. Decentralized protocols are the most crucial part in the blockchain stack – they help peers to connect to datasets simultaneously, avoiding the dependency on single entities for validations, transactions, and so on. The blockchain is typically managed by a peer-to-peer network that collectively adheres to the protocol for inter-node communication and validates new blocks.

The underlying layer is that of networks, which are built on top of other networks and support the shared ledger, smart contracts, and storage. The transactions are carried out through virtual links and added to the public ledger after gaining...
consensus (smart contracts, agreement) through a proof-of-work system (mining).

The implementation layer or the blockchain open source layer is used to maintain a continuously growing list of records (called blocks) that record transactions chronologically.

Figure 2 illustrates a typical supply chain management (SCM) scenario to explain how a software product can be integrated into the blockchain. We know that the supply chain function is one of the earliest adopters of blockchain. The traditional SCM software treated all the vendors as separate entities or modules, and the transactions took place in a cyclic or sequential fashion. With the onset of blockchain, these modules are interconnected and each of these nodes will conform to the architecture described above. A shared ledger is updated and validated in real time with each participant, according to the prescribed smart contract. Such a blockchain-enabled system can therefore improve supply chain transparency and security. It will ensure faster, automated transactions and reduce effective costs.

Figure 2: Illustration of a Blockchain-Enabled Supply Chain Management Model
Improving Billing Cycles for SaaS-based Products

The software product industry has seen a significant shift from licensed, on-premise products to cloud based, SaaS products that follow the ‘pay-per-use’ model. Thus, billing and cost models have evolved significantly with regard to software products. Revenue streams for software product companies can be based on numerous pricing models like transaction-based pricing, cyclic billing, in-app purchases (mobile products), revenue sharing with strategic business partners, licensing and consulting fees, as well as subscription-based or account-based billing. Across these models, the companies face challenges in managing the complexities for varied audiences and high thirdparty costs, while maintaining transparency.

SaaS product companies can effectively manage customer onboarding and commercials by implementing blockchain. Processes like payment management, metering functionality, validation, verification, and authentication would be automated, removing the dependency on human intervention, thereby eliminating delays and making the transaction more trustworthy and secure. With a distributed database mechanism rather than a central record keeping system, blockchain technology leverages the ecosystem by storing identical
transactions at every node connected to the network. This involves transaction sign-off from a large number of participating nodes, ensuring 100% transparency and seamless tracking. It also mandates automation of transaction processing, which improves efficiency of the entire billing procedure.

As no central authority or third-party mediator is involved, middle men costs are eliminated. Every record in the distributed ledger has a timestamp and unique cryptographic signature, with immutable history of all transactions in the network. Smart contracts define the business rules and penalties around the agreement made and automatically enforce those obligations. Specially formulated cryptocurrency (encrypted, decentralized digital currency) can also be used for financial transactions among entities. Thus, funds can be transferred independently and securely depending on the cost model being implemented.

**Building Trust in Next-gen Products**

Software products capture a lot of customers’ personal data such as name, email addresses, and more, along with a high amount of data around user-specific behaviors and patterns. Moreover, in the context of next-generation products, this data is being collected through multiple digital channels such as mobiles, desktops, and wearables, resulting in a huge amount of scattered personal data across the ecosystem. As more customized products are created, this kind of data will be leveraged heavily. With growing regulatory oversight in this area, the stakeholders of this data need to build in transparency and security in its usage.
Blockchain can play an important role in building trust in such scenarios. For example, it would be important to establish that the data being used is authentic and not from incorrect sources. A shared ledger system; along with immutable transparent transactions, can establish the level of trust of an identity based on who trusts or confirms the identity. It forms an attestation infrastructure for customer identity and data.

Additionally, a challenge with personal information could be that multiple parties in the value chain store the information at different places, leading to duplication. Most of the times these parties are unaware that the information exists elsewhere. Each party has their own mechanism to store and control the data, which makes this data vulnerable. This creates a ‘weakest link’ security problem as the data is only as secure as the least secure party. Software companies are thus exposed to bigger penalties if the data is not handled appropriately. Blockchain, with its single, decentralized database, offers the perfect solution to this scenario. We also recommend the provisioning of personal information over blockchain-as-a-service solutions, so that the information is even more secure, used only when required, and that too by the right entities and with an auditable record of use.
This is Just the Beginning

The three use cases are just indicative of the exponential value software product companies can bring into their products by adopting blockchain. Smart contracts can prevent the copying and redistribution of software, thus evolving into tools for protecting the Intellectual Property (IP) of software products - a challenge for most product companies today. Distributed ledgers are extremely useful in software products where multiple entities are involved and approval or attestation is needed from third parties; for example, educational, criminal and nationality checks during the hiring process in human resources products. Blockchain can help in faster and more transparent processes here. To truly understand the extent of its impact, therefore, software companies will need to think out of the box with regard to using blockchain to transform the way their products are designed, delivered, and managed.

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Modernizing Data Centers: The Era of Hyper Convergence

Abstract

The Business 4.0™ era requires organizations to operate intelligent and agile systems integrated in the cloud. These systems generate an astronomical amount of data of extensively diverse range. This drives the need for flexible infrastructure that can be scaled quickly to meet the ever-increasing demand for data storage. What is also needed is the processing power to run complex machine learning algorithms to generate meaningful insights, cost effectively. Achieving it is possible only if data centers actively evolve with the changing industry needs to support both modern and legacy workloads without compromising on performance and security.

This paper will discuss how hyper converged infrastructure (HCI) contributes to solving the data center problem and the essential aspects that merit consideration when selecting an HCI solution.
The Data Center Challenge

Cyber systems require a data center infrastructure that can aid cloud computing, Internet of Things (IoT), big data, and other emerging technologies. To harness the full potential of digital innovations, business leaders are coming up with digital transformation strategies and IT divisions are opting for software-defined resources and scale-out platforms. This is where hyper converged infrastructure is gaining popularity. Like other infrastructure models, HCI can also be sourced from various original equipment manufacturers (OEM) in different configurations and needs to be introduced carefully in the data centers.

Selecting the Best Fit

Before looking into the factors that should be considered when selecting an HCI solution, here are a few use cases for understanding where and how it can deliver maximum benefits:

i. Virtual desktop infrastructure (VDI): Every VDI instance is processed and stored by the server, and even a relatively small number of instances can demand significant computing resources and network access. As the company grows, more HCI nodes can be added to the existing cluster. Deploying HCI for VDI hence provides easy scalability that siloed infrastructure lacks.
ii. Test and Dev: It is common knowledge that test and development environments should be similar to the production environment for test runs to depict the actual behavior of an application. Such environments therefore must be highly dynamic, as they may require an increase in capacity over time. In conventional environments, adding storage to the network is a challenging task, whereas the modular design of HCI allows the addition of nodes to increase the capacity as and when the need arises.

iii. Multi-access edge computing (MEC): In MEC, telecom service providers deploy HCI at cellular base stations to offload traffic from the network backbone. This requires computing at the edge (such as next to a highway) and micro data centers (which have less than 20 racks) across locations. Such an HCI should have faster CPUs, GPUs, RAMs, network, and storage input/output, but can run on low storage capacity as a lot of data is discarded after analytics and some of it is saved in the cloud as well.
iv. Enterprise applications: HCIs are being used to host enterprise applications such as RDBMS, CMS, and mail servers. These applications are very high on storage requirement. The subsequent addition of storage and computing resources increases the complexity of the infrastructure, making the applications underperform. For seamless scalability and streamlined performance, systems that are predictable and easier to deploy are preferred. In this regard, HCI checks most of the boxes in the expectation list. It is easy to configure and scale, and performs consistently when supported by flash storage.

v. Big data analytics: Extracting meaning from data quickly is critical in today’s dynamic business landscape, and that necessitates rapid adaptation of the infrastructure for big data. Distributed file systems, NoSQL databases, and data analytics applications are the most popular big data workloads. Such workloads have very specific infrastructure requirements. For instance, Hadoop replicates data across nodes, which requires twice or thrice the storage capacity. Similarly, NoSQL requires rapid data processing due to the varieties of formats it deals with while data analytics applications require faster access to data to extract insights quickly. Compared to traditional infrastructure, HCI is easier to manage and scale even in clustered environments.

Factors to be considered when selecting an HCI solution:

- **Deployment architecture:** Broadly, there are two types of HCI available in the market – software-centric (build your own server or BYOS) and hardware integrated (turnkey). BYOS provides flexibility with the hardware components; turnkeys are quick to configure and expand the data center. Therefore, customers who want to continue with their preferred hardware vendor may opt for a BYOS-oriented HCI and incorporate the certified appliances from their hardware supplier into it. Alternatively, they can buy turnkey solutions from another HCI vendor, where they do not get the freedom to choose hardware vendors. In both scenarios,
product support is provided by the HCI vendor.

- **Virtualization:** A variety of hypervisors is supported for virtualization. VMware vSphere is the popular choice while MS Hyper-V and Citrix Xenserver are also great options. There are a few solutions that offer license-free hypervisors leveraging open-source Kernel-based Virtual Machine (KVM), which helps reduce the cost while providing similar functionality.

- **Hardware configuration:**

  i. **CPU** – HCI solutions run virtualized workloads, and to speed-up instruction execution in a virtualized environment, CPUs should have integrated virtualization extension. To support increased virtual memory (VM), it is crucial to have more computing power, which can be obtained by increasing the number of sockets or cores. Even though a dual-core CPU may not be as fast as two single-core CPUs, it is advisable to select multi-core CPUs to save cost, which is generally based on the number of sockets, though it may vary for different OEMs.

  ii. **Memory** – Memory capacity starting from 64 GB to 3 TB can be used as long as it is proportional to the number of VMs helping in better resource utilization and the number of slots available for scaling the memory.

  iii. **GPU** – When the workload requires running machine learning algorithms, simulations, or analytics, it is advisable to opt for high-end GPUs that assist in math-heavy software.

  iv. **Storage** – HCI solutions can be hybrid (hard disk and flash) or all-flash. For business-critical applications, where minimal latency and high throughput is required, all-flash storage is advisable. For other cases, hybrid flash can be used. SSD and NVMe SSD are available for flash storage; the latter is the latest innovation and preferred for workloads that require higher bandwidth and queue depths, such as databases.
- **Data availability** – HCI solutions have built-in erasure coding (EC), which protects data at the cluster level. In disaster-like situations, it is imperative to have a comprehensive policy-based data protection strategy, including the creation of multiple backup copies replicated across geographies.

- **Efficiency** – Techniques like de-duplication and compression offer the flexibility to have disk capacity smaller than the size of data. However, though effective, it may impact the system performance during execution since there is no dedicated CPU for running such programs. Such services are generally not provided as default but as additional licenses.

- **Manageability** – Resource administration, granular monitoring of critical system parameters (such as capacity and performance), and centralized management console is provided with most of the HCI solutions. Besides, analytical insights to predict future resource usage and integration with public cloud platforms to operate in Hybrid cloud environment are also essential.

**Powering Data Center Evolution with HCI**

With the proliferation of digital technologies, it is also critical that data centers, which serve as the backbone of the digital revolution, rapidly evolve with the change. Data centers are, therefore, undergoing a paradigm shift – from a hardware centric approach to an application-centric one. This has enabled organizations to fully manage their data center engagements from a centralized console. When evaluated with the right set of technologies for workloads, operational expenditure on HCI is lower than in case of legacy infrastructure, with lesser data center footprints and reduced management overhead. Since the onset of its innovation, HCI has seen major enhancements from leading vendors and has now become a mainstream technology. Gartner predicts that
HCI is expected to grow at 48% CAGR by 2021\(^2\). This further highlights its proven capability to take the business forward when deployed judiciously.

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