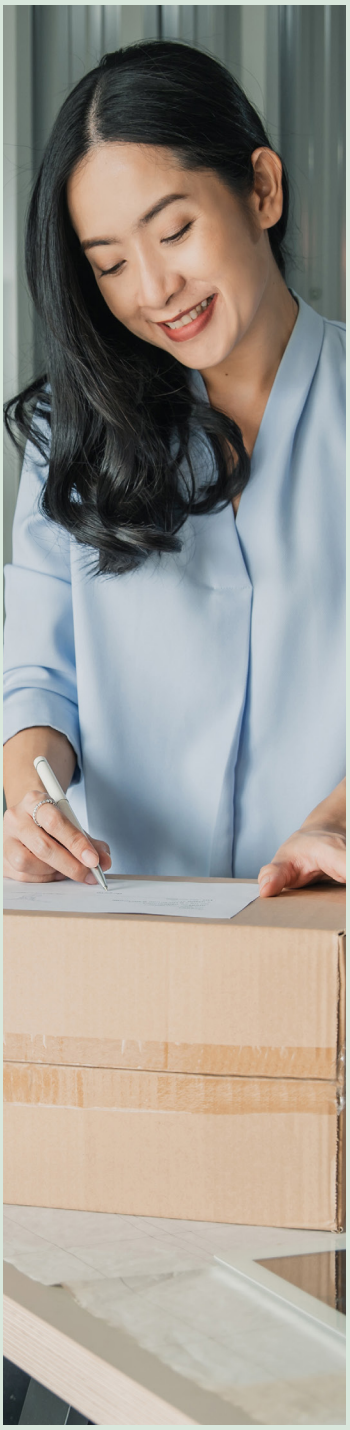
WHITE PAPER



COMPOSABLE ENTERPRISE ARCHITECTURE – FUTURE OF DIGITAL LANDSCAPE

Infosys®
Navigate your next

Executive Summary

Modern day business demand for speed, flexibility, and agility in launching new product ideas and innovative features. In the recent unprecedented times of pandemic, geo-political crisis, growing cyber security attacks and natural calamities, it was much evident that the ability to respond faster to any disruption is the key to success for any organization. Resiliency in the face of disruption and being always future ready determines the fate of an organization in crisis. In such times organizations must quickly find ways to sustain in the market by creating new revenue generating value streams and provide configurable and contextual customer experience.

Some enterprises failed as they faced obstacles in responding to the disruption due to rigid business processes backed by inflexible monolithic technology suites. Businesses that could thrive and came out successful in these times were the ones that could easily redefine their strategy to accommodate disruptive customer needs, adapt to remote and distance economy by disassembling and reassembling existing capabilities and launching newer innovative solutions. This helped them to stay relevant in the market and gain competitive edge.

Reacting to disruptions quickly and innovate faster creates a need for a more agile, sustainable, resilient, evolvable, and scalable enterprise. Industry Analysts have defined such an enterprise as 'Composable Enterprise '(also called as Lego Brick Enterprise).

Composability is becoming increasingly popular across verticals and enterprises should incorporate it as a key success factor in defining digital strategy. In this context, we present our paper covering the key ingredients to build such an architecture and present a reference architecture for digital transformation programs in alignment with latest technological trends.

Paradigm Shift from Monolithic to Composable Architecture

Organizations have a long history of using COTS vendor suites to meet their business needs. Vendor Suites provide 'All in One, fully integrated' solution for the required business capabilities and are typically evaluated based on initial MVP requirements availability during the business discovery phases. These suites provide OOTB capabilities and adapters to integrate with chosen partners or vendor ecosystem. Although they provide a very Robust, all-inclusive, well integrated solution and are 'built to last' longer, but they are not 'built for Change'. Change is expensive and not very easy and often comes with associated risks. This leaves organizations to live with a limited set of options and offerings to select from and slows down innovations. Organizations get constrained by product offered solutions and reliance on product roadmaps and new version releases. This leads to transformations and replacements or multiple customizations which is not easy and usually involves migration risks and replacement costs.

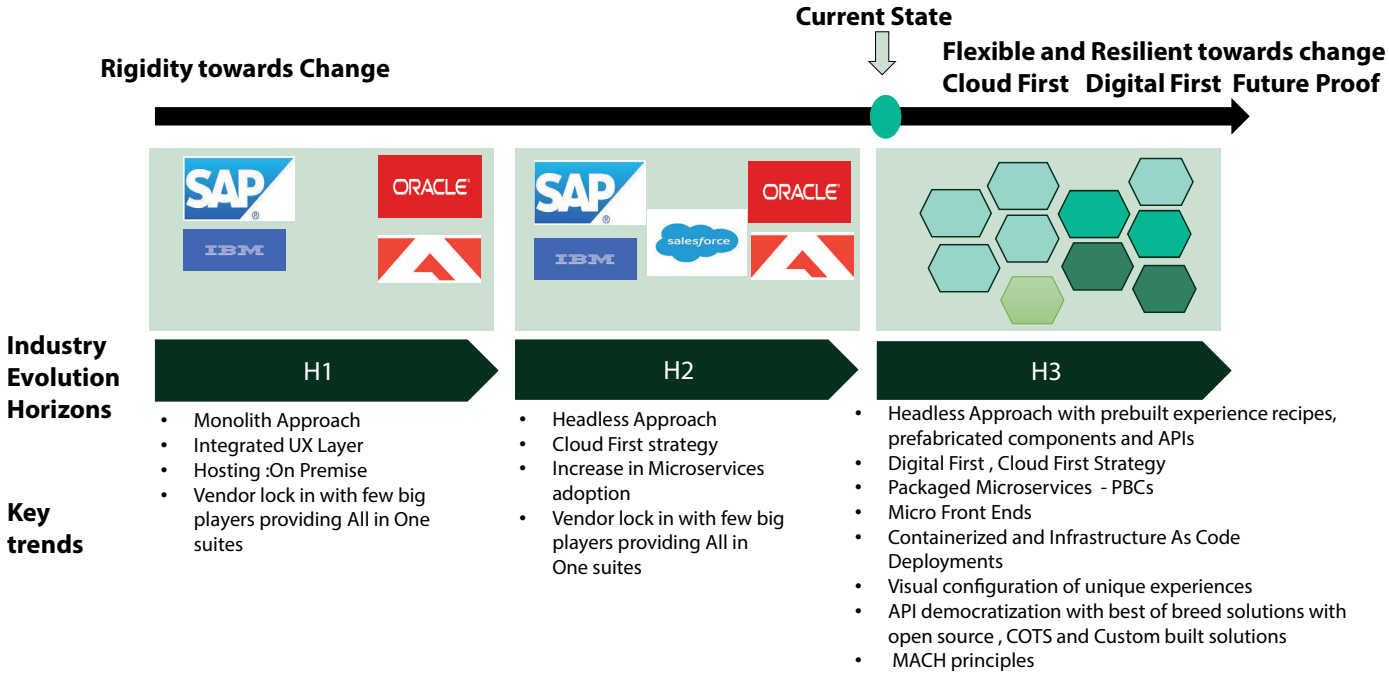
The pandemic and ensuing lockdown forced organizations to open their business digitally and establish several newer digital touchpoints with customers. Virtual showrooms and event platforms, online sales channels, online meetings, remote workforce management tools saw a larger demand in the market. Companies that must succeed in future must effectively implement 'Digital First 'business strategy supported by 'Cloud First' infrastructure strategy. Investment into appropriate technology platforms and Infrastructure services becomes crucial to support the strategy.

Composability is an essential part of the **Digital First** strategy as it provides organizations resilience, robustness, and adaptability to change in a cost-effective way. This necessitates to move away from Heavy weight – All in One suites and vendor lock ins. The democratization of services and business capabilities will help organizations to easily develop a plug and play architecture which enables constant change and easily replacement of non-value providing blocks. Change should become a tool for success rather that a reason for fear or failure.

By 2027, 41% of an enterprise's revenue will come from digital products and services.

As reported by IDC Link

Composability Evolution



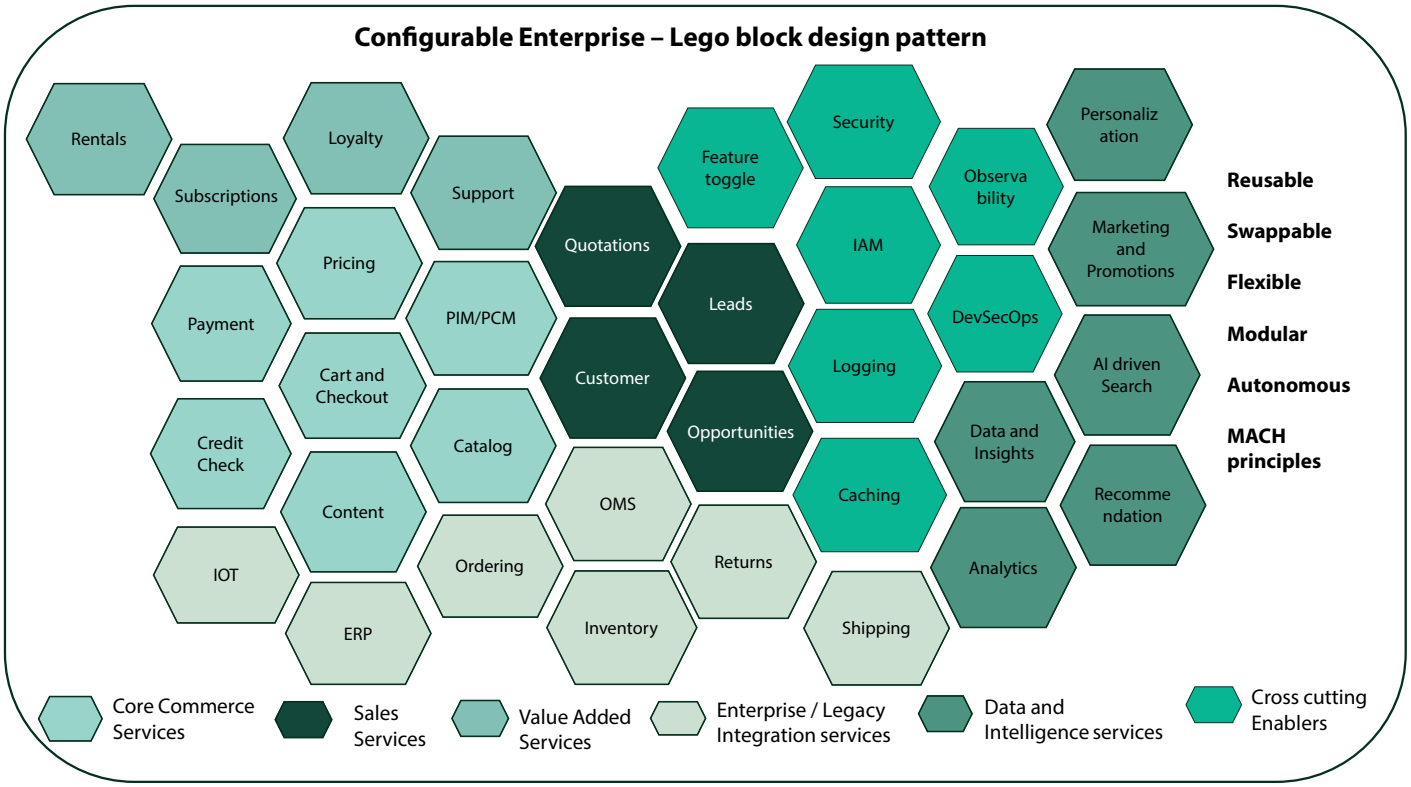
Analyst prediction and Reports on Composability

Analyst reports and market studies have indicated that in near future companies that adopt composability will become more successful and sustainable in terms of launching new ideas to markets and showing flexibility and adaptability towards market demands.

> In the continuously changing business context, demand for business adaptability directs organizations toward technology architecture that supports fast, safe, and efficient application change. Composable application architecture empowers such adaptability, and those that have adopted a composable approach will outpace competition by 80% in the speed of new feature implementation.
>
> **Gartner Link**

Building block of Composable Enterprise: **Packaged Business Capability (PBC)**

A packaged business capability (PBC) is the smallest building block in the overall composable and evolvable architecture. It fits together with other blocks to build configurable customer journeys and business use cases. This serves like a Lego block system where each block could be one piece in the end solution. Different Lego blocks are reusable entities that could be combined to build different outputs and applications. Each block is replaceable.

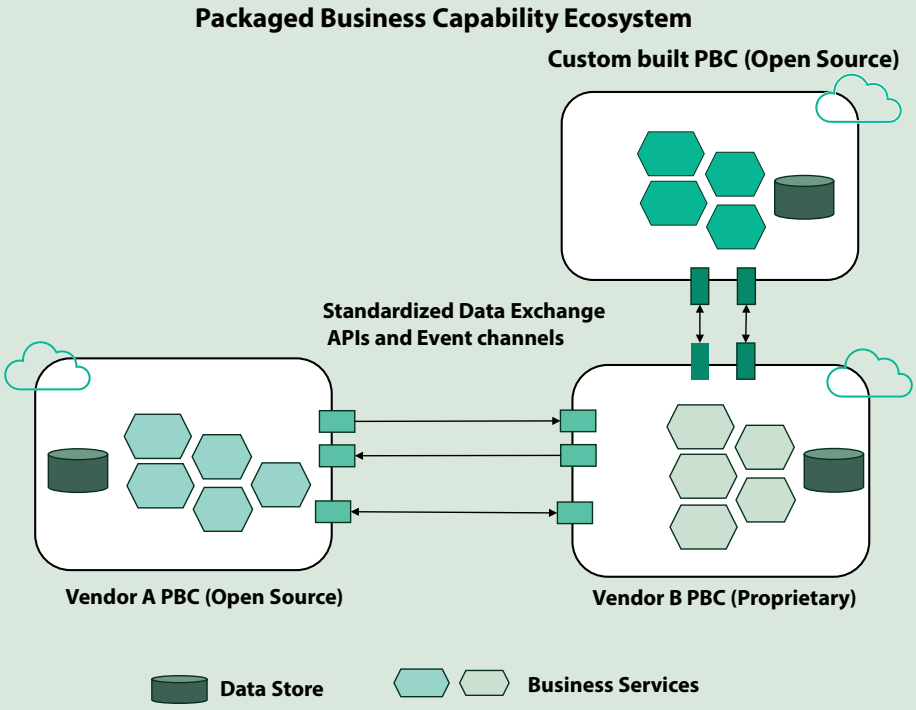


> Packaged business capabilities (PBCs) are **software components representing a well-defined business capability, functionally recognizable as such by a business user.** Technically, a PBC is a bounded collection of a data schema and a set of services, APIs, and event channels.
>
> **Definition by Gartner**

A PBC contains a set of microservices or a single micro service. Each PBC is created to provide a business value to a customer and can consolidate a set of fragmented microservices. Multiple PBCs assembled with technical capabilities can provide larger solutions to organizations.

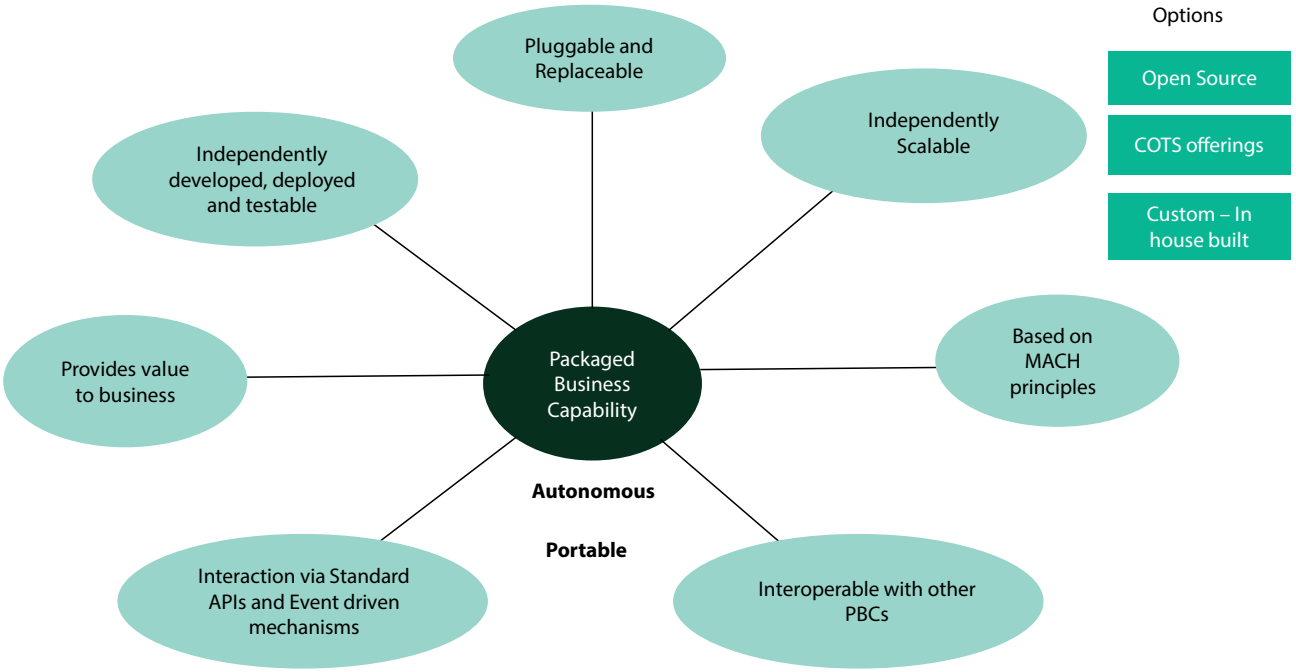
A single PBC should be able to directly provide value to business. To site an example - A catalog PBC can be directly mapped to a commerce use case to provide product catalog. Technically the catalog PBC can contain multiple micro services to manage and expose the catalog to end users. The size of a PBC depends on what value it delivers.

Examples of PBCs– Catalog, Cart, Checkout, Search, Payment, Tax calculation, Profanity check, image recognition, PDF conversion, Contacts, Accounts, Loyalty Reward calculation, Web Analytics, Lead Management, PIM capabilities



Key Features of PBC

A PBC is fully autonomous unit built on MACH principles. A PBC can be available as commercial off the shelf component or composed in house using paid or open-source libraries or platforms. PBC helps in reducing the business complexity by breaking down larger journeys and processes into smaller manageable blocks. Headless SAAS is a popular option to package commercial PBCs.



Business and Customer Centricity via Composability

Overcoming the challenges of monoliths, businesses should rethink their approach towards enterprise and reengineer organization structure and business processes to smaller fusion teams and composable business processes. A composable enterprise built on the foundation of adaptable and composable architecture provides business centricity and becomes essential for success.

Business users are empowered to create new innovative features and journeys, changing the business models without relying much on the IT teams. A few of the advantages that businesses gain by leveraging the composable approach

Agility and Faster Time to Market

Composability provides flexibility and agility to release newer features to market and provide resiliency towards challenges. Each PBC is autonomous, independent in nature and enables integrity of change. Off the shelf MACH certified commercial offerings can be quickly included in the ecosystem to provide value driven features. Custom built PBCs using open-source libraries help in creating highly customized capabilities.

High Modularity

Composability provides modular, reusable business value driven capabilities that could be assembled and reassembled to provide targeted customer journeys.

If the feedback of one capability is non positive, it could be replaced with another capability.

This empowers brands and LOB to launch new features by configuring the UX with prebuilt capabilities or identifying newer capabilities for development or procurement.

Lower Cost of Change

Cost of change and replacement in a modular composable approach is not as significant as compared to in monolithic approach. Due to the autonomous nature of PBCs, they could be easily switched by another service.

Open ecosystem to support best of breed solutions

Composability provides a platter of best of breed vendor solutions, custom-built and open-source solutions for common business needs. Lines of business and brands can easily create customized offerings by assembling these using reusable and pluggable building blocks.

In the monolithic world this is a challenge due to heavy vendor lock ins and dependency on product vendor innovations, roadmaps, and version upgrade timelines.

Resiliency towards Disruptive changes

In unprecedented times like the recent pandemic, geopolitical situation, and other crisis the spending pattern and sentiments of customers shift fast. In these situations, businesses can only survive and thrive by immediately recognizing the change and tapping into customer sentiments. Organizations can quickly align their digital strategy to meet newer demands and stay on track to meet larger vision. Upgrading the business model and launching new features and ideas will provide them resiliency towards disruptive changes.

In a Composable enterprise features and customer journeys could be quickly assembled using the existing or new business capabilities. Businesses can use change as a driver for innovations.

Encourage Customer centricity by hyper personalization

Shift in Customer sentiments arising due to digital disruptions and geopolitical needs give rise to constant changing environments and demands.

Hyper personalization, multi-touchpoint and multi-modality customer experience is the need of the hour and can be achieved by composing personalized and targeted customer journeys using a combination of packaged business and technical capabilities and leveraging low code no code platforms.

Rapid innovations at scale

Fail fast, fail safe, replace, and evolve approach provides opportunities for faster innovations and keeps the company always ahead of competitors even in the times of crisis. Composability encourages and fosters innovative culture and supports a dynamic business model for any organization.

Industry direction and push for composable enterprise

Composability paradigm is strongly backed by Industry support and a constant guidance from Industry thought leaders. There is huge momentum and initiative seen from industry and various consortiums to support the direction.

Industry consortium - MACH Alliance

MACH alliance is a non-profit alliance of independent product vendors, Service Integrators, enablers, and ambassadors who advocate and promote the use of MACH principles to build a composable architecture. MACH also provides certifications to vendors that follow the standard guidelines and MACH principles to build composable products and offerings.

Alliance partners and MACH members are constantly evolving, and, on the constant rise, this shows good movement and acceptance of the composable paradigm across industry.

MACH = Microservices-based| API First |Cloud-native | Headless

Proliferation of new vendors and composability in existing vendor strategy

Composable architecture is giving opportunities for new Start-ups and Independent Software Vendors (ISVs) to enter a variety of business domains and offer SAAS based headless capabilities. The existing Monolithic software vendors are also including composability in their product roadmaps and making a concerted effort trying to offer API based offerings and modernize the current platforms to be more modular, cloud native and flexible.

In recent years, several new composable services and tools have proliferated into the markets. These encompass various MarTech domains – Customer Experience and Content, Commerce and Sales, Advertising and Promotions, Social and Relationships, Data and Management. Once again this indicates that Industry is openly embracing the change and entering the new era of the composable enterprise.

Open-Source Support

Open-source tools are becoming favourites of composable vendors and organizations. Open source is driving composable containerized infrastructure using open-source platforms like Docker containers, Kubernetes container orchestration and Istio service mesh framework. Companies are achieving hyper scalability with much lower costs in a cloud vendor agnostic way. Other open-source tools like Prometheus, Grafana are gaining momentum and wider acceptance as open-source observability and monitoring platforms.

A few product vendors are implementing their composable offerings completely based on open-source platforms. This provides code transparency, easy customizations to organizations and easy connection and information sharing with partners. An example is the Magnolia CMS, which is built completely on Open Source.

Support from Hyperscalers

Composable enterprise needs to be backed by a composable infrastructure. Hyperscalers like AWS, Google, Azure, Alibaba provide composable infrastructure as services. Composable infrastructure is a framework that decouples device resources to treat them as services. Physical compute, storage and network fabric resources are some examples of device resources that can be treated as service.

Recently the biggest Hyper scaler AWS has joined MACH alliance to advocate and support more future proof, resilient and Composable architecture.

The growth of MACH concept from a nascent stage to a globally recognized need for digital transformations in mere two years of time frame is amazing and indicates the industry direction and enthusiasm to embrace this change.

> ***Surveys have shown that there is a push from C Suite executives to increase MACH elements in Enterprise Architecture in next coming months. A progress has been made over the past year with a 19% increase in companies that have moved away from a monolithic stack to best-of-breed composable. Tech leaders see MACH technologies as the future of architecture with 79% planning to increase investment over the next 12 months and beyond.***
>
> **Survey :** Link

Composable Enterprise – The market platter options on the table

As established, there is a great momentum towards creating a composable enterprise and the push from Industry leaders, this has given rise to plenty of 'Off the Shelf' capability offerings for various business requirements. A lot of the vendors listed here are MACH certified or in the process of getting certified and form a great partner ecosystem. Other vendors are big players already well established in the market. These vendors have started positioning their platforms as composable platforms and are expanding their ecosystems by having multiple partnerships and modernizing their current stack.

An organization can cherry pick best of breed solutions from the available market platter. A few of the key players in the composable ecosystem today are listed below as an example. However, the complete ecosystems, domains covered, and options are much larger than what has been represented here.

An enterprise can choose from the COTS offering readily available in the market or could build the capabilities using open-source libraries and tools in house.

Domain Group	Description	Options				
Commerce and Sales	Core Commerce platforms	CommerceTools	VTEX	SAP commerce cloud	SFDC commerce cloud	Adobe Commerce
	Payments	Stripe	Speedly	Checkout.com	Braintree	
	Fulfilments	ShipStation	ShipEngine	stitchlabs	ShipBob	
	Checkout	Fast	Bolt	Bold	Infosys Equinox	
	Catalog	Pimcore	Akenio	Salsify	Infosys Equinox	
	Promotions and Loyalty	Talon.one	Vocherify	Open Loyalty	Infosys Equinox	
	Fraud Protection	Sift	Riskified	Bolt	Fraudlabs pro	
	Orders	Tradegecko	Ordoro	Orderhive	fluentcommerce	
	Tax Calculation	Tax Cloud	Avalara	Vertex	TaxJar	
	Reviews	Trustpilot	Reviews.io	Bazaarvoice	Reevoo	
	PIM	BlueStone PIM	PIMCore	Akeneo	SALSIFY	
	Helpdesk	Zendesk	Zohodesk	Freshdesk	Help Scout	
	Fontend as a Service	VUE storefront	Mobify	MoovWeb	FRONTASTIC	
Digital Experience and Content platforms	Digital Experience Platforms	Contentful	Sitecore	Amplience	Contentstack	Adobe Experience cloud
Digital Asset Management	Image and Video management solutions	Cloudinary	Bynder	Aprimo	Brandfolder	Adobe DAM
Digital Marketing and Campaigns	Marketing and Campaigns	Eloqua	Marketo	Customer.io	mapp	SFMC
Enterprise Search	Advanced search	Algolia	Elastic Search	Lucidworks search	Constructor.io	Bloomreach

Personalization and Recommendations	Personalization and recommendations	Liftigniter	Recombee	Personify XP	Attraqt	Adobe Target
Data and Analytics	Intelligent Data platforms	Composable.ai	Segment	Good Data	AWS data and Analytics	Azure Data and Analytics
Web Analytics and SEO	User behaviour analytics	GA360	IBM Watson	Baqend	Similarweb	Adobe analytics
Translations	Translation services	Translations.com	Amazon translate	Smartling	Memsource	SDL
Digital Communications	Email, SMS, Voice	Postmark	Customer.io	Twilio	AWS SES, SNS	Azure communication services
Digital Chat	Optimize-It	iAdvize	livechat service	Chatlio	LiveHelpNow	Kore.ai
Digital Process Automation	Process automation tools	UiPath	Blue Prism	Power automate on Azure	Automation Anywhere Automation 360	Pega
Machine Learning	ML tools	DataRobot	Amazon SageMaker	Azure Machine Learning	Google cloud AI	Salesforce Einstein
Customer Data Platforms	Customer behaviour data and marketing analytics	Snowplow	Sitecore CDP	ActionIQ	Blueshift	SalesForce CDC
Data Lake and Warehouses	Data Lake platforms	Snowflake	Amazon Redshift	databricks	Azure DataLake	Google DataLake
Master Data Management	MDM platforms	Informatica	Semarchy	Riversand	Stibo	SAP Hana
Data pipeline and ETL automation	ETL	Informatica	AWS Data Pipeline	Fivetran	Stitch	Azure Data factory
Domain platforms	CRM	Dynamic 365	SFDC	HubSpot	servicenow	Pega
ERP	ERP	Nekom	Actindo	Xentral	U-ERP	SAP S/4HANA Cloud
Identity and Access Management	Authentication, Authorization, SSO	Auth0	Okta	Azure IAM	onelogin	SAP CDC
Privacy and Data Governance	Consents and Privacy	Data Grail	Trust Arc	One Trust	usercentrics	Segment
Image and Video recognition	Intelligent image and video recognition	AWS Recognition	Brightcove	Azure Cognitive services	Google Cloud Auto ML Vision	Syte Visual AI
Build and DevOps	CICD pipelines	Next	Netlify	Azure DevOps	AWS DevOps	Jenkins
A/B testing	Multivariate testing	Uniform	Dynamic yield	Monetate	Optimizely	LaunchDarkly
Integration services	API gateways and ESB	Anypoint Mulesoft	AWS API gateway	Google Apigee	Azure API gateway	Boomi

Composability across Enterprise Architecture Layers

Shifting from monolithic to composable and evolvable enterprise requires a complete mindset change. A new modular mindset with risk taking culture backed by right technology platforms across all the enterprise architecture layers. Composability requires a stronger Business IT collaboration to achieve the enterprise vision.

1. Business Architecture:

Business owners and architects should start thinking of composable business capabilities. Each larger Business process needs to be broken down into smaller fully autonomous business capabilities. These capabilities can be improved independently and are also replaceable in future. Key questions to be asked by business owners and architects are

a. Which part of business needs agility, innovations, speed of delivery?

b. What are my key modular capabilities that could be used to assemble, disassemble the larger experience journeys, and personalize them?

c. What bare minimum services each module capability should offer to make it usable and expandable in future?

d. Can these capabilities be developed inhouse or are readily available as COTS services?

2. Data Architecture

A composable enterprise should be supported by a composable data architecture. The architecture should be built ground up, piece by piece with composable components.

The public cloud and SAAS vendors provide multiple options in this space for data hosting, data quality management, data governance, data extraction, data transformation, data harmonization, AI driven data intelligence and data visualizations and Predictive analytics.

The composable data and analytics will enable customer insights to be mapped to business actions and provide a flexible, collaborative, and agile way for scaling and implementing data initiatives across organizations.

Key questions to be asked by Data Architects and leaders in this space are

a. How to build an E2E data stack using modular, reusable components where each components serves a purpose?

b. Are chosen composable components adaptable, scalable, and interoperable to accommodate any future demands and integrate well with growing tools over next few years?

c. How to consolidate and connect the unstructured and fragmented data to gain customer insights and run contextualized marketing campaigns, provide proper recommendations, promotions, offers and discounts.

d. Design for future – Data Monetization aspects should be kept in mind while designing and structuring data

e. How to leverage key trends like XOps/DataOps, Data graph, Data and Analytics at edge for the success of organization?

3. Application Architecture

As applications are the key touch points for customers, application architects should take care of providing frameworks and right tools to compose configurable customer journeys using packaged capabilities. Plug and play modular application factories should be built for independent development and deployment of experience modules. Contextual experiences need to be built by using micro applications.

Key areas that Application architects should take care of are:

a. What tools and techniques can be used to assemble PBCs into larger customer journeys and business processes?

b. Which frameworks and stacks are fit to provide an extensible, plug and play architecture using Micro front ends and Backend for front ends design patterns?

c. How to automate the development using Low Code No Code platforms and provide more power in the hands of Business users for faster innovations

d. How to maximize the use of modular prefabricated components, PBCs across customer touchpoints and channels by providing a central catalog

e. Design for future – Application module monetization aspects should be kept in mind while designing modularity

4. Technology (Infrastructure) Architecture

Infrastructure architecture is the backbone of an enterprise. Hyperscalers like AWS, Google, Azure and Alibaba offer multiple infrastructure components as services that can be quickly assembled to support faster delivery and innovations at scale. The pay as you go cost model or reserved capacity model provides a cost-effective way to host applications. Fully manged serverless options help in reducing operations maintenance overhead.

Key considerations for Infrastructure architects to move towards composability

a. What deployments options we have for deploying applications and PBCs in containerized approach – cloud agonistic way?

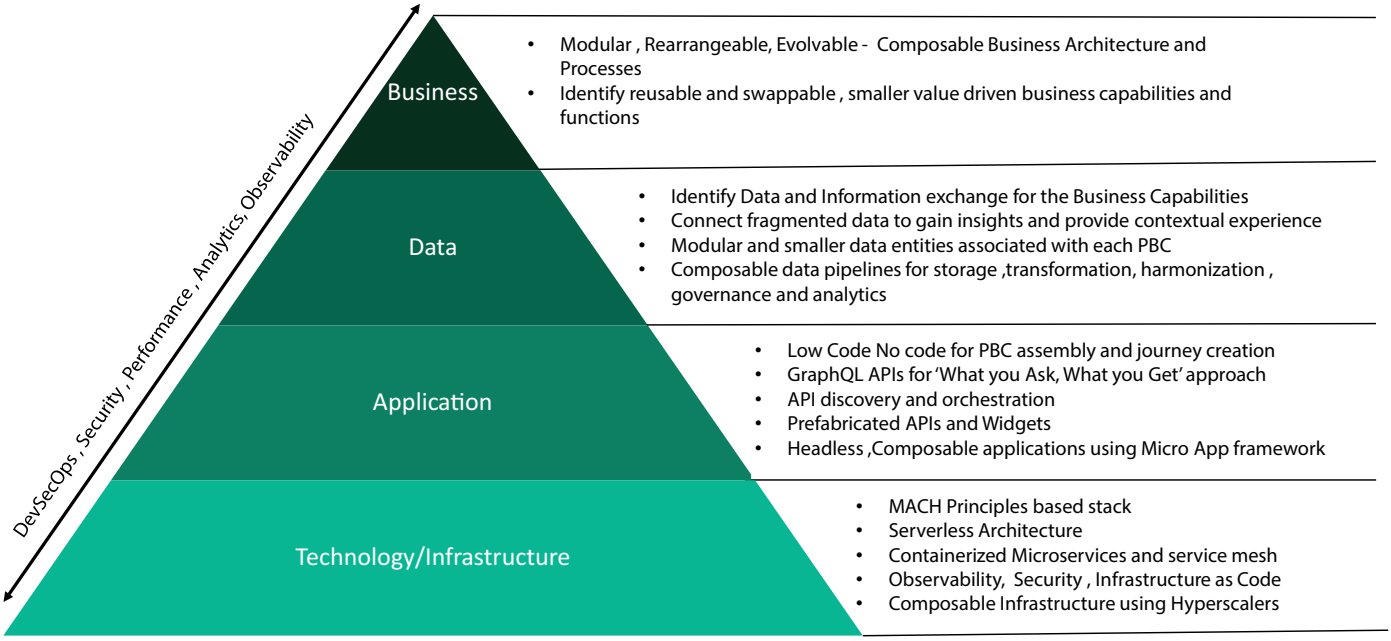
b. How to observe distributed, decoupled applications using cloud monitoring and observability services

c. Which security and network services to be deployed to prevent cyber-attacks and security risks in a distributed architecture

d. Create reusable, repeatable infrastructure using Infrastructure as Code services

The composable infrastructure market is expected to grow at 21.3% CAGR during the forecast period of 2020-2025.

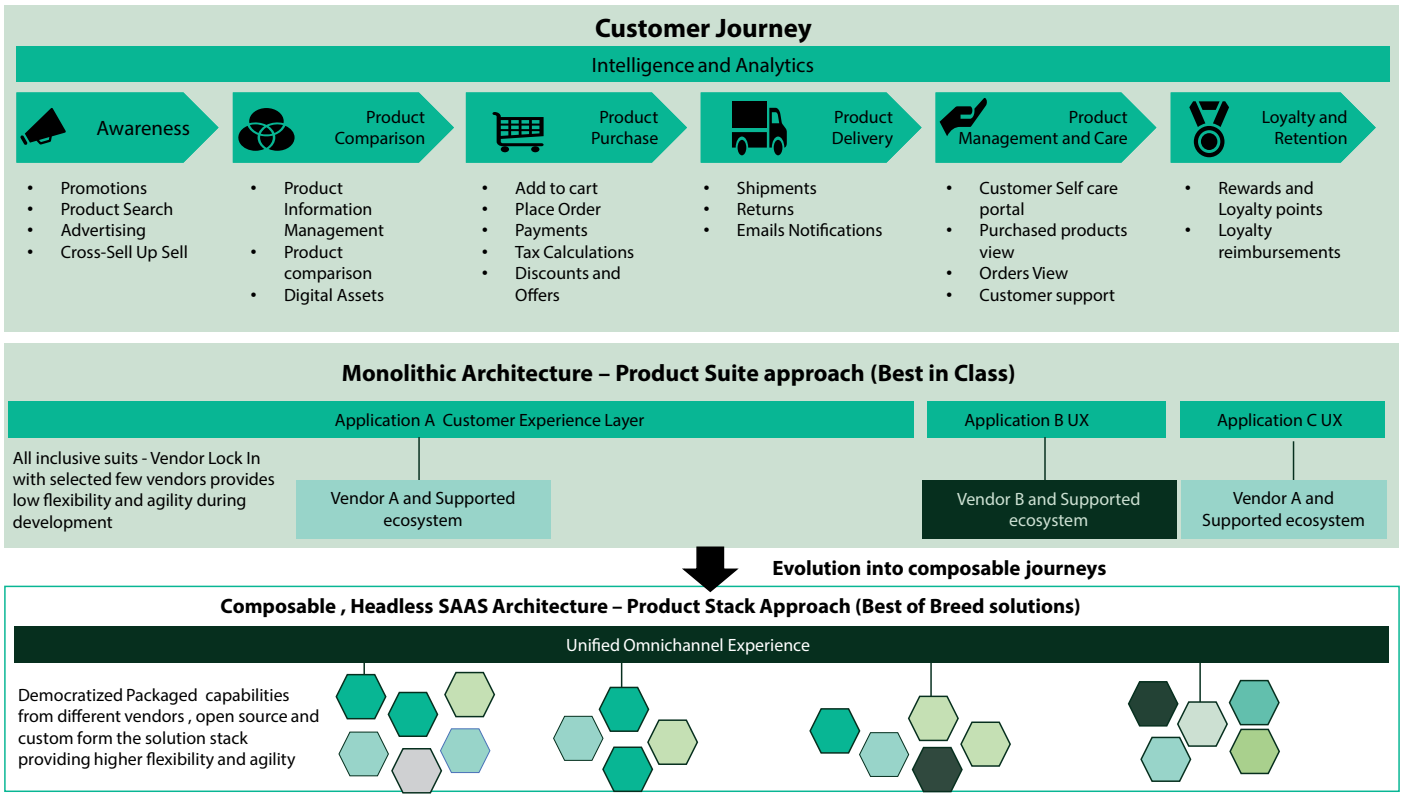
Predicted in a report by ResearchAndMarkets Link



Composability and Modularity across Enterprise Architecture Layers

Composable Customer Journeys

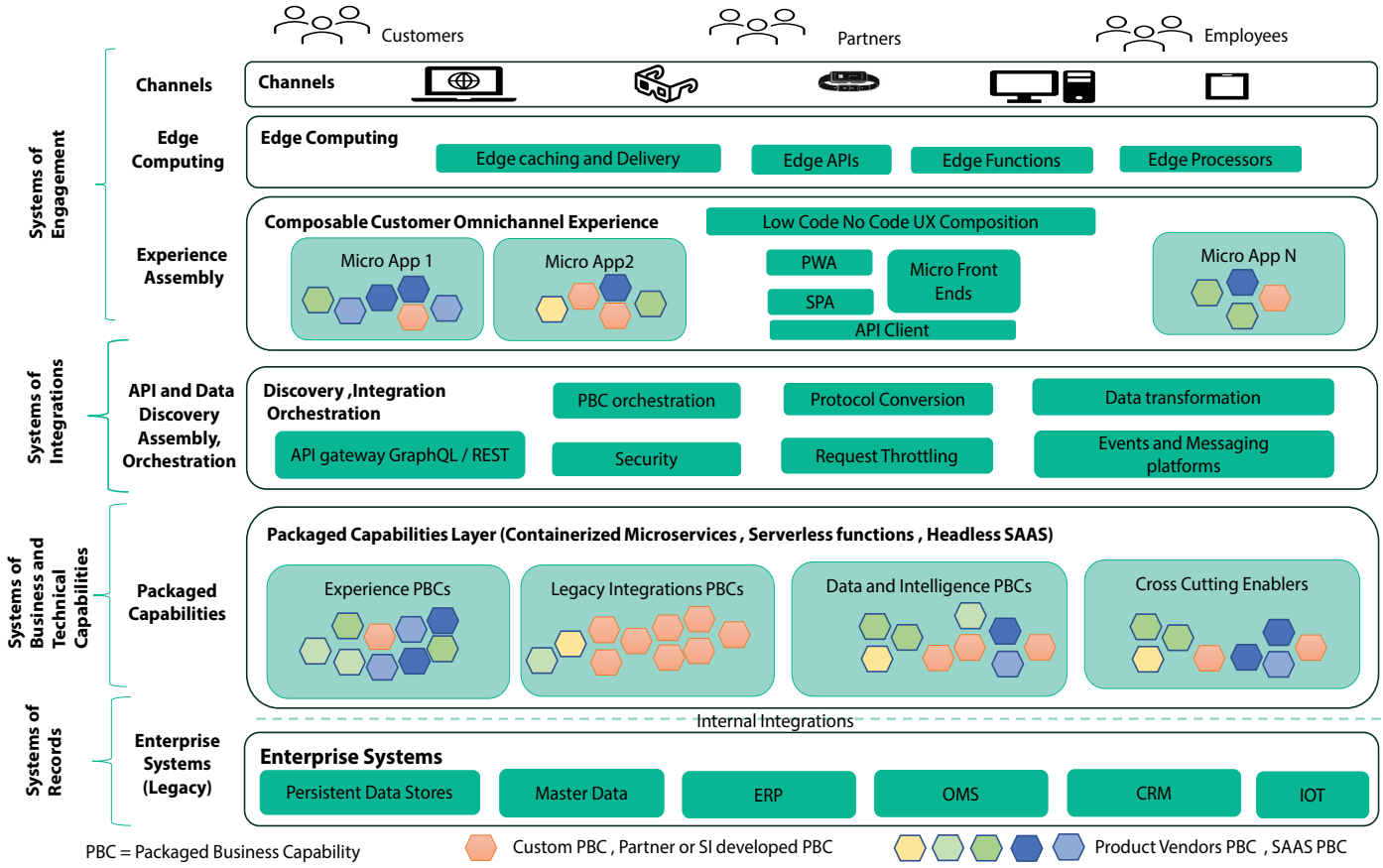
In traditional architecture approach, the Customer Experience journeys are mapped and implemented using monolithic systems – All-inclusive suits. However, in composable architecture each small capability in the overall journey could be implemented using a vendor provided headless SAAS or custom implementation on cloud or open-source services. This is explained with the help of a sample Customer online Sales and Self Care journey.



Composable Digital Landscape – A Reference Architecture

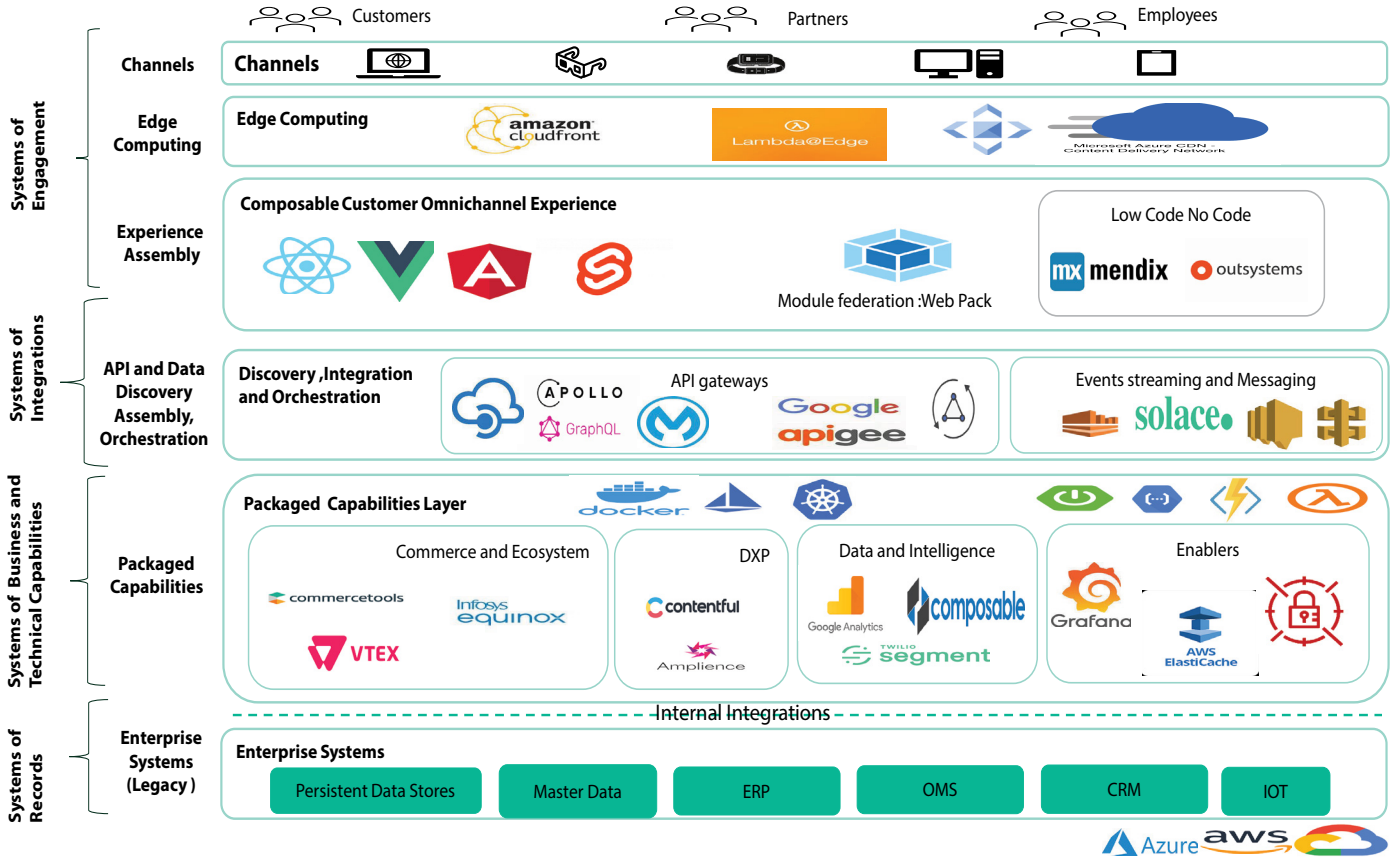
A consolidated reference architecture for a modern Enterprise that shows various layers in a Digital landscape and maps to the latest technological trends is depicted below.

Reference Architecture Layers



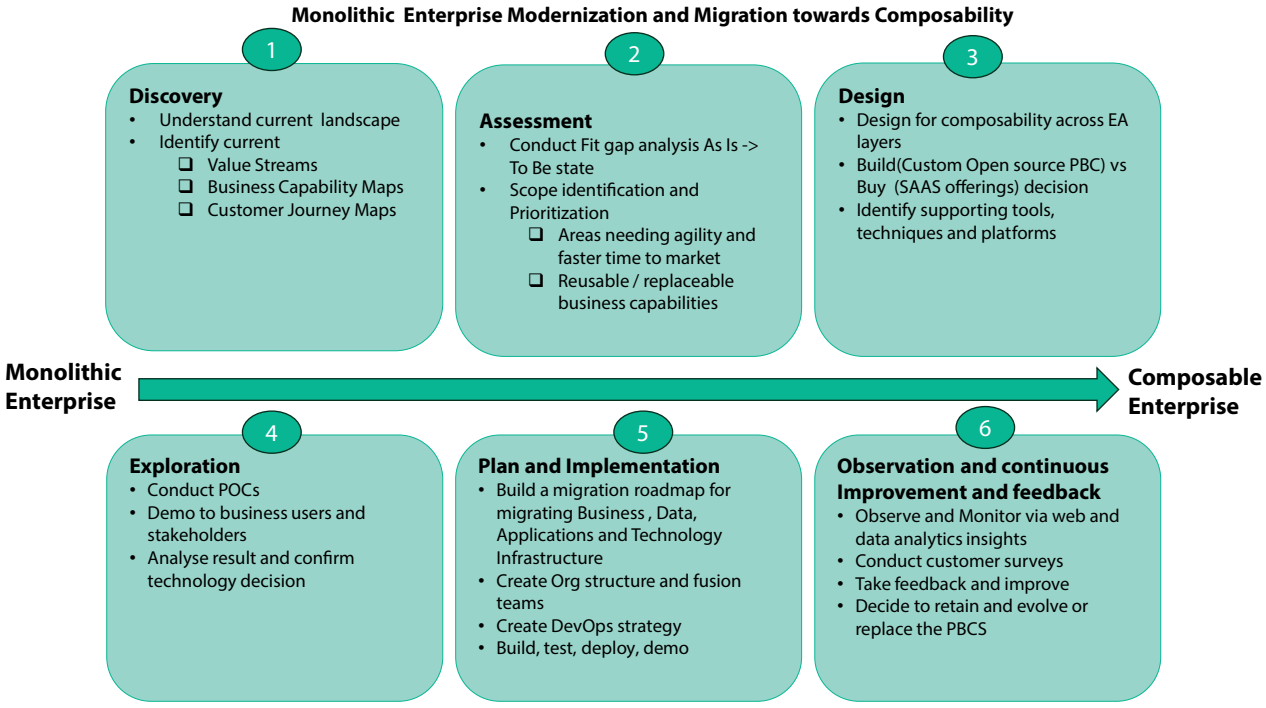
Layer	Details	Technology Mapping
Edge Computing	This layer provides edge computing over applications to enhance the application performance and leverage cloud edge networks to reduce latency for global consumers.	• CDN • Functions@Edge (example Lambda Edge) for edge processing • Edge Optimized APIs
Experience Assembly	Omnichannel, integrated and intelligent experience layer built using JAMStack and Low Code No Code platforms. This layer consolidates PBCs into contextual and relevant customer experience journeys.	• Low Code No Code based capability assembly and orchestration • Micro Front End based App factory and Module Federations • API client for consuming GraphQL / REST APIs • PWA, SPA
API Discovery, **Orchestration** and **Assembly**	Integration layer providing central catalog, orchestration and security. It exposes API to internal and external consumers.	iPAAS Middleware platforms, Public cloud API gateways as fully manged services Integrations with Events and messaging platforms like SOLACE, KAFKA.
Packaged Capabilities	This layer provides the packaged capabilities – Custom built or that are available from product vendors or SAAS offerings	The capabilities can be broadly grouped into following categories **Experience PBCs** – Experience PBCs provide direct value to customers and can be used to build customer journeys example – Order, Cart, Checkout. These contain business logic for applications and integrate with other PBC groups. Other PBCs are more of supporting PBCs that enable experience PBCs by providing cross functional, data or integration capabilities. **Legacy Integration PBCs** – These PBCs provide data and integration capabilities from downstream enterprise systems that are still implemented as monoliths ex- send order to ERP system, Receive shipment status from Fulfilment system **Data and Intelligence PBCs** – These provide data, data transformations, Analytics, AI, and ML PBCs and act as an intelligence hub for the enterprise to provide insights into customer and partner data **Cross Cutting Enabler capabilities** – Any capabilities that provide common enablers like Observability, Caching, Central logging, Security, Error Handling, Health Checks can be clubbed under this category
Enterprise Systems	These are the existing legacy systems that are still on a Monolithic architecture and provide data via APIs or other mechanisms such as EDI, File based integrations etc.	Existing legacy monoliths until they are modernized to a composable stack.

Composable Digital Landscape – Technology Mapping



Migration Approach towards Composable Enterprise

Migration from an existing monolith to a composable enterprise should be done using a well-designed, stepwise approach. Instead of opting for a big bang migration, it is recommended to follow an iterative methodology. The discovery and assessment phases are very critical for the success of this transformation journey. In these phases it is recommended to identify the areas that need immediate migration and require faster time to market and resiliency to change.



Future of Composability - Low Code No Code

The new era of Hyper-Digitalization requires speed of execution - quicker and faster way to discover, compose and evolve the customer experience and reduce time-to-market. Businesses need more power and DIY capabilities to demo innovative features to the end users. Open source based containerized microservices and automation tools like No Code Low Code will help companies to evolve into a composable digital enterprise quickly and effectively.

Many product vendors have established themselves in the market for providing low Code No Code platforms. These platforms offer reusable UI controls and components, templates and layouts, Open APIs, and business process workflows. Vendors are also constantly upgrading their product offerings in the space of DesignOps, DevOps, AI, Machine Learning and Business Intelligence via Advanced Data and Web analytics. Appian, Mendix, OutSystems, App Builder, Pega, Zoho are some key players in Low Code No Code space.

An omnichannel application can be built using drag and drop mechanisms (WYSIWYG) by multidisciplinary fusion teams in a collaborative way. This promotes co-creation ecosystem. Business users can discover reusable PBCs and quickly compose user journeys to showcase and demo innovative features to end users without much dependency on IT. This will foster a culture of iterative experimentation and a faster way to fail and then retry again.

Low-Code and No-Code Technologies Use Will Nearly Triple by 2025

By 2025, 70% of new applications developed by organizations will use low-code or no-code technologies, up from less than 25% in 2020.

Prediction by Gartner Link

Key focus areas to address challenges in designing for Composability

Although Composability brings in a lot of benefits for organizations in terms of supporting agility and business centricity, it also comes with a set of challenges that need attention and deeper understanding. With multi-vendor approach the onus of integrations and application risk management shifts from monolithic software vendor towards the application owner. A good Service Integration partner can help here in bringing the overall composable vision to life and managing E2E integrations and handling application issues.

Organizations should consider the following factors to build a more manageable and maintainable enterprise rather than ending up in another Frankenstein solution.

Enterprise Governance

In traditional monolithic approach the organizations must deal with a handful of vendors whereas in the composable approach the no. of vendors could be significantly higher.

Modular approach and consuming headless SAAS from different vendors require proper governance models in place. Tracking of the vendors, vendor communications, subscription management, managing SLA agreements, API keys need a proper structure and governance in place. A properly created stakeholders and accountability matrix for management and interactions with these vendors is important for a successful transformation.

SAAS Management tools like Blissfully, Better Cloud, Vendr and Torri could help in providing E2E visibility, track and analyse usage and optimize spend on SAAS services.

Enterprise Integrations

As APIs are the essential elements to build a composable architecture, organizations should choose right API management platforms to provide discovery, documentation, security, orchestration, and a platform for cohesive development. Cloud Native API tools like AWS API Gateway, AWS App Synch, Google Apigee, Mulesoft, Azure API, Boomi etc. should be evaluated for providing a unified API and integrations management layer. These should be clubbed with distributed event bus like SOLACE and Kafka for managed Event Driven Architecture (EDA).

Enterprise Observability and Monitoring

Distributed, decoupled, and modularized architecture introduces another level of complexity in terms of monitoring and observability. Open-source observability and monitoring platforms like Prometheus for metric collection, Grafana for visualization and various public cloud vendor provided services like AWS Cloud watch, AWS cloud trail, AWS Guard Duty need to be integrated and leveraged intelligently in the ecosystem to keep track of data flows, unexpected and malicious access, and attacks, predict system behaviour, and prevent outages before they occur.

Enterprise Security

API centricity and modular approach brings in challenges in terms of newer security threats and risks. Secured, encrypted data exchange between PBCs and applications become of paramount importance. Threat detection and observability tools should be employed to reduce security risks at all levels namely Applications, Services, Infrastructure and Code. Data at rest and Data in transit need to be encrypted.

All API and Event driven interactions, internal or external should be tracked, and unexpected behaviours should be acted upon. Along with this, safeguarding the vendor API keys using a centralized key and credential management solution can provide a secured access to the vendor APIs. API management tools along with WAF, DDoS tools and IDAM provide a good, secured ecosystem for API traffic for both internal and external communications.

DevSecOps pipelines should test for code level and integration security in an automated way

Zero trust security via shift left security paradigm, providing perimeter security for containers, functions and PBCs, adoption of adaptive security mechanisms and minimal privileges design will help creating a robust and secured landscape.

DevSecOps

Optimizing and recreating DevSecOps pipelines to deliver modular components and containerized microservice at scale will support innovations at scale. DevSecOps need a mindset shift and start to think modular, break down monolithic deployments into smaller autonomous deployment pipelines.

There is a need to have enhanced security mechanisms due to citizen developers (non-IT developers) gaining more power and democratized API economy with multi-vendor and custom approach. Vulnerability detection and remediation across SDLC is essential to have a secured applications ecosystem. DevSecOps pipelines should include all levels of automated security testing tools such as SAST, DAST, SCA, IAST and integration with CWPP tools.

Central API Management, Discovery, and Orchestration

In an API central solution, API Management tools and central catalog will provide quick discovery and orchestration of APIs. iPAAS based platforms like Mule Soft, Boomi and public cloud vendor provided managed API gateways like Google Apigee, AWS API gateway, Azure API gateway can help in API management and orchestrations. These tools will also support API security and certificates and credential management in collaboration with public cloud or external key management systems.

Infrastructure as Code (IaC)

Continuous innovations via continues delivery and testing will ensure delivering customer value faster. This requires faster infrastructure components and underlying security and network services creation using Infrastructure templates and declarative code.

Infrastructure as Code (IaC) is an IT strategy to manage and codify IT infrastructure as software. IaC workflows can be created using multiple tools available in the market like open-source, cloud agonistic tools like Terraform or public cloud tools like Cloud Formation scripts that can help to quickly create a pipeline for validated, secured, containerized, reproduceable and repeatable infrastructure setup.

The IaC pipelines should be integrated with DevSecOps pipelines to create and manage infrastructure components and complete environments as code.

Conclusion

Change is inevitable and organizations should start embracing it. Modern digital enterprise CIOs and CXOs should consider making composable enterprise architecture and composable user experience as part of their key strategic goals. This helps the organizations to grow and sustain in unprecedented times, innovate, and realize value faster to gain competitive advantage. 'Fail faster', 'Reinvent and Replace' should be the way forward rather than 'fail later' with monoliths and not able to replace due to heavy vendor lock in and costs involved.

Proposed reference architecture and technology mapping showcases how the enterprises should leverage composability and latest technological trends to create a future proof Composable Enterprise. Market is blooming with open source and COTS offerings to mix and match and build a composable enterprise. Even complete custom stacks built with open-source technologies need to adhere to the composable design pattern to provide a flexible and agile development approach.

Moving from monolithic to composable evolvable architecture approach requires composability across enterprise architecture layers – Business, Data, Applications and Technology and a shift in mindset. Organization should be restructured to create cross functional fusion teams to deliver packaged capabilities and custom experiences. The Business and IT leaders should work in tandem to achieve the transformation journey towards a Composable Enterprise. The migration approach suggested takes a careful stepwise iterative approach rather than a big bang migration. The interim solution during migration is foreseen as a mix of monolithic and composable capabilities.

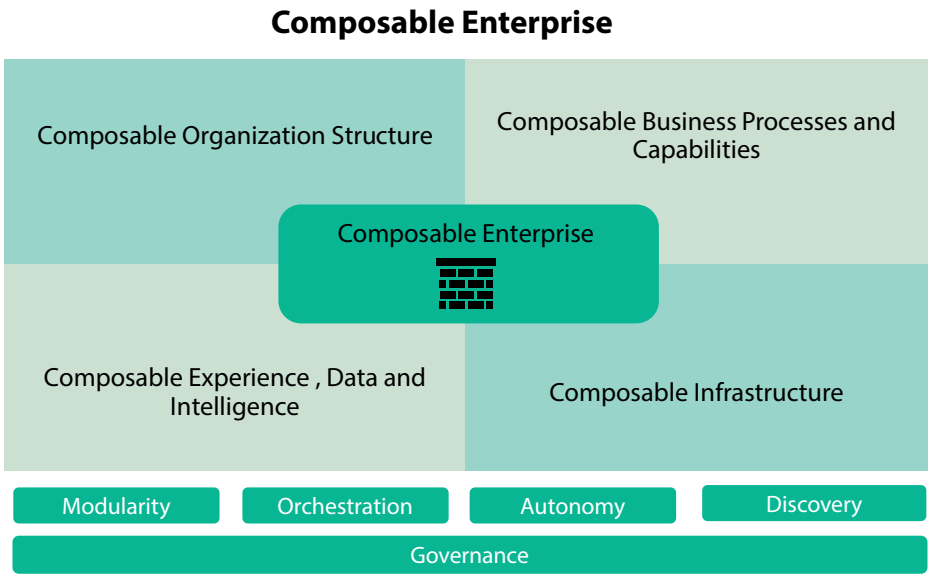
The backbone of Composable architecture is a PBC supported by democratization of API economy concept. As any democracy cannot sustain and function well without proper governance, A proper governance model and standardized processes backed by right tools should build a solid foundation for democratization. The discovery, availability of APIs via a central catalog or API management tool is another key aspect in API economy for enhancing reusability and reduce duplication. Security dimension will also see a shift towards zero trust security. Composability requires stringent security mechanisms, E2E observability and monitoring of data flows, application and infrastructure health, unexpected behaviours, and threat incidents. Right tools and cloud services should be deployed to support this. DevSecOps should be strengthened and made modular to achieve delivery at scale and meet security goals.

With the right strategy, risk taking mindset and right technology mix organizations can successfully move towards their enterprise composability vision. Moving away from monoliths will enable organizations to consider change as a tool for innovation and delivering immediate value to customers and not a reason for failure.

A good digital consultant and Implementation partner can help organizations achieve their transformation goals to move from a monolithic enterprise to a composable, evolvable, continuously improving, and sustainable enterprise. Organizations should leverage a knowledgeable, capable, and experienced System Integrator and partner for migration consulting, implementation, and management of composable enterprise.

By 2024, 80% of CIOs surveyed will list modular business redesign, through composability, as a top-five reason for accelerated business performance.

Prediction by Gartner Link



References and credits:

1 https://blog.bitsrc.io/the-composable-enterprise-a-guide-609443ae1282

2 https://www.elasticpath.com/blog/what-are-packaged-business-capablities

3 https://blog.bitsrc.io/the-composable-enterprise-a-guide-609443ae1282

4 https://www.frontastic.cloud/blog/what-is-composable-commerce

5 https://www.expressanalytics.com/blog/the-why-what-and-how-of-composable-data-and-analytics/

6 https://www.gartner.com/en/newsroom/press-releases/2021-10-18-gartner-identifies-the-top-strategic-technology-trends-for-2022

7 https://fusionalliance.com/maintaining-a-composable-enterprise/

8 https://www.elasticpath.com/blog/Announcing-Composable-Commerce-XA-De-Risk-Composable-Multi-Vendor-Solutions

9 https://www.processmaker.com/blog/why-composability-is-the-single-most-important-requirement-in-software/

10 https://devops.com/safeguarding-composable-architecture-applications-based-on-api-enabled-components/

11 https://www.techtarget.com/searchitoperations/definition/composable-infrastructure

12 https://www.architectureandgovernance.com/elevating-ea/composable-architecture-the-latest-trend-in-ea-helping-companies-adapt-and-grow/

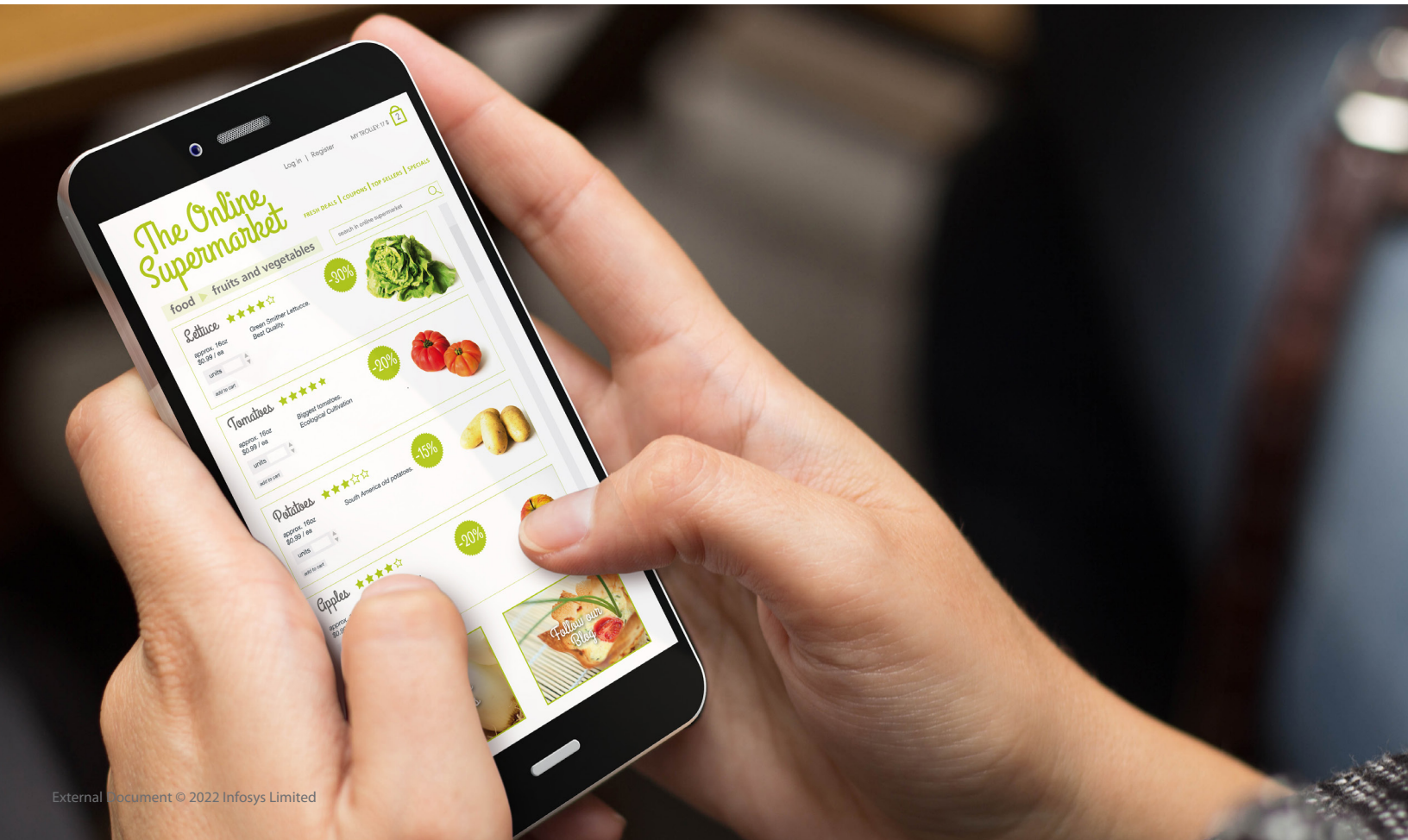
13 https://www.bloomreach.com/en/blog/2021/composable-commerce

14 https://www.gartner.com/en/newsroom/press-releases/2021-11-10-gartner-says-cloud-will-be-the-centerpiece-of-new-digital-experiences

15 https://www.globenewswire.com/news-release/2021/01/12/2157057/0/en/Worldwide-Industry-for-Composable-Infrastructure-to-2025-IT-Telecom-Vertical-is-Expected-to-Grow-at-a-Significant-Rate.html

16 https://venturebeat.com/2021/05/07/gartner-says-composable-data-and-analytics-key-to-digital-transformation/

17 https://diginomica.com/salesforce-expands-commerce-cloud-bid-help-retailers-grappling-complexity



Analyst Reports

Few key reports that are guiding the Enterprise Composability and enforcing the need for a Composable Enterprise. Many such reports are also available across each vertical driving industry wide composability.

Analyst Reports	Links
Gartner	Gartner key trends https://www.gartner.com/en/doc/becoming-composable-gartner-trend-insight-report
Forbes	How CIOs Can 'Tune Up' For the IT Composability Paradigm https://www.forbes.com/sites/forbestechcouncil/2022/02/22/how-cios-can-tune-up-for-the-it-composability-paradigm/?sh=1adc3e894b83
Forrester	From Monolithic to Composable Commerce https://insights.myplanet.com/from-monolith-to-composable-commerce-forrester-report
Gartner	Composable Architecture for Manufacturing https://emtemp.gcom.cloud/ngw/globalassets/en/publications/documents/innovation-insight-for-composable-for-manufacturers.pdf
IDC	Composable Infrastructure forecast https://www.idc.com/getdoc.jsp?containerId=US47689621

About the Author

Archa Shukla
Principal Technology Architect

About the Mentor

Anoop Kumar P
AVP, Senior Principal Technology Architect

Previous publications:

Serverless Architecture in Digital Landscape

https://www.infosys.com/services/digital-marketing/documents/serverles-digital-landscape.pdf

For more information, contact askus@infosys.com

Infosys®
Navigate your next