Whitepaper

The Managed Open Source Paradigm on Azure

Gold
Microsoft
Partner

Azure
Expert
MSP

Microsoft

Contents

Abstract

In recent times, organizations across the globe have recognized the adoption of cloud computing platforms as a game-changer in business transformation and technology innovation. One such highly sought-after technology trend has been the ability to adopt open-source software (OSS) platforms on public Cloud platforms. Ever since the advent of IT, the concept of open-source software has existed and so have myriads of OSS technology stacks. However, traditionally these OSS platforms have been shunned by most of the larger enterprises due to a lack of their credentials in terms of reliability, security, support, and brand value.

With OSS being embraced and managed by the large public cloud providers, businesses are now getting that assurance from OSS which lacked till now. At the same time, they are gaining the agility and the ability to innovate and experiment faster, which have always been the typical advantages of OSS. Combining these two benefits has led to a rising trend within enterprises towards using OSS in Cloud.

Furthermore, the Covid-19 pandemic and the economic downturn in the last 2 years has amplified demand for secured cloud adoption at an even faster pace and lesser rates, which in turn is also driving the open-source technology innovations on the cloud.

In this paper, we look into how Microsoft, as a leading Cloud hyperscaler, has adopted the OSS platforms as managed services on their Azure Cloud platform, thereby taking these options to the global customers backed with their assurance and promise. We also look at how LTI as a partner of Microsoft and as a prominent Azure Solution provider has successfully implemented the philosophy of Microsoft in their engagements.

In the end, we conclude the paper with a Point of View from LTI on what seems to be the future of OSS platforms on the cloud and what are the various open-source technologies, which have maximum growth potential in the near future and also in the longer term.

Rise of Open-Source Software

Back in the 1950s, in the infancy of computing technology, when the use of computers was limited to academia, software was bundled with hardware machines and distributed freely within the academic community. During the late 1960s, as operating systems and compilers evolved, software started to become more complex, hence building software become more expensive.

The behemoths of the industry started to emerge, with IBM, Apple, Microsoft, Oracle, etc. who began commercializing their software and selling them separately from the hardware.

It was only in the mid-1980s that the current open-source culture was initiated with the launch of the GNU (Not Unix!) project, which saw the birth of the first open-source operating system. What followed was an eruption of open-source operating systems from Linux to the Free BSDs (Berkeley Software Distribution).

Then the 1990s saw a revolution in programming languages. It was a time when the release of a new language in open-source form became the norm rather than the exception. It was during this time that the formal Open Source Initiative (OSI) was formed in 1998. Ever since then, open-source software has co-existed with proprietary software within their own areas of dominance.

Limited Acceptance of OSS despite Clear Advantages

Although OSS and proprietary software have co-existed for decades, OSS always had a limited acceptance in terms of user bases. It was most widely used in academia and research communities, as well as in small and medium businesses. Large enterprises with heavy and critical software workloads and huge hardware needs have traditionally gone with commercial software from the likes of Microsoft and Apple.
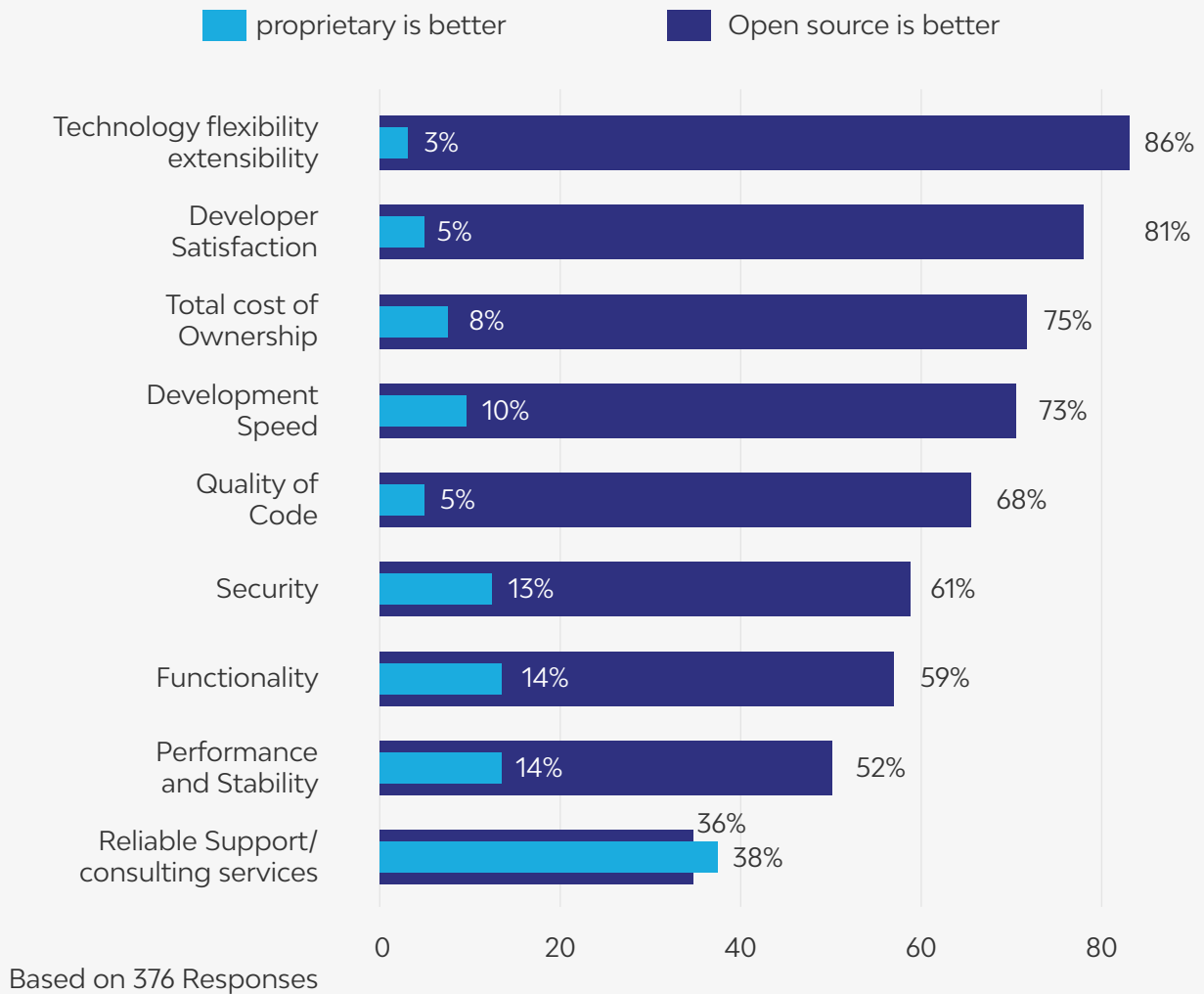
Benefits of OSS

Over the years, OSS has provided a lot of benefits to developers as well as end consumers.

According to respondents of a Tidelift and The New Stack survey, the biggest benefit of open source is technology flexibility and extensibility, with an astounding 86% agreeing that open source is better. This is followed closely by developer satisfaction, where 81% say that open source is their choice.

Open source also is preferred by significant margins when it comes to the total cost of ownership (75% for open source to 8% for proprietary), development speed (73% for open source to 10% for proprietary), quality of code (68% for open source to 5% for proprietary), security (61% for open source to 13% for proprietary), and functionality (59% for open source to 14% for proprietary).

Comparing open source and proprietary software

■ proprietary is better   ■ Open source is better

Category	proprietary	open source
Technology flexibility extensibility	3%	86%
Developer Satisfaction	5%	81%
Total cost of Ownership	8%	75%
Development Speed	10%	73%
Quality of Code	5%	68%
Security	13%	61%
Functionality	14%	59%
Performance and Stability	14%	52%
Reliable Support/ consulting services	36%	38%

Based on 376 Responses

Limitations of OSS

Despite these overwhelming advantages, there were a few limitations due to which open-source software has traditionally been shunned by large enterprises. The most critical problem has been a lack of reliable support for the software.

While commercial software is backed by continuous and reliable support, as well as consultancy for their products, open-source software is mostly the responsibility of the developer who avails and uses it. Besides, due to the lack of clear ownership from recognizable brands, security has always been a weak area in most of the OSS platforms.

Current Wave of OSS

The Cloud Disruption

Cloud computing as a paradigm was introduced to Information Technology in the late 1990s. In the last 2 decades, the adoption of the cloud has brought about disruptive changes not only in the technology sector, but in almost all industries.

The technology behemoths were quick to recognize the importance of cloud and have turned themselves into hyperscalers, providing cloud, networking, and internet services at scale to organizations via the IaaS, PaaS, and SaaS models.

The Container Revolution

Another revolution brought to information technology in the last decade has been the pioneering of containerization technology by Docker. Docker is an open-source container technology utilized by developers and system admins to build, ship, and run distributed applications. Docker has been a game-changer since its release in 2013 and has today become a massively popular containerization technology.

AI, IoT, and Analytics

The rise of Artificial Intelligence (AI), Internet of Things (IoT) and Big Data Analytics are the other dominating trends in technology today, all of which are powered end-to-end by open-source software. Python has been established as the leader in programming language for data science and artificial intelligence applications. It also has a very extensive developer community, where developers exchange codes & ideas. According to analysts, one of the reasons behind its continued relevance is its ease of use and high adaptability. Similarly, several OSS software like Arduino, Zetta, ThingsBoard and Kaa dominate the IoT scene of today, while analytics engines like Grafana, Kibana, and Apache Spark are the most popular solutions for Big Data Analytics.

OSS Adoption in Cloud

With so many new OSS-powered technology paradigms appearing simultaneously in the last decade, the public cloud hyperscalers understood the huge advantages of open-source software and readily started including the availability of the open-source platforms in their cloud platforms. Adopting a cloud-based open-source technology empowers enterprises to accelerate innovation, create & deploy applications faster and enhance consistency. A Forrester research forecasts that the global public cloud infrastructure market will soon expand and witness a 35% growth, reaching USD 120 billion in sales.

Cloud Market	sharetribe	COCORICO	Mangocat
Cloud Brokers	projectjellyfish/jellyfish-manageiq Project Jellyfish ManageIQ Module		OPEN SERVICE BROKER API
Cloud Management	SCALR	Apache MESOS	oneops
SaaS, PaaS & IaaS	Joomla!	Drupal	Linux	openstack
Virtualization	CLOUD FOUNDRY	CLOUDIFY	docker
Hardware	IBM BladeCenter	HP BladeSystem	

Managed Open Source

With the cloud hyperscalers adopting OSS, it gave rise to today's paradigm of "managed open source". As cloud platforms provide infinitely available compute and ready to use platform services at an elastic scale, customers consuming OSS from the cloud platforms could also avail stringent security measures, extremely high SLAs for reliability as well as managed support of these OSS platforms offered by the hyperscalers themselves. Above all, these hyperscalers being some of the largest IT giants of the world, they provide the brand value that the OSS platforms lacked till today.

Adequate enterprise security, which ensures that all the cloud infrastructure components are secured against the fast-growing security threats, is the need of the hour. Applications and endpoints need to be protected from the business perspective, and users are granted access as per the eligibility configuration based on role-based access control. Advancements in cybersecurity guarantee that Cloud access is secure. Hyperscaler

Cloud providers have strict security policies in place, which include physical security policies that minimize access. Oauth2 and OpenID are a few of the open-source tools that are used in the cloud for enterprise security.

With the help of their sponsorships and contributions, hyperscalers are also ensuring more rapid and cutting-edge innovation to the OSS platforms. The managed platforms enable agility and capabilities to move faster, experiment, and innovate, which are all critical to get that extra mileage in business. Businesses also need to find a mix of solutions, such as some combination of open-source software and cloud technology that work best for them and their individual use cases. Solutions implemented with adequate support can help businesses grow, remain agile, and innovate fast.

Hence, this Managed Open-Source approach allowed the cloud hyperscalers to not only bring all advantages of open source to their customers, but also enabled them to take care of the limitations of OSS.

Managed Open-Source approach allowed the cloud hyperscalers to not only bring all advantages of open source to their customers, but also enabled them to take care of the limitations of OSS.

Common Use Cases of Managed Open Source

In the Cloud computing world, with the Cloud hyperscalers adopting and managing open-source platforms, some of the most common use cases where growing uses of OSS is seen are as follows:

API Implementation: With the advent and rise of containerization with Docker, building and managing microservice API environments on the cloud have become the standard of distributed cloud-native development. Docker containers help bring services built in any technology or programming language to the cloud-managed container service.

Managed Container Orchestration: As the microservice workloads get bigger and more complex, managing them becomes a challenge. In comes the orchestration platforms like Kubernetes. Originally, an internal project in Google, made open-source subsequently, Kubernetes has been adopted and offered as a managed service today by all cloud hyperscalers.

Migration to Cloud: With Docker and Kubernetes available in all Cloud platforms, today it has become very easy to host legacy on-premises applications in any technology to cloud. With that as a fast way to adopt cloud, many enterprises use this route to get rid of their data centers and hardware and then go about transforming their software landscape from cloud to cloud upgrades.

Automation: Over the course of years, various independent automation platforms developed in an isolated manner. Tools like Ansible, Chef, Puppet, Jenkins have been all popular and accepted in their own rights. Now with the cloud being the dominant approach, DevOps automation has seen a consolidation of all these diverse tools into common platforms, like Azure DevOps.

Better Maintenance of OSS Platforms

Managed Open source has become an excellent way of learning how to code. With the hyperscalers contributing to

Over the course of years, various independent automation platforms developed in an isolated manner. Tools like Ansible, Chef, Puppet, Jenkins have been all popular and accepted in their own rights.

documenting and maintaining the changes and upgrades to the platforms, there is much more reliable and well-managed code now. Users can read the documentation of the software that powers it and even join the local meetups for the framework or language.

Developers can also submit a pull request to the project to fix a minor bug or ad. Irrespective of the open-source project type (internal or external), it can supply source code, design documents, and provide opportunities to try out new ideas and discuss them with designers and implementers.

Enterprises are not only using open source for internal transformations, but are also contributing open-source tools to the community, thus improving their visibility and relevance. The worldwide open-source community accelerates the innovation and development of various open-source software projects.

Comparison between Managed OSS and Proprietary Models

Businesses are now shifting to open source as it is driving business growth. Large technology companies are actively participating in the open-source community.

Over the period, the growth of OSS has happened in multiple generations. It all started with operating systems and databases with the revolution in programming languages in Gen 1. These laid the foundation for the next generation, with Cloudera, Hortonworks, and Hadoop, wherein these software were mostly driven within existing companies. Finally, we have the current Gen 3 OSS, where we have seen a merger between OSS and cloud for good.

In the image below, we can see a table displaying comparative advantages for the different generations of OSS against closed-source or proprietary software:

Enterprises are not only using open source for internal transformations, but are also contributing open-source tools to the community, thus improving their visibility and relevance.

Chart: Competitive Advantages of the Open Source Model

Business Attribute	Gen 3 Open Source (2019)	Gen 1 Open Source (2009)	Closed Source
Market Size	Large	Small	Large
Innovation Velocity	High	High	Low
Customer Acquisition Costs	Low	Low	High
Average Selling Price (ASP)	Low	Low Very	High
Market Elasticity	High	High	Low
Customer Lock-in	Low	None	High
Cost of Development	Low	Very Low	High
Lifetime Value	High	Low	High
Cloud First	High	Low	Low
Business Value	High	Low	Mid

Impact of the Pandemic

The Covid-19 Pandemic has shaken the world in the last 2 years. It has brought disruptions in all spheres of human life, from health, economy to industries. Many organizations have undergone budget cuts due to economic downturn. Economically sensitive industries like consumer, retail and manufacturing were worst hit. In such scenario, businesses have become more keen to adopt OSS, since it helps to innovate faster without having to write all of the code or purchase expensive proprietary software tools, turning out to be a cheaper investment in the end.

Work from home requirements have led to newer ways of working from remote environments. Prior to the pandemic, companies were localized and restricted, but the transition to remote work has begun to change that. With the new ways of work came demands for new applications. Telecommunication, system monitoring requirements skyrockets as the companies struggled to manage work from geographically dispersed remote locations.

The ask of the day is for even faster builds and shorter times to market at lower costs. This naturally has amplified the demand for open-source software solutions even further since OSS can satisfy these demands easily due to the available resources and reusability of the existing implementations.

Businesses have been continuously challenged during this period of unprecedented change, and it necessitated preparing for life post-Covid-19 by figuring out how to stay ahead of the competition as we move towards a 'new normal'.

Enterprises have increasingly shifted to open-source software solutions since 2020 to fulfil their organizational needs and address new market requirements for innovation, quality, and speed.

A recent survey found that over 90 percent of enterprise cloud developers believe open source will be a part of the future of their organizations. Similarly, another research found that almost half of the organizations rely more on open-source due to the pandemic. Thus, growth in the

adoption of open-source software (OSS) has only accelerated over the last year since the onset of the pandemic.

OSS Adoption Success Stories

Several organizations have now opted to use open-sourced technologies to develop their products and even use open-source tools designed for internal usage.

Facebook is one of the biggest open-source success stories of recent times. The pioneering social media giant was built on open-source technologies since birth, with the likes of Linux, Apache, MySQL, and PHP serving as the building blocks for what is now one of the 10 most valuable companies in the world.

Netflix and Uber are also excellent examples of OSS adoption in organizations that need quick turnaround time to market their solutions while still being start-ups. Both companies use prevalent OSS languages such as Java, databases such as MySQL and Cassandra, and open-sourced tools developed internally. Photon (for content encoding) and Security Monkey (for security monitoring) are open-sourced by Netflix while maintaining projects like RESTify. Uber has also open-sourced projects like Jaeger Tracing (distributed tracing), Ludwig (No-Code ML), and Pyro (Native Probabilistic Programming Language).

Spotify is another recent instance of OSS driving design and innovation in an organization. Kubernetes empowered Spotify to build and deploy new features without managing the infrastructure or scaling around it. Spotify's data pipelines and machine learning were moved to Kubernetes to utilize its highly distributed structures and build ephemeral environments.

Microsoft in OSS Space

In the rest of the paper, we analyze the journey of Microsoft from being a staunch proponent of proprietary software to a leader of the OSS revolution.

Re-imagination in Microsoft

Microsoft, a technology giant, has been traditionally known as a proponent of proprietary software and opposition to the open-source paradigm. From the 1970s through the early 2000s, Microsoft viewed the community creation and sharing of code as a threat to the global software business. In alignment with the common perception of the time, open-source was considered as counter-competitive.

However, in the last 2 decades, as the open-source revolution grew stronger and the industry turned towards cloud, embedded, and mobile computing plat-forms with technologies powered by the open-source, Microsoft gradually changed their stance and slowly moved towards open-source adoption to stay apace and gain leadership position in these fields.

The OSS Journey in Microsoft

From being an embodiment of the proprietary software and product paradigm in the industry during its early years of 1970s till the turn of the century, to being the largest contributor to open-source projects in the world by 2017 and beyond, following are some key milestones achieved by Microsoft in their journey with OSS:

Stage	Year	Details
Early adoption	2004	WiX: First Microsoft Project released with open-source license
	2005	F# Programming Language released under Apache 2.0
	2006	CodePlex for hosting open-source code for Microsoft platform
	2006	PHP ported to Windows under PHP license
	2008	Microsoft joined Apache Foundation & Open Web Foundation
	2010	StyleCop re-released as open-source
	2011	Node.js & Python ported for Windows & release as VS tools
	2015	Visual Studio Code posted in GitHub under MIT license
	2016	Bing search engine made open-source
	2017	Windows development made open-source and moved to Git
	2017	Microsoft joined OSI, CNCF, MariaDB
Linux adoption	2006	Partnership between Microsoft & Novell for SUSE
	2009	Started contribution in Linux Kernel
	2012	Azure cloud services powered by Linux-based OS
	2014	Wireless Display Adapter, first MS hardware using Linux
	Today	More than 50% workloads in Azure run on Linux distributions
.NET as OSS	2014	Part of .NET Framework code made open-source
	Today	All of .NET and .NET Core, Roslyn, C# are open-source
GitHub Acquired	2017	Microsoft became biggest open-source contributor in GitHub
	2018	Microsoft acquired GitHub
	Today	Microsoft is biggest contributor to open-source projects
Recent Stories	2019	Quantum Development Kit open-sourced with Q# compilers
	2019	Released Teams app for Linux
	2019	Microsoft is most prominent contribution in OpenJS foundation
	2020	Released DeepSpeed, optimization library for PyTorch
	Today	Major contributor to Hyperledger project

OSS Adoption in Microsoft Azure

According to McKinsey Developer Velocity Survey, organizations using open-source technologies score 30% higher on innovation and 20% higher on developer satisfaction. The Azure public cloud platform provides various options of leveraging OSS for different types of businesses, across all layers of software development and maintenance:

Azure Compute

Users can host their workloads on various distributions of Linux on Azure, applicable for compute, containers, and managed services. At the same time, these workloads can leverage built-in identity, security, management & hybrid capabilities of Azure.

Azure App Development
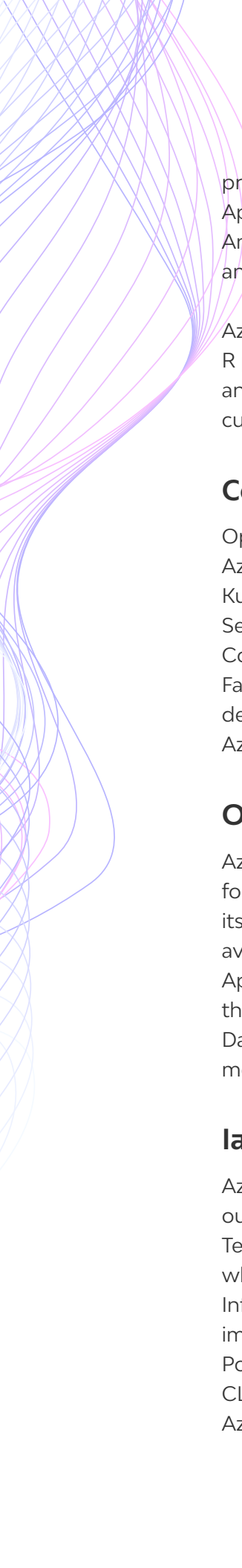
Azure App Services is a managed platform that supports web apps and APIs using all the popular OSS frameworks, including Java, JavaScript, Kotlin, PHP, Python, Ruby, Perl, and Node. These applications can be built and deployed as web apps or REST APIs

into Linux VMs, Managed App Services, Serverless Functions or on various Containerized Platforms in Azure. Azure Functions custom handlers can also be used to host apps built in any other programming language which is not officially supported in Azure, like Go, Rust, etc.

Azure Data and Analytics

Azure platform provides access to fully-managed versions of popular open-source database options. These include, Azure Cosmos DB with open-source APIs for Gremlin, Graph DB, MongoDB and Cassandra, PostgreSQL, MySQL, MariaDB and open-source Elastic and Redis Cache APIs.
In the Data Analytics domain, Azure

provides popular OSS options like Apache Spark for Data Processing, Dbt Analytics, Presto Distributed SQL engine, and Kafka real-time stream analytics.

Azure also allows using the Python and R programming languages and relevant analytics packages with these to build custom Analytics solutions.

Containers on Azure

Option for hosting Docker containers in Azure include the managed Azure Kubernetes Service (AKS), Azure App Service for Containers, Serverless Azure Container Instances, and Azure Service Fabric. Finally, there is also the option of deploying the Docker Containers on Azure Virtual Machines.

Observability on Azure

Azure Monitor, the primary umbrella tool for monitoring Azure, is open-source by itself. Its SDKs and APIs are made available in GitHub for the community. Apart from Monitor, Azure also supports third-party open-source tools like DataDog and Prometheus for monitoring.

IaC on Azure

Azure DevOps is integrated out-of-the-box with HashiCorp Terraform, Ansible, Chef, and Puppet, which are open-source platforms for Infrastructure-as-Code implementations. Besides, Microsoft's PowerShell, ARM Templates, and Azure CLI are also available to be applied in the Azure DevOps environment as OSS.

Machine Learning and AI with OSS on Azure

Microsoft has come up with managed service offerings in Azure to make ML and AI developments much easier:

Azure Cognitive Services: These are general-purpose ready-made AI services available on Azure PaaS in the form of REST APIs. These are designed to help developers create intelligent apps more easily. For example, Cognitive Services include Speech, Language, Vision, and Decision Services.

Azure-Applied AI Services: These are built on top of Cognitive Services with additional task-specific AI and business logic to optimize for specific use cases so that developers spend less time designing solutions or setting up pipelines. Some Applied Services include Bot Service, Cognitive Search, Metrics Advisor, Video Analyzer, Immersive Reader & Form Recognizer.

Azure Machine Learning: This is a set of services that support the end-to-end machine learning life cycle, starting from data preparation, model creation & training, model validation & deployment, and model management & monitoring. It provides the studio experience with drag-and-drop, as well as the ability to incorporate custom models built using notebooks.

Azure AI at Scale: AI today is all-pervasive in Microsoft Azure. There are various layers in which ML and AI services are leveraged and made available for end-user consumption. Starting with Infusing AI into products like Bing, Microsoft 365, Dynamics CRM, to the availability of various ML Services, pre-trained and fine-tuned Models, and finally, large-scale Infrastructure enabling high-performance computation for heavy-duty ML and AI models.

Success Stories of OSS on Azure

With Microsoft Azure providing all advantages of leveraging OSS along with its world-leading safety, security, reliability, and scale, it has become the go-to platform for many enterprises. The following section highlights a few customer stories who successfully leveraged OSS on Azure: [Case Study Source]

Vehicle manufacturer Daimler AG uses Microsoft Azure DevTest Labs to speed up software development and innovation. They use Java, Tomcat, Docker containers, Red Hat & SUSE Linux, by which their developer onboarding process has reduced from weeks to hours.

Bosch was trying to solve the problem of drivers going the wrong way on highways. To get precise-enough real-time location data, Bosch adopted OSS on Azure & built a wrong-way driver warning (WDW) service. The tool's architecture pivots on an innovative map-matching algorithm using AKS with Azure HDInsight tools integrating with Apache Kafka streaming platform.

Lufthansa Technik developed a digital platform called AVIATAR that enables data-driven operational excellence for airlines, MRO providers, and lessors, using Red Hat & Cloudera. Later they chose Azure to migrate the tool to the cloud. It resulted in a solution that helps airlines not only cut costs but also increase aircraft reliability.

Adobe created Experience Cloud, a set of marketing, analytics, and advertising tools to deliver amazing customer experiences. Adobe selected Azure as its preferred cloud platform to ensure that

its growing portfolio of OSS tools on the Cloud runs fast, reliably, and more securely, giving customers an exceptional digital experience.

LTI's Contribution for Open-Source on Azure

LTI as a Microsoft Azure Gold Partner

LTI has been an early adopter of Cloud Technologies. Cloud grew into a core and most critical practice within the organization which has contributed largely to the growth of the fastest growing Indian IT organization.

LTI has always been very focused on building competencies and delivering top-quality solutions using the Microsoft Technology stack. For several years, LTI has been a Gold Partner of Microsoft in almost all core areas, including Azure. LTI has also earned several specializations in areas of Microsoft Azure, ranging from App Modernization to Containerization (AKS) to CSP (Cloud Solution Provider).

LTI's Azure Practice boasts of nearly 5,000 associates, with more than 2000 certified in various Azure capabilities. The team serves more than 50 active engagements across the globe with large enterprises to small and medium businesses across all industries and has also built 25+ tools and accelerators in areas of Azure Cloud.

The practice is continuously involved in activities ranging from Azure Consultancy, App Modernization on Azure, DevOps Transformation, and Operations on Azure.

Azure Practice Capabilities

5000+
Azure Associates

50+
Active Engagements
across Globe – North
America, Europe, UK, APAC

2000+
Azure Certified

15+
Strong Partner
Ecosystem–Tech
Service, Innovation

25+
Tools and
Accelerators

Cloud Consulting
• Cloud Strategy & Roadmap
• Evaluation & selection of right PaaS Platforms
• Business Case & TCO Analysis
• Assessment & Remediation for ROI

DevOps Transformation
• DevOps Assessment
• DevOps Enablement
• DevOps- as- a – Service
• Purposeful DevOps
• Managed Services

Cloud Enablement
• Cloud Platform Build & Migration
• PaaS Migration (Re-Factor, Re-Host, Re-Architect)
• Custom application development
• Microservices & Containerization

Cloud Operations
• Monitoring & Alerting
• Incident Management, DR Drills
• Access and Backup Management
• Cost Optimization
• Security Compliance
• Next Gen Operations

Our Domain Experience I Banking & Financial Services I Insurance I Manufacturing I Technology I Retail & Consumer Goods I Energy & Utilities I Media & Communications I Automotive

LTI has a 365-degree partnership with Microsoft as an organization. Besides being a Gold Partner and a CSP of Microsoft, LTI is also a major software vendor for the IT giant, responsible for building and maintaining many of their internal software platforms.

LTI's OSS on Azure Practice

Every category of Azure services including Compute (App Service Functions, AKS), Data (MySQL, PostgreSQL, Cosmos DB), Analytics (Spark), and Machine Learning (ML Services, Cognitive Services, Applied AI) support open-source technologies. Azure Databases for OSS offer the capacity to scale performance with little or no downtime built-in.

With enterprises around the globe increasingly leaning towards building their workloads using OSS on Cloud, LTI's Azure Practice needed to put more focus to deliver solutions using OSS on Azure. Hence, with a focus on OSS as an objective, Azure Practice has incubated "OSS on Azure" as a dedicated sub-practice to develop competencies and build a skilled team aligned to the path that Microsoft has taken with Open-Source adoption in Azure.

Thereby, the team has extracted the best value out of the innovation in the space for our clients. It includes providing solutions aligned with the advancements in containers with AKS and OSS-driven transformation of AI/ML/DS workloads by leveraging Microsoft's expertise in these domains.

LTI's Success Stories with OSS on Azure

OSS on Azure sub-practice has designed and implemented various solutions leveraging the open-source technology stack available in Azure services.

In this section, we showcase some of the diverse and successful customer stories delivered by LTI's OSS on the Azure practice team.

Operationalized Risk Prediction of Machine Learning models for a US client in the Insurance domain using Azure Machine Learning Studio and created Azure Data Factory pipelines to gather and transform the feedback data received from the users. The models and the data transformation logic were written in R scripts, while the backend system was designed using .Net Core. Additionally, the team co-designed and developed another award-winning tool for the same customer, which involved building a REST API around a regression-based Python model for the prediction of vehicle losses and recommending solutions for the same.

Migrated the customer acquisition applications of a US loyalty card provider from an on-premises server and AWS to Azure. These recent improvements in support for open-source languages in App Services simplified the Ruby-on-Rails backend migration with minimal change requirement within the functional code, while the available deployment options allowed for a robust setup of a multi-region Hot-Hot Active-Active Disaster Recovery Setup. Additionally, the variety of programming stack options for Azure Functions, including Custom Handlers for unsupported languages, simplified the migration of background jobs written in Kotlin.

Designed High-Performance Applications for an Indian OTT platform to provide search and health check capabilities for millions of requests within a short response time of 50ms. This was enabled by Python APIs and ELK stack for search on Azure Kubernetes Service for high scalability and administration.

Re-engineered and migrated Java and Ruby application portfolio from on-premises data centers to Azure Kubernetes Services. Built the end-to-end orchestration clusters using Terraform in Azure DevOps. Also built Alert mechanisms using Azure Monitor and Alerts.

Design Standardization for GxP Regulation Enforcement performed for a US-based global pharmaceutical company. Deployment of Azure services using standardized Design adhering to GxP Compliance guidelines. Defined the regulatory enforcements via Azure Policies & Initiatives. Developed the policies & initiatives using Azure SDKs via python considering reduced complex custom code deployment patterns. Testing of the policies via automated BDDs, X-Ray tests using integrated Jenkins platform across multiple environments ensuring quality standards adhering to Azure Best practices & Standards.

Designed and implemented Alation Data Catalog with data ingestion, transformation, and load into the catalog from custom internal sources for multi-national consumer good company. Used Azure Blobs for ingesting source JSON data. Processed and transformed data using chained Durable Functions with Activity Triggers. Finally uploaded the target data to Alation SQL Data Store. Leveraged ADF for orchestration and Power BI or visualization of the critical datasets.

What does the Future hold?

Next-gen Technology is OSS-dominated

Managed Open-source continues to Dominate

OSS is already spreading its wings and dominating most of the futuristic technological developments of the day. It promises to power several next-generation tools, while "Managed" cloud implementation/services like OSS on Azure continue to amplify their productivity by delegating management responsibilities & functions, saving costs, and improving operations. Managed Service Providers (MSPs) like LTI would simplify migrating to a cloud platform and provide advanced technologies that help organizations move their cloud services to effective hybrid clouds. This trend will continue to facilitate organizations to make use of a range of applications and technologies continuously.

OSS on Cloud will continue to grow in ML, AI, IoT, and Analytics

Cloud Hyperscalers will continue to focus on the areas of ML and AI, targeting at maturing their service offerings. The coming years will see rapid Adoption of AI at Edge. AI, ML, and Data Analytics will become mainstream implementations, driven by offerings like OSS on Azure. IoT Platforms and Services will also

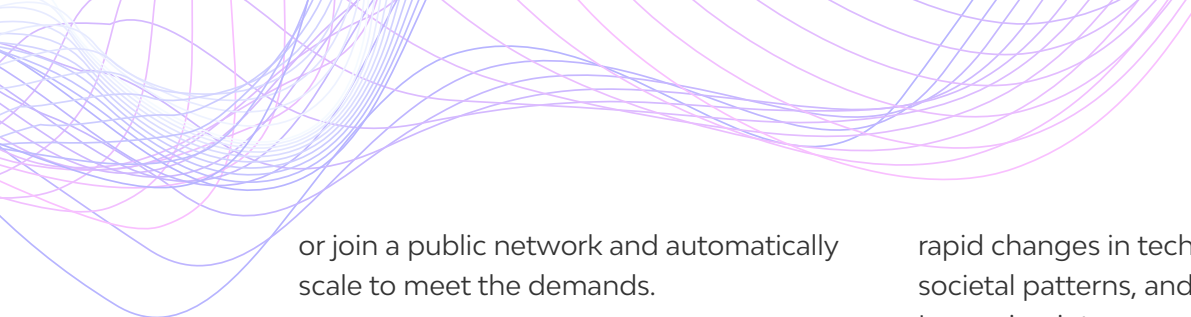continue to mature in the Azure and other Cloud platforms.

Managed Container Orchestration becomes a de-facto standard

Container orchestration automates the operations and tasks around deploying and running containerized applications & services. The latest IBM research reports that 70% of developers that use container orchestration solutions at their organizations have reported using a fully-managed or cloud-managed container orchestration service. Platforms like Kubernetes will continue to flourish and become the de-facto standard for managing a containerized workload. As the workloads increase and become more complex, orchestrating the environment does not remain simple. Hence, the Managed Kubernetes offerings and likewise from Cloud Providers like Azure become critical for the success of orchestrated containerized applications.

Along with containers, serverless approaches will also pick up pace as a favoured approach for hosting on Cloud. The technology world would see a rise in the implementation of event-driven Serverless Containers.

Rise of Managed Blockchain Services

Consumers and businesses are now looking forward to adopting blockchain technology, but the technical complexities and operational overhead often act as barriers. Managed blockchain services eliminate the overhead required to create

or join a public network and automatically scale to meet the demands.

Managed blockchain Services, also referred to as Blockchain-as-a-service (BaaS), is third-party cloud-based infrastructure & management for companies building and operating blockchain apps. BaaS allows customers to leverage cloud-based solutions to create, host, and use their blockchain apps and related functions. The cloud-based service providers, at the same time, help to keep the infrastructure agile & operational. Further, BaaS is seen as the catalyst promoting the adoption of blockchain technology across businesses.

Alongside other hyperscalers, Azure will continue as a major player in the BaaS space:

- Azure Blockchain Service is a fully managed service designed to eliminate the complexity and pain points of creating and maintaining blockchain networks at scale. It supports Ethereum, Quorum Ledger, Corda, and Hyperledger Fabric.

- Azure Workbench is built on a predefined template on Ethereum Protocol, and it provides access to client apps to create & manage users and blockchain applications.

- Hyperledger Fabric on AKS simplifies the process of setting up and deploying the HLF and operating the same on Azure Cloud.

The disruption caused by Industry 4.0

Industry 4.0 (Fourth Industrial Revolution - 4IR) in the 21st century conceptualizes the rapid changes in technology, industries, societal patterns, and processes. Increasing interconnectivity and smart automation have made these transitions not just efficient but express a significant shift in industrial capitalism. This phase of industrial change is like joining several advanced technologies (such as Gene Editing, Digital Twining, and Information Technology) powered by IoT, Artificial Intelligence, Machine Learning, and Big Data Analytics to Advanced Robotics. These advanced technologies have blurred the lines between the physical, digital, and biological worlds.

Open-Source Software (OSS) and Public Cloud Platforms have laid the foundation stones for radical changes in the industry. Data and Insights are the most critical components of any enterprise workload, and Microsoft Azure cloud-based technology & services, along with support for OSS, can deliver the demand for intelligent insights.

Metaverse

Metaverse is a digital space represented by digital representations of people, places, and things. In other words, it's a "digital world" with real people represented by digital objects The Metaverse Project is open-source, modular, flexible, and extensible. The project was built to fulfil the demand and prominent developer-following for virtual worlds that allow customization and creation of one's worlds. Metaverse projects are built using open-source stacks and use Cloud platforms as the backbone. Existing technology in Machine Learning is heavily used to power the Metaverse elements.

One of the biggest announcements in the technology industry during 2021 has been the renaming of Facebook's parent organization as Meta, indicating its plunge in the area. More recently, in January 2022, Microsoft, by acquiring the gaming company Activision Blizzard has announced their entry into the scene. Their next big step in the Metaverse would be when they release the Avatar tool Mesh for Teams in 2023.

Many large enterprises around the globe have already started investing billions of dollars into the Metaverse which indicates the possible birth of a new paradigm in the near future.

Gartner's Emerging Technologies

According to Gartner, some of the key technologies to watch out for in the next decade would be Non-fungible Tokens (NFT), Quantum ML, Sovereign Cloud, Data Fabric, Generative AI, Homomorphic Encryption, and Composable Applications & Networks. Engineering trust, accelerating growth & sculpting change are the overarching trends on the Gartner Inc., Hype Cycle for Emerging Technologies, 2021 as shown in the figure below. According to Gartner, these three trends will drive organizations to explore emerging technologies to secure a competitive advantage.

Hype Cycle for Emerging Technologies, 2021
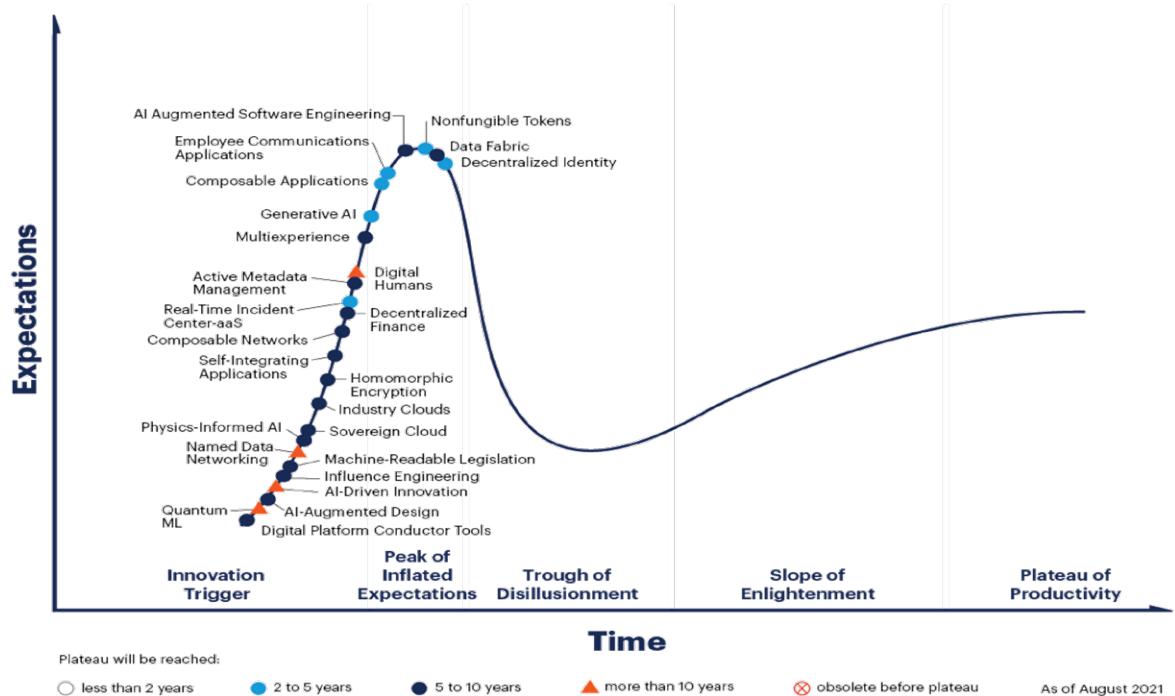
gartner.com

Source: Gartner
© 2021 Gartner, Inc. and/or its affiliates. All rights reserved. Gartner and Hype Cycle are registered trademarks of Gartner, Inc. and its affiliates in the U.S. 1448000

Gartner.

Conclusion

Open-source has revolutionized the software industry with a permanent impact. OSS today is driving tremendous growth in businesses with low barriers to entry, fast innovation, and flexibility. As cloud platforms provide compute at scale, security and reliability, managed open-source has overcome the earlier limitations in OSS and has become the driving force behind all the disruptions in the technology world of recent past and upcoming future, including AI, ML, Data Analytics, IoT and Blockchain.

Microsoft has established itself as a formidable player in the field with OSS on Azure. With successful implementations of OSS platforms on the cloud by service providers like LTI, the managed open-source is going to shape the future of information technology for a long time to come.

References

Tidelift and The New Stack Survey	https://blog.tidelift.com/theres-one-thing-stopping-developers-from-using-open-source-even-more
Comparing open source and proprietary software	https://blog.tidelift.com/hs-fs/hubfs/graphics_13-01.png?width=620&name=graphics_13-01.png
Forrester Research	https://go.forrester.com/blogs/predictions-2021-cloud-computing-powers-pandemic-recovery/
Open Source Cloud Platforms for Enterprises	https://www.opensourceforu.com/2019/04/an-overview-of-open-source-cloud-platforms-for-enterprises/
Comparative Advantage of Open Source	https://free-and-open-technologies.github.io/papers/Rodriguez_and_G%C3%BCrcay_-_Open-Source_Software_in_Business_and_its_Advantages_&_Disadvantages_(2020).pdf
Survey: Future is Open Source	https://aiven.io/press/research-the-future-is-open-source-over-90-of-developers-believe-that-open
Research: Open Source Usage is rising	https://blog.tidelift.com/open-source-use-is-rising-during-the-covid-19-recession
McKinsey Developer Velocity Survey	https://azure.microsoft.com/mediahandler/files/resourcefiles/developer-velocity-how-software-excellence-fuels-business-performance/Developer-Velocity-How-software-excellence-fuels-business-performance-v4.pdf
OSS Options in Azure	https://optimusinfo-wpengine.netdna-ssl.com/wp-content/uploads/2018/04/optimus-mark-qanda-blog-1030x486.png
Microsoft Case Studies on Azure	https://azure.microsoft.com/en-in/overview/open-source/#success-stories
IBM Research on Containerization	https://www.ibm.com/downloads/cas/VG8KRPRM
Gartner Hype Cycle 2021	https://www.gartner.com/smarterwithgartner/3-themes-surface-in-the-2021-hype-cycle-for-emerging-technologies

About the Author

Angshuman Mukherjee

Angshuman is a Senior Cloud Solutions Architect at LTI, working with open-source platforms and technologies on Microsoft Azure, building competency within the practice organization and providing consultancy and solutions to enterprise customers across the globe.