Hype Cycle for ICT in China, 2023

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Initiatives: Digital Technology Leadership for CIOs in China

To confront economic uncertainty, Chinese enterprises must prioritize IT cost optimization, composable application and infrastructure modernization. CIOs should use this Hype Cycle to identify technologies to help manage IT rationalization and seize digital business opportunities.

Analysis

What You Need to Know

This document was republished on 17 July 2023. The document you are viewing is the corrected version. For more information, see the Corrections page on gartner.com.

The 2023 Gartner CIO and Technology Executive Survey revealed that digital transformation is the top priority among CIOs in Chinese enterprises. Digital transformation normally involves continuous and large investments, but in this volatile market, CIOs must be cautious about IT spending.

- In 2023 and 2024, China enterprises will focus more on business profitability and sustainability.
- The goal of digital transformation has evolved from revenue growth to profit generation.
- IT budgets in China are expected to increase by 0.7% in 2023, on average, based on Gartner's CIO and Technology Executive Survey results. Taking inflation into account, this is actually a decrease, and that's forcing cost optimization to become a high priority.
- OpenAI's ChatGPT is driving business interest in generative AI.
- China's 2025 "Dual Circulation" model is increasing sustainability initiatives in IT. [1]
- The government is encouraging state-owned enterprises and government agencies to procure products with locally owned IP.

The Hype Cycle

Enable Digital Business for New Opportunities

- **Generative AI:** GenAI has gained a lot of visibility and major vendors in China are prioritizing delivery of AI-enabled applications and tools. CIOs must investigate how generative AI techniques can benefit their industry or sector and identify initial use cases.

- **Homegrown AI chips in China:** For AI-based workloads, AI chips have a more important role than traditional chip architectures. U.S. restrictions on advanced semiconductor manufacturing are driving high demand for homegrown AI chips that follow open architectures. CIOs must monitor new semiconductor technologies that don't require advanced process nodes.

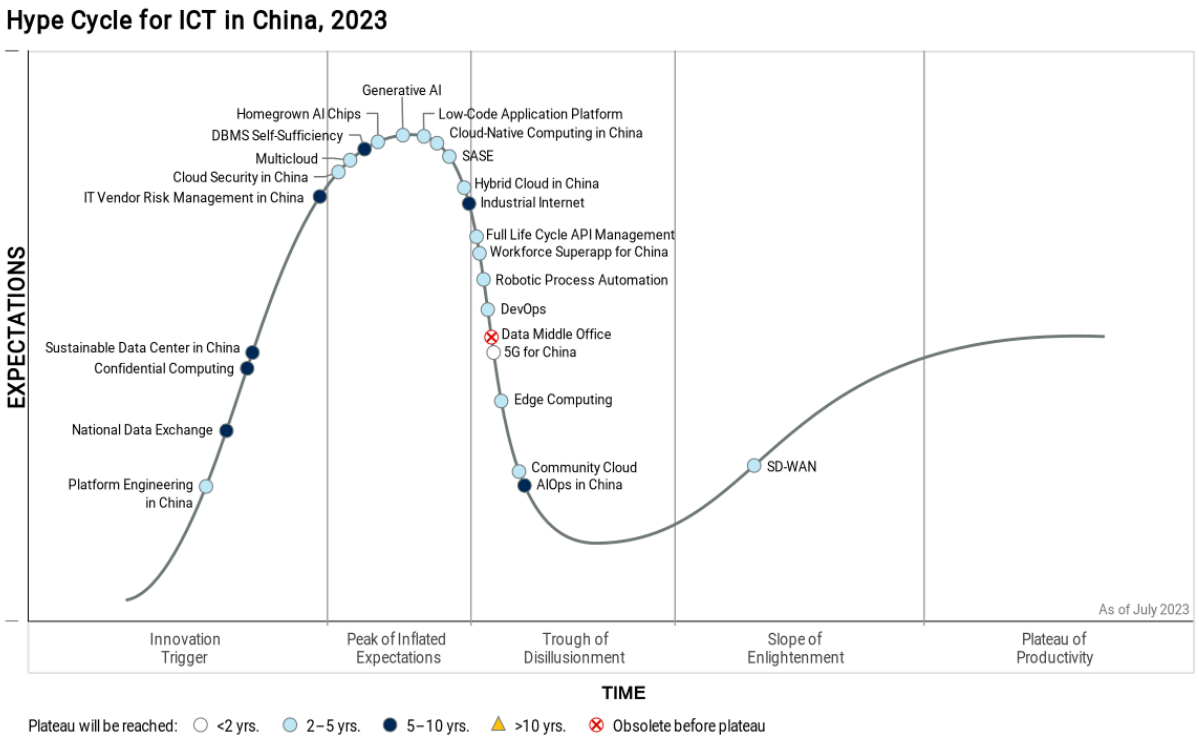
Use API and Platform Engineering to Adopt Composable Architecture

- **Full life cycle API management:** Provides the framework and tools needed to manage and govern APIs that are foundational elements of multiexperience applications, composable architectures and digital transformation.
- **Platform engineering in China:** To support digital competitiveness at pace, CIOs must implement composable architecture transformation, which drives increasing adoption of cloud-native platforms, DevOps platforms and API management platforms.
- **National data exchange:** Various stimulation policies and standards established by government and industry associations in China promote data sharing. CIOs in Chinese enterprises must leverage government-backed data exchanges that have certified data products.

Modernize Applications and Infrastructure to Support Business Agility

- **DBMS self-sufficiency:** DBMS self-sufficiency is key to the regional market in China, in which vendors offer DBMSs primarily to Chinese organizations and international enterprises that have operations in China. The highly dynamic geopolitical environment in recent years has forced Chinese organizations to ensure their DBMS technologies are self-sufficient. CIOs should assess DBMS vendors by evaluating not only their product capabilities, but also their openness to the domestic technology vendor ecosystems (such as cloud platform, hardware, business application and data security) from both product features and postsales SLA perspectives.
- **IT vendor risk management in China:** The lack of visibility into China's local IT vendors, major security breaches and increasing regulatory requirements have enhanced the need for IT vendor risk management (VRM).

Figure 1: Hype Cycle for ICT in China, 2023



The Priority Matrix

The Priority Matrix illustrates the relative benefits and likely adoption times of relevant technologies and services in China. Because of the technology selection criteria, the technologies in this year's update are mainly transformational, with a high or moderate impact in less than a five-year time frame.

The following technologies offer benefits to CIOs:

- **Workforce superapp for China:** A workforce superapp provides digital workers with an integrated workspace with core collaboration features (including workstream collaboration, meeting, content service and email) and role-specific miniapps (including HR services, CRM and approval). CIOs must evaluate and improve the adoption of workforce superapps to adapt to the evolving working model and establish governance reinforced with a miniapp management policy to satisfy security and data-protection constraints.

- **Confidential computing:** Confidential computing is a security mechanism that executes code in a hardware-based trusted execution environment (TEE). Enterprises in China are increasingly seeking to exchange and process data with third parties (for both business intelligence and training of AI models) to maximize the value of their data.

Table 1: Priority Matrix for ICT in China, 2023

(Enlarged table in Appendix)

Benefit ↓	Years to Mainstream Adoption: Less Than 2 Years ↓	2 - 5 Years ↓	5 - 10 Years ↓	More Than 10 Years ↓
Transformational		Generative AI Platform Engineering in China SASE	Industrial Internet National Data Exchange	
High	5G for China	Cloud-Native Computing in China Cloud Security in China DevOps Edge Computing Full Life Cycle API Management Homegrown AI Chips Hybrid Cloud in China Multicloud Robotic Process Automation SD-WAN Workforce Superapp for China	AIOps in China DBMS Self-Sufficiency	
Moderate		Community Cloud Low-Code Application Platform	Confidential Computing IT Vendor Risk Management in China Sustainable Data Center in China	
Low				

Source: Gartner (July 2023)

Off the Hype Cycle

In this year's Hype Cycle, we have removed, renamed or replaced some technologies to reflect changing market dynamics:

Removed

We planned to phase out these IPs because these areas lack use cases based on current market adoption, and they are no longer the CIO's priority since they are mature and fully adopted in the Chinese market.

- Metaverse in China
- Hypercoverged infrastructure
- Live commerce
- Augmented data and analytics.

Replaced

- Natural language technologies was replaced by generative AI (to reflect market trends — generative AI is high on CIO agendas).
- Workstream collaboration for China was replaced by workforce superapp for China (after the pandemic, enterprises wanted to extend the workforce to improve efficiency. Since collaboration demand is one option, we made the change to reflect trends in China).

Renamed

- CaaS was renamed to cloud-native computing in China (container as a service [CaaS] is the foundation of infrastructure agility. We recommend that CIOs focus more on cloud-native computing, which drives organizational change through platform operation).

On the Rise

Platform Engineering in China

Analysis By: Carolin Zhou, Elaine Zhang

Benefit Rating: Transformational

Market Penetration: 20% to 50% of target audience

Maturity: Emerging

Definition:

Platform engineering is the discipline of building and operating self-service internal developer platforms (IDPs) for software delivery and life cycle management. Each platform is a layer, created and maintained by a dedicated platform product team, designed to support the needs of software developers by interfacing with tools and processes. The goal of platform engineering is to optimize the developer experience and accelerate product teams' delivery of customer value.

Why This Is Important

Driven by digital transformation, the adoption of cloud and microservices architecture, cloud native are increasing in China, which brings complexity for modern software architecture and hybrid infrastructure. Platform engineering can help to reduce the cognitive load by providing self-service, automation and reusable capabilities to improve developer experience and accelerate value delivery.

Business Impact

Platform engineering enables software development teams to improve the developer experiences and release them from the complexity of infrastructure and siloed processes to focus on product development to scale the software delivery and time to market for digital business. It makes compliance and controls more consistent and simplifies the chaotic explosion of tools used to deliver software. It also reduces the unnecessary cognitive load and developers frustration.

Drivers

- In order to support digital competitiveness at pace, organizations in China are moving forward to composable architecture transformation which drives the increasing adoption of cloud native platform, DevOps platform and API management platform. Platform engineering planning or platform strategy are defined as one of the critical parts of IT strategy by CIOs.

- Agile development approaches introduce multiple tools and pipelines than ever before, especially in the complicated hybrid cloud environment, organizations are looking for a better way to manage it as a platform product as shared services to improve the consistency, efficiency, agility and cost effectively.

- Software development teams are struggling to scale the delivery to customers, as unnecessary cognitive load and tasks consume a substantial amount of time which is hard to fulfill the agility and speed-to-market requirements of digital initiative.

- For supporting digital transformation, some infrastructure and operation team leaders embrace a new platform engineering role to drive infrastructure modernization to better deliver business value and enable agility.

- The movement to “shift left” has forced developers to have an end-to-end understanding of an ever increasing amount of complex infrastructure-centric tools and workflow that their workloads run on. A platform engineering approach is needed to reduce such unnecessary cognitive load and provide platform as service to multiple software development teams.

Obstacles

- Many organizations in China are confused about the definition of platform engineering and platform itself, and still use the traditional way to manage it rather than Agile and product management.

- Platform engineering requires a platform owner and may evolve toward a dedicated platform team with solid skills in software engineering, modern cloud infrastructure, emerging technologies, such as: Container, Kubernetes and GitOps. However, lack of skills and talents are the big challenges for the organizations who are planning to establish platform engineering.

- Some organizations are asking for the business value and business cases for platform engineering, and may refuse to fund it without clear ROI and business value or outcomes.

- Platform engineering approach also has pitfalls. These include concentration of risk on shared services, challenging feature prioritization, challenging investment and funding decisions, lack of adoption, and a temptation to impose the platform on developers.

User Recommendations

- Adopt platform engineering to improve the developer experience that is affected by high-friction development tools, technologies and processes.
- Platform engineering team must have platform owners together with platform teams to manage the life cycle of the platform via product management methodology, and start small, learn, improve and demonstrate the value of the platform.
- Closely collaborate with software developers and other stakeholders, such as enterprise architecture and security, in order to identify the pain points and business future use cases to build a thinnest viable platform (TVP).
- Build up a cloud native foundation for your platform with focus on container, kubernetes, CI/CD to enable self-service provisioning and automatic infrastructure capabilities for your consumers.
- Regularly promoting the catalog of tools and services that platform offers and marketing all platform development initiatives that are in progress to ensure it meets customers' needs.

Gartner Recommended Reading

Top Strategic Technology Trends for 2023: Platform Engineering

Leverage Platform Engineering to Scale DevOps Platforms Into Hybrid Cloud

Adopt Platform Engineering to Improve the Developer Experience

How to Start and Scale Your Platform Engineering Team

National Data Exchange

Analysis By: Mike Fang, Feng Gao, Ben Yan, Anson Chen

Benefit Rating: Transformational

Market Penetration: Less than 1% of target audience

Maturity: Emerging

Definition:

National data exchanges are government organizations where groups of members can securely collaborate around data. Various data products offered by data providers can be traded to data consumers through data sharing for money or other value equivalents. This helps break data silos across organizations and industries, and eventually benefits the whole society. The concept of the data exchange injects a methodology to evaluate the usefulness, as well as the ethical and privacy concerns, of data.

Why This Is Important

Data is seen by the Chinese government as the fifth production factor, in addition to land, labor, capital and technology. The recently established Chinese National Data Bureau aims to leverage data to enable high-quality growth and technology innovation. The enterprise, as the data provider, must understand the various rights associated with data possession, processing and use, and franchise rights of data-related products. Data rights become complex, risky and vague — especially related to enterprise use of core data and personal data. National data exchanges such as Shanghai, Beijing and Shenzhen should be the ideal places to deliver high-value data products while fulfilling legal and compliance requirements.

Business Impact

National data exchanges help accelerate the sharing of data assets to support various scenarios, such as better fraud detection, accurate marketing, efficient supply chains, operational resilience, predictive maintenance and rare-disease detection. Businesses could look into opportunities and ideas to create their own data product. For example, electricity consumption behavior data to forecast the green power adoption rate could help banks provide better financial assistance to companies that made efforts for green power utilization.

Drivers

- The recently established Chinese National Data Bureau aims to leverage data to enable high-quality growth and technology innovation by developing data industry plans, introducing data regulatory policies, promoting data resource sharing, and breaking down data barriers.
- The 20 new measures will guide Chinese enterprises to build basic data systems in four aspects: data property rights, circulation and transaction, revenue distribution, and security governance. The measures are in accordance with the efforts made by the Central Economic Work Conference to support a data-sharing digital economy.
- Access to larger datasets through data exchanges will tremendously accelerate the development and adoption of artificial intelligence, which is the key strategy for most Chinese enterprises.
- Various stimulation policies and standards were set up by the government and industry associations in China to promote data sharing, such as Shanghai Municipal Data Regulation, Financial Data Security Classification Guidelines and Technical Specifications for Multiparty Secure Computing Financial Applications.
- The emerging privacy-enhancing computation (PEC) techniques have provided possibilities to help protect data privacy and intellectual property while allowing the data to still be used securely. More business success stories from data sharing, such as fraud detection, anti-money-laundering, marketing, rare-disease diagnostics and predictive maintenance, enhance the overall awareness and drive more exploration and use cases.

Obstacles

- Trust is not well-established between the data suppliers and the data consumers for most data exchange scenarios. The efficiency of the data exchange would be sacrificed if semihonest or malicious parties were involved.
- Various data standards applied by the enterprises have led to huge consolidation efforts.
- Complex contract negotiation is needed regarding data ownership, intellectual property and valuation.
- Lack of proficiency within enterprises in data product design, curation, publishing and exchange.
- The lack of data governance is still a key roadblock for bringing trustworthy and high-quality data products to the data consumer.
- Concern regarding the leakage of critical data and personally identifiable information leads to data hoarding.
- Enterprises could directly share data outside the data exchange if the data exchange itself is not offering additional value.

User Recommendations

- Explore detailed artificial intelligence and analytic use cases regarding what kind of exchange mode and datasets could be leveraged to achieve desired business value.
- Leverage government-backed data exchanges that have certified data products listed to get immediate benefits.
- Generate additional revenue streams or partnerships for your enterprise via monetizing, managing and measuring your own data assets.
- Define your enterprise data sharing strategy and business cases. Build your own data exchange or use national data exchanges to augment your data sharing ecosystem.
- Secure the data sharing in a compliant way via various emerging techniques such as blockchain and PEC.

Gartner Recommended Reading

3 Ways to Promote Your Data Agenda at the Center of the Chinese Digital Economy

Quick Answer: How Should Chinese Enterprises Better Deliver Data Monetization Regarding “20 Data Measures”?

Quick Answer: How Should Chinese Enterprises Use Privacy-Enhancing Computation in Artificial Intelligence Initiatives?

Top 3 Priorities for Chinese Enterprises to Promote Effective Data Sharing

Confidential Computing

Analysis By: Anson Chen, Feng Gao

Benefit Rating: Moderate

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Definition:

Confidential computing is a security mechanism that executes code in a hardware-based trusted execution environment (TEE), also known as an enclave. Enclaves isolate and protect code and data from the host system and the host system’s owners, and may also provide code integrity and attestation.

Why This Is Important

- Regulatory requirements in China are pushing enterprises to look for data protection. The Digital China 2023 Plan encourages organizations to create commercial data value on top of the protected baseline.
- Confidential computing combines chip-level TEE with conventional key management and cryptographic protocols. It enables computation facilities — inaccessible to the infrastructure provider — to support projects where cooperation is critical without sharing data or intellectual property (IP).

Business Impact

Confidential computing mitigates data security concerns for highly regulated enterprises and organizations preoccupied with unauthorized, third-party access to data in the public cloud. It facilitates advanced data analytics, business intelligence and training of AI models based on data confidentiality and privacy controls between competitors, data processors and data analysts — which is very difficult to achieve with traditional cryptographic methods.

Drivers

- China's Data Security Law (DSL) and Personal Information Protection Law (PIPL) became effective in 2021. The stringent data security and personal information protection regulations drive the adoption of confidential computing to protect data-in-use, particularly in the public cloud inside and outside China.
- The security specification and technical testing method of TEE have been published by the National Information Security Standardization Technical Committee (TC260) and the China Academy of Information and Communications Technology (CAICT). An increasing number of commercial TEE platforms passed the CAICT assessment — more than 15 platforms prior to 2021.
- Enterprises in China increasingly seek to exchange and process data for analytics, business intelligence (BI) and training of AI models with third parties to maximize the value of data. This drives the adoption of confidential computing to provide secure computing environments — for example, clean rooms — for data exchange and process activities.
- The combination of software and hardware solutions, such as privacy-enhancing computation (PEC) integrated platforms, is increasingly appreciated by users in China. From the PEC vendors' perspective, this combination is considered the perfect solution to overcome performance issues while guaranteeing the promised level of security through adopting confidential computing.
- Competitive concerns are adding to the drivers of confidential computing — not just around personal data, but also IP. This includes the need for confidentiality and protection against third-party access.
- China's 14th Five-Year Plan has increased the number of innovative initiatives on frontier technologies, such as chips, biotechnology and AI. This led to more local chip makers launching CPU and graphics processing unit (GPU) chips supporting TEE based on x86 or TrustZone platforms. This provides heavily regulated organizations with more options for TEE hardware — for example, HYGON, Kunpeng, PHYTIUM and Zhaoxin — and international vendors, such as Intel, Arm and AMD.

Obstacles

- Confidential computing brings potential performance impacts and extra costs. For example, to ensure the existing software stack can run within confidential computing environments, you will have to use special development tools, libraries or APIs. Confidential computing instances based on infrastructure as a service (IaaS) will cost more to run, whether based on Intel Software Guard Extensions (SGX) or Trusted Domain Extensions (TDX), Arm TrustZone, confidential computing architecture (CCA) or other approaches.
- The heterogeneity of the different technology frameworks and the lack of trained staff and understanding of best implementation methods may hinder adoption or weaken deployments.
- Confidential computing isn't just a plug-and-play deployment and should be reserved for high-risk use cases. Depending on the vendor, it may require a high-level effort. However, it offers diminishing marginal security improvement over more pedestrian controls, such as Transport Layer Security (TLS), multifactor authentication (MFA) and customer-controlled key management services.

User Recommendations

- Design or duplicate a sample application using one of the available abstraction mechanisms and deploy it into an instance with an enclave. Perform processing on datasets representing the kinds and amounts of sensitive information you expect in real production workloads. Doing so will help you determine whether confidential computing affects application performance and seek ways to minimize negative results.
- Capitalize on confidential computing vendors whose products have trusted third-party certifications, such as CAICT.
- Depending on the use case and the robustness required, review alternatives that achieve similar protection of sensitive data-in-use, such as multiparty or homomorphic encryption.
- Examine confidential computing for projects in which multiple parties, who might not necessarily trust each other, need to process (but not access) sensitive data so that all parties benefit from the common results. In this scenario, none of the parties should control the TEE.

Sample Vendors

Alibaba Group; Ant Group; Baidu; Huawei; Impulse Online; Intel; Tencent

Gartner Recommended Reading

Three Critical Use Cases for Privacy-Enhancing Computation Techniques

Select the Right Key Management as a Service to Mitigate Data Security and Privacy Risks in the Cloud

2022 Strategic Roadmap for Compute Infrastructure

Sustainable Data Center in China

Analysis By: Elaine Zhang

Benefit Rating: Moderate

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Definition:

Sustainable data centers are service facilities that meet high-sustainability standards. They may encompass multiple disciplines, including driving high energy and water efficiency, using renewable energy and adopting a circular economy that reduces carbon emissions for running IT services. This minimizes environmental impacts.

Why This Is Important

China's goal of carbon peaking by 2030 and carbon neutrality by 2060 was written into the 14th five-year plan. Sustainable data centers are playing an important role in driving energy efficiency, using sustainable hardware and renewable energy to reduce carbon emissions in many industries. This will help enterprises achieve their sustainability targets. Energy is a substantial cost for data center operators, and increased energy efficiency will reduce those running costs significantly.

Business Impact

Sustainable data centers have many business impacts:

- New power usage effectiveness (PUE) standards require operators to comply when building or retrofitting data centers.
- Buyers will be considering energy-efficient, sustainable products as significant buying criteria.
- Renewable energy will be important in reducing Scope 2 greenhouse gas (GHG) emissions.
- Data center management solution vendors will provide products with holistic approaches, including data metrics for data analysis.

Drivers

- To meet carbon neutrality targets, the Chinese government has published several guidelines, together with its 14th five-years plan for the ICT industry, specified low-carbon requirements for existing data centers improvement, as well as new data center build-out. One of the purposes of the East Data and West Computing initiative is to use natural cooling and renewable energy from western areas to build sustainable data centers.
- Carbon utilization effectiveness (CUE), water usage effectiveness (WUE) and other carbon emission sources, such as circular economy adoption and heat reuse, have been added as standards of green data center grading in China. This requires enterprises to focus on overall carbon emissions; however, PUE is still the main criterion for evaluation.
- For large data center operators, such as colocation providers and cloud hyperscalers, the sustainability-related performance of their data centers and networks will be central to their environmental, social and governance (ESG) strategies and associated ratings. These strategies can enhance public reputation, as proven sustainability can be a powerful selling point in the market.
- Some hyperscalers leverage their successful experiences to provide solutions to their customers. This includes data center build-out, as well as developing artificial intelligence (AI)/machine learning (ML) operation platforms to support other enterprises' efforts to improve energy efficiency and reduce water consumption and carbon emissions.
- Sustainable data centers can help IT-intensive enterprises across multiple industries (e.g., telecommunications, the internet, banking, energy and steel) achieve their carbon targets from GHG Scope 2.

Obstacles

- Lagging standards in key emerging technologies are causing slow adoption. Some industry standards are still under discussion. For the released standard, technology providers and the trading market will take time to react to the changes.
- New technologies for data centers in China — e.g., immersion liquid cooling, waste heat recycling and operation solutions based on AI/ML — require more use cases to prove feasibility and effectiveness.
- Data center depreciation can extend to a more than 10- to 15-year period. Chinese enterprises lack incentives to invest in new technology for GHG Scope 2 emissions for old data centers' retrofits. Instead, they focus on lower PUE only. Due to the large investment required and the slow ROI, CFOs may resist new investments to avoid further liability.
- Scope 3 emissions can be as high as 50% of the GHG footprint of data centers; hence, it's more complex and difficult to tackle. It's early for upstream and downstream suppliers to make changes.

User Recommendations

CIOs of large enterprises in industries required to build data centers should:

- Select new data center locations by prioritizing areas with advantages such as natural cooling or access to renewable energy sources.
- Adopt advanced cooling, power and computing technology in a new data center to improve energy use and reduce carbon emissions.
- Use AI/ML to analyze all data from data centers and automate adjustments to electricity utilization.
- Establish sustainability initiatives by focusing on reductions in PUE score and carbon emissions, including GHG Scope 3 emissions, by selecting sustainable products.

CIOs of small and midsize enterprises (SMEs) should:

- Use colocation, instead of a self-built data center, if the enterprise must own full control of hardware or operation.

- Reduce or eliminate the need for a data center by migrating workloads to the leading public cloud provider, if possible, because cloud hyperscalers have better sustainability strategies, compared with small cloud providers.

Sample Vendors

Alibaba; China Telecom; Dawning Information Industry (Sugon); GDS; Huawei; IEIT Systems; KPMG; Schneider Electric

Gartner Recommended Reading

The Road to a Net Zero Data Center

Key Environmental Sustainability Considerations While Using Different Hosting Services in China

Unlock the Business Benefits of Sustainable IT Infrastructure

The Role of the CIO and Technology in the Enterprise Sustainability and ESG Endeavor

IT Vendor Risk Management in China

Analysis By: Angela Zhao

Benefit Rating: Moderate

Market Penetration: 5% to 20% of target audience

Maturity: Adolescent

Definition:

IT vendor risk management (VRM) is the process of ensuring that the risks associated with vendors and service providers are effectively managed. The discipline of VRM addresses the identification, mitigation and remediation of these risks to avoid business disruption, and financial and regulatory impacts. VRM technology supports various activities as part of a broader VRM framework.

Why This Is Important

More and more IT vendors are brought into organizations to help achieve their digital goals in China. With increased reliance on vendors, organizations are exposed to greater risk of business disruption and damage to their brand and reputation. Emerging technologies and wider data exchange for digitalization have further added complexity. The lack of visibility into IT vendors, major security breaches and increasing regulatory requirements enhance the need for IT VRM.

Business Impact

Ineffective IT VRM may cause disruption of IT service delivery and business impact. It could also lower the quality of vendor deliverables, increase the chances of security attacks to the supply chain, leaks and compromise data, and other disturbances. When effectively implemented, IT VRM provides organizations a consistent and formal approach to managing IT vendor risks and making IT vendor management decisions while helping them comply with ever-changing regulations.

Drivers

- Not all organizations in China have enough internal IT headcounts and competencies to support the digital business. This expands the scope of IT vendors and the diverse forms of service deliveries. In this context, regulations have been developed because of the limited number of authorized vendors in this emerging ecosystem.
- Some industries, such as financial and healthcare, have specific regulations that mandate VRM. Organizations need to ensure their IT vendors can meet the requirements for business continuity management (BCM), and data security and privacy regulations.
- The volatility, uncertainty and geopolitical risks make services from vendors unstable. Also, organizations are eager to manage IT vendor risks before incidents interrupt their IT systems and business operations.
- IT vendors' personnel may have access to organizations' important business processes and sensitive data — sometimes even have privileged access rights, such as system administrators.
- Supply chain cyber threats remain significant risks for Chinese organizations. The integration between IT vendors and an organization's infrastructure and processes expands the traditional boundaries of the attack surface.
- IT VRM can be a catalyst to improve supplier performance. It can identify supplier-related risks early in the process and reduce costs through effective controls and process improvements.

Obstacles

- A comprehensive IT VRM practice for continuous risk identification, (re)evaluation and mitigation is missing in many organizations in China.
- IT VRM involves multiple stages, including procurement, service performance monitoring, vendor security management, service exit and others. However, IT VRM teams are currently facing resource shortages — skills and tools — for all capabilities.
- There are dependencies and connections among the services from different IT vendors, but many organizations manage individual vendors separately rather than seeing the big picture of IT vendors' ecosystems. Long-term planning is missing due to a lack of business forecasts and continuous last-minute purchasing.
- Vendor operational resilience management is a weakness in many organizations that are not well prepared for emergencies, such as vendor operation disruption or, in extreme scenarios, even stopping services. Emergency response plans related to IT vendors either never move past the paperwork phase, are not included in the organization's VRM strategy or become siloed from the vendors' and organizations' perspectives.

User Recommendations

- Define a systematic IT VRM framework to conduct regular risk assessments based on business criticality. Present mitigation options to vendors and business owners.
- Select the right IT VRM solutions by shortlisting vendors serving your industry, business size and maturity. Identify the needs of other teams, such as procurement, cybersecurity and legal, and support collaboration between them.
- Understand what services each IT vendor offers and identify where those services fit within the organization's IT function. Doing so will help you build a holistic and connected view of the IT VRM. Also, this allows for a clear identification of the risks and implications for the entire IT function when adding partners or exiting services with a vendor.
- Establish emergency plans for mission-critical IT vendors and, more importantly, for mission-critical business processes. This should include operational procedures from the vendor and the organization, drills and an exit plan to secure critical IT functions and business data.

Gartner Recommended Reading

Formalize Vendor Risk Management to Reduce Business Disruption

Market Guide for IT Vendor Risk Management Solutions

At the Peak

Cloud Security in China

Analysis By: Feng Gao, Kevin Ji

Benefit Rating: High

Market Penetration: More than 50% of target audience

Maturity: Adolescent

Definition:

Cloud security is a broad concept, encompassing a collection of procedures, controls and technologies to protect an organization's assets in the cloud. It covers core concepts, from people and processes to technology, including cloud security architecture and tools. In China, cloud security has been extended to cover business operation security management.

Why This Is Important

The increasing cloud adoption in China introduces challenges for those tasked with protecting enterprises' critical digital business and assets in the cloud. Cloud security differs from traditional perimeter-focused protection, as it requires organizations to partner with cloud service providers when implementing security controls over cloud resources. Effective and manageable cloud security plays a vital role in helping enterprises use the cloud securely and compliantly.

Business Impact

Cloud security can deliver the following business benefits:

- Protects business applications and data in the cloud from external attackers.
- Ensures cloud usage is compliant with China's regulatory and security requirements.
- Enables businesses to leverage the benefits of cloud, such as ready-to-use emerging technologies, high elasticity and stability, and low cost.
- Cloud-native applications require full-life-cycle protection from development to runtime production, leading IT organizations to redistribute security responsibility.

Drivers

- The adoption of cloud computing is increasing, as is the expansion of use cases (PaaS, serverless, SaaS and more) and capabilities based on existing cloud computing environments.
- The use of cloud services breaks the enterprise's boundaries. Traditional perimeter-focused security controls cannot meet the requirements of cloud protection.
- Stringent government regulations (e.g., MLPS 2.0, data security/sovereignty requirements) lead enterprises to implement security controls and data protection in the cloud.
- Cloud resources are highly scalable, automated and complex to secure. Most cloud security issues are caused by misconfiguration. Cloud security is designed to reduce the complexity of security controls through automation and continuous risk identification.
- The unique characteristics of cloud-native applications make them impossible to secure without a complex set of overlapping tools spanning application development and runtime production. This creates the need, not only for cloud security, but also for tools such as cloud workload protection platforms (CWPP), cloud security posture management (CSPM) and cloud-native application protection platforms (CNAPP), to protect enterprises' cloud-native applications.

Obstacles

- Large enterprises treat private cloud adoption as an extension of data center protection, but have less desire to embrace cloud security.
- Large volumes of private cloud/on-premises deployments results in excessive customization, chaotic version management, closed ecosystems and high local support costs. These factors hinder security vendors in delivering better products.
- Lack of cloud security knowledge and skills leads organizations to prefer to replicate traditional controls in the cloud.
- Due to the nature of cloud-native applications, security must be implemented at the start of the development process, and must span testing and production. This requires developer support and minimal interruption to the development process.
- Because of China's unique and rapidly changing digital ecosystem, global practices and tools are often not viable, but local vendors are still catching up to their global competitors.

User Recommendations

- Define the optimal cloud security strategy by aligning it with your cloud platform and business strategy, such as business outcomes.
- Establish skills by training employees or utilizing external experts to implement cloud security.
- Implement an integrated security approach that covers the entire life cycle of cloud-native applications, starting at development and extending into production.
- Establish cloud security governance and proper software development guidance around cloud platform configuration to help avoid common flaws and pitfalls that could lead to security breaches and data exposure.
- Work closely with business and local digital providers and security vendors to standardize cloud security technologies and solutions.

Sample Vendors

Alibaba Cloud; Chaitin Tech; DAS Security; H3C; NSFOCUS; QI-ANXIN; Qingteng; River Security; Sangfor Technologies

Multicloud

Analysis By: Stephen Du

Benefit Rating: High

Market Penetration: 20% to 50% of target audience

Maturity: Early mainstream

Definition:

Multicloud refers to the intentional use of cloud services from multiple public cloud providers for the same general class of IT solutions or workloads. It is more common in IaaS and converged IaaS/PaaS scenarios than SaaS. Although multi-SaaS environments are possible, they would typically be stovepiped situations and not considered as a multicloud.

Why This Is Important

Multicloud can provide best-of-breed capabilities for specific use cases, easy access to innovative technologies, service resilience and migration opportunities, in addition to the core cloud benefits of agility, scalability and elasticity. It may also be used to obtain public cloud services in different geographic locations for global companies.

Business Impact

Multicloud provides agility, reduces cloud vendor lock-in and enables workload migration flexibility. However, it can also create complexity and increase management costs, resulting from uncoordinated adoption and bad planning. It rationalizes multiple cloud systems, achieves innovations and compliance with regulations, data and service placement for applications that can't be solved by a single provider. Workloads may require placement in countries and areas where providers lack data centers.

Drivers

- Many organizations end up in a multicloud environment through unintentional, uncoordinated cloud adoption, poor planning, or mergers and acquisitions (M&As). Proactive cloud strategies facilitate M&As, but not always with the same cloud provider. Unintended multicloud environments can be rationalized into purposeful multicloud strategies.
- Enterprises typically start with one provider, but can become concerned about lock-in. Thus, initial multicloud use is often procurement-based to encourage competition, or it results from M&As.
- Some enterprises eventually get to multicloud architectures, relying on architectural principles and portability solutions, and can even enable cloud bursting and other dynamic placement efforts. Many deliberate multicloud strategies are designed to take advantage of differentiated capabilities in the same general class (e.g., IaaS) from multiple cloud providers, while applications run in a single cloud provider stack. Some applications may have multicloud architectures themselves.
- Multicloud hype is driving adoption, as providers often use this industry buzz term to justify why their offering should be considered when there is already another cloud service.
- Multicloud computing enables multinational corporations to host workloads with sensitive data in the local cloud service provider (CSP) or private environment and other nonsensitive or global business workloads in a global CSP. This ensures that they comply with enterprise policy and local government regulations.

Obstacles

- Multicloud environments often increase costs, requiring more time, effort and budget to manage them.
- Multicloud and hybrid cloud in multihybrid cloud environments raise concerns about cybersecurity and data transmission across cloud boundaries.
- Multicloud is not practical for high-availability disaster recovery (DR) and business continuity (BC), because it's achieved more effectively in other ways in provider ecosystems.
- Multicloud is sometimes considered a solution to DR/BC as part of an exit strategy, as well as to comply with regulatory requirements involving risk concentration. However, it doesn't solve these issues. An overall architectural approach (potentially using multicloud) is key. Multicloud sometimes complicates solutions, making them more challenging.
- Multicloud reduces the scope of leveraging more advanced services from each provider.
- Rather than pursue multicloud strategies, enterprises need to invest in skills to manage more complex integration solutions.

User Recommendations

- Tap into best-of-breed capabilities and quick time to value for business-specific use cases and resilience through multicloud.
- Be prepared to incur additional expenses on training and skills development across roles, including for engineers and operators.
- Ensure your multicloud strategy is purposeful and coordinated with overall cloud strategy. When embracing multicloud, account for the tools, skills, processes and other resources needed to ensure you achieve the right outcomes.
- Establish security, management, governance guidelines and standards to manage cloud service sprawl and increasing cost, and develop decision criteria to decide placement of services.
- Focus on coordination and strategy to identify the types of services needed to deliver the benefits of a cloud environment.
- Do not just shift vendor lock-in to a cloud management platform and/or a cloud service brokerage, even if they may enable governance and optimizations.

Sample Vendors

Alibaba; Beijing Teamsun Technology; Bespin Global; Deloitte; FIT2CLOUD; Futong Yunteng Technology; Inspur Cloud; Shanghai Anchang Network Technology; Shanghai LianWei Pan Cloud Technology; Yungoal

Gartner Recommended Reading

How to Successfully Adopt Multicloud in China

Differentiate Container Management With Multicloud Enablement

Market Guide for Cloud Management Tooling

Technology Insight for Multicloud Networking

DBMS Self-Sufficiency

Analysis By: Xingyu Gu, Julian Sun

Benefit Rating: High

Market Penetration: 20% to 50% of target audience

Maturity: Adolescent

Definition:

DBMS self-sufficiency is key to the DBMSs regional market in China, in which the vendors offer DBMSs primarily to Chinese organizations and international enterprises that have operations in China. A DBMS is a product used for the storage and organization of data that typically has defined formats and structures. In China, technology self-sufficiency, which aims to make local organizations resilient in the dynamic global environment, dominates the local DBMS market.

Why This Is Important

Within the enhanced digital transformation of different industries in China, DBMSs, acting as the key part of data infrastructure, are required to have high performance, elasticity, strong AI compatibility and cost-effectiveness. At the same time, the highly dynamic geopolitical environment in recent years has stimulated Chinese organizations to ensure their DBMS technologies are self-sufficient. These two factors have led to a pressing need for modern DBMSs developed in China.

Business Impact

DBMS self-sufficiency acts as a strategic component, which is aligned with local organizations' digital transformation roadmap. It helps:

- Keep organizations aligned with the "information technologies self-sufficiency" national strategy.
- Reduce the huge maintenance cost from expensive mainframe hardware.
- Address performance bottlenecks when local events with extremely high-concurrent data transactions happen (for example, the Double 11 shopping festival).
- Ensure data science and real-time analysis use cases can be further scaled and embedded into production.

Drivers

- Technology infrastructure demands in China are significant due to a large population, many internet users, and a growing desire for enhanced technology to sustain digital initiatives like smart cities and live commerce at a scale unique to China.
- Legacy DBMS solutions — largely based on implementations of non-Chinese vendors — are aging and falling short in addressing these needs.
- Rather than engaging with upgrading non-Chinese technology investments, the recent geopolitical environment has demanded that Chinese organizations become self-sufficient, driving the transition to local vendors.

Obstacles

- Immature DBMS migration tools and services are impeding organizations from migrating existing business workloads to modern DBMSs. Because unsuccessful DBMS migrations in critical business workloads have huge business impacts, organizations in China require more mature DBMS migration tools and services to help them enable a seamless migration.
- Due to the technical debt deeply embedded with legacy software and hardware, the effort and risk to migrate DBMSs from old systems to modern ones is still large. Large-scale DBMS migrations frequently take more than a year.
- Due to concerns about data security, data sovereignty and vendor lock-in on public cloud, organizations in industries like finance, government and public services prefer to modernize their mission-critical DBMSs to a hybrid cloud environment. The to-be-improved hybrid cloud capabilities of local DBMS products impede them from fully realizing the benefits of modern DBMS deployments.

User Recommendations

- Evaluate the most suitable deployment model (public cloud/on-premises/hybrid) for your use cases with respective value preferences like elasticity, flexibility, cost-effectiveness or regulation compliance.
- Observe how the cloud data ecosystem in China emerges. Choose the appropriate ecosystem best suitable for your organization from an industry, primary business region, organization scale and business portfolio variety perspective.
- Assess local DBMS vendors by evaluating not only their product capabilities, but also their openness to the local technology vendor ecosystem (such as cloud platform, hardware, business application and data security) from both product features and postsales SLA perspectives.
- Evaluate emerging DBMS capabilities (for example, distributed transactional database, lakehouse and augmented transactions) in China under consideration by leveraging Gartner research on cloud database management systems and associated RFP toolkits. Understand the pros and cons of each, and engage with business stakeholders to judge where the most suitable use cases are for them.

Sample Vendors

Alibaba Cloud; HUAWEI CLOUD; OceanBase Database; PingCAP; SequoiaDB; Tencent Cloud; Transwarp; Wuhan Dameng Database

Gartner Recommended Reading

Market Guide for DBMS, China

中国数据库管理系统市场指南

Magic Quadrant for Cloud Database Management Systems

Exploiting the Evolving Database Management System Trends in China

Homegrown AI Chips

Analysis By: Roger Sheng, Mike Fang, Julian Sun

Benefit Rating: High

Market Penetration: Less than 1% of target audience

Maturity: Emerging

Definition:

An AI chip is a type of semiconductor device optimized for processing AI algorithms, such as deep neural networks (DNNs). AI chips are typically designed to accelerate a specific element of an AI workflow, such as training and inference. AI chips are important components to both largely increase AI processing capabilities and offload CPU workload in the data centers, edge and devices. Chinese companies designing AI chips remain in the early stage compared with global vendors such as NVIDIA.

Why This Is Important

Chinese companies are investing hugely in the AI technology field in which AI accelerator chips are the key components in AI development. However, the U.S. export regulations restricted advanced AI chips to Chinese companies from 2022. This situation forced Chinese companies to seek alternative resources for AI chips. Both established IT giants and venture startups have launched the development of AI chips for the ongoing global competition in the AI field.

Business Impact

For AI-based workloads, AI chips take a more important role than traditional chip architecture. Most hyperscale cloud service providers use high-performance AI accelerator chips to increase the efficiency of massive data processing. The recently hyped generative AI requires thousands of AI accelerators for training of foundation models. These chips are typically manufactured on leading-edge semiconductor process technologies with a consequent cost impact and power budget.

Drivers

- The demand for AI innovation usages. The recently hyped generative AI is based on the foundation model that requires more powerful AI accelerator chips, especially in the training stage. Due to the U.S. government's export restrictions, Chinese companies have to seek alternative chip suppliers locally as backup. The large established companies had already built the internal team for chip development and also invested in the local emerging vendors.
- The government local-sufficient initiatives. The Chinese government is strongly supporting the development of the local supply ecosystem for the IT area, especially in the strategic high-performance computing areas by considering the nation's high-tech industry growth and cybersecurity. The Chinese government encourages more locally designed chips used in the government-guided data center projects. For example, Cambricon Technologies' AI chip business is mainly from government clients.
- The efficiency of system operation. Current GPU-architecture-based AI accelerator chips are dominated by global vendors that are priced high with limited supply. Although the GPU capabilities are superior in the general AI data training, customized application-specific integrated circuits (ASICs) that are designed for dedicated AI applications will have advantage in power efficiency. Thus, Baidu decided to use its in-house-developed AI chips in its searching business.
- The fragmented demand from AI Internet of Things (IoT) applications. The combination of AI and IoT is one of the important elements to create a digital business process. Considering the different types of AI IoT use applications and use cases, the system requirements are fragmented. It gives Chinese AI chip vendors great opportunities to develop optimized solutions for various AI IoT requirements. For example, most AI chips used in China-made surveillance systems to support AI compute vision capabilities are developed by Chinese chip vendors.

Obstacles

- The lack of general AI toolkit support. One of the key success factors of NVIDIA is its CUDA platform that is based on its GPU architecture and can support most AI development tools. Chinese AI chip companies must have more investment in software to support mainstream toolkits for AI development.
- The immaturity of the developer community. Chinese companies lack the experience to build a broad, cross-company software developer ecosystem, which is important to the development of AI applications.
- U.S. restrictions on advanced semiconductor manufacturing. The U.S. restrictions forbid Chinese companies to get the advanced chip manufacturing service (e.g., 5 nm and 3 nm) from global foundry suppliers if the product is designed for high-performance computing. The restrictions also ban the equipment for 14 nm and more advanced semiconductor chip manufacturing shipping to China.

User Recommendations

- Take a holistic solution approach in the AI infrastructure by cooperating with established Chinese semiconductor companies to both focus on the development of customized AI chips and accumulate expertise.
- Monitor and engage in research and development of new semiconductor technologies that don't require advanced process nodes, such as heterogeneous integration, RISC-V CPU and interchip optical interconnects.
- Improve the computing system performance by focusing more on the software optimization and customized chip design for dedicated applications.
- Prepare for and invest in the reasonable inventory of advanced AI chips from global vendors for AI infrastructure.
- Cooperate with industry peers to build China-specific AI ecosystems by unifying the industry standard and development platform.

Sample Vendors

Baidu; Biren Technology; Cambricon Technologies; Enflame; Huawei; Hygon

Gartner Recommended Reading

Market Trend: U.S. Restrictions Force China ICT Industry to Seek Alternative Semiconductor Solutions

Market Trends: China's New 'Secure and Trustable' Initiative for the IT System Will Accelerate the Growth of Domestic Chip Vendors

Generative AI

Analysis By: Ben Yan, Mike Fang, Tong Zhang, Tracy Tsai

Benefit Rating: Transformational

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Definition:

Generative AI technologies can generate new derived versions of content, strategies, designs and methods by learning from large repositories of original source content. Generative AI has profound business impacts, including on content discovery, creation, authenticity and regulations; automation of human work; and customer and employee experiences.

Why This Is Important

Generative AI exploration is accelerating, thanks to the popularity of models and generative AI applications from vendors such as Stable Diffusion, Midjourney, OpenAI (ChatGPT) and numerous others. End-user organizations in most industries aggressively experiment with it. Technology vendors in China, such as Baidu, Alibaba and SenseTime, prioritize delivery of generative-AI-enabled applications and tools. Many startups emerged in 2023 to innovate with generative AI, and we expect this to grow. Some governments, including China, are evaluating the impacts of generative AI and preparing regulations.

Business Impact

Leading technology products and services will incorporate generative AI capabilities in the next 12 months, introducing conversational ways of creating and communicating with technologies, leading to the democratization of generative AI technologies. Generative AI will progress rapidly in industry verticals, scientific discovery and technology commercialization. Sadly, it will also become a security and societal threat when used for nefarious purposes. Responsible AI, trust and security will be necessary for safe exploitation of generative AI.

Drivers

- The popularity of ChatGPT is accelerating the hype around generative AI, pushing it to the peak of the Hype Cycle. It is garnering substantial attention from executives, driving enthusiasm for broader generative AI adoption.
- Foundation models largely improve both the quality of AI-generated content and the speed of generation across a broad array of artifacts, including language, code, images, voice and multimodal data.
- Prompt engineering with zero-/few-shot learning has been rapidly improving generative modeling while reducing the need for training data and fine-tuning.
- Machine learning (ML) and natural language processing (NLP) platforms are adding generative AI capabilities, along with transfer learning, for reusability of generative models, making generative models customized and accessible to AI teams.
- When integrated with other models or applications — such as visual generation models, scientific computing models or web applications — generative AI models unlock more potential business use cases.
- Generative AI offers the industry a much-needed opportunity to drive productivity, which is a required component of any growing economy. Few other technologies offer such an opportunity to reinvent how work gets done.
- Synthetic data draws enterprises' attention by helping augment scarce data, mitigate bias or preserve data privacy. It boosts the accuracy of brain tumor surgery.

Obstacles

- The foundation models underlying generative AI are not mature enough. Fully relying on foundation model outcomes is risky as it may introduce incorrect results. A human in the loop (HITL) is required.
- Generative AI can be used for nefarious purposes. Generated deepfakes are dangerous in politics, business and society. Full and accurate detection of generated content will remain challenging for years and may not be completely possible.
- Fragmented and specialized technology offerings (such as generating only images or only text) currently lead to a combination of tools rather than a single solution.
- Compute resources for training large models are heavy and not affordable to most enterprises. Most enterprises can exploit existing models, but can't develop their own.
- Generative AI vendors will need to adjust their approaches as regulations on the technology are introduced.
- Local generative AI models in China with similar performance to ChatGPT/GPT-4 are not available yet. Organizations that are impressed by ChatGPT/GTP-4 and looking for local alternatives have to wait or leverage other specialized solutions instead.

User Recommendations

- Investigate how generative AI techniques can benefit your industry or sector. Identify initial use cases where you can rely on purchased capabilities or partner with researchers.
- Explore how synthetic data could accelerate the development cycle, lessen regulatory concerns, mitigate data bias, facilitate data monetization and lower the cost of data acquisition, especially if you lack data for rare events.
- Examine and quantify the advantages and limitations of generative AI. Use it first to improve an existing process. Provide guidelines where generative AI could bring breakthroughs, as it requires skills, funds and caution. Weigh technical capabilities with ethical factors.
- Prepare to mitigate the impact of deepfakes, which can cause serious risk. Mitigation methods, such as applying algorithmic detection and authenticating content provenance, are still evolving. Technical, institutional and political intervention will be necessary to fight deepfakes.
- Pay close attention to the generative AI techniques, as we expect their adoption to be rapid.

Sample Vendors

aiXcoder; Alibaba Cloud; Amazon Web Services; Baidu; Huawei; Microsoft; SenseTime; Tencent; Zhipu AI

Gartner Recommended Reading

Innovation Insight for Generative AI

Top Strategic Technology Trends for 2022: Generative AI

Predicts 2022: Generative AI Is Poised to Revolutionize Digital Product Development

Quick Answer: China Perspective — Frequently Asked Questions on ChatGPT and Large Language Models

Cloud-Native Computing in China

Analysis By: Carolin Zhou, Kevin Ji, Uko Tian

Benefit Rating: High

Market Penetration: 20% to 50% of target audience

Maturity: Adolescent

Definition:

Cloud-native is a modern approach to building and running software applications that exploits the flexibility, scalability and resilience of cloud computing. In China, cloud-native practice refers to the combined use of container-based cloud infrastructure, agile methodologies, continuous integration/continuous delivery (CI/CD), service mesh and microservices architectures to implement the next generation of IT applications.

Why This Is Important

Cloud-native involves speed and agility. Business systems are evolving from enabling business capabilities to strategic digital transformation that accelerates business velocity and growth. Speed to market, innovative features, microservice architecture transformation and zero downtime are increasingly being demanded by business as digitization initiatives. Cloud-native accelerates time to market with features and products that scale and operate with less operational overhead.

Business Impact

Cloud-native provides productivity and/or agility benefits, including the ability to accelerate and simplify the application life cycle, enabling workload portability between different environments and improving resource utilization efficiency, and more. Microservice/modernization architecture and agile development approaches require new expertise and new technologies/tools, such as container, service mess, infrastructure automation, CI/CD and specialized operations capability.

Drivers

- The primary driver for cloud-native computing in China is a desire to “get the most out of the cloud.” As “cloud-native” itself means different implementation models to different constituencies, it is not surprising that this can mean different things. What drives people to one or another of these approaches varies.
- Enterprises favor cloud-native solutions now for such reasons as the total cost of ownership (TCO), performance and security of the solution; business agility; and accommodating distributed teams.
- For supporting digital competitiveness at pace, organizations in China are moving forward to composable architecture transformation, which drives the adoption of cloud-native, especially for container, service mesh and CI/CD, to improve business agility and speed to market.
- Cloud-native has the potential to optimally leverage cloud technologies and benefits. The two most common meanings in use are quite contradictory. One (cloud-service-provider-native) is all about using native features and, therefore, locking yourself into the provider. The other (container-native) is focused on containers (and may evolve into other technologies, like: CI/CD), which don’t guarantee portability, but are directionally consistent with the goal.
- Cloud-native is a concept that can be expressed in degrees. The more something aligns with core cloud characteristics, the more we consider it to be cloud-native and the more cloud-native outcomes it will produce.
- Major players increased their investment in the cloud-native areas, especially for container/Kubernetes, container security, CI/CD, etc. This includes DaoCloud Network Technology, BoCloud, Alauda, Alibaba Cloud, Huawei Cloud and Tencent Cloud.

Obstacles

- Cloud-native computing in China is associated with lack of skills, complexity of environments, fast-evolving toolchains, organizational and process changes associated with agile methodologies, container security concerns and enterprises-commencing container deployments, but without an ability to adopt DevOps/agile principle and process.
- Cloud-native is a broad and loose trend that can be interpreted in different ways, leading to confusion in implementations. It's concerning with respect to hype, as confusion amplifies hype. The biggest obstacle is getting beyond the confusion to focus on desired outcomes.
- Some enterprises are containerizing legacy applications to modernize the operational pipeline which is hard and may bring business risks.
- In cloud strategy efforts, principles are the most important component. Cloud-native are often stated as principles in a cloud strategy. But the use of the term "cloud-native" requires a clear definition and further explanation.

User Recommendations

- Focus on the business outcomes you want, then focus on the specific set of talents and skills, cloud-native platforms, processes and tools that support it.
- Choose the points of lock-in carefully. Where possible, implement open-source software (OSS), and strongly consider cloud-native as an alternative, but assess the capability of cloud-native that vendor provides, especially for the impact of each vendor technology on application portability and security risks.
- Implement cloud-native processes (Agile, DevOps) to take maximum advantage of cloud-native architectures and tools. This applies especially to the DevOps-oriented organizations.
- Improve the success rate by ensuring that a strong business case exists. Identify appropriate use cases, and work to institute a DevOps culture among your teams, while you deploy early cloud-native pilots.

Sample Vendors

Alauda; Alibaba Cloud; Amazon Web Services (AWS); BoCloud; DaoCloud; Huawei Cloud; Kubernetes; Microsoft; Red Hat; Tencent Cloud

Gartner Recommended Reading

Market Guide for Container Management

Tool: Vendor Identification for Container Management in China

A CTO's Guide to Navigating the Cloud-Native Container Ecosystem

A CTO's Guide to Cloud-Native: Answering the Top 10 FAQs

Low-Code Application Platform

Analysis By: Tracy Tsai, Andy Wang

Benefit Rating: Moderate

Market Penetration: 5% to 20% of target audience

Maturity: Emerging

Definition:

A low-code application platform (LCAP) supports visual programming abstractions, such as model-driven and metadata-based application development. Customers of LCAP create user interfaces, design data schemas, and implement business logic with simplified tooling and the catalog of packaged capabilities.

Why This Is Important

LCAP is one of the most in-demand low-code development tools to accelerate digital transformation in China. It is used as a general purpose platform for web and mobile application development, with high productivity and requiring fewer specialized developer skills. The no-code feature is particularly valued as it empowers nontechnical developers with the agility to create digital solutions. Leading global vendors and many local vendors offer localized solutions to meet the diversity of needs.

Business Impact

LCAP significantly impacts organizations in China due to there being:

- A large number of small and midsize enterprises with limited IT resources for citizen developers to create digital applications more efficiently and effectively.

- Large enterprises, with hundreds or thousands of branches and employees, requiring effective modernization of legacy systems, which is usually done by more technical developers.
- An increase in innovation speed to create customer-facing applications, which are more agile in a dynamic business environment.

Drivers

- Large number of enterprises with limited IT resources prefer citizen automation and development platforms (CADPs), as a part of LCAP, to create form or office automation (OA) applications.
- Many local startups offering CADP highlight no-code features designed for nontechnical developers.
- Growing number of enterprises are initiating hyperautomation to optimize business and IT processes automation.
- Enterprises that are leading in digital innovation have begun pursuing composable business and composability of applications through modular programming abstractions, integrated platform as a services (iPaaS), API interfaces and reusable packaged business capabilities.
- Many enterprises adopt multiple low-code development tools so they realize the business value. Some enterprises initially adopt CADP for no code and later look for LCAP to extend support for professional developers. While other enterprises initially adopt LCAP and start looking for CADP for non-IT developers to build (OA)/form applications for the workgroup.
- There is an increasing need for LCAP governance, guardrail and collaboration support between professional and fusion teams with citizen developers.
- Though there are not many global vendors present in China, there are many local LCAP providers including enterprise application vendors, LCAP-focused vendors, citizen development platform vendors and cloud service providers. Each offers specialized solutions for target use cases, such as custom business applications, business workflow automation, industry digital solutions, or OA/form automation apps.
- Purpose-built solutions for specific industry or business domains, as well as integration with local enterprise applications, help to drive enterprises' adoption of LCAP products and realize business value faster.
- More enterprises in China are expanding business outside the country, which brings the demand for LCAP to support global business operations, including compliance with government regulations.

Obstacles

- Many enterprises in China still lack the understanding about LCAP, including how to evaluate and select vendors, whether the ROI can match or exceed investment, and potential productivity improvement.
- LCAPs have been implemented by the main SaaS platform vendors, whose market dominance and deep pockets could diminish opportunities for a large number of small LCAP vendors.
- LCAP trades productivity for vendor lock-in (of both applications and developer skills). Lock-in reduces customer flexibility and can increase costs.
- Licensing models vary across vendors, and often change, and may not scale for new use cases. This can lead to vendor disillusionment.
- Some enterprises with low IT capabilities may think LCAP is too complex for them to learn.
- Enterprises' business units prefer tactical solutions to solve issues, which hinders IT from adopting LCAP as it takes a longer time to implement.
- The economic uncertainty could impact the government and enterprises' IT budget for LCAP.

User Recommendations

- Review use cases based on the long-term effects of LCAP lock-in and the lack of portability or standards. Technical debt will accumulate fast and vendor relationships (and contracts) need to be considered strategically.
- Weigh annual subscriptions of LCAP against the productivity benefits (development speed and developer costs).
- Ensure developers are governed according to their needs. Different developers with different skill sets will vary in their successful adoption of different LCAP.
- Assess LCAP vendors by evaluating their partner ecosystem and developer community, such as whether they provide training and support to developers for their industry and business domains.
- Prioritize LCAP and CADP that supports both professional and citizen developers, or at least extends support for professional developers for needs such as customization, governance or guardrails.

Sample Vendors

Alibaba Group; ClickPaaS; Definesys; Huawei; Joget; Macrowing; Mendix; Microsoft; Mingdao; Tencent

Gartner Recommended Reading

Magic Quadrant for Enterprise Low-Code Application Platforms

Critical Capabilities for Enterprise Low-Code Application Platforms

Competitive Landscape: Enterprise Low-Code Application Platforms in China

SASE

Analysis By: Evan Zeng, Feng Gao

Benefit Rating: Transformational

Market Penetration: 5% to 20% of target audience

Maturity: Adolescent

Definition:

Secure access service edge (SASE) delivers converged network and security-as-a-service capabilities such as SD-WAN, SWG, CASB, next-generation firewall (NGFW) and zero trust network access (ZTNA). In addition to its global use cases, in China, SASE supports community cloud and customers' on-premises access security use cases. CASB is a recommended rather than a core capability, as enterprises in China adopt cloud PaaS and SaaS services less than their worldwide peers.

Why This Is Important

SASE is a key enabler of digital business transformation, increasing visibility, connectivity and security by using a platform approach, rather than a point-product approach, to deliver network and security services. In China, SASE platforms are often bundled with commonly needed capabilities, such as low-latency access to cloud (public and community clouds) and pay-as-you-go pricing models, increasing its importance.

Business Impact

SASE delivers:

- A platform approach for unified management across WAN and security, which significantly reduces the complexity of operations and enhances cybersecurity capabilities.
- A security and networking platform with local footprints in China, which can meet compliance requirements and can reduce WAN infrastructure and security services costs.
- Enhanced security and governance for enterprise digital assets at data centers, cloud and edge locations.

Drivers

- Enterprise digital business transformation needs secure connectivity to distributed hosting and cloud-based workloads without increasing complexity and buying overlapping capabilities.
- Chinese enterprises cite zero trust networks and SD-WAN as important capabilities, both of which are core capabilities in SASE solutions.
- SASE provides as-a-service infrastructure and reduces procurement and deployment time for customers. It also enhances security protection and shortens remediation time to provide much better observability for cloud and edge-based resources.
- A distributed digital workforce and similar dynamic access needs of modern businesses are common and widespread in China. SASE brings a more complete and transformative approach to network security, which is better-suited to these use cases than legacy solutions.

Obstacles

- Organizational silos, incumbent investments, cultural change, maturity of security management and skills gaps are major obstacles to SASE adoption in China.
- Enterprises in China prefer on-premises environments more due to the organizational and regulatory risks of public cloud, making the cloud-delivered architecture of SASE less relevant in China.
- Indigenous SASE offerings are generally immature in China, as most solutions still lack fully converged capabilities such as a unified management platform and policy control.
- Due to security concerns and cloud security service regulation in China, non-China-based SASE providers require considerable time to navigate the regulatory and business landscape to decide their business strategy and how to land their SASE solutions into China.
- Managed SASE offerings — a different SASE adoption option — are still at an early stage in China because they are low priority for most technology providers.

User Recommendations

- Adopt SASE offerings to deliver the business benefits of security and network vendor consolidation.
- Involve the chief information security officer (CISO) as well as security and network leaders when evaluating SASE offerings and roadmaps from incumbent and emerging vendors to ensure an integrated platform approach.
- Avoid SASE solutions with more than two participating vendors, favoring single vendors where possible. Only consider SASE offerings with three or more vendors when they are offered as a managed service.
- Give higher consideration to vendor offerings that deliver unified management and operation approaches across services in the SASE platforms.
- Shortlist SASE vendors that can not only address global use cases but also China-specific use cases such as the global SaaS acceleration across China's internet borders.
- Combine branch-office access and remote access into a single implementation to ensure consistent policies and minimize the numbers of vendors required. Deploy ZTNA to augment or replace legacy VPN.

Sample Vendors

Alibaba Cloud; Huawei; NSFOCUS; QAX; Sangfor Technologies; Topsec; Wangsu

Gartner Recommended Reading

Accelerate SASE Adoption by Leveraging the Security Vendor Consolidation Wave

Emerging Tech: Leverage Cloud Connect Infrastructure to Improve Connectivity Experience of Cloud Workloads for SASE Solutions

Market Guide for Single-Vendor SASE

2022 Strategic Roadmap for SASE Convergence

Hybrid Cloud in China

Analysis By: Elaine Zhang, Carolin Zhou

Benefit Rating: High

Market Penetration: 5% to 20% of target audience

Maturity: Early mainstream

Definition:

Hybrid cloud computing comprises one or more public and private cloud services that operate as separate entities, but are integrated. A hybrid cloud computing service is automated, scalable and elastic. It has self-service interfaces and is delivered as a shared service using internet technologies. Hybrid cloud computing needs integration between the internal and external environments at the data, process, management or security layers.

Why This Is Important

Hybrid cloud brings diversity to infrastructure to meet control, compliance and security requirements in private cloud. This enables enterprises to leverage scalability, elasticity and cloud-native capabilities from public cloud, to support application development ability and business innovation.

Business Impact

Hybrid cloud enables enterprises to leverage public cloud for cloud-burst workloads, speed-to-market and innovation, and to keep data in-house due to security, compliance, and latency concerns. Businesses can develop and run digital business on hybrid cloud to grow revenue, while maintaining compliance.

Drivers

- Digital transformation initiatives have accelerated cloud adoption in China, but public-cloud-first is not the strategy for many enterprises in China. Because legacy systems, latency requirements, regulation, compliance and security concerns still require an on-premises environment, hybrid cloud has become popular in China.
- Hybrid cloud supports enterprises to leverage cloud capabilities for faster delivery and innovation, using a single management platform to streamline application deployment and IT operation experience. Hybrid cloud is attractive for Chinese infrastructure and operations (I&O) leaders because modernizing a traditional data center helps data center teams to build cost visibility and multitenant, and enable the capabilities of automation, scalability, and resilience.
- All of the public cloud providers in China offer hybrid cloud solutions. It brings seamless infrastructure as a service (IaaS) capabilities to enterprises, leveraging the same tooling for deployment and operation.
- Many third-party providers in China have developed products to support hybrid cloud platform deployment and management, including cloud management toolings, container management, monitoring tools, and DevOps toolchains.

Obstacles

- Many enterprises lack a clear hybrid cloud strategy, and often struggle with workload placement and hybrid cloud architecture.
- Hybrid cloud causes conflict between traditional IT and cloud teams because it requires collaboration, governance, and alignment of the infrastructure roadmap.
- IT organizations attempting to achieve cost optimization by leveraging hybrid cloud often fail, because they don’t know how to calculate and compare the total cost ownership (TCO) between private and public cloud.
- Although there are different tools to manage hybrid cloud environments, the complexity of operation still exists.
- Lack of skills and internal resistance also creates obstacles for hybrid cloud adoption.

User Recommendations

- Justify hybrid cloud adoption by assessing application portfolio and infrastructure gaps between private and public cloud, and their impact on near-term business requirements.
- Create workload placement principles that inform governance guidelines by identifying the benefits of placing the workload in the private or public cloud.
- Establish a collaborative culture for the cloud by working with the data center team on your infrastructure roadmap. This strengthens the I&O organization by fostering knowledge sharing and cross-training.
- Simplify operation and management of hybrid environments by consolidating legacy environments, and private and public cloud solutions from different providers in a cloud management platform.
- Provide opportunities to team members to learn by upskilling or reskilling existing talent, before considering outside resources for hybrid cloud adoption. Bring visibility and encourage everyone to speak up their concerns.

Sample Vendors

Alibaba Cloud; BoCloud; Huawei Cloud; IEIT Systems; New H3C Technologies; Sangfor Technologies; Tencent Cloud

Industrial Internet

Analysis By: Milly Xiang

Benefit Rating: Transformational

Market Penetration: 5% to 20% of target audience

Maturity: Emerging

Definition:

Industrial internet refers to the convergence of industrial systems (including people, processes, information systems, infrastructure, all kinds of assets) with the power of advanced digital technologies (e.g., computing, connectivity, analytics and IoT), to empower transformation of the industrial sector. This includes industries such as manufacturing and natural resources, transportation and logistics, and utilities.

Why This Is Important

Industrial internet drives tools and decision transformation, and the transition toward new business models and revenue streams through IT/OT convergence and automation, improved processes and production optimization. This transformation is not limited to the technologies used; it represents a culture of change integrated into all work areas and a transformation in the way different parts of the value and supply chain cooperate.

Business Impact

The industrial internet leads to a transformation of procedures, resulting in overall process optimization and cost-efficient production. It improves resilience, flexibility and responsiveness of the entire industrial value chain. It enables faster, more effective decisions based on consistent, real-time and contextual data. It facilitates rapid response to volatile changes in demand and accelerates the production of new products and/or services, thereby creating new sources of revenue.

Drivers

- Industrial transformation empowered by the industrial internet is a key component of China's "Digital Economy," with strong government policy and funding support.
- Industrial enterprises are motivated to modernize their operations, cut their operational cost, improve product quality and drive innovation to compete globally.
- The uncertainty resulting from economic headwinds and geopolitical dynamics leads to changing demand patterns and supply constraints, highlighting the importance of flexibility and resilience in the manufacturing process and organizations' ability to respond to future shocks.
- Digital transformation in the industrial sector has gone from being an option that could give companies a competitive advantage, to being a necessity for surviving. Without the digital skills involved in transformation, companies won't be able to keep up with emerging demands or compete against the rest of the industry.
- Large industrial internet platform providers, in many instances, have sacrificed their operating margin during the past few years to incentivize adoption. In addition, more emerging vendors are focusing on a specific industry, subsector, region or a particular technology segment, presenting industrial enterprises with more options specific to their challenges and objectives.

- The increasing adoption of industrial Internet of Things (IIoT), entwined with cloud, analytics, AI and machine learning (ML) techniques, is accelerating the transformation of the industrial sector in managing complex processes and driving innovation, therefore driving up combined value delivery.
- The emergence of industry cloud platforms, which prepackaged technology and business foundations and capabilities with greater composability and data fabric use to accelerate meeting specific industry needs and delivery of expected outcomes.

Obstacles

- Components for industrial internet implementation are complex and maturity levels are diverse. Most Chinese enterprises do not have expertise to support this initiative with a roadmap aligned to business objectives.
- Industrial internet initiatives incorporate orchestrated digital transformation efforts across IT systems, industrial assets, customers and supply chain, inherently introducing new integration challenges. The integration strategies of industrial enterprises fall short in both technology and competencies required to fully address these new requirements.
- Excessive focus on technologies leads to ignorance of internal drivers for deployment of these solutions. Specifically, more efforts are needed around exploration and practice of innovative business models.
- Skills shortages exist on both the supply and demand sides, and span technology and business acumen.
- Other obstacles include solution complexity, fragmented supplier landscape, lack of standards and security concerns.

User Recommendations

- Create a roadmap for current and future use cases that align with business objectives for holistic planning of architecture, deployment models and interoperability.
- Prioritize use cases that can support cost and process optimization in the current economic cycle to generate faster payback.
- Frame your decision around buy, build, acquire or partner based on in-house capabilities, time, budget and deployment environment.
- Shortlist vendor proposals by prioritizing solutions that match the most important elements of the use-case requirements for your enterprise. Also prioritize vendors' capabilities around cloud, on-premises or hybrid deployments, multicloud integration, and ability to scale and implement vertical use cases.
- Use certified systems integrators to build custom solutions (for complex requirements) that involve unique sensors, edge devices, algorithms and visualization capabilities to offset various vendor risks and address cyber and physical security risks.

Sample Vendors

Alibaba Cloud; Baidu; COSMOPlat; Guangdong Meiyun Zhishu Technology; Huawei; Inspur YUNZHOU; ROOTCLOUD; Tencent; XCMG; Yonyou

Gartner Recommended Reading

Smart Manufacturing Challenges Every Industrial Manufacturing CIO Must Resolve

Magic Quadrant for Global Industrial IoT Platforms

Sliding into the Trough

Full Life Cycle API Management

Analysis By: Wei Jin

Benefit Rating: High

Market Penetration: 5% to 20% of target audience

Maturity: Emerging

Definition:

Full life cycle API management is the entire life cycle of APIs, which involves planning, design, implementation, testing, publication, operation, consumption, versioning and retirement. Also, it combines developer portals, API gateways, API design, development and testing tools, and policy management and analytics. Full life cycle API management enables API ecosystems to publish APIs, ensure secure operations and collect data for monitoring and business-value reporting.

Why This Is Important

As cloud adoption and microservices continue to evolve extensively in China, APIs are being widely used by an increasing number of leading organizations. These organizations often engage in digital transformation to integrate systems and sensitive data. Full cycle API management is now an essential technology due to the demand for API creation, management, operations and security.

Business Impact

Full life cycle API management provides the framework and tools needed to manage and govern APIs that are essential for multiexperience applications, composable architectures and digital transformation. It enables the creation of API products — which may be directly or indirectly monetized — while protecting organizations from business risks related to API breaches.

Drivers

- Online applications, such as superapps and educational apps, are booming. China organizations prefer APIs because it supports the heavy burden of online applications connectivity and data transmission. API is the enabler for low-code application platforms.

- The need to integrate applications, data and devices seamlessly is leading to rapid growth in the number of APIs.
- The rapid adoption of microservices and hybrid architectures is increasing the complexity of API management. Effective API management requires complete visibility, control and performance monitoring of the API life cycle.
- APIs are no longer just programmable interfaces that provide access to data or an application. They can generate revenue directly (through monetization) or indirectly (by providing a new channel to traditional businesses). Full life cycle API management provides the tools to treat APIs as products.
- Developer interest in APIs is growing in China. New approaches to event-based APIs, design innovations and modeling methods, such as GraphQL, are driving interest, experimentation and growth in full life cycle API management.
- Commoditization and widespread availability of API gateways as part of cloud services, security solutions and other bundled software applications are increasing the need for distributed API management involving multiple gateways.
- The Hype Cycle position of full life cycle API management in China differs from the global one. This is because China's information and communication technology (ICT) market lags behind the global market. However, there is a lot of potential for growth in the China market.
- The rising influence of generative AI and large language models (LLMs) in software engineering will likely increase and reshape the need for APIs.

Obstacles

- Misplaced business value and strategy for APIs, misunderstanding of business returns and excessive expectations may not deliver the promised returns. This ultimately causes users and sponsors to lose interest in APIs.
- Lack of focus on and effective management of API security has led to many data leakage use cases and violations of data protocols. This affects the business and may impact market opportunities.
- Traditional, single-gateway approaches to API management no longer adapt to modern, distributed API management approaches.
- Some organizations think API management tools are simple coding and labor costs are lower for in-house development. They prefer to manage APIs by themselves.

- China business use cases, such as e-commerce, are unique and complex. Therefore, the standard API solution cannot always fulfill complex business requirements and the required ad hoc changes.
- Global full life cycle API management tools are much more mature and have already penetrated the China market. This can potentially shrink the market opportunities for local API providers.

User Recommendations

- Use full life cycle API management to power your API strategy and address technical and business requirements for APIs. Select offerings that can address needs well beyond the first year.
- Treat APIs as products managed by API product managers in a federated API platform team. Adopt business metrics for API products.
- Increase the adoption of monetized APIs by collaborating with API product managers.
- Select an API management solution with broad functionality to support modern API trends, including microservices, multiple gateways and multicloud architectures. Ensure the chosen solution covers the entire API life cycle, not just the runtime or operational aspects.
- Use full life cycle API management to enable governance of all APIs, not just the ones you produce, including the third-party APIs (private or public) you consume.
- Ask your full life cycle API management vendor about its support for API maintenance automation, automation of other functions and automated monitoring and reporting.

Sample Vendors

Alibaba; API7.ai; Huawei; JKStack; ParaView

Gartner Recommended Reading

Market Guide for API Gateways

Critical Capabilities for Full Life Cycle API Management

Quick Answer: What Are the 3 Steps for a Successful API Product?

API Security: What You Need to Do to Protect Your APIs

Workforce Superapp for China

Analysis By: Lacy Lei

Benefit Rating: High

Market Penetration: 5% to 20% of target audience

Maturity: Adolescent

Definition:

A workforce superapp provides digital workers an integrated workspace with core collaboration features (workstream collaboration, meeting, content service, email, etc.) and role-specific miniapps (HR services, CRM, approval, etc.). The superapp platform is open for ecosystem partners and end-user organizations to develop and integrate miniapps on it. Workforces in different teams collaborating on superapp can also explore, activate and build their miniapps within it as business needs.

Why This Is Important

Workforce superapp started from an application that the employee communication needs. It is now a paradigm shift of integrating employment management, group productivity, organizational culture, business model, innovation adoption, product and service offerings, as well as a governance point for policy controls including security and compliance. As a fundamental pillar of digital transformation, its openness and integration make it easy to interoperate with a growing landscape of applications.

Business Impact

Workforce superapp improves team productivity by consolidating collaboration activities. The open platform makes it extensible for fitting into process-driven, role-based, operational and external (such as customers or partners) use cases. As a key part of the strategy to empower organizations' digital transformation in China, workforce superapps help organizations gain competitive advantages by providing better total experiences to their employees and clients.

Drivers

- The remote work mode has been driving the evolution of employee communications applications into workforce superapps through the addition of plug-ins for HR, payroll, shift management and other miniapp functions.
- Managing numerous applications brings inconvenience and risk to both digital workers and the IT team. Workforce superapp reduces digital frictions by integrating most of the essential functions within the digital workplace framework, including the new work hubs, business role hubs, employee engagement hubs, technology services hubs and employee services hubs.
- The changing business needs make digital workers always seeking for the most efficient tools. Workforce superapps make it easy to orchestrate the interoperability of an ever-growing need for purposeful applications from various vendors. Their capabilities such as API and no code, allow citizen developers, business technologists and third-party partners to customize it to automate the work and ease the integration.
- Workforce superapp forms the core for work governance efforts because they provide a connected and centralized experience for organizations to satisfy communication, information sharing and work management needs while enabling IT to centralize policy, security and compliance controls.
- Chinese digital dragons have expanded their superapp concept to the digital workplace and invested in the workforce superapp to expand their market position. Meanwhile, global workstream collaboration application vendors are evolving into superapp. The customers can benefit from the vendors' ecosystem capability, customized services, product portfolio and technology innovation (AI, VR, Internet of Things [IoT], etc.).
- The mass adoption of the consumer superapp in China enables digital workers to adapt to the workforce superapp at work seamlessly.
- The implementation of a workforce superapp strategy in an organization can demonstrate the ambition for its digital transformation and even the vision, culture and leadership of an organization.

Obstacles

- The trust in SaaS service adoption is a challenge in China, especially considering concerns for security and privacy issues when employees need to work outside of enterprises' security perimeters.
- The business teams' autonomy adoption or customization of miniapps brings data privacy concerns especially the data sharing between the miniapp and workforce superapp.
- Global vendors have limited applicabilities in China. This brings some issues for end users and the IT department, especially in global organizations, such as quality of service, local partner support and extra work in network plans.
- The solutions offered by Chinese vendors are usually packaged with broader services other than just workforce superapp. Organizations have to consider interoperability and consistency with the existing cloud infrastructure when adopting this superapp, as well as the transferability and exit strategy.

User Recommendations

- Evaluate and improve the adoption of workforce superapp to adapt to the evolving working model today.
- Be aware of the vendors' rapid updates of portfolios, product iterations, new license plans, and case studies in their communities as well as their local strategies and services. Include SLA in vendor contracts to ensure stability and scalability of the platform, as well as data privacy.
- Establish governance reinforced with miniapp management and customization policy to satisfy security and data protection constraints.
- Encourage the internal fusion team to build their own miniapps and take opportunities to develop tailored features with vendors or miniapps from their eco partners to address the specific need. In order to optimize the value of workforce superapp in the organization.
- Work with the chief information security officer and network architect to enable a frictionless work environment, such as zero trust strategy, which protects access from anywhere.

Sample Vendors

Alibaba Group; ByteDance; Huawei Technologies; Microsoft; Salesforce; Tencent

Gartner Recommended Reading

Quick Answer: How Does a Superapp Benefit the Digital Employee Experience?

CIOs in China: Adopt These 5 Flexible Working Practices to Empower Digital Workers

Quick Answer: What Is a Superapp?

Robotic Process Automation

Analysis By: Andy Wang, Tracy Tsai

Benefit Rating: High

Market Penetration: 5% to 20% of target audience

Maturity: Adolescent

Definition:

Gartner defines robotic process automation (RPA) as the software that automates tasks in business and IT processes via scripts that emulate human interaction with the application's user interface (UI). RPA is used across different business functions to perform tactical task automation. RPA software enables a human process or task to be recorded or programmed into a software script, which can then be deployed and executed into different runtimes.

Why This Is Important

Under pressure for digital business process optimization and transformation, enterprises in China are investing in RPA to automate manual tasks and processes. Given the number of repeated manual tasks, the need for efficiency and the rising costs of skilled labor in China and elsewhere, RPA is critical in enabling enterprises to optimize labor costs, productivity and faster time to value. The automation process drives the quality of production and business effectiveness.

Business Impact

- RPA provides business outcomes on efficiency, efficacy, agility and cost reduction via augmenting or replacing staff.

- The embedded artificial intelligence (AI) in RPA platforms in China and other markets, such as generative AI and generative pretrained transformers (GPTs) or intelligent document processing, extends RPA's value in business applications.
- RPA aids China's digital transformation by offering noninvasive integration, without changing the structure of the source or destination system.

Drivers

- Continued adoption from enterprises and organizations to digitize manual tasks and processes.
- Industries such as financial, manufacturing and online retail that handle large volumes of transactions with routine and standardized processes benefit most from the cost-saving and operational efficiency.
- RPA's low-code features accelerate citizen developers to build automation rapidly, which accelerates automation delivery.
- Improvement of workers' experience to avoid repeated and tedious work, leading to employees focusing on other tasks that require more-strategic decisions or creativity.
- The maturity of RPA solutions and extension to other capabilities — such as process mining, intelligent document processing (IDP), OCR and text analytics augment RPA — to handle more situational processes or decisions and unstructured data.
- The number of RPA software platform providers worldwide has decreased in China, and local vendors continue to increase in China.
- Embedded GPT empowers RPA to extend business process automation scope.

Obstacles

- The use of RPA in China remains limited to enterprises with higher levels of IT maturity.
- Many organizations started to adopt RPA, but struggle to identify more use cases to scale or lack IT resources to evaluate or further deploy RPA.
- For complex use cases, enterprises must look beyond RPA and move into process automation.
- The global RPA software providers might not support China-developed enterprise applications that need heavy customization or integration work.
- There is a lack of understanding about RPA tools or confusion with the terms in China. For example, some enterprises confuse RPA with office automation applications.
- Although RPA is a low-code development platform, it requires training for some technical skills. However, the learning difficulties are less than heavy-code tools.
- There are still areas of improvement to simplify robot-building processes and management.
- Process identification, lack of understanding and governance challenges are common obstacles to RPA adoption.

User Recommendations

- Identify the business objectives for automation process initiatives and plan what hyperautomation technologies are needed to support the goal.
- Focus on empowering employees with greater capabilities to achieve their goals, including better user experiences, improving work quality or agility to adapt business needs than automating tasks.
- Evaluate RPA vendors by their extended capabilities or API connectors to the third-party applications, such as process mining and discovery, iBPMS or integrated platform as a service (iPaaS), which support hyperautomation.
- Set proper expectations toward RPA about the limitation that RPA cannot replace all human work.
- Organizations should hold regular technical training before and after the deployment of RPA to ensure up-to-date understanding.

Sample Vendors

Cyclone Robotics; DataGrand; Encoo; Intelligence Indeed; Kingsware; Laiye; Shanghai i-Search Software

Gartner Recommended Reading

Toolkit: RFP Template for RPA

Beyond RPA: Build Your Hyperautomation Technology Portfolio

Magic Quadrant for Robotic Process Automation

Critical Capabilities for Robotic Process Automation

Competitive Landscape: Enterprise Low-Code Application Platforms in China

DevOps

Analysis By: Carolin Zhou

Benefit Rating: High

Market Penetration: 20% to 50% of target audience

Maturity: Early mainstream

Definition:

DevOps represents a change in IT culture, focusing on rapid IT service delivery through the adoption of agile and lean practices in the context of an integrated approach. DevOps is a perspective that emphasizes people and culture to enable collaboration between business, development and operations, and other groups. However, organizations define and approach DevOps in myriad different ways. There is no standard definition for DevOps. It should be defined in terms of how it meets business goals.

Why This Is Important

Driving digital transformation in China, agility and valuable business outcomes are becoming more and more important for business. IT takes the leading role in enabling business and transforming into an agile and “nimble” organization. DevOps is a collaboration between all stakeholders in the value stream with a focus on improving flow and more frequent deployments without sacrificing stability or speed to market while enhancing the customer experience.

Business Impact

DevOps has moved from being an emergent perspective for organizations requiring a high-speed change to a proven collection of practices, technologies and tools that can enable all organizations to deliver customer value faster, more reliably, with better quality and/or more predictably. DevOps enables improved business agility by providing the much-needed atmosphere of mutual collaboration, communication and integration across globally distributed teams in an IT organization.

Drivers

- To deliver customer value faster and improve agility, many large organizations integrate agile transformation into their IT strategy using DevOps and agile.
- Movements toward digital business are driving the adoption of products and the use of DevOps.
- To achieve organizational nimbleness, many enterprises are shifting toward operating models that are centered around products and empowered teams.
- The impacts of the COVID-19 pandemic and economic slowdown are catalysts for cloud adoption, increasing the need for automation practices such as continuous integration/continuous deployment (CI/CD). This enables faster environment provisioning, accelerates software delivery and improves service reliability. Cloud service providers have also invested in this area to provide cloud-native solutions for DevOps.

Obstacles

- Cultural resistance to new ways of working. Teams are still working in silos of development and operations, rather than working collaboratively.
- Focusing too much on the technology part, such as CI/CD and automation, rather than on culture, people and collaboration.
- DevOps requires automated end-to-end testing solutions/tools that integrate existing processes to reduce technology stacks or security risks automatically. However, people to implement and manage are the heart of it, and most organizations in China don’t have the talent and skills to handle it.
- Organizations can be impatient to realize the value of DevOps quickly rather than start small, iterate and learn.
- Many organizations in China are adopting hybrid cloud, which leads to more complex environments and challenges with scaling DevOps efforts.

User Recommendations

- Verify the vision and roadmap for DevOps in your organization, including the likely organizational topology, operating model and platforms that will be used.
- Change the organization's culture and mindset by establishing shared objectives and metrics. Bring the development, testing, data, operations and security teams together, working as one team to frequently deliver high-quality solutions.
- Champion a culture of continuous learning that values experimentation. Encourage employees to apply what they learn by implementing continuous improvement practices to change how they work to increase agility.
- Consider DevOps delivery platforms to provide fully integrated capabilities that enable continuous delivery of software in hybrid cloud environments.
- Adopt a continuous approach to security by defining security needs across the full software development life cycle, including the underlying software delivery pipeline.

Sample Vendors

Alibaba Cloud; Atlassian; Amazon Web Services (AWS); BoCloud; Huawei Cloud; Microsoft Azure; Tencent Cloud

Gartner Recommended Reading

Keys to DevOps Success

Leverage Platform Engineering to Scale DevOps Platforms Into Hybrid Cloud

Quick Answer: How to Enable Collaboration Between I&O and DevOps in China

5G for China

Analysis By: Peter Liu, Sylvain Fabre

Benefit Rating: High

Market Penetration: More than 50% of target audience

Maturity: Mature mainstream

Definition:

5G is the fifth-generation cellular technology standard by the 3rd Generation Partnership Project (3GPP). The standard targets maximum downlink and uplink throughputs of 20 Gbps and 10 Gbps, respectively. Latency is as low as 4 milliseconds in a mobile scenario and can be as low as 1 millisecond in ultrareliable low-latency communication scenarios, down to centimeter-level location accuracy indoors, and massive IoT scalability. New system architecture includes core slicing and wireless edge.

Why This Is Important

5G has been positioned as a national priority of the digital transformation and connectivity of the economy. It is a critical enabler for the booming digital economy together with big data, AI and cloud computing. 5G will also unlock new enterprise services that have stricter connectivity and computing requirements, such as AR/VR, metaverse, smart cities, autonomous driving, Internet of Things (IoT) and smart manufacturing.

Business Impact

5G has the following impacts on enterprises:

- It brings up to 10 Gbps of capacity, higher quality and more secure mobile connectivity options for enterprise networking.
- The introduction of network slicing and edge computing allows customized networks that map to an organization's IT needs.
- With the introduction of private mobile networks (PMNs), enterprises can have their own 5G setup on-site, which leads to performance, security as well as bandwidth economics.
- 5G enables other emerging technologies, such as AI/ML, metaverse, robotics and IoT, to further drive enterprise digital transformation.

Drivers

- China is ramping up plans to construct new digital infrastructure across the country — including 5G networks, AI and IoT. These drive investment in and deployment of 5G.
- 5G offers fiberlike bandwidth and latency capabilities, but with significantly shorter deployment time. With this advantage, it can be positioned as a comparable alternative to fiber for the enterprise data network.
- 5G features, such as network slicing and service-based architecture, allow networks to be purpose-built for use cases (e.g., ultralow latency and security) and be more responsive to the application and IT environments they support. These networks can potentially work with existing SD-WAN solutions or overlay fixed networks.
- There is a growing interest in private mobile networks across multiple industries. 5G is expected to be a potential connectivity option to support future applications such as robotics and mixed reality.
- With the government's policy support, Chinese enterprise CIOs are showing great interest in 5G and proactively collaborating with communications service providers (CSPs) to develop 5G services. This drives innovation and accelerates adoption. In the 2023 Gartner CIO and Technology Executive Survey, 34% of respondents said their organization already adopted or is going to adopt 5G in the next year.
- Fast shipment and penetration of 5G devices is another driver for 5G network rollout.

Obstacles

- Alternative connectivity options such as Wi-Fi and fiber continuously challenge the necessity of 5G adoption in indoors enterprise networks.
- Costs, complexity, lack of skills and knowledge, and security are major concerns for enterprise CIOs when considering 5G technology, especially for enterprises that want to build their own private 5G networks. Current private 5G networks normally are deployed in a silo mode to support niche applications, which hardly justifies the investment.
- The majority of 5G vertical use cases are still in the conceptual and developmental stage. These use cases are mainly driven by the network vendors and CSPs. While 5G will enable various industry applications, the real value to the end users remains unclear.
- The 5G-related capabilities and standards are still evolving. Major enterprise innovation opportunities are based on 3GPP R16 and R17, which are not largely available in today's 5G deployment.

User Recommendations

- Plan for 5G adoption by considering the match between the 5G connectivity service and use-case requirements. Cut through the "5G washing," and set realistic expectations by understanding the multilevel technology dependencies that impact 5G adoption.
- Engage with CSPs to understand the different offers, deployment specifics and how these services integrate with your existing system.
- Leverage 5G to offer new applications such as AR/VR on mobile devices in the mass market to enhance your customer experience and brand advantage.
- Validate expected network performance by making sure that the underlying CSPs provide the coverage data for branch locations, frequencies used and expected throughput.

Sample Vendors

Baicells; Comba Telecom Systems Holdings; Ericsson; FiberHome Telecommunication Technologies; Huawei; Nokia; Qualcomm Technologies; Samsung Electronics; ZTE

Gartner Recommended Reading

Emerging Tech: 5G mmWave at a Crossroads

Magic Quadrant for 5G Network Infrastructure for Communications Service Providers

Communications Industry: 2023 Top Market Trends for CSP Tech Suppliers

Market Guide for 4G and 5G Private Mobile Networks

Quick Answer: What Vendor Product Leaders Need to Know About MWC Barcelona 2023

Data Middle Office

Analysis By: Fay Fei, Xingyu Gu

Benefit Rating: Moderate

Market Penetration: 5% to 20% of target audience

Maturity: Early mainstream

Definition:

Data middle office (DMO) is an organizational and technical practice that empowers users from different lines of business to efficiently use enterprise data to make decisions through a single source of truth. Think of building a data middle office as the way a company curates the composable and reusable data and analytics (D&A) capabilities that deliver distinct digital operations and connect them throughout the value chain via its technology stack.

Why This Is Important

Many companies in China adopt data middle office practices to reduce technology redundancy in their data and analytics architecture, bridge data silos across different systems, and drive reusable data and analytics capabilities.

Business Impact

Data middle offices optimize data utilization and eliminate D&A silos by:

- Triggering CIOs/D&A leaders to rethink how to build business-driven D&A with a composable architecture. Business users could access and utilize the enterprise's information resources with flexibility and agility.
- Redirecting organizations to leverage and complement the existing assets instead of rebuilding everything.
- Transforming the organization's project-oriented D&A initiatives into platform-oriented initiatives by continuously building up reusable data analysis capabilities.

Drivers

- The well-known success stories of the data middle office in some industries and organizations has made it a key project for digital transformation across a wide range of industries.
- The growing capabilities from local vendors, especially on metadata management, data integration and data preparation based on open-source technologies, will improve the practical implementation of the data middle office.
- It has been promoted by vendors and the market as the most advanced and holistic D&A platform and, thus, vital to all organizations.

Obstacles

- Data middle office has been diluted in the market since it fails to deliver its commitment to composable and agile D&A capabilities in many cases. Organizations that are not digital-native are not prepared to build reusable D&A capabilities within their own business context.
- The goal and the value proposition of DMO is often not clear, which leads to vague project scope. Business users underestimate the challenges involved in — and the resources required to — implement a data middle office. They subsequently face overwhelming obstacles in the process of cooperating with the implementation, making DMO seem like an impossible goal.
- DMO uses a “collecting” data management practice that moves the data into one place and lacks a “connecting” practice that links diverse data from different systems. This results in a long time to value and fails to react to the fast pace of changes.
- Instead of focusing on constant business outcomes, the traditional project delivery method focuses on the go-live time stamp, which cannot retain users and create sustainable value.
- Most of the organizations in China lack the data literacy to engage broader citizen data users with tools.

User Recommendations

- Switch the focus from the “data middle office” terminology itself to nurturing core data and analytics capabilities behind it.
- Establish an ongoing data literacy program, which is essential for the data middle office to act as a “force multiplier.”
- Use composable D&A (e.g., analytics packaged business capabilities and data fabric) as a guiding principle for the vision and architecture of data middle office.
- Define the reusability of data and analytics capabilities via business exploration by creating a hybrid organizational model that features a centralized team working with decentralized lines of business teams through the organization.

Sample Vendors

DEEPEXI; Kangaroo Cloud; Kejie; Mininglamp Technology; Shulan Technology; StartDT

Gartner Recommended Reading

Demystify Data Middle Office by Nurturing Core D&A Capabilities

Video: Demystifying the Data Middle Office

From Logical Data Warehouse to Data Fabric

Data and Analytics Essentials: Architect an Analytics Platform

Market Guide for Analytics Platforms, China

Edge Computing

Analysis By: Evan Zeng, Leo Li, Kevin Ji

Benefit Rating: High

Market Penetration: 20% to 50% of target audience

Maturity: Adolescent

Definition:

The edge computing market in China provides the hardware, software and services to extend agile digital capabilities to the edge, enabling lower latency and semiautonomous computing. It must connect seamlessly and enable compute capabilities where needed in the distributed computing value stream, from simple filtering to rich machine learning. Edge computing can be delivered as a service or through hardware and software deployed in the path of data flow at or near the edge.

Why This Is Important

The edge computing market is rapidly evolving as vendors in existing markets modify their offerings to support new requirements, and as new technologies and vendors fill gaps. Edge computing will complement the hyperscale public cloud. China is seeing increased building of edge facilities, including the rollout of the national 5G network. Edge computing will enable digital business scenarios requiring computation capabilities at locations closer to users, things and data, especially in utilities, energy, media and manufacturing.

Business Impact

Edge computing is mostly used in real-time processing scenarios (data or business functions) that are distributed to multiple physical locations to achieve planned business outcomes.

Drivers

Edge computing provides computing resources to complement cloud services. The drivers are diversified across the areas below:

- Vertical industries, such as utilities, energy, media and manufacturing
- Specific use cases, such as real-time data processing and function response
- Unique interactions, such as interactions between people, things and businesses
- Specific business improvements, such as improving the customer experience
- Operations improvements, such as factory automation

Many technology requirements for edge computing will span verticals. Requirements within enterprises will also extend from the customer-facing storefront edge to the factory edge, the smart-building edge and the workplace edge. This will increase requirements on holistic, horizontal processes and technologies to improve integration and security and reduce costs.

Obstacles

- The diversity of use cases leads to many solutions that are first-of-a-kinds or highly customized.
- There is a lack of compatibility between edge technologies and platforms.
- The lack of industrial standards for hardware and software is an obstacle that increases costs and creates technical silos.
- Network and edge computing infrastructures are highly integrated but hard to implement with limited enterprise delivery budgets. Chinese carriers have the privilege of building and operating foundational national network services and are achieving aggressive penetration in the edge computing market, but edge computing delivery capabilities are lacking. Cloud providers, in contrast, have strong edge computing solutions and delivery ecosystems.

User Recommendations

CIOs responsible for edge innovation should:

- Develop an edge strategy to support enterprise digital transformation by leveraging their cloud strategies and redeveloping them for edge scenarios.
- Identify initial edge use cases for their enterprises by focusing on real business outcomes. For example, the mining industry requires ultralow latency compute infrastructure on data analytics at the edge.
- Develop a plan to reskill IT teams with new edge skills, such as IT and operational technology (OT) convergence at the edge.
- Build a special team to focus on edge innovation. This can be a virtual or physical team. The team can work together regularly to build edge architecture, identify edge use cases, and create edge strategies, among other tasks related to edge innovation.

Sample Vendors

Alibaba Cloud; Amazon Web Services (AWS); China Mobile; China Telecom; China Unicom; Huawei; IEIT Systems; Microsoft; Tencent; Volcano Engine

Gartner Recommended Reading

Market Guide for Edge Computing

Building an Edge Computing Strategy

Top Practices for Building Edge Computing Solutions in China

AIOps in China

Analysis By: Leo Li, Kevin Ji

Benefit Rating: High

Market Penetration: 5% to 20% of target audience

Maturity: Emerging

Definition:

Artificial intelligence for IT operations (AIOps) involves (1) data and analytics tools leveraging general AI/machine learning (ML) to address IT operations; (2) IT operations tools applying AI components to monitoring and management; (3) AIOps platforms to augment, accelerate and automate manual efforts in event management.

Why This Is Important

Increased application/infrastructure complexity (e.g., running monolith and cloud-native in hybrid environments), and business value realization required by IT operation team (e.g., raising digital business operation efficiency by uplifting the IT operation incident resolution time and prediction), are raising AI to power IT monitoring tools. This is because it can meet these requirements, while providing capability from real-time monitoring to incident remediation.

Business Impact

- **Productivity:** By reducing alert fatigue through identification and correlation of related events so that operators can focus on fewer, more critical events.
- **Service availability and triage cost:** By reducing the time and effort required to identify both root causes and augmenting, accelerating or automating remediation.
- **Extracting value:** This results from increasingly large and complex volumes of monitoring telemetry, which are no longer possible manually.

Drivers

- **Increasing system integration complexity:** Large organizations in China use an increasingly complex mix of IT assets. They rely on highly integrated combinations of on-premises assets, cloud IaaS/PaaS providers and SaaS platforms, with different application architecture (monoliths, microservices, etc.) to deliver solutions.
- **Increasing monitoring/observability expectations from business view:** Investments and improvements in monitoring and the pursuit of observability are generating more data from more sources. Increasing demand and advances in monitoring trends, such as application performance management (APM) and digital experience monitoring (DEM), present operators with detailed views into their business applications and the end-user experience. The effective use of this additional data requires near-real-time analysis and rationalization with telemetry from related assets and services.
- **Demands for reliability:** There have been shifts in roles and responsibilities driven by modern operating models, such as DevOps and site reliability engineering (SRE), in the pursuit of greater availability and faster incident resolution. AIOps platforms enable agility by offloading some of the mechanical tasks of event triage, root cause analysis and solution identification. This accelerates response for common issues and frees up human creative capacity for novel events and business priorities.

Obstacles

- **Unrealistic expectations:** Clients struggle to separate claims of AI and magical automation from practical, achievable use cases. AIOps success demands clarity on capabilities and limitations of solutions.
- **Time to value impactful use cases:** AIOps platforms learn normal data ranges and patterns, and associate a solution with these patterns. This often depends on frequency of occurrence. Developing accurate detection models for rare events can take months.
- **The quality of the data:** AIOps initiatives require good data. Fragmented IT systems and siloed data will negatively affect analytics results, causing dissatisfaction.
- **The customized efforts on complex-project-based delivery:** Chinese enterprises always need scale, end-to-end and on-premises deployment with customization and integration initiatives. This can be costly for vendors/customers.
- **Chinese enterprises IT stack support:** IT stacks become more localized. Most AIOps vendors are starting to support China stack, but this will require time.

User Recommendations

- Validate AIOps pilot use cases to reveal value that might be missed when evaluating aggregate impact. This step will underpin a strategy, while scoping vendor landscape, clarifying telemetry requirements and separating hype from reality.
- Leverage AIOps features in monitoring tools, then layer an AIOps platform, if needed.
- Don't expect immediate, full "automation" from AIOps platforms. There's value in accelerating and augmenting human activity. These approaches often avoid probabilistic uncertainty, combined with automated change in production environments.
- Facilitate task automation, knowledge management and change analysis by selecting AIOps platforms that support bidirectional integration with IT service management (ITSM). Choose between domain-centric or agnostic AIOps by allowing the use case to determine the approach.
- Use domain-centric AIOps built into a monitoring tool for one-off use cases. Deploy domain-agnostic, stand-alone AIOps platforms with roadmaps for multiple use cases.

Sample Vendors

AsiaInfo; Bonree Data Technology; Canway; Cloudwise; EOITEK; IEIT Systems; LinkedSee; Netis Technologies; Sangfor; Tingyun

Gartner Recommended Reading

Market Guide for AIOps Platforms

Solution Criteria for AIOps Platforms

Infographic: Artificial Intelligence Use-Case Prism for AIOps

Demystifying XOps: DataOps, MLOps, ModelOps, AIOps and Platform Ops for AI

Quick Answer: What Are the Key Success Factors for I&O Leaders in China When Adopting an AIOps Platform?

Community Cloud

Analysis By: Leo Li

Benefit Rating: Moderate

Market Penetration: 20% to 50% of target audience

Maturity: Adolescent

Definition:

Community cloud, also called “multitenancy, dedicated cloud” in China, is a multitenant cloud which subscribers explicitly choose to share with a community of organizations, such as government agencies and large conglomerates. It is neither a fully public nor private model for a dedicated organization. Instead, it can be offered as an on-premises model for both customer or vendor with deep customization.

Why This Is Important

Enterprises in highly regulated industries (e.g., energy, finance and healthcare), state-owned enterprises (SOEs) and government agencies remain apprehensive of adopting critical data in the public cloud due to regulators’ concerns around data privacy, security and industry compliance. These enterprises and government agencies prefer industry-trusted community clouds based on a shared infrastructure pool with proper certification and/or permits.

Business Impact

In China, most community clouds are based on a shared infrastructure pool with industry- or enterprise-based limited tenancy and/or regulator-certified compliance. They reduce concerns around public cloud security and governance, while achieving smaller-scale cloud economics and experiences similar to public cloud. Industry-based ecosystems and offerings in a community cloud platform enable faster cloud adoption in targeted industries and/or enterprises.

Drivers

- Regulators in highly regulated industries embrace community cloud more than public cloud. For example, the People's Bank of China (PBC) is one of the top regulators in the financial services industry and its Fintech Development Plan (2022-2025).
- China-based large enterprises (e.g., SOE, state-owned companies) are concerned about public cloud security and governance while also wanting to achieve cloud benefits (e.g., agile). Additionally, the limited capabilities (e.g., PaaS) and complicated daily operation support (e.g., skills, roles, processes) of internal private clouds, also prevents it from being a first choice. Thus, community cloud (including but not limited to multitenancy, public-cloud-like, enterprise-own and dedicated) provides such benefits.
- The 14th 5-year plan's call for industry modernization, which is powered by cloud computing, is also raising the demand for adopting community cloud cross industry.

Obstacles

- The financial services industry is regulated by the PBC, China Securities Regulatory Commission (CSRC) and China Banking and Insurance Regulatory Commission (CBIRC). This challenges enterprises to find "one-stop" solutions that meet all the regulation requirements.
- Unlike public cloud's service (i.e., PaaS) operated by providers, community cloud in China is more like a co-team (provider and end user) operation which some enterprises that lack skill (e.g., PaaS operation), may bring service-level downgrades and not meet business demand risks.
- Community cloud is not a new offering but still at an early stage and without consensus understanding across providers and end users. This confuses enterprises during the business case study and expectation setup.
- Some enterprises using the community cloud are treating it the same as the public cloud. This can lead to business dissatisfaction, especially for enterprises that use the "cloud" for business agility and innovation since it provides limited capabilities compared with public cloud.

User Recommendations

CIOs from small and medium enterprises in highly regulated industries should:

- Choose public cloud over community cloud for workloads where innovation is the desired result while the environment is not under regulation limitation. This is because the public cloud's fast developing IaaS/PaaS capability and bigger ecosystem is improving innovation.
- Communicate closely with industry regulators about the progress of certified, industry-based community cloud providers.

CIOs from large enterprise in highly regulated industries should:

- Acknowledge regulators' guidelines on whether their industry can host industry-based production workloads in any public cloud.
- Adopt an enterprise-dedicated community cloud based on a shared infrastructure pool when private cloud does not meet their multitenancy requirements and public cloud does not meet their organizational requirements, which is a balance between regulation, efficiency and agile service delivery

Sample Vendors

Alibaba Cloud; CCB Technology; China Telecom; CIB Fintech; Huawei Cloud; Inspur; Tencent Cloud

Gartner Recommended Reading

Market Guide for Cloud Infrastructure and Platform Services, China

Industry Cloud Platforms Drive Chinese Enterprises to Reform Their On-Premises I&O Services Strategy

Climbing the Slope

SD-WAN

Analysis By: Evan Zeng

Benefit Rating: High

Market Penetration: More than 50% of target audience

Maturity: Early mainstream

Definition:

Software-defined wide-area network (SD-WAN) products replace traditional branch routers. They provide dynamic path selection based on application policy, management of appliances, VPN and zero-touch configuration. China has significantly different cost factors at WAN infrastructure services across different tiers of providers. By managing multiprovider WAN infrastructures, SD-WAN can deliver strong cost reduction benefits in China.

Why This Is Important

SD-WAN optimizes site availability, performance and agility for enterprise WANs, and is aligned with the broader shift of applications to public cloud workloads. SD-WAN improves the manageability of multiprovider WAN infrastructure, enabling the significant WAN cost reduction in China by adopting low-cost WAN services. Gartner sees high client demands for SD-WAN and inquiries about SD-WAN in China have been increasing, including from overseas clients with operations in China.

Business Impact

SD-WAN can significantly reduce capital and operational expenditure at the WAN edge (at least by 15%, if using SD-WAN to manage hybrid WAN or dual internet access architecture in China). It enables centralized WAN management to reduce operation overheads. SD-WAN consolidates different networking and security appliances at branches to one SD-WAN appliance. It also enables architectural change for WAN and secure access to distributed hosting workloads, which greatly enhance security posture.

Drivers

- The big price differences for internet access and WAN infrastructure between different providers in China push enterprises to adopt hybrid WAN and/or dual internet architecture, and they need SD-WAN as a tool to manage their WAN infrastructure.
- Enterprise cloud migration and/or internet-based workloads are driving the traffic pattern from branches to cloud, which boosts the SD-WAN adoption at branches to secure local internet breakouts.
- Centralized management, provisioning and automation of WAN appliances at headquarters and branches are increasingly important for enterprises.
- China is a telecom-regulated market where Chinese carriers are the dominant Tier 1 WAN services providers. All Tier 1 carriers and some Tier 2 network service providers have embraced SD-WAN technology by providing their own managed SD-WAN services.
- SD-WAN's automated and remote operation allows global enterprises an additional technology to address networking and security challenges for their China operations, apart from opportunistic cost optimization objectives.

Obstacles

- Enterprises' cloud migration is a driver for SD-WAN adoption. However, the lack of cloud governance skills in China slows down their cloud migration pace and is the obstacle for SD-WAN adoption.
- Most Chinese enterprises have not included WAN infrastructure into DevOps and automation projects, reducing the immediate need to adopt SD-WAN.
- Chinese carriers' significant discount on their traditional WAN services, such as Multiprotocol Label Switching (MPLS) networks, which can reduce the adoption of SD-WAN to manage hybrid WAN and dual internet access architecture.
- Enterprises' delay in refreshing their traditional WAN appliance due to the concerns of low economic growth outlook.

User Recommendations

- Reskill networking staff with SD-WAN and secure access service edge (SASE) knowledge for the potential upcoming adoption.

- Include network automation and orchestration into your enterprise DevOps pipelines, which can improve the awareness of SD-WAN in your enterprises.
- Review your current WAN architecture to use SD-WAN to manage hybrid WAN, local internet breakout at branches and remote sites, and/or dual internet access architecture to reduce cost and improve WAN agility.
- Select SD-WAN providers and ask their roadmap to support SASE services, which is one of the requirements to shortlist SD-WAN providers.

Sample Vendors

China Telecom; Huawei; InfoQuick; New H3C Technologies; Ruijie Networks; Sangfor Technologies

Gartner Recommended Reading

Emerging Tech: Leverage Cloud Connect Infrastructure to Improve Connectivity Experience of Cloud Workloads for SASE Solutions

Market Guide for Cloud Infrastructure and Platform Services, China

Magic Quadrant for SD-WAN

Critical Capabilities for SD-WAN

Appendixes

See the previous Hype Cycle: Hype Cycle for ICT in China, 2022

Hype Cycle Phases, Benefit Ratings and Maturity Levels

Table 2: Hype Cycle Phases

(Enlarged table in Appendix)

Phase	Definition
Innovation Trigger	A breakthrough, public demonstration, product launch or other event generates significant media and industry interest.
Peak of Inflated Expectations	During this phase of overenthusiasm and unrealistic projections, a flurry of well-publicized activity by technology leaders results in some successes — but more failures, as the innovation is pushed to its limits. The only enterprises making money are conference organizers and content publishers.
Trough of Disillusionment	Because the innovation does not live up to its overinflated expectations, it rapidly becomes unfashionable. Media interest wanes, except for a few cautionary tales.
Slope of Enlightenment	Focused experimentation and solid hard work by an increasingly diverse range of organizations lead to a true understanding of the innovation's applicability, risks and benefits. Commercial off-the-shelf methodologies and tools ease the development process.
Plateau of Productivity	The real-world benefits of the innovation are demonstrated and accepted. Tools and methodologies are increasingly stable as they enter their second and third generations. Growing numbers of organizations feel comfortable with the reduced level of risk; the rapid growth phase of adoption begins. Approximately 20% of the technology's target audience has adopted, or is adopting, the technology as it enters this phase.
Years to Mainstream Adoption	The time required for the innovation to reach the Plateau of Productivity.

Source: Gartner (July 2023)

Table 3: Benefit Ratings

Benefit Rating ↓	*Definition* ↓
Transformational	Enables new ways of doing business across industries that will result in major shifts in industry dynamics.
High	Enables new ways of performing horizontal or vertical processes that will result in significantly increased revenue or cost savings for an enterprise.
Moderate	Provides incremental improvements to established processes that will result in increased revenue or cost savings for an enterprise.
Low	Slightly improves processes (e.g., improved user experience) that will be difficult to translate into increased revenue or cost savings.

Source: Gartner (July 2023)

Table 4: Maturity Levels

(Enlarged table in Appendix)

Maturity Levels	Status	Products/Vendors
Embryonic	In labs	None
Emerging	Commercialization by vendors Pilots and deployments by industry leaders	First generation High price Much customization
Adolescent	Maturing technology capabilities and process understanding Uptake beyond early adopters	Second generation Less customization
Early mainstream	Proven technology Vendors, technology and adoption rapidly evolving	Third generation More out-of-box methodologies
Mature mainstream	Robust technology Not much evolution in vendors or technology	Several dominant vendors
Legacy	Not appropriate for new developments Cost of migration constraints replacement	Maintenance revenue focus
Obsolete	Rarely used	Used/resale market only

Source: Gartner (July 2023)

Evidence

[1] What Is Behind China's Dual Circulation Strategy, Bruegel

2023 Gartner CIO and Technology Executive Survey: This survey was conducted to help CIOs and technology executives overcome digital execution gaps by empowering and enabling an ecosystem of internal and external digital technology producers. It was conducted online from 2 May through 25 June 2022 among Gartner Executive Programs members and other CIOs. Qualified respondents are each the most senior IT leader (e.g., CIO) for their overall organization or some part of their organization (for example, a business unit or region). The total sample is 2,203 respondents, with representation from all geographies and industry sectors (public and private), including 75 from China. *Disclaimer: Results of this survey do not represent global findings or the market as a whole, but reflect the sentiments of the respondents and companies surveyed.*

Document Revision History

Hype Cycle for ICT in China, 2022 - 26 July 2022

Hype Cycle for ICT in China, 2021 - 13 July 2021

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Hype Cycle for ICT in China, 2019 - 29 July 2019

Hype Cycle for ICT in China, 2018 - 13 July 2018

Hype Cycle for ICT in China, 2017 - 21 July 2017

Hype Cycle for ICT in China, 2016 - 8 July 2016

Hype Cycle for ICT in China, 2015 - 16 July 2015

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Tool: Create Your Own Hype Cycle With Gartner's Hype Cycle Builder

What CIOs Need to Know About China in 2023

2023 Growth Agenda: A China Perspective

2022 CIO and Technology Executive Agenda: A China Perspective

Top Practices for Security Operations in China

Best Practices for Cloud Compliance in China

Best Practices for Public Cloud Adoption in China

Market Guide for DBMS, China

Table 1: Priority Matrix for ICT in China, 2023

Benefit ↓	*Years to Mainstream Adoption*			
	Less Than 2 Years ↓	*2 - 5 Years* ↓	*5 - 10 Years* ↓	*More Than 10 Years* ↓
Transformational		Generative AI Platform Engineering in China SASE	Industrial Internet National Data Exchange	
High	5G for China	Cloud-Native Computing in China Cloud Security in China DevOps Edge Computing Full Life Cycle API Management Homegrown AI Chips Hybrid Cloud in China Multicloud Robotic Process Automation SD-WAN Workforce Superapp for China	AIOps in China DBMS Self-Sufficiency	

Benefit ↓	*Years to Mainstream Adoption*			
	Less Than 2 Years ↓	***2 - 5 Years*** ↓	***5 - 10 Years*** ↓	***More Than 10 Years*** ↓
Moderate		Community Cloud Low-Code Application Platform	Confidential Computing IT Vendor Risk Management in China Sustainable Data Center in China	
Low				

Source: Gartner (July 2023)

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Source: Gartner (July 2023)