

China Summary Translation: 'Hype Cycle for ICT in China, 2019'

Published: 9 December 2019 ID: G00464176

Analyst(s): Kevin Ji

This Hype Cycle research analyzes the trends in information and communication technology in China, focusing on the impact, adoption pattern and maturity of 20 technologies.

中国语境

由于中美贸易摩擦等诸多原因，未来世界整体经济前景充满不确定，导致中国企业 2019 年 IT 投入趋于理性，很多全球化的推进也主要关注在一带一路沿线的国家和地区。Gartner 每年定期发布针对中国市场的技术成熟度曲线，分析在市场高度关注以及技术不断发展的背景下，各热门技术来到了什么位置，为企业 IT 管理者何时以及如何投资新技术提出建议，它可作为一种重要的技术评估工具。

在 2019 年的中国信息与通信技术 (ICT) 技术成熟度曲线中，Gartner 选择了 20 种目前市场关注度比较高的技术，特别是增加了量子计算、云分析工具和广域软件定义网络 (SD-WAN)。因为国家政策扶持，区块链技术未来在中国也会有很大的发展前景，Gartner 会有专门行业报告对其进行分析。而由于中美贸易摩擦，中美两国在技术使用与供应商选择方面的差异也会进一步加大。

Gartner 认为，2019 年人工智能 (AI)、机器人流程自动化 (RPA)、区块链与 5G 是 ICT 市场最为关注的技术。中国企业的首席信息官 (CIO) 可以关注报告中各项技术的成熟度并参照行业的适用度，选择合适的技术，以便在风险可控的前提下，提升 IT 能力，支持数字化转型需求。

本文介绍了中国 ICT 技术发展成熟度曲线，分析了目前各热门新兴技术在中国所处的位置，以及市场普及及预计所需要的时间，为中国企业 IT 领导者规划投资开发和新技术采用提供参考。

报告摘录

分析

技术成熟度曲线

2019 年 Gartner 中国 ICT 成熟度曲线旨在帮助 CIO 和技术提供商评估中国市场的新兴趋势和技术。为了维持可持续的经济增长，ICT 行业需要构建能力来支持这一趋势，特别是在满足终端用户需求和创造实际业务价值方面。

Gartner 发现，中国 ICT 市场中的大型企业乐于拥抱新的机会，愿意采用开源软件来推动 IT 能力转型。他们已经开始构建新的采购流程，利用初创技术公司来推动业务创新。

在基础设施领域，部署混合云而非单纯的私有云已经成为趋势。考虑到公有云在规模经济和业务工作负载创新方面的价值，Gartner 坚信越来越多的企业客户将会认识到公有云的重要性，以及它对于未来的必要性。Gartner 还注意到，人才短缺和安全与合规的顾虑是企业 IT 部门使用公有云基础设施即服务 (IaaS) 的最大挑战。

在应用领域，如何实现应用交付模式转型和提高敏捷性已成为最热门的话题，所涉领域包括持续集成 (CI) /持续交付 (CD)、微服务和容器。Gartner 将应用和基础设施相结合，利用 DevOps 来实现敏捷交付。根据 Gartner 的观察，交付模式转型的主要挑战是组织就绪度。另外，很多客户纷纷利用平台架构来重构应用，推动业务转型。但是，Gartner 观察到的这一方面成功用例目前并不多。

今年的技术成熟度曲线增加了四项新技术，它们在中国刚刚兴起或正受到热炒，处于技术萌芽期或期望膨胀期。这些技术包括 RPA 软件、SD-WAN 托管服务、云分析与商业智能 (ABI)、量子计算，它们将对中国 ICT 市场产生越来越大的影响。此外，本报告还将超融合集成系统更名为“超融合”。

同时，本报告移除了四种技术，这些技术或者在中国的发展速度和成熟度与全球发展一致，或者被纳入了中国智慧城市和可持续发展技术成熟度曲线中。

以下是该文件的英文版全文

Hype Cycle for ICT in China, 2019

K. Ji, R. Sheng

This Hype Cycle research analyzes the trends in information and communication technology in China, focusing on the impact, adoption pattern and maturity of 20 technologies.

Analysis

What You Need to Know

Large enterprises still insisted on investing in new technology to support digital business transformation despite U.S.-China trade tension. Compared with last year, the investment is more rational in 2019 and the go-abroad strategy is not as hot. Driven by these trends, the Chinese information and communication technology (ICT) industry is focused on building business with domestic, sustainable and innovative capabilities, especially in artificial intelligence (AI), 5G, data analytics, the cloud, robotics and semiconductors.

In the Chinese domestic market, enterprises are focused on new technology that drives operational efficiency such as software-defined infrastructure and automation area. Besides AI and machine learning, which are still hot areas, we introduce managed SD-WAN services and robotic process

automation software as new technologies in this Hype Cycle. In addition, we have added quantum computing.

In considering the China context, we selected 20 technologies. Enterprises can leverage this Hype Cycle to better understand the Hype Cycle position, user advice and possible business impact of the technologies they're interested in, which will help them decide where and when to invest. Technology vendors can also benefit from a better understanding of what public expectations are in the hot topic markets and the requirements of these new technologies to refine their go-to-market strategies.

The Hype Cycle

The Gartner Hype Cycle for ICT in China, 2019 is designed to help CIOs and technology providers evaluate emerging trends and technologies in the China market. In order to keep sustainable economic growth, the ICT industry needs to build its ability to support this trend, especially in addressing end-user demands and bringing real business value.

In the Chinese ICT market, we have observed that large enterprises welcome the opportunity to adopt open-source software to drive IT capability transformation. They've started to build new procurement processes to embrace startup tech companies for business innovation areas.

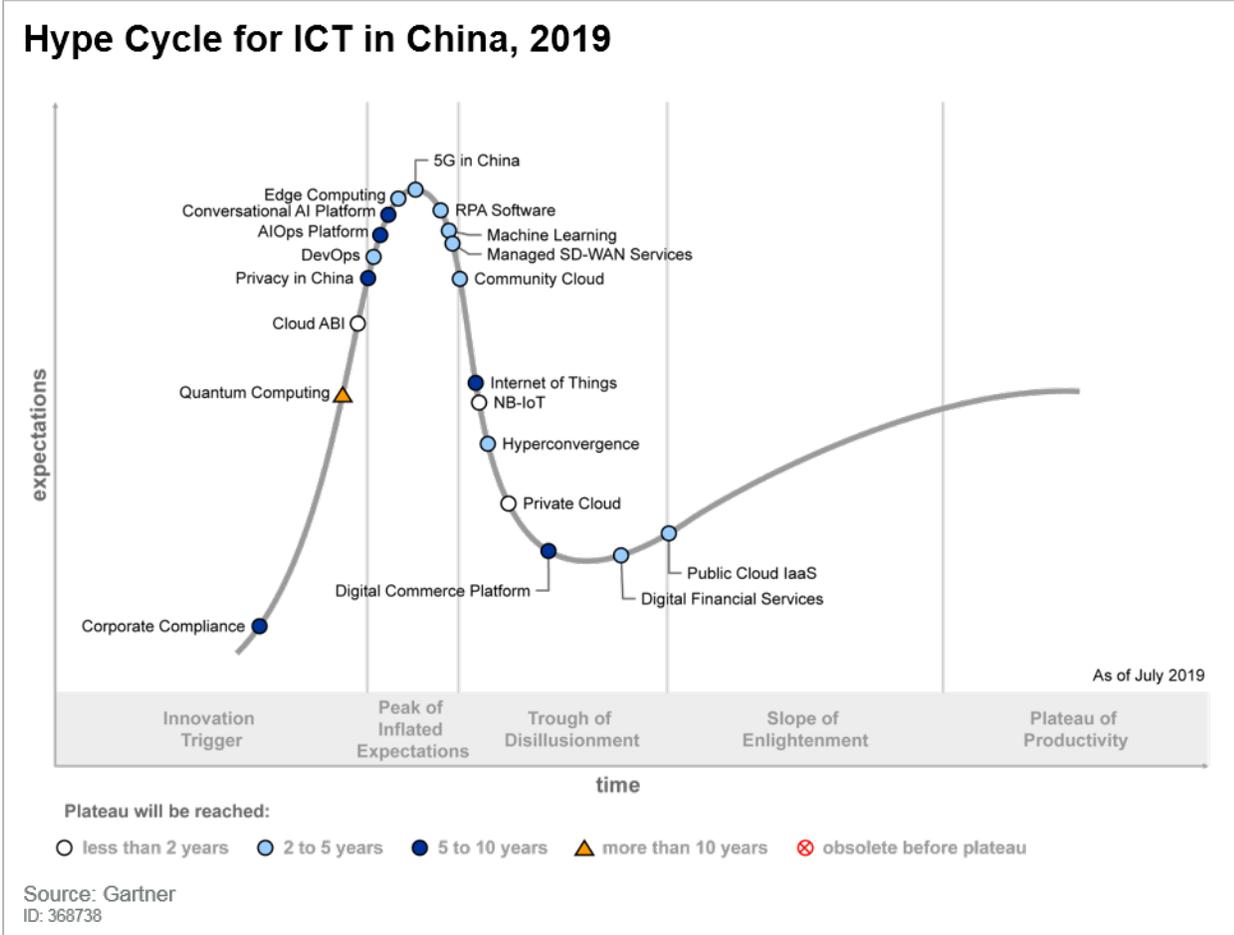
For the infrastructure area, rather than pure private cloud adoption, hybrid cloud is the trend of adoption. Given the value of public cloud in generating economies of scale and business workload innovation, we believe more and more enterprise clients will realize that the public cloud is very important and is inevitable in the future. We have noticed that talent gap and security concerns are the top challenges to enterprise IT organizations that want to use public cloud IaaS.

For the application area, to embrace agility, application delivery model transformation is very hot with topics including CI/CD, microservices and containers. We use DevOps to address agility delivery by combining application and infrastructure. Based on Gartner's observation, the main challenge in delivery model transformation is organizational readiness. In addition, many clients leverage a platform framework to rearchitect their applications to support business transformation. However, we have not observed many successful use cases at this moment.

In this Hype Cycle release, we have added four new technologies that are emerging or being hyped in China, specifically from the Innovation Trigger to the Peak of Inflated Expectations. These technologies — RPA software, managed SD-WAN services, cloud ABI and quantum computing — demonstrate increasing impact in the China ICT market. We have renamed hyperconverged integrated systems as "hyperconvergence."

We've also retired or suspended four technologies that are at the same speed and maturity as the worldwide situation or have been addressed by the Hype Cycle for Smart City and Sustainability in China.

Figure 1. Hype Cycle for ICT in China, 2019



The Priority Matrix

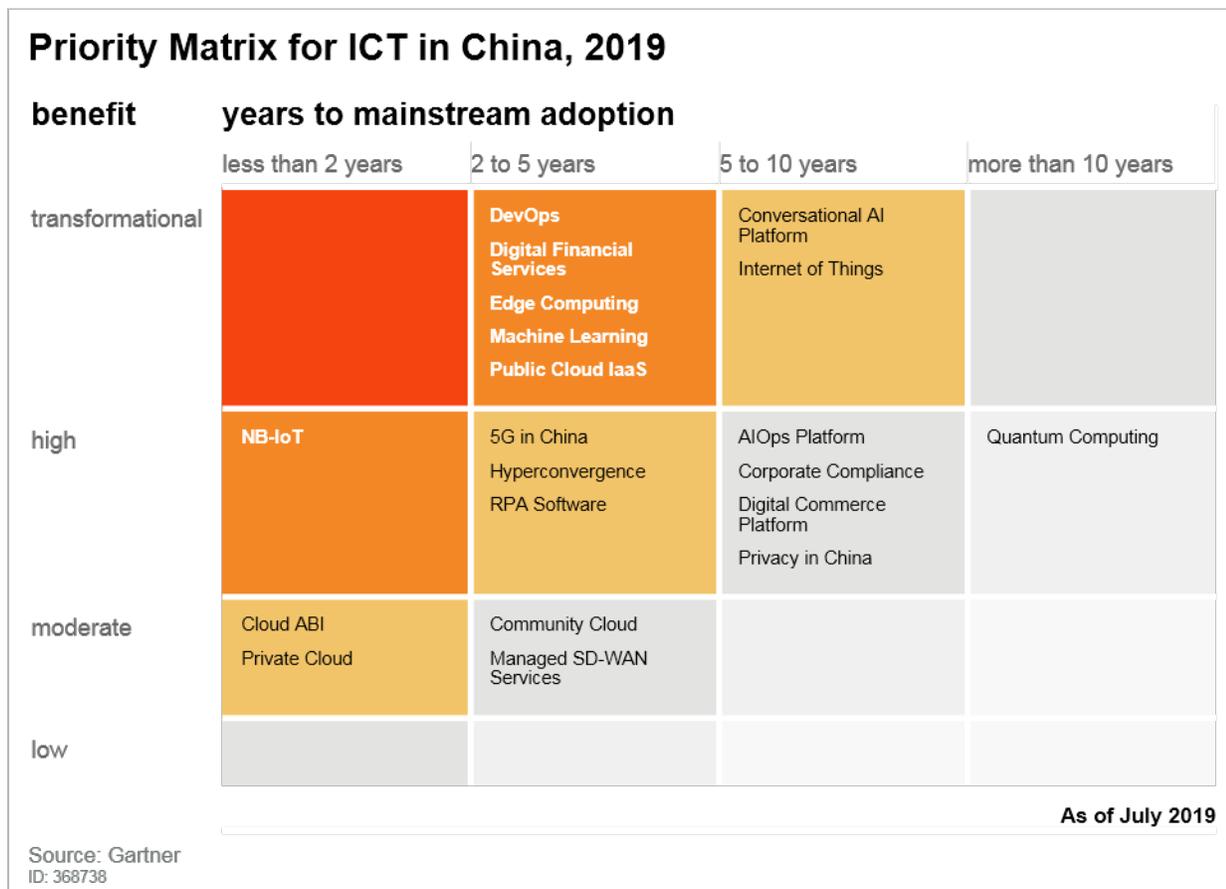
The Priority Matrix illustrates the relative benefits and likely adoption times of relevant technologies and services in China. Because of the technology selection criteria, the technologies in this year’s update have mainly been of transformational, high or moderate impact during a 10-year time frame. Of those, the following innovation profiles are introducing transformational benefits to cities:

- Machine learning, conversational AI platform and digital financial services are transformational. These initiatives are core functions used to enable the ecosystems needed to embrace extra business value, but the adoption risk is also high.
- Edge computing and Internet of Things are the extension of current platforms to drive a disruptive business case that contributes extra revenue.
- Public cloud IaaS and DevOps can enable transformational delivery models that drive more agile and innovative capability.

In this year’s Priority Matrix, under “years to mainstream adoption,” we moved community cloud to “moderate” from “high” benefit, and changed the years to mainstream adoption for 5G in China, NB-IoT and private cloud. This year, we added four new technologies:

- Quantum computing and RPA software in the “high” benefit category
- Cloud ABI and managed SD-WAN services in the “moderate” benefit category

Figure 2. Priority Matrix for ICT in China, 2019



Off the Hype Cycle

We have retired the following technologies from the Hype Cycle this year:

- Autonomous vehicles in China
- New-type smart city framework
- Unified endpoint management
- ARM servers

We dropped these technologies for one or more of these reasons. They:

- Are trending to align with worldwide adoption and maturity
- Have been moved to the Hype Cycle for Smart City and Sustainability in China
- Have become obsolete
- Were renamed
- Have merged with new technologies

On the Rise

Corporate Compliance

Analysis By: Jie Zhang; Sandy Shen

Definition: Corporate compliance via a formal management program provides the framework for standardizing compliance activities and lowering compliance risks. It enables a common enterprisewide approach to corporate compliance activities that most affect the regulatory oversight of corporate governance. It is a critical component supporting decision making and authority alignment under the supervision of the board of directors or senior management.

Position and Adoption Speed Justification: The position is not adjusted from 2018. China's regulatory body for corporate governance is still being developed. Existing regulations are uneven and sometimes under-developed among industries. This marks the main difference in corporate compliance practices between China and the mature economies. For example, the financial services sector is better defined in corporate governance and compliance; but not so extensive in other areas such as information and IP protection, consumer protection, product quality and labor law. China is working on a number of guidelines and policies related to cybersecurity and privacy. The design and implementation of China's Social Credit system is a part of the effort to increase the monitoring of corporate behaviors and improve compliance. The current trade dispute between China and the U.S. may add pressures on Chinese businesses that operate in the U.S. and other mature markets to formally adopt programs targeting corporate compliance and oversight.

Successful Chinese enterprises have not only taken the leadership position in the domestic market but also started their global expansions. Yet, these local companies have trailing practices in corporate compliance management especially related to information and IP protection and cross-regional compliance management. Some of the local companies have entered partnerships with global businesses or acquired assets from non-Chinese companies. For those, they need to educate themselves and expand corporate compliance to international or other regional and national, legal and regulatory standards.

Failures of compliance management incur financial fines, reputational damages and disciplinary sanctions. In the last few years, China is rapidly developing its compliance requirements on data protection and privacy management. This pushes the recognition of the importance of corporate compliance and fuses its adoptions too.

User Advice:

- Establish a body of corporate compliance oversight (CCO) to enable compliance ownership and charter a corporate compliance program
- Recognize the importance of corporate compliance and build it into your overall risk management practice
- Include policy development, continuous monitoring and case management into the core activities of a corporate compliance program which links to the overall corporate governance (such as audit, legal, entity management)
- Leverage regulatory content and service providers for the most up-to-date compliance requirements
- Invest in corporate compliance and oversight technologies to automate compliance management

Business Impact: Corporate compliance management is a part of risk management. It links to audit both internally and externally. It facilitates effective responses to investigative cases launched by auditors or regulators. Without a corporate compliance management program, businesses rely on random effort to fulfill compliance obligations. When managed properly and sufficiently, corporate compliance programs can reduce various risks that are essential to business success such as operational, reputational and legal risks. Successful corporate compliance leads to better corporate governance. In turn, this increases trust of customers and partners. Increased maturity on corporate compliance frees businesses to focus on new market opportunities and innovations.

Benefit Rating: High

Market Penetration: 1% to 5% of target audience

Maturity: Embryonic

Sample Vendors: Refinitiv; SAI Global; Wolters Kluwer

Recommended Reading: “Market Guide for Corporate Compliance and Oversight Solutions”

“China’s Data Privacy Standard Unfolds Measures for Its Cybersecurity Law”

Quantum Computing

Analysis By: Owen Chen; Venecia Liu

Definition: Quantum computing is a type of nonclassical computing that operates on the quantum state of subatomic objects. The particles represent information as elements denoted as quantum bits (qubits). A qubit can hold all possible results simultaneously (superposition) until read. Qubits can be linked with other qubits, a property known as entanglement. Quantum algorithms manipulate linked qubits in their undetermined, entangled state. The qubits resolve to the solution when read.

Position and Adoption Speed Justification: There are various research and development areas of quantum computing technologies. These range from semiconductor quantum computing and qubit chips to the quantum annealing process, control and readout of qubits, fault-tolerant quantum computing, entanglements of qubits, quantum cryptography, quantum optics, quantum communications, and intersections of AI and quantum computing. China's developments of quantum computing have been recognized in quantum communications after secure satellite communications were conducted in 2017. Quantum computing chips are more advanced in the U.S. than in China, so the position of this profile is lower on the Hype Cycle curve. There is much recent interest around quantum computing, and China has been applying for patents around application areas of quantum computing.

Quantum computing technology continues to attract significant funding. Additionally, a great deal of research is underway at universities like the University of Science and Technology of China, institutes like the Chinese Academy of Sciences, and corporate labs like Alibaba Group, Tencent, Baidu and Huawei. China also plans to open a National Laboratory for Quantum Information Science in 2020.

User Advice: In the short term, commercial use of quantum computing will be dedicated to solving a narrow, but important, class of problems. Several auto and aviation manufacturers and transport agencies are testing quantum computing in dedicated quantum acceleration engines for route optimization and traffic analysis. Other applications include image analysis, biochemistry and drug discovery, materials science, and code breaking (as prime number factoring). Several vendors are offering cloud-based quantum computing or quantum as a service (QaaS). Avoid buying a quantum computer for on-premises deployment given the cost and ROI for exploration.

Quantum computers, in the distant future, will compromise today's cryptographic key exchange protocols. Quantum safe cryptography is emerging, implemented in software, and should be a medium-term strategic initiative for organizations where data must be protected over decades.

CIOs can explore the benefits of faster computational power of quantum computing by either choosing QaaS or working with vendors in your interested use case or application area.

Business Impact: Quantum computing is nascent and is not a general-purpose computing solution.

Quantum computing could have a huge effect, especially in areas such as optimization, machine learning, cryptography, DNA and other forms of molecular modeling, large database access, encryption, stress analysis for mechanical systems, pattern matching, image analysis and (possibly) weather forecasting. Analytics is likely to be a primary driver as the technology becomes useful, but this is outside the planning horizon of most enterprises.

Benefit Rating: High

Market Penetration: Less than 1% of target audience

Maturity: Embryonic

Sample Vendors: Alibaba Group; Baidu; Huawei; Tencent

Recommended Reading: “Top 10 Strategic Technology Trends for 2019: Quantum Computing”

Cloud ABI

Analysis By: Julian Sun

Definition: Analytics and business intelligence (ABI) platform as a service — aka cloud ABI — delivers analytics capabilities and tools as a service. Solutions are often architected with integrated information management and business analytics stacks. These comprise database, integration capabilities and business analytics tools — or solutions that include only business analytics tools (to produce reports and dashboards, for example). Most leverage autonomous, cloud-based data repositories, but some can query on-premises data repositories directly.

Position and Adoption Speed Justification: Most organizations have either already deployed their ABI platforms in the cloud, or plan to do so. Cloud ABI or web-based analytics are the most natural ways for organizations in China to start and scale their analytics effort. Low data literacy levels in general do not allow centralized IT or BI teams to open too many self-service capabilities — such as direct data queries on data warehouses by decentralized teams. Embedded analytics as a service helps traditional information portals to evolve into an analytics workbench, which lets users go beyond regular reporting. The major obstacle is that business users are not highly involved in the analytics pipeline. Analytics solutions such as Quick BI (which relies on Alibaba Cloud) and other local analytics solution in general, are bringing organizations in China to the cloud and web-based BI solution is the mainstream.

User Advice: Organizations usually overinvest in planning on data management, rather than analytics initiatives. However, data management is a continual and iterative project because of the growing volumes and types of data. Modern ABI solutions provide built-in memory engines to establish a light analytics hub that lets business users get started quickly. To move this type of analytics capability to the cloud can empower the masses and achieve a quick win. The more data gravitates to the cloud as time goes by, the more value organizations can get if they plan to adopt analytics earlier. The analytics ecosystem in China is growing with more megavendors such as Alibaba, Tencent and NetEase moving into the space. This should make it easier for IT departments to ease the burden on integration. Hybrid solutions that combine on-premises and cloud, or multicloud implementations, should be seen the best-of-breed solution.

Recommendations:

- Use the vertical strength of local vendors to build analytics solution.
- Complement existing technology portfolios with innovative Cloud ABI offerings.
- Use cloud ABI to pilot packaged analytics in your current information portal (such as visual interaction) to improve data literacy.
- Provide self-service capabilities based on the integration between cloud ABI deployment and governed data sources.

- Embed cloud ABI in business processes to bring fast value to everyday tasks (such as email).

Business Impact: The lack of analytics skills continues to be a major concern for China-based organizations that want to be data-driven. Business users need to participate in analytics rather than just using data passively.

A cloud-based analytics and BI solution provides three approaches that improve how organizations can:

- **Get faster insights:** The interactive visualization that comes with cloud ABI goes beyond static reports, and provides more obvious insights. Users with higher data literacy can start from the first interaction to deliver their own analysis in a familiar, browser-based environment.
- **Improve business and IT feedback:** While IT provides just enough analytics capability to service to business users, when cloud ABI is integrated into existing systems it provides an environment that allows business users to give feedback on how to evolve the organization's data capabilities. This agility could encourage better data management and sharing in the analytics value chain.
- **Increase cross-team collaboration:** Groups of teams can use existing initiatives to develop and share best practice, and explore and prototype their own use cases in the cloud.

Benefit Rating: Moderate

Market Penetration: More than 50% of target audience

Maturity: Early mainstream

Sample Vendors: Alibaba Cloud; Amazon QuickSight; FineBI; Microsoft; NetEase; SAP; SAP Analytics Cloud; Tableau Software; Yonghong Tech

Recommended Reading: "Hype Cycle for Analytics and Business Intelligence, 2018"

Privacy in China

Analysis By: Jie Zhang

Definition: Privacy in China is preserved by a national standard for privacy, a cybersecurity law and is enforced by regulations. Personal information for Chinese citizens is defined to include two categories: general and sensitive. The Privacy Standard and the Chinese Cybersecurity Law outlined special data protection practices on both types of personal information. For example, locally storing private data collected in China or data localization is a mandate.

Position and Adoption Speed Justification: The position is adjusted from 2018 as the drivers for hype continue to exist. The rapid adoption of digital business in China (especially mobile payment, online shopping, and news and information content platform) continue to add risks for personal data to be hacked or mishandled. The overall trailing privacy practice in society, fraud activities, excessive data collecting and trading, etc., have driven Chinese lawmakers and regulators to establish guardrails for protecting its citizens' privacy. The government established its first Privacy

Standard in May 2018, enacted the first Cybersecurity Law in June 2017 and subsequently drafted a regulation on cross-border data transfers. In early 2019, China also finalized its “Guidelines for Internet Personal Information Security Protection” offering additional detailed privacy requirements. These guardrails have a direct impact on how both global and local businesses operate in China. Reactions to Chinese privacy-related topics peaked immediately after the enactment of the law (demonstrated by media and business interest, and Gartner client interactions). Cases of severe penalties have been reported on [mishandling](#) or [insufficient protection](#) of personal information since these privacy management requirements have been effective. The clarity provided by the Privacy Standard and the higher pressure on the enforcement of compliance have created urgencies on business to pay attention to privacy management. However, it will take time for the overall (lack of) privacy culture and laws to mature.

User Advice: Security and risk management leaders should:

- Classify and map data between operations in China and other corporate locations, as it is the necessary first step to prepare for data localization.
- Incorporate a privacy assessment for the Chinese privacy standard in enterprise information governance by treating it as a parallel, but complementary, effort to General Data Protection Regulation (GDPR) and other privacy compliance requirements.
- Continuously monitor the development of future guidelines relevant to privacy by working with legal experts that specialize in the Chinese market with strong privacy practices.
- Treat the Chinese Privacy Standard within the context of the Chinese Cybersecurity Law as privacy requirement is not only an integral part of the law but also guided and enforced by the law in reality.
- Separate data protection and retention for China operations from global information governance as local privacy rules could often be enforced differently from other regions.

Business Impact: Defining and addressing privacy compliance needs support business goals and market access especially for businesses in highly regulated sectors such as financial services or multinational operations expanding in China. Therefore, global business leaders need to rethink their market growth strategy. Additional investment is necessary, or a path of China market strategy is needed as potentially the privacy risks outweigh business benefits; because costs for new IT infrastructure, application architecture, data management and skills will rise. Although the central government and industry-specific agencies continue working on defining details on privacy requirements, compliance risks and potential penalties for violations in China are real and can be significant. For businesses serving the China market, privacy leaders need to consider inserting new roles, controls and policies to manage Chinese privacy requirements. Near-term privacy management changes from various Chinese authorities (i.e., industry-specific agencies) are also expected. Therefore, privacy in China has an ongoing impact on monitoring and security audit/assessment as well.

Benefit Rating: High

Market Penetration: 1% to 5% of target audience

Maturity: Adolescent

Sample Vendors: BigID; Nymity; OneTrust; SAP

Recommended Reading: “China’s Data Privacy Standard Unfolds Measures for Its Cybersecurity Law”

“Security Assessment Becomes Prerequisite for Transmitting Data Out of China”

“Address Chinese Cybersecurity Law With This Playbook”

At the Peak

DevOps

Analysis By: Manjunath Bhat; Kevin Ji

Definition: DevOps is a customer-value-driven approach to deliver solutions using agile methods, collaboration and automation. It emphasizes people and culture to improve collaboration between development, operations and other stakeholders to navigate uncertainty and accelerate the delivery of customer value. DevOps implementations use architecture and tools to improve the flow of work.

Position and Adoption Speed Justification: Gartner has seen a 50% YoY increase in the number of DevOps inquiries from China. The nature of inquiries has changed from seeking to understand what DevOps is to now ensure that organizations have the right culture, practices and tools in place to realize value from DevOps initiatives. Most organizations in China differ from their counterparts in the western markets in their approach to DevOps in that DevOps is often confused as being synonymous with automation or adoption of modern cloud-native technologies such as containers, microservices or software-defined infrastructure. DevOps thus becomes a technology-first discussion with the focus primarily on enabling faster delivery using CI/CD.

Organizations in China have traditionally had rigid hierarchies and organizational structure that defined their day-to-day operational work. So, a cultural transformation that requires aligning business, dev., QA, security and operations teams using a product line operating model is seen as very disruptive. On the other hand, Organizations in China have been ahead of their western counterparts in their approach to rapid experimentation even when they did not explicitly refer to it as being “agile.” The startups and digital native companies in China adopt a culture of “fail-fast,” “fail-early” that is at the heart of DevOps — this culture is now starting to influence the more traditional companies in existing verticals such as manufacturing, BFSI, utilities and government agencies.

The rapid digital transformation in the country has led to organizations adopting open source technologies in a big way. However, a dearth of open-source skills and talent poses an immediate challenge. Adopting open-source technologies, such as Docker, Kubernetes, Jenkins, Chef, Ansible or the Elastic Stack (monitoring), requires modernizing legacy applications and this is where the talent shortage becomes acute.

Gartner sees DevOps initiatives in China align with the broader adoption of cloud services (private/public), microservices and the shift from project to a product line operating model.

User Advice: Successful adoption of DevOps and agile development methodology require an organizational cultural and philosophy shift, which is not easy to change, particularly in China as organizations tend to have rigid organizational structures.

Establish an adaptive and responsive culture by selecting DevOps leaders with a team-oriented mindset focused on enabling collaborative learning teams with shared goals and responsibilities.

Create an open-source talent pool by hiring and training individuals in open-source technologies and behaviors, such as community mindset and continuous learning. Automate open-source governance by implementing software composition analysis (SCA) and binary repository tools for security and license compliance.

Select personal focus areas from the following: agile practices, automation, cloud operations, platform operations and service delivery. Determine the specific platforms, providers and tools used in your focus areas, and start experimenting and training with them to gain familiarity. Learn coding and software deployment skills. Formalize a personal skills development plan to bridge gaps in knowledge, based on your target role and focus areas. Request time and budget to train and practice on key tools.

Establish dedicated platform teams by recruiting diversified subject matter experts (SMEs) who will promote agility and responsiveness to product teams. Redefine the platform as a set of products that continuously evolves to fulfill developer needs by building a collaborative product mindset.

Business Impact: DevOps initiatives must begin with identifying the business justification. Placing customer value at the core of DevOps results in driving right behaviors. DevOps teams must focus on customer business outcomes, rather than their own individual metrics. The success of the team and of every individual is assessed by the degree to which the business metrics, business process requirements and customer needs are being met.

Faster cycles times and realization of business value are the most frequent organizational outcomes from DevOps. Organizations must not use cost reduction as the primary driver for DevOps — costs will indirectly reduce due to improvement in process efficiency, collaboration and automation. However, starting with reducing costs will be counter-productive. Organizations can expect an increase in initial costs due to reskilling and retooling of processes.

Gartner views DevOps as transformational because it accelerates an organization's journey to digital business. DevOps invariably brings IT closer to business and the customer due to rapid feedback loops and closer collaboration thus enabling faster shortening the time an idea takes to go from inception to realization.

As a consequence, Gartner expects the emergence of DevOps toolchain providers that specifically address the unique needs of the China market in 2020 and beyond.

Benefit Rating: Transformational

Market Penetration: 5% to 20% of target audience

Maturity: Adolescent

Sample Vendors: Atlassian; CloudBees; Datadog; FOSSID; Octopus Deploy; Red Hat; Selenium; Snyk; Splunk

Recommended Reading: “How to Navigate Your DevOps Journey”

“Adopt an Iterative Approach to Drive DevOps Success in Large Organizations”

“Three Ways Midsize Enterprises Can Maximize Value From DevOps”

“Four Steps to Adopt Open-Source Software as Part of the DevOps Toolchain”

“DevOps Success Requires Shift-Right Testing in Production”

“Avoid Failure by Developing a Toolchain That Enables DevOps”

“How to Scale DevOps by Building Platform Teams”

“Top SRE Practices Needed by Teams Scaling DevOps”

AIOps Platform

Analysis By: Peter Liu; Kevin Ji

Definition: Artificial intelligence for IT operations (AIOps) platforms combine big data, AI/machine learning and other technologies to support all primary IT operations functions with proactive, personal and dynamic insight. AIOps platforms enable the concurrent use of multiple data sources, data collection methods, analytical technologies (real-time and deep) and presentation technologies.

Position and Adoption Speed Justification: Growing demand for AIOps platform capabilities is fueled by the need to automate more and more IT operations functions as roles and responsibilities converge (with DevOps as a leading example) in the pursuit of greater agility. These IT operations functions include data-at-rest (aka historical) and data-in-motion (aka real-time) data analysis. This required degree of automation necessitates continuous insights derived from machine learning algorithms based on data-generated ITOM disciplines, such as APM, ITIM, NPMD, DEM and service management.

Adoption of AIOps platforms — in particular, machine data, event, telemetry and log-management-oriented tools — continues to rise in support of monitoring and root cause analysis efforts. This is due to their ability to rapidly perform and support highly complex diagnostic tasks across multiple domains.

Interest and investment in AIOps platform technologies in China will continue to grow due to:

- Growing demand for increasingly proactive IT operations

- The speed, scale and complexity resulting from multicloud and hybrid cloud and digitization stress traditional rule-based performance monitoring and management
- Rising data diversity, cost optimization goals and quality expectations
- Continued data growth, dynamism and related complexity in IT operations
- Requirements for autonomous governance (part of adaptive governance) to enable business sustainability

Similar to AIOps adoption worldwide, adoption in China is tempered by broad “analytics” market confusion, intentional obfuscation by vendors and the rising costs associated with ever-increasing data volumes. In addition, China faces its own challenges in AIOps adoption. For example, the majority of vendors in China take a modular approach rather than a platform-centric approach. This requires users to supplement capabilities with data ingestion technology, which most users lack. In addition, due to regulations, heterogeneous system architectures, skill sets and cultural issues, CIOs in China are able to achieve only a small portion of AIOps, such as monitoring and analytics.

The following trends are emerging in this space:

- Vendors outside the AIOps market, including APM solution providers, are expanding into the AIOps market in hopes of broadening their market opportunity.
- AIOps solutions are beginning to offer capabilities to triage problems and direct their resolution via integration with run book automation and application release orchestration (ARO) tools.
- Some vendors are pursuing an “open box” approach, allowing the algorithms to be accessible for user modification, while the majority of vendors are pursuing a “closed box” approach, disallowing user interaction.

User Advice: I&O leaders must build and implement a strategic AIOps platform investment plan that supports multiple, major IT operations functions (such as performance analysis, experience management and delivery automation) and incorporates:

- Prioritization of high-value use cases across all IT operations management
- Inventory of existing skills and tooling capabilities across all IT operations management
- Incentive and organizational changes to drive collaboration between the operations team and data science team
- Leveraging of existing AIOps platforms so the focus can shift toward data sources and the presentation layer
- Development of an AIOps strategy with an eye on (1) balancing ease of implementation/use with interchangeability of platform capabilities; (2) IT operations management tool portfolio rationalization; and (3) key technology gap investment
- Staged implementation of AIOps capabilities

An architected AIOps strategy can serve as a useful mechanism for focusing both skills and tooling investments on an ongoing basis. Enterprises that already have various AIOps platforms in the form of stand-alone products or as capabilities in domain-centric tooling must routinely audit their capabilities. Few I&O teams have the skills or vision needed to take full advantage of all the capabilities of the AIOps platforms they already have. Organizations that are able to take advantage of these capabilities rarely have incentives in place to share and grow the necessary skills; thus, both areas should be addressed as soon as possible.

Business Impact: By enabling I&O teams to enhance and transform major operational functions with a real, automated insight generation capability, organizations across all verticals stand to realize:

- **Agility and productivity gains** via active analysis of both IT and business data, yielding new insights on user interaction, business activity and supporting IT system behavior.
- **Service improvement and cost reduction** via a significant reduction of time and effort required to identify the root cause of availability and performance issues. Behavior-prediction-informed forecasting can support resource optimization efforts.
- **Risk mitigation** via active analysis of monitoring, configuration and service desk data identifying anomalies from both operations and security perspectives.
- **Competitive differentiation/disruption** via superior responsiveness to market and end-user demand based on machine-based analysis of shifts, beyond those that are immediately obvious to human interpretation.

Benefit Rating: High

Market Penetration: 5% to 20% of target audience

Maturity: Emerging

Sample Vendors: Alibaba Cloud; AsialInfo; Baidu; BigPanda; CloudChef; Cloudwise; EOITek; Huawei; LinkedSee; Tingyun

Recommended Reading: “Market Guide for AIOps Platforms”

“Use AIOps for a Data-Driven Approach to Improve Insights From IT Operations Monitoring Tools”

“Predicts 2019: IT Operations”

Conversational AI Platform

Analysis By: Tracy Tsai; Adrian Lee

Definition: Conversational AI platforms can be used by developers to build conversational user interfaces, chatbots and virtual assistants for a variety of use cases. They offer integration into chat interfaces such as messaging platforms, social media, SMS, websites or similar. A conversational platform has a developer API so third parties can extend the platform with their own customizations.

Position and Adoption Speed Justification: Conversational platforms in China were initially used for messaging-style chatbots, which are mostly rule-based. However, the use of conversational platforms is rapidly evolving to handle more complex customer-experience-oriented tasks such as customer service, digital commerce and travel booking — moving from pure tech deployment to refining customer experiences and cost reduction. The rule-based approach is only suited to linear or noncomplex customer interactions. Currently, the approach is shifted toward natural language understanding (NLU) using recurrent neural networks (RNN), generative adversarial networks (GANs) or specific long- or short-term memory RNNs as an example to better understand users' intent. In addition to NLU, localized relevant content, domain knowledge graphs and business logic for dialogue management are critical to support a conversational platform. Most Chinese speech-to-text (STT) vendors such as Baidu, Alibaba Group (AliGenie) and iFLYTEK can support multiple Chinese dialects and accents. However, the mature use cases of STT are more limited to “command” type applications, such as in virtual personal assistants or smart speakers. Chinese natural language processing (NLP)-based conversational platforms will require at least five to 10 years to mature as NLU, domain knowledge graphs and algorithmic training models based on localized languages will need time.

User Advice: Enterprise architecture and technology innovation leaders planning to deploy conversational platforms should consider the following factors in evaluating and selecting vendors:

- Identify your business objectives and what kind of incremental value conversational platforms will bring to support the organization's objectives.
- Collaborate with line-of-business stakeholders on how to scope your conversational platform's requirements, features and experiences.
- State your requirements during preliminary vendor qualification to ensure that Automatic Speech Recognition (ASR), STT, Text to Speech (TTS), NLP, domain knowledge graphs and ease of use are offered. Only STT and keyword-/rule-based NLP do not provide natural conversational experiences.
- Request vendors to provide inference model for testing at least 30 or up to 90 days with your own company data. Each model needs to be trained and optimized with the new set of data.
- Be prepared to change to or add new providers of conversational platform applications. Ensure the datasets and business logic can be retrained and transferred seamlessly to the next vendor.

Business Impact: The initial business value of a conversational AI (CAI) platform for enterprises was to improve customer experience. Other benefits came from improving operational efficiency via cost reduction in call centers or increase in sales transactions. The NLP-based CAI allows enterprises to maintain and improve the conversational AI applications more effectively than rule-based and keywords search approach. Gartner has observed an increase in the number of inquiries regarding conversational AI platforms to support enterprise employees and improve productivity in China. Finally, there are new revenue models created by voice-enabled conversational commerce through retail apps, smart speakers or home appliances. Voice-enabled conversational platforms remain elusive in most use cases, especially for virtual assistants, as consumer questions are too unstructured and generalized. In addition, the lack of relevant services to support revenue-

generating use cases is another issue. Chinese enterprises cannot delay the deployment of conversational platforms for customers or employees or face the risk of losing their brand relevance to customers, as well as operational competitiveness.

Benefit Rating: Transformational

Market Penetration: 5% to 20% of target audience

Maturity: Adolescent

Sample Vendors: AISpeech; Alibaba Group; Baidu; Emotibot Technology; iFLYTEK; IBM; Microsoft; Tencent; Zhuiyi Technology

Recommended Reading: “Market Guide for Conversational Artificial Intelligence in China”

Edge Computing

Analysis By: Evan Zeng; Kevin Ji

Definition: Edge computing describes a distributed computing topology where information processing is placed close to the things or people that produce and/or consume that information. Edge computing is used to keep traffic and processing at network edge and off the centralized cloud or data centers.

Position and Adoption Speed Justification: Most of the technology for creating the physical and virtual infrastructure of edge computing is readily available, but widespread application of the topology and viable business cases are not yet developed materially in China. Also, 5G infrastructure development has been accelerating in China, and major Chinese carriers have their plans to rollout multiaccess edge computing infrastructure. But these are all still under construction and are not yet used for any commercial services.

There are some use cases proliferate, such as those in the IoT domain for the edge as a topological design pattern to support IoT applications and those in mobile gaming domain to leverage the multiaccess edge infrastructure to offload intensive computing tasks and build low-latency features to enhance gamer experience. Application, data, infrastructure systems and security will need to be stretched to include edge locations and edge-function-specific technologies such as data thinning, software defined perimeter, video compression and edge analytics, etc.

User Advice: By far, IoT contributes most use cases for edge computing with IoT applications requiring edge infrastructure to provide near-real-time interactions between people and/or things and reduce network cost for data transmission. However, much more use cases outside of IoT domain are fast developing, such as mobile gaming, ultra-low or low latency applications such as Virtual Reality/Augmented Reality/Mix Reality applications and high accuracy remote operation.

I&O leaders responsible for planning and enabling infrastructure delivery should:

- Address emerging digital business requirements by not only including edge computing as a part of your infrastructure strategy but also defining your edge requirements.

- Prepare in-house skill sets for edge computing by identifying skill and organizational gaps.
- Investigate your technologic architectural gaps such as security, network and management in adopting edge computing.
- Plan your pilot use cases of adopting edge computing by starting with well approved business cases such as preventative maintenance in manufacturing industry to accumulate development and operational expertise.
- Keep an eye on 5G network development in China and include multiaccess edge computing into your planning of adoption on edge computing.

Business Impact: Edge computing solves some pressing issues such as unnecessary WAN costs and unacceptable latency. It also enables ultra-low latency application scenario that requires less than 10 ms latency from things to edge infrastructure, such as autonomous driving. The edge computing topology will enable the specifics of digital business and IT solutions uniquely well in the near future.

Benefit Rating: Transformational

Market Penetration: 5% to 20% of target audience

Maturity: Adolescent

Sample Vendors: Alibaba Cloud; Amazon Web Services; Baidu; China Mobile; China Telecom; China Unicom; Huawei; Tencent Cloud

Recommended Reading: “Market Guide for Cloud Infrastructure as a Service, China”

“Market Guide for Edge Computing Solutions for Industrial IoT”

“Exploring the Edge: 12 Frontiers of Edge Computing”

5G in China

Analysis By: Peter Liu

Definition: 5G is the next-generation cellular standard after 4G (LTE, LTE-A and LTE-A Pro). It has been defined across several global standards bodies — International Telecommunication Union (ITU), 3GPP and ETSI. The official ITU specification, International Mobile Telecommunications-2020 (IMT-2020 Standard), targets maximum downlink and uplink throughputs of 20 Gbps and 10 Gbps, respectively, latency below 5 milliseconds, and massive scalability. New system architecture includes core network slicing, as well as edge computing.

Position and Adoption Speed Justification: According to [GSA](#), as of April 2019, 39 operators have announced a 5G technology in their network. This is less than 5% of mobile networks (excluding MVNOs and subbrands) and includes both 3GPP-compliant and noncompliant technology. Fifteen have launched FWA.

The 3GPP's Release 15 was frozen on June 2018, with commercial network infrastructure based on the earlier New Radio (NR) specification launched by the end of 2018. NR allows CSPs to launch 5G with only new radio access network (RAN) deployments, leaving the existing core intact. 5G core and edge topology also need to be added to realize the full benefits of 5G. This may occur later toward 2022 to 2025.

Examples of early CSP commercial 5G deployments include those in the U.S. (AT&T and Verizon), South Korea (KT, LG U+ and SKT), the Middle East (various CSPs) and Australia (Telstra). Major challenges include terminal availability, coverage, and clear 5G use cases and business models.

Chinese government policy is to support both the development of 5G standards and the commercial deployment of 5G networks through a range of policies and initiatives, including government support for research and development. The Chinese government allocated 5G spectrum in the midband frequency range to three state-owned CSPs, preparing the way for large-scale network testing in 2019. Both China Telecom and China Unicom received 100 MHz in the 3.5 MHz band, while China Mobile obtained 260 MHz of spectrum in the 2.6 GHz and 4.8 GHz bands. Confirming the frequency bands will enable CSPs and equipment providers to determine product development goals and accelerate the process. The Chinese government granted 5G licenses to the country's three major telecom operators and China Broadcasting Network on 6 June 2019, giving the go-ahead for full commercial deployment of the next-generation cellular network technology.

China is well-equipped for 5G, thanks to factors such as widespread fiber availability, LTE maturity, supportive government policies, and leading equipment and device manufacturers. The established 5G ecosystem is poised to create strong 5G demand in China. However, early 5G networks will most likely be served as a hot spot technology to supplement existing LTE in Tier 1 cities. It will take two to five years to reach nationwide coverage.

User Advice: CSPs should:

- Focus mobile infrastructure planning on LTE, LTE-A, LTE-A Pro, small cells and heterogeneous networks (HetNet) as part of a planned transition toward 5G. 5G will coexist with those technologies for many years.
- Test backward compatibility to preceding-generation (LTE) devices. This is necessary because initial 5G coverage may be limited, so new devices need to be able to use at least 4G infrastructure as a fallback. 3GPP is looking only at 4G/5G interoperability; IMS providers will be required to handle additional intergeneration interwork for 5G.
- Focus on related architecture initiatives — such as software-defined network (SDN), network function virtualization (NFV), CSP edge computing and distributed cloud architectures, as well as end-to-end security in preparation for 5G. 4G mainly adopts cellular network architecture, but 5G will prove more complicated, and a heterogeneous network will be commonly adopted, with a denser grid in hot spots, so topology changes must be planned. Operations will need further automation and orchestration at scale as well, so self-organizing network (SON) frameworks need to be in place.

Enterprises should:

- Plan on using widely available standards-based 5G equipment or services before 2020. Factor in the potentially higher total cost of ownership (TCO) of using a nonstandard offer or device.
- Clearly define use cases that will benefit from 5G's unique performance characteristics by documenting use-case or application performance requirements. Use legacy services and technologies to support all other use cases through at least 2022.
- Question potential price increases for future 5G plans by notifying carriers that the enterprise will give purchase preference to providers that do not charge a premium for 5G data service that supports legacy applications.

Business Impact: 5G requirements cover primarily three technology aspects:

- Enhanced mobile broadband (eMBB)
- Ultrareliable and low-latency communications (URLLC)
- Massive machine-type communications (mMTC)

URLLC and mMTC will be implemented after eMBB. Only eMBB addresses the traditional mobile handset requirement of ever-higher throughput. URLLC addresses many existing industrial, medical, drone and transportation requirements — where reliability and latency requirements surpass bandwidth needs. Finally, mMTC addresses the scale requirements of IoT.

We believe the first application will focus on eMBB and mobile edge computing that includes media, gaming and AR/VR.

We also believe 5G may focus more on enterprise applications compared with previous generations. B2B and B2B2C models may become more popular. Key industries in the beginning will include government (smart city), utilities (smart grid) and entertainment (gaming, video and AR/VR).

Benefit Rating: High

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Sample Vendors: Cisco; Ericsson; FiberHome Telecommunication Technologies; Huawei; Intel; Mavenir; Nokia; Qualcomm; Samsung; ZTE

Recommended Reading: “Market Guide for CSP Edge Computing Solutions”

“Market Trends: Make Compelling 5G Technology Selections and Be First to Attain 5G Success”

“IT Market Clock for Communications Service Provider Infrastructure, 2018”

“Magic Quadrant for LTE Network Infrastructure”

“3 Requirements to Successfully Offer Commercial 5G Services”

“Exploit the Innovation Opportunities Enabled by Future 5G Wireless”

RPA Software

Analysis By: Roger Sheng; Cathy Tornbohm

Definition: Robotic process automation (RPA) software is combined by user interface recognition technologies and business process execution. It can simulate the human operations’ (such as mouse clicks and keystrokes) drive applications and process execution work. Sometimes it can be designed for application to application automation as a software-based robotic operation. It is a type of automation that needs structured data for working process.

Position and Adoption Speed Justification: The RPA can reduce the human workload on a routing work process, which is rule-based and repetitive rekeying or data collation. Insurance and financial industry companies are the largest users in China, which is similar as the global situation. RPA can be used for accounting or client data collection, which requires human operation heavily as a “digital labor” to reduce both labor cost and the mistakes in the process. On the other side, RPA doesn’t work for frequent process/rule change scenarios. Also, a robust system with strong recovery capability is required to roll back or recover any exception if there is an execution accident.

Internet e-commerce companies also are the major users for RPA because the massive volume of trading data only can be processed by automatic process. Alibaba Cloud developed an RPA solution based on its internal RPA development experience and promotes it to outside cloud clients.

The major barrier for RPA in China is the software development capabilities of the end users. Usually there are not enough IT engineers engaged in business operation and process in traditional Chinese enterprises, which is important to RPA development. Recently, thanks to the hype of digital business, Chinese companies see RPA as one important solution for digitalization for the operation process. Also, the adoption of AI technologies can improve the data collection accuracy, which supports more structured RPA solutions.

User Advice: Most RPA solutions include screen capture and working process automation, and some will use AI for data collection and process decisions. The end users need to integrate the RPA in their systems throughout the execution process to achieve the returns of automated work.

Currently, there are many examples to prove that RPA can develop automation capabilities and reduce the labor workload by software tools. In China, enterprises should consider using RPA by the following factors:

- RPA tools can eliminate keying errors.
- Automated work is time-stamped, trackable and auditable.
- RPA software can be cheaper than increasing labor cost.
- RPA can reduce the employee management issues.
- RPA tools can be designed to operate 24/7.

- User interface recognition is less able to work in complicated system environments.

The labor-intensive traditional industry enterprises should consider RPA but it is not a complete solution. End users should consider developing RPA with their BPO and IT suppliers, which have built RPA tools. The existing process automation should be incorporated with both process transformation and digitalization. For digital-business-oriented enterprises, RPA should be developed by working with business flow partners to ensure the structured data and process output sync. The selection of RPA vendors should consider flexibility, stability, compatibility, maintenance and system costs.

Business Impact: For the enterprises that have huge demand on data work, which rely on heavily replicated labor work, RPA can be the effective solution to reduce the need of employees and increase the working efficiency. It can lead to the lower cost for all process operations. The enterprises can design the process automation for digital business outcomes and develop new business models. Especially in the digital transformation, RPA software will take an important role to optimize the business process operation.

Benefit Rating: High

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Sample Vendors: Alibaba Cloud; Automation Anywhere; i-search; Leanpro Tech; UiPath

Recommended Reading: “Robotic Process Automation: Eight Guidelines for Effective Results”

“Market Guide for Robotic Process Automation Software”

“Strategies for Effective Application of Robotic Process Automation”

“When and How to Use Robotic Process Automation in Finance and Accounting”

“Solution Comparison for Three Robotic Process Automation Vendors”

Machine Learning

Analysis By: Melody Chien

Definition: Machine learning is a technical discipline that aims to extract certain kinds of knowledge and pattern from a series of observations. There are three major subdisciplines, which relate to the types of observation provided: supervised learning, where observations contain input/output pairs (also known as “labeled data”); unsupervised learning (where labels are omitted); and reinforcement learning (where evaluations are given of how good or bad a situation is).

Position and Adoption Speed Justification: In China, artificial intelligence (AI) is regarded as a major national economic strategy for the next decade by the Chinese government. As the core technology of AI, machine learning is one of the hottest technologies at the moment, given its

extensive range of effects on business. Backed by strong government mandates, incentive plans and billions of dollars in both private and public investment, China has made significant progress in machine learning technology in recent years. It estimates the data science platform market to be over \$76.3 million of revenue in 2018 in greater China region. This reflects significant growth of 31.7% compared with 2017, which is a good proxy for the growing use of ML (see “Market Share: All Software Markets”), due to increased digitalization.

Seen as disruptive force, machine learning technology has been used in many industries in China to create competitive advantage for better products, or services. For examples, the fraud detection in banking industry and predictive analysis in equipment maintenance in manufacturing industry. Many technology providers in China offer industry-based solution with prepackaged algorithms in machine learning technology. The drivers of continued massive growth and adoption are the growing volume of data and the complexities that conventional engineering approaches are increasingly unable to handle. In the future, advances in transportation, energy, medicine and manufacturing will be impossible without machine learning.

User Advice: Start with simple business problems for which there is consensus about the expected outcomes, focus on a quick win and gradually move toward complex business scenarios. Nurture the required talent for machine learning, and partner with universities and ML service providers to keep up to date with the rapidly changing pace of advances in data science. Evaluate the capabilities of machine learning and its potential business impact across a wide range of use cases — from process improvement to the development of new services and products. Focus on data as the fuel for machine learning by adjusting your data management and information governance for machine learning. As data is a unique competitive differentiator, it’s essential to consider the proper size of the training dataset and the quality of it, and any possible human bias. Although the choice of machine learning algorithms is limited, data sources are abundant and a good long-term investment.

To facilitate the adoption of machine learning technology, it’s encouraged to consider cloud-based data science/ML tools to minimize the upfront setup. The vendors of these tools also provide off-shelf prebuilt and pretrained data models and algorithm (such as image recognition and natural language processing). As market and technology matures, many more of these ML products will be available to meet various use cases. When selecting these ML products, it’s important to make sure that vendors provide adequate information about the products such as any potential bias in data.

Many organizations struggle when it comes to systematically productizing machine learning results, as the production process is either overlooked or left solely to the DevOps team. Machine learning operationalization is a critical step — the “last mile” toward business value (see “How to Operationalize Machine Learning and Data Science Projects”). Organizations should maximize operationalization success with close collaboration among domain experts, process engineers, IT professionals and business practitioners, in addition to existing data science talent.

Business Impact: Machine learning drives improvements and new solutions to business problems across a vast array of business and social scenarios:

- Automation

- Drug research
- CRM
- Supply chain optimization
- Predictive maintenance
- Operational effectiveness
- Workforce effectiveness
- Fraud detection
- Automated vehicles
- Resource optimization

Machine learning impacts can be explicit or implicit. Explicit impacts result from machine learning initiatives. Implicit impacts result from products and solutions that you use without realizing they contain machine learning.

Benefit Rating: Transformational

Market Penetration: 5% to 20% of target audience

Maturity: Adolescent

Sample Vendors: Alibaba Group; Huawei; IBM; SAP; SAS; Tencent; Transwarp

Recommended Reading: “Artificial Intelligence Primer for 2019”

“Magic Quadrant for Data Science and Machine Learning Platforms”

“Critical Capabilities for Data Science and Machine Learning Platforms”

“How to Choose the Right Data Science and Machine Learning Platform”

“AI Governance Spotlight: Early Lessons and Next Practices”

Managed SD-WAN Services

Analysis By: Evan Zeng

Definition: Managed SD-WAN services include the SD-WAN product, WAN transport and management, and are fast emerging in China. Such providers include NSPs, carriers, cloud providers, OEMs with service arms and network SIs/VARs. They operationally manage customers’ SD-WAN products (physical appliances or software instances) that are either enterprise-owned or are included with the service. Overlay network with optimized internet performance is a new feature.

Position and Adoption Speed Justification: China's telecommunication market is tightly regulated, and its enterprise WAN service market is mainly dominated by the big three carriers (China Telecom, China Unicom and China Mobile). Such carriers are at the early stage to offer managed SD-WAN services, partially because of the investment protection of their MPLS networks. The competition between carriers to win enterprise WAN business is a major catalyst to drive SD-WAN deployment and related managed services. Startup NSPs and public cloud providers are the major competing forces in this market. Some of them have self-built, over-the-top networks with smart routers to leverage carriers' internet as WAN transport. However, noncarrier providers still have small share of the overall enterprise WAN market and carriers' move to embrace managed SD-WAN services determines the pace of overall market development.

Even though enterprises' adoption of SD-WAN technology is fast growing in China, majority of enterprises are still on legacy hub-and-spoke WAN architecture with centralized internet access at their data centers. Such legacy WAN and internet access architecture should be modernized in the next few years with the adoption of SD-WAN technology and managed SD-WAN services.

User Advice: The benefits of managed SD-WAN services are not only for better agility, higher performance and centralized management of all WAN devices, but also the WAN network cost optimization by leveraging lower-cost WAN technologies and optimized internet.

I&O leaders should evaluate managed SD-WAN services when planning to adopt SD-WAN technologies. The capabilities of SD-WAN technology continue to grow, and managed SD-WAN service providers will enrich their services with critical new features such as WAN access security, access authentication and internet performance optimization, etc. If some of such features are important and cannot self-build at reasonable cost, I&O leaders should consider the adoption of managed SD-WAN services.

Business Impact: Managed SD-WAN services aim to optimize enterprise WAN costs in four ways:

- SD-WAN products facilitate easier integration and operation of often lower-cost internet services as a WAN transport option than a traditional router.
- Compared with routers, SD-WAN offers superior application-policy-based control — allowing critical applications to be preferred over noncritical applications — affording enterprises more granular control in meeting business requirements.
- The managed SD-WAN services enable enterprises to quickly adopt these capabilities without enhancing skills more typical of new technology adoption.
- The self-built backbone from managed SD-WAN service providers offer much enhancing capabilities than enterprises' self-built SD-WAN. For example, the optimized internet performance can significantly reduce internet delays, which is hard for enterprises to develop such features because it requires the deployment of many smart routers at the middle of the internet to detect and avoid path congestion.

However, adopting such services will also bring in network lock-in to enterprises, reducing network choices or becoming over-relied on external managed network service providers.

Benefit Rating: Moderate

Market Penetration: 1% to 5% of target audience

Maturity: Adolescent

Sample Vendors: Alibaba Cloud; China Mobile; China Telecom; China Unicom; Huawei; Tencent Cloud

Recommended Reading: “Market Guide for Managed SD-WAN Services”

“SD-WAN and NFV Bring New Managed WAN Competition”

Community Cloud

Analysis By: Evan Zeng; Kevin Ji

Definition: Community cloud refers to a multitenant offering where the subscribers have explicitly chosen to share the offering with a precertified community of organizations like government agencies. It is neither a fully public, nor private model. It can be offered at customer premises or at provider premises. In China, tenants are often organized and isolated by the industry named industry cloud.

Position and Adoption Speed Justification: Regulators in highly regulated industries such as government agencies and banking still have major concerns on high availability, security, compliance and risk control of public cloud in China and they prefer community cloud infrastructure with certified access by only enterprises that are in the same industries and are under the same regulator’s governance. Due to the potential high-consumption volume, hyperscale cloud providers want to access this market, but regulators prefer providers that have established operational and compliance expertise in specific industries and are under their regulation. Hyperscale cloud providers such as Alibaba Cloud and Tencent Cloud are not under any regulation of state council or China’s Banking and Insurance Regulatory Commission (CBIRC), thus they don’t fully meet such requirements. Providers such as Pingan Cloud and CIB Fintech get favored in financial service industry because they are under the regulation from CBIRC. Similarly, providers such as Inspur Cloud and China Telecom get favored in government cloud projects because they are under the regulation of China’s state council. Providers are progressing their product offerings at much slower speed than those at hyperscale public clouds.

Industries outside of highly regulated industries do not have such limitation on cloud providers and it is an open market for competition. But community cloud makes less sense in such industries and if there are some, the size each one is normally not big.

User Advice: We have observed that there are two scenarios where many clients leverage community clouds to deliver business value in the China market:

- In highly regulated industries, clients have built a dedicated compliance cloud service for the enterprise and its partners.

- Inside large conglomerates, clients have built community clouds to drive shared services across different subsidiaries. This is useful because there are so many conglomerates in China. Their size is so big to justify building community cloud and continue to take full-stack control.

CIOs in highly regulated industries:

- Evaluate community cloud for vertical applications or sensitive workloads when public cloud is unable to offer the same level of industry regulatory compliance or unable to achieve the required level of security and governance.
- Position community cloud services as an alternative way of sourcing to achieve better compliance, cost savings, service agility and IT service innovation.

CIOs in other industries:

- Evaluate community cloud for mission-critical workloads or sensitive workloads when public cloud is considered not fit to your requirements of compliance, security, data privacy or governance.
- For large conglomerates, evaluate community cloud for implementing shared-service strategy across all your subsidiaries to achieve better IT efficiency and agile service delivery.

Business Impact: Community cloud is being increasingly adopted in enterprises because it can provide the following business benefits:

- **Security** — Community cloud is not entirely public and can have more access restriction to limit tenants for their access. It is considered to be less exposed to security risks than public cloud.
- **Industry regulatory compliance** — Public cloud does not customize its cloud platforms by industry regulation, but industry-based community cloud does. This can help tenants to easily achieve industry regulatory compliance.
- **Business agility** — In comparison to internal private cloud, community cloud can provide better agility to tenants, although less agility than public cloud.
- **IT efficiency** — Building an internal private cloud is a high-cost activity. Leveraging existing community cloud is a lower-cost approach if enterprises do not have mature skill sets to govern public cloud adoption.

Benefit Rating: Moderate

Market Penetration: 5% to 20% of target audience

Maturity: Adolescent

Sample Vendors: Alibaba Cloud; Baidu Cloud; China Telecom; China TravelSky Holding Co.; CIB Fintech; Inspur; Pingan Cloud; Tencent Cloud

Recommended Reading: “Industry Vision: Transition Business Models by Adopting Chinese Enterprises’ Industry Cloud Strategies”

“Market Guide for Cloud Infrastructure as a Service, China”

Sliding Into the Trough

Internet of Things

Analysis By: Milly Xiang

Definition: The Internet of Things (IoT) is the network of dedicated physical objects that contain embedded technology to communicate and sense or interact with their internal states and/or the external environment. IoT comprises an ecosystem that includes assets and products, communication protocols, applications, and data and analytics. IoT is a core building block for digital business and digital platforms.

Position and Adoption Speed Justification: Gartner’s CIO Survey 2019 shows that IoT is regarded by CIOs as one of the top four game-changing technologies. IoT is widely perceived as the essential component for digital business optimization and transformation across all industries. In the meantime, the deployment of IoT is not purely about technology, it requires strong alignment with an enterprise’s business vision and objectives. Gartner’s 2018 IoT Strategies Survey indicates that creating a digital platform or ecosystem to support partners and customers, improving product quality and design, and improving customer or user experience are the top three business drivers for IoT initiatives.

IoT adoption in China is proliferating, largely because companies often find that IoT investment delivers good business outcomes. Gartner’s 2018 IoT Strategies Survey shows that 80% of Chinese organizations found that IoT delivered more than planned outcomes. But IoT involves complicated technology stacks ranging from IoT-connected things, IoT edge computing and an IoT core platform, as well as one or more business applications. Thus, IoT drives profound changes to core business applications and distributed IT infrastructure, which requires Chinese enterprises to continuously invest in the requisite skills needed to support IoT-enabled applications.

Chinese enterprises increasingly recognize that the factors driving true proliferation of IoT into enterprises is not simply technology maturity. It also requires considerations on business (linking IoT adoption and integration with business and financial performance) and organization (having the right skills and aligning with how IoT is used) dimensions. We are expecting to see that Chinese organizations increasingly align IoT strategies with their digital business innovation efforts. This enables them to identify the technologies and applicable use cases that will impact their business in a positive way, while ensuring they have the skills and partners to deliver them when required.

Due to the broad and fragmented nature of IoT, deployment and maturity levels differ in use cases and verticals across consumer, commercial and industrial sectors. We are expecting that commercial and industrial sectors where visible business outcomes can be generated will enjoy faster penetration of IoT, while the consumer sector will remain hardware-driven while exploring viable business and monetization models.

User Advice: For Chinese companies that want to implement IoT technologies for their digital business optimization and transformation, Gartner has the following recommendations:

- IoT trends and emerging technologies will drive digital business innovation for a decade. CIOs must identify and evaluate the IoT trends and technologies that either will drive innovation in your industry and organization or will create new risks. Implement the technical and organizational changes required to address the risks and opportunities.
- Exploiting IoT trends to enable innovation will demand substantial changes to IT infrastructure, skills and sourcing strategies. CIOs should transform the IT infrastructure and the IT organization to support key emerging IoT trends and technologies. Obtaining the necessary skills and partnerships will be a key priority.
- An end-to-end IoT business solution comprises multiple technical components, which is not possible to source from a single vendor. CIOs shall adopt a whole-solution thinking, shifting the focus on the “best” technology product or brand to a focus on the best experience from a solution including related outcomes.
- New technologies and trends introduce new risks alongside with new opportunities. CIOs should consider risks from several levels including business, technology, legal/social as well as market risks, so as to evaluate: Will the technology or trend increase or decrease risk? And what action do you need to take and when? This kind of preparation will help you to identify a right balance between opportunities and risks, to ensure a smooth introduction of technologies into your organization to enable business innovation.

Business Impact: IoT is enabling digital business innovation in virtually every industry, derived from four aspects: value model innovation, operating model innovation, product/service innovation and relationship innovation, both within and outside the organization boundary. Meanwhile, the emergence of new sensors, innovative IoT chip technologies, edge technologies and mesh architectures enable a wide diversity and possibility of use cases that we cannot imagine today.

Benefit Rating: Transformational

Market Penetration: 5% to 20% of target audience

Maturity: Emerging

Sample Vendors: Alibaba Cloud; China Mobile; China Telecom; Huawei; Microsoft; New H3C Group; Quectel Wireless Solutions; Tencent; Tuya; Xiaomi

Recommended Reading: “Top Strategic IoT Trends and Technologies Through 2023”

“2019 Strategic Roadmap for IoT Network Technology”

“Use the IoT Platform Solution Reference Model to Help Design Your End-to-End IoT Business Solutions”

“Deploying IoT Analytics, From Edge to Enterprise”

NB-IoT

Analysis By: Peter Liu

Definition: NarrowBand Internet of Things (NB-IoT) is a low-power wide-area (LPWA) radio technology standard developed by 3GPP that provides wide-area connectivity for massive machine-type communication for IoT. The NB-IoT specification was frozen in 3GPP LTE Release 13 in June 2016, and enhanced features were added in LTE Release 14, which was frozen in August 2018. NB-IoT is also known as LTE Cat-NB1.

Position and Adoption Speed Justification: NB-IoT, along with LTE for machine-type communications (LTE-M) (also known as LTE Cat-M1 and EC-GSM-IoT), is 3GPP's effort to address the emerging LPWA market for supporting use cases for IoT in a WAN setting. As with other LPWA technologies, its key focus areas include low data rate, low power consumption and low module cost, as the target use case is for connected devices that typically have a long life, low data rate and low data volume, together with a sporadic transmission frequency.

For NB-IoT, the cost of the wireless module is expected to drop below \$5. The key trade-offs to support this price point include a narrow bandwidth (180 kilohertz) and low data rates (200 Kbps in half-duplex mode). However, one of the advantages of NB-IoT is that it can use the existing LTE spectrum that mobile network operators (MNOs) have been allocated. Then, NB-IoT can be rolled out via a simple software upgrade on existing LTE infrastructure.

Based on a [GSA report](#), as of the end of March 2019, 88 operators in 50 countries have deployed or launched NB-IoT networks, up from 59 operators in March 2018. Commercial deployments include those of China Mobile, China Telecom, China Unicom, T-Mobile (the Netherlands), Telia (Norway), TELUS (Canada) and Vodafone (Spain). NB-IoT has the potential to become a mainstream LPWA technology, but first it has to see significant price erosion to achieve cost parity with alternative variants (LoRa, Sigfox and Random Phase Multiple Access [RPMA]).

In terms of chipset, more than 10 chipset suppliers announced their commercial NB-IoT products. Most of them support 3GPP Release 13. Regarding shipments, Huawei (HiSilicon Technologies) is currently in the leading position, benefiting from the mass rollout in China.

China is currently the biggest market for NB-IoT. NB-IoT was designated as the country's preferred LPWA technology, and it plays a key role in national IoT policy. Backed by strong government support, all three operators claim to have rolled out the technology to tens of thousands of base stations. Developments in China will benefit the entire NB-IoT ecosystem. China's three operators (China Mobile, China Telecom and China Unicom) have built the world's largest NB-IoT network so far by upgrading more than 1 million base stations across China to support NB-IoT. The target is to update more than 3 million base stations by 2025. The massive rollout and operator subsidy allow the price of NB-IoT modules to fall to 20 renminbi (about \$3). By the end of 2018, China Telecom operators had more than 3 million NB-IoT connections.

User Advice: CIO and IT leaders who are responsible for IoT initiatives should:

- Test NB-IoT for more-demanding industrial use cases, as NB-IoT supports authentication (which is supported by the SIM card on mobile devices in 3GPP) and high reliability, which a licensed spectrum operation supports better than unlicensed alternatives.
- Formulate an IoT strategy on the basis that investing in NB-IoT will be a long-term play but a low-risk strategy.
- Work closely with NB-IoT ecosystems and effectively reduce the NB-IoT device price to achieve scale and business value.

Business Impact: Among LPWA alternatives, NB-IoT will address the needs of use cases with higher requirements for reliable connectivity, higher SLAs and robust 3GPP security. It is expected that NB-IoT can be enabled in existing radio access network (RAN) infrastructure without the need for additional hardware upgrades, although vendors' implementations vary.

NB-IoT is technically complicated and is covered by numerous patents, contributing to the cost of implementation at the endpoints. The main difference between NB-IoT and other proprietary LPWA technologies (such as LoRa, Sigfox or Weightless) is that NB-IoT is backed by 3GPP standards. As such, it will be deployed in a majority of mobile CSPs and will benefit from the stronger and richer 3GPP ecosystem.

Finally, as an extension of LTE, NB-IoT will be deployed within mature networks, with established operational and customer experience management key performance indicators (KPIs) and practices, along with mature systems, such as self-organizing network (SON) IT support systems.

Benefit Rating: High

Market Penetration: 5% to 20% of target audience

Maturity: Adolescent

Sample Vendors: China Mobile; China Telecom; China Unicom; Ericsson; Huawei; Intel; Nokia; Qualcomm; u-blox; ZTE

Recommended Reading: "Exploit LPWA Networks Now — 5G Won't Change Them"

"Competitive Landscape: IoT Mobile Virtual Network Operators"

Hyperconvergence

Analysis By: Uko Tian

Definition: Hyperconvergence is scale-out software-integrated infrastructure seeking operational simplification. Hyperconvergence provides a building block approach to compute, network and storage on standard hardware under unified management. Hyperconvergence vendors build appliances using off-the-shelf infrastructure, engage with system vendors that package software as an appliance, or sell software for use in a reference architecture or certified server. Hyperconvergence may also be delivered as a service or in a public cloud.

Position and Adoption Speed Justification: The adoption of hyperconvergence solutions is rapidly expanding in China. Time to deploy and management simplicity are main values recognized by users. In addition to the typical workloads running on hyperconverged infrastructure (HCI), such as VDI, server consolidation and remote office/branch office (ROBO), HCI has also been marketed by vendors as a valid option to build private cloud. Midsize business are major users.

From supply side, the market remains fragmented. Local vendors take a leading role. Some of them are established data center vendors such as Huawei, New H3C Group and Sangfor. Some are purely new players focusing on this area, such as SmartX and Zettakit. Local vendors that used to focus on cloud, such as QingCloud and EasyStack, also extended offerings to HCI. Due to market diversification, there remains growth opportunity for small vendors. Local players show more flexibility in pricing and better scalability, which bring them competence in the market.

User Advice:

- IT leaders should implement hyperconvergence when agility, modular growth and management simplicity are of greatest importance. The acquisition cost of hyperconvergence may be higher and resource utilization rate lower than for three-tier architectures, but management efficiency is often superior.
- Plan strategically, but invest tactically. IT leaders should evaluate carefully vendors' viability, service capability and product reliability because the market is still evolving.
- Keep in mind that current hyperconvergence offerings in the market may vary significantly in terms of performance, availability, data services and hypervisor support. Identify your use cases and workload characteristics to validate your HCI vendors' solutions.
- Be aware of the infrastructure and process challenge that HCI deployment may bring. For example, network maybe an issue when dealing with demanding workloads; and HCI will require consolidation of compute and storage in operations, budgets and capacity planning.

Business Impact: The lower total cost of ownership, modularity and scalability offer resource-constrained organizations fast deployment, simplified management and opportunities for automation. Hyperconvergence is of particular value to midsize enterprises that can standardize on hyperconvergence and the remote sites of large organizations that need cloud-like management efficiency with on-premises edge infrastructure.

Benefit Rating: High

Market Penetration: 5% to 20% of target audience

Maturity: Adolescent

Sample Vendors: Dell EMC; EasyStack; Huawei; New H3C Group; Nutanix; QingCloud; Sangfor; SmartX; Winhong; Zettakit

Recommended Reading: "Magic Quadrant for Hyperconverged Infrastructure"

“Solution Comparison for Four Hyperconverged and Software-Defined Infrastructure Solutions”

“Toolkit: Sample RFP for Hyperconverged Infrastructure”

“Use Hyperconverged Infrastructure to Free Staff for Public Cloud Management”

Private Cloud

Analysis By: Kevin Ji; Evan Zeng

Definition: Private cloud computing is a form of cloud computing used by only one organization, or one that ensures that an organization is completely isolated from others. As a form of cloud computing, it has full self-service, and full automation behind self-service and usage metering. It does not have to be on-premises, or owned or managed by the enterprise.

Position and Adoption Speed Justification: In the Chinese market, enterprises use private cloud to enable enterprise agility and cost optimization, despite the scaling issues this approach presents. Based on private cloud dynamics in the Chinese market, Gartner has identified four different approaches, with available suppliers:

- **Commercial software.** Leverage current virtualization software to build the private cloud. The purpose is infrastructure agility through virtualization and automation driven by faster virtual machine provisioning. In this approach, VMware and Red Hat are reference vendors.
- **Hardware.** Massive investment made in private cloud infrastructure, including hardware and software. I&O leaders use this solution to optimize the IT operations process to deliver a full-function private cloud platform. In this approach, Huawei, New H3C Group, Inspur and Lenovo are reference vendors.
- **Solution leveraging public cloud.** Public cloud providers leverage their cloud best practices to deliver an on-premises solution. In this approach, public cloud suppliers such as Alibaba Cloud, and Tencent Cloud are reference vendors.
- **Software delivery solution.** Pure software solution providers normally use an open-stack framework to build a platform-neutral private cloud. I&O leaders use this solution to protect current infrastructure investments and save on private cloud deployment costs. In this approach, EasyStack, 99Cloud and Huayun are reference vendors.

In China, the major investment in private cloud initiatives is the capital expenditure. Because software deployment is only a small part of the total private cloud expenditure, enterprise IT leaders prefer to leverage large server providers like Huawei or New H3C Group to help deploy the private cloud, in combination with the hardware construction or refresh. This practice is popular in government agencies and the finance industry.

Actually, this approach offers the advantage of the evaluation process being clear, with an all-in-one solution. But it also brings on several challenges for enterprises, including:

- The hardware price has a greater influence on decisions.

- The solution vendor is locked in.
- Ongoing professional services are needed to cover software maintenance.

Based on Gartner's survey, IT operational readiness to deliver suitable value from private cloud is much harder than a technology implementation. We suggest concentrating on addressing the business results of private cloud rather than hardware implementation. Here are some recommendations:

- **Start small and think big** — Clients need to choose a suitable workload for private cloud and migrate it step by step, as it is very important to get the business's support through demonstrating real value.
- **Set the process and structure first** — Building a suitable process and structure for the organization is a critical success factor for private cloud.
- **Define the success criteria** — Embrace business values through operational excellence criteria such as improving efficiency.

User Advice: Align private cloud initiatives with business outcomes by identifying the desired business result first and then defining the private cloud approach to support it. Determine whether vendor offerings suit your organization's needs by evaluating successful use cases for the business result.

Control private cloud spending by taking a "just enough" approach to achieve the desired business result and leveraging public cloud for short-term, high scalable workloads. Launching an unnecessarily elaborate private cloud initiative will introduce technical complexity and excessive costs, and may not align well with business goals.

Train attention on business results by building a private cloud governance team to focus on technology, process and talent to align each area with business goals.

Simplify private cloud deployments by prioritizing standardization early in the project.

Improve stability by shifting solution design from infrastructure resilience to application resilience, in collaboration with application leaders.

Business Impact: The primary benefit of private cloud is enterprise agility. However, building a full-function infrastructure as a service (IaaS) private cloud is complex and expensive, and many Gartner clients struggle to achieve a good return on investment with private cloud projects. IT leaders need to leverage a suitable supplier to focus more on virtualization and automation in their private cloud initiatives to maximize agility, as this will have the greatest impact on business value.

Benefit Rating: Moderate

Market Penetration: 20% to 50% of target audience

Maturity: Early mainstream

Sample Vendors: 99Cloud; Alibaba Cloud; EasyStack; FiberHome Telecommunication Technologies; Huawei; Microsoft; New H3C Group; Red Hat; UMCloud; VMware

Recommended Reading: “How to Overcome the Challenges of Adopting Private Cloud in China”
“Building ‘Just Enough’ Private Cloud With Virtualization Automation”

Digital Commerce Platform

Analysis By: Sandy Shen

Definition: Digital commerce platforms enable customers to purchase goods and services through an interactive and self-service experience. The platform provides necessary information for customers to make purchase decisions and uses rules and data to present fully priced orders for payment. It includes multiple channels such as web, mobile, stores, social, IoT devices and call centers.

Position and Adoption Speed Justification: Chinese B2C organizations tend to rely more on online marketplaces that account for more than 80% of the online retail transactions. This situation is unlikely to change in the next five years, a key reason why it will take five to ten years before the technology reaches the Plateau of Productivity. On the other hand, as consumers look for differentiated and personalized experiences, B2C organizations with strong brand recognition and a large number of followers are deploying their own commerce platforms to own the customer experience. They often start testing the water by using alternative channels such as WeChat before they build a full-blown commerce platform. Large B2B organizations are more likely than B2C organizations to build their own platforms due to the lack of dominating marketplaces. They intent to improve customer experience, reduce sales costs, reach out to new customers or increase their influence. There is an increasing use of AI to improve digital commerce performance in personalization, product recommendation, review management and supply chain management. This will make building stand-alone commerce platforms more attractive than third-party marketplaces.

On the technology front, local commerce platform providers are not well established, and their solutions are not as comprehensive or sophisticated as their global peers, even though they are well integrated with the local ecosystem. Some providers choose to focus on marketplace integration to help organizations manage multiple channels, and some choose to become fully outsourced service providers. Many platforms offer mobile and WeChat solutions that can be more attractive to SMBs, but may not be viable choices for larger enterprises. These factors mean it will take at least five years before digital commerce platforms reach plateau.

User Advice: B2C organizations looking to deploy their own digital commerce platforms should be aware of the dominance of online marketplaces.

- Consider starting with a marketplace store to better understand the local market before building a platform of your own. Follow the best practices suggested in “Balance Marketplaces and Direct Channels for Digital Commerce Growth and Customer Engagement” to take advantage of both channels.

- Look for a marketplace integration solution that allow you to integrate with multiple marketplaces and manage products and orders from a single place.
- Follow the three-level cyclic process outlined in “How to Develop a Digital Commerce Strategy” to align digital commerce with your business goals and local market conditions.
- Obtain management commitment for long-term investment as digital commerce especially your own commerce platform doesn’t usually turn profit in a short time.

Organizations offering B2B services should start by clearly defining goals for digital commerce and target customer segments.

- Define your B2B motivation and business model — whether it is to serve end customers or partners, and what products and markets to be supported.
- Investigate enterprise marketplace business model where you open the commerce platform to third parties that include partners, suppliers, solution providers and other brands, and see how you can benefit from this model strategically and/or financially.
- Align digital commerce with your overall channel strategy to avoid conflict with your existing sales force and channel partners. Sometimes you want to engage partners while other times you may want to cut them out.
- Deliver a consumer-like user experience and help customers streamline the purchase process.

Consider local providers, especially for integration with local channels and partners. Use Gartner’s “Toolkit: RFP for Digital Commerce Platforms” to compare vendor solutions on functionality, compatibility with your existing applications, integration needed and support level from the vendor. Be aware of local cybersecurity laws, the newly effective personal information standard and the upcoming cross-border data transfer guidelines that may impact your architectural and vendor decisions.

Business Impact: Organizations in China face a highly competitive market, not only because of the large number of brands and providers, but also the diverse customer preferences, business practices and infrastructure in regional markets. Although marketplaces are good at reaching a large number of customers and driving sales, companies don’t own customer experience and data. Customer data and insights are key in developing a differentiated experience and offering in this competitive market, and this is a reason why more organizations are deploying their own platforms in addition to marketplace presence. B2B organizations have the chance to establish their own platforms due to the lack of dominant third-party marketplaces, and can even operate their own marketplace to create an ecosystem.

Benefit Rating: High

Market Penetration: 5% to 20% of target audience

Maturity: Adolescent

Sample Vendors: Baozun; HiShop; IBM WebSphere Commerce; Kingdee International Software Group; Magento; Oracle Commerce; Salesforce; SAP Hybris; ShopEx; Youzan

Recommended Reading: “How to Develop a Digital Commerce Strategy”

“Toolkit: RFP for Digital Commerce Platforms”

“Address Chinese Cybersecurity Law With This Playbook”

“China’s Data Privacy Standard Unfolds Measures for Its Cybersecurity Law”

Digital Financial Services

Analysis By: Sandy Shen

Definition: Digital financial services use digital technologies to deliver financial services to both consumers and businesses that include payment, investment, loan, credit, peer-to-peer (P2P) lending and banking.

Position and Adoption Speed Justification: After a large number of P2P platforms went bankrupt in 2018, which led to hundreds of billions in losses, the Chinese government has put in place a number of steps to register P2P platforms. It also asks for information to improve transparency of the platforms’ practices and safeguard the investors’ money. This has stabilized the market by resurrecting investor confidence. A number of leading platforms such as Lu and Yirendai have gained a strong foothold and positioned themselves for steady growth. At the same time, digital giants such as Alibaba and Tencent continue to offer a range of financial services to their users that include digital banking, credit lending, loans, investment and insurance. These digital giants especially Alibaba benefited from the variety and large amount of data gathered, and the risk management capabilities they have developed over the years are highly competitive compared to traditional financial institutions. They have also encouraged other digital players such as JD and Xiaomi to launch their financial services portfolios.

Regulators encourage the competition from technology players as a means to stimulate innovation, and have introduced enabling policies to level the playing field and ensure fair competition. The service will evolve quickly in the next two to five years as internet firms and financial institutions compete for customer wallet share and improve market positions.

User Advice: Financial institutions should:

- Focus on presenting a strong value proposition to customers by leveraging their broad product offerings in financial services to solve customer problems.
- Shift away from product development practices that primarily focus on the organization’s own benefits to those that help address customers’ real problems and deliver win-win results.
- Balance the need to offer an easy-to-use UX versus the need to ensure security and manage risks.

- Pay attention to the specification for personal information protection that requires proportionate customer data collection and a transparent consent mechanism.
- Consider establish a subsidiary focusing on digital financial services that can experiment with innovative technologies such as AI or machine learning for critical capabilities such as fraud detection and risk management. The subsidiary should also hire talent with internet background and install metrics that encourage fast product development and trial-and-error approaches to quickly respond to customer needs and market trends.

Organizations with a large amount of customer data, especially transactional and behavioral data, that are looking for new sources of revenue can consider collaborating with digital financial service providers to develop new offerings. Protect customer data if you need to share data with the partner as you don't want to destroy customer trust when developing new products.

Technology providers with an ambition of launching their own digital financial services should identify a target segment to avoid head-to-head competition with Alibaba or Tencent. Focus on niche segments such as use-case-specific consumer credit such as plastic surgery, international travel and education — opportunities that are not yet fully exploited. Work with financial institutions not only for compliance but also for risk management expertise, which is key in making such an offering successful.

Business Impact: Digital financial services is a digital transformation opportunity for financial institutions to change the way they design products and services, and the way they manage customer relations. They need to break down the organizational silos to share information about the business and customers, and to shorten the decision-making process in order to move quickly and compete against the challengers. The biggest challenge is the change of organizational culture, more so than people, skills, funding or technologies. If they cannot transform into a more agile and innovative culture, it will be difficult for financial institutions to compete with internet players, and they will always play catch up.

Benefit Rating: Transformational

Market Penetration: 5% to 20% of target audience

Maturity: Adolescent

Sample Vendors: Alibaba Group; Baidu; CreditEase; JD.com; Renrendai.com; Tencent; Tongdun Technology; Xiaomi; Yirendai

Recommended Reading: “The Art of Culture Hacking”

Public Cloud IaaS

Analysis By: Kevin Ji; Evan Zeng

Definition: Public cloud IaaS is a type of computing service in which scalable and elastic IT-enabled capabilities are delivered as a service using internet technologies. Cloud infrastructure as a service

(IaaS) is a type of cloud computing service; it parallels the infrastructure and data center initiatives of IT.

Position and Adoption Speed Justification: Public cloud IaaS is well-accepted by Chinese small and midsize clients in specific vertical industries such as retail, P2P, banking, media and gaming. The innovation demanded through digital business transformation is a key factor to trigger this change. It requires application agility and faster time to market through public cloud enablement. China's local cloud providers such as Alibaba Cloud and Tencent Cloud also use their business ecosystems to attract customers to use more of their cloud recourses, in order to help clients drive more competitive advantage in the Chinese market.

Compared with the mature global market, for China's large enterprises and government agencies, public cloud IaaS adoption is three to five years behind. Compared with last year, the major challenges have not changed and include compliance fulfillment, especially in highly regulated industries and those with data security concerns. In addition, a talent pool shortage, complex system architecture and stability are challenges addressed by Gartner in many client interactions currently.

Multinational corporations (MNCs) normally prefer to use public cloud, and align with global cloud strategy to migrate their applications to Amazon Web Services (AWS) and Microsoft Azure in the China region to meet Chinese privacy regulations such as cybersecurity laws. For digital business demands, Gartner has observed MNCs leveraging local cloud partners (such as Alibaba Cloud or Tencent Cloud) through their strong internet business ecosystems.

User Advice: China's cloud IaaS market is still growing. Chinese large enterprises should:

- Focus on not only regulation compliance, but also business values, especially to get trial-and-error or faster time-to-market business demands fulfilled.
- Strengthen their security capability on cloud management. The skill set of public cloud security management is different from that of on-premises data centers. Clients need to build a security evaluation plan for cloud suppliers that is aligned with the security and audit teams, and set up related processes to monitor the results.
- Assign the cloud architecture and cloud center of excellence teams to build a solid cloud strategy, including public and private cloud migration plans.
- To build the related talent, Gartner suggests that clients try using cloud on digital experience applications first.

For MNCs that plan to use public cloud in China:

- Identify the business value of cloud migration, including compliance for cybersecurity, agility for local customer service and digital opportunities for new revenue.
- Leverage global cloud suppliers to migrate applications to China, in order to fulfill the Chinese compliance requirements with limited code revisions.
- Evaluate the code migration cost to justify the use of a local public cloud supplier or global brands.

- Use Alibaba Cloud or Tencent Cloud to address digital business opportunities in China.
- Leverage MSP partners, since the cloud expert talent pool is very limited in China. Clients need to consider local partners to support cloud migration and hosting.

Business Impact: Based on technology trends, cloud IaaS will be broadly advantageous to infrastructure modernization and will affect all sizes of Chinese businesses. Many enterprises want to use public cloud to address new business-oriented architecture (middle platform in the Chinese market). However, Gartner has also observed the challenges that enterprises face in adopting it.

For large enterprises, many clients have tried to address digital business opportunities through public cloud, especially digital business demands or faster time-to-market demands. However, most of them are conservative in their migration of core application systems to public cloud.

Benefit Rating: Transformational

Market Penetration: 20% to 50% of target audience

Maturity: Early mainstream

Sample Vendors: Alibaba Group; Amazon Web Services; China Telecom; Huawei; Microsoft; QingCloud; Tencent

Recommended Reading: “China Summary Translation: ‘A Public Cloud Risk Model: Accepting Cloud Risk Is OK, Ignoring Cloud Risk Is Tragic’”

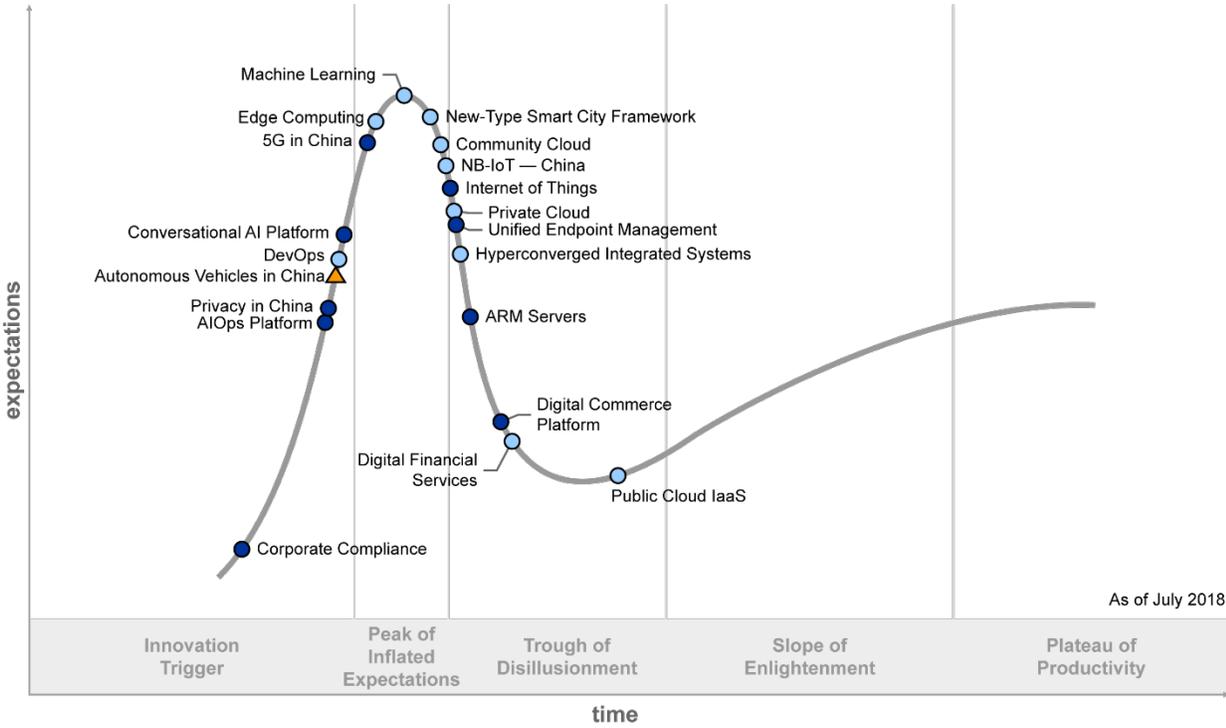
“China Summary Translation: ‘Cloud Computing Primer for 2019’”

“SWOT: Alibaba Cloud Services, Worldwide”

“Three Critical Factors Can Help You Decide Whether Alibaba Cloud Infrastructure as a Service Is Right for You”

Appendixes

Figure 3. Hype Cycle for ICT in China, 2018



As of July 2018

Plateau will be reached:

- less than 2 years
- 2 to 5 years
- 5 to 10 years
- ▲ more than 10 years
- ⊗ obsolete before plateau

© 2018 Gartner, Inc.

Hype Cycle Phases, Benefit Ratings and Maturity Levels

Table 1. Hype Cycle Phases

Phase	Definition
<i>Innovation Trigger</i>	A breakthrough, public demonstration, product launch or other event generates significant press and industry interest.
<i>Peak of Inflated Expectations</i>	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 technology is pushed to its limits. The only enterprises making money are conference organizers and magazine publishers.
<i>Trough of Disillusionment</i>	Because the technology does not live up to its overinflated expectations, it rapidly becomes unfashionable. Media interest wanes, except for a few cautionary tales.
<i>Slope of Enlightenment</i>	Focused experimentation and solid hard work by an increasingly diverse range of organizations lead to a true understanding of the technology's applicability, risks and benefits. Commercial off-the-shelf methodologies and tools ease the development process.
<i>Plateau of Productivity</i>	The real-world benefits of the technology 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.
<i>Years to Mainstream Adoption</i>	The time required for the technology to reach the Plateau of Productivity.

Source: Gartner (July 2019)

Table 2. Benefit Ratings

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

Source: Gartner (July 2019)

Table 3. Maturity Levels

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

Source: Gartner (July 2019)

Gartner Recommended Reading

Some documents may not be available as part of your current Gartner subscription.

Understanding Gartner's Hype Cycles

2019 CIO Agenda: A China Perspective

Cool Vendors in Digital Business Innovation in China

Innovation Insight for 5G Networking — Cutting Through the Hype

How to Select the Right Local Partners for a Successful China Strategy

Market Guide for Cloud Infrastructure as a Service, China

Address Chinese Cybersecurity Law With This Playbook

How to Overcome the Challenges of Adopting Private Cloud in China

SWOT: Alibaba Cloud Services, Worldwide

GARTNER HEADQUARTERS

Corporate Headquarters

56 Top Gallant Road
Stamford, CT 06902-7700
USA
+1 203 964 0096

Regional Headquarters

AUSTRALIA
BRAZIL
JAPAN
UNITED KINGDOM

For a complete list of worldwide locations,
visit <http://www.gartner.com/technology/about.jsp>

© 2019 Gartner, Inc. and/or its affiliates. All rights reserved. Gartner is a registered trademark of Gartner, Inc. and its affiliates. This publication may not be reproduced or distributed in any form without Gartner's prior written permission. It consists of the opinions of Gartner's research organization, which should not be construed as statements of fact. While the information contained in this publication has been obtained from sources believed to be reliable, Gartner disclaims all warranties as to the accuracy, completeness or adequacy of such information. Although Gartner research may address legal and financial issues, Gartner does not provide legal or investment advice and its research should not be construed or used as such. Your access and use of this publication are governed by [Gartner Usage Policy](#). Gartner prides itself on its reputation for independence and objectivity. Its research is produced independently by its research organization without input or influence from any third party. For further information, see "[Guiding Principles on Independence and Objectivity](#)."