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Delivering Scalable Cloud Services in China: Microsoft and 21Vianet Collaboration

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ABSTRACT: Microsoft Azure, operated by 21Vianet, is a specialized version of Microsoft cloud services for China that meets the requirements of regulatory compliance and data sovereignty. The pact signed in March 2014 was Microsoft's first foray into China, and at that point made them the first international public cloud provider in the country, working in line with local laws including the Cybersecurity Law and the Personal Information Protection Law, which insist on local storage and processing of data. Azure China operates as an instance entirely separate from the main Azure service operated by Microsoft, and is managed by 21Vianet, utilizing data centers in China for compliance and data residency locally. The partnership successfully combines 21Vianet's vast local infrastructure and knowledge sources with Microsoft's leading cloud technology and security framework, and has acquired over 100,000 Chinese enterprises, some of which are leading Chinese firms including Tencent and Xiaomi. Their partnership continues to grow, where Office 365 has become the leading SaaS platform in China. Driven by security and privacy in 21Vianet's operations including compliance mechanisms for consumer data protection and regulatory compliance. As China's digital economy continues to evolve, Microsoft and 21Vianet are continuing to grow their services and expand their infrastructure to support digital transformation and sustainability in accordance with national programs including the 14th Five-Year Plan.

KEYWORDS: Microsoft Azure, 21Vianet, China's stringent regulations, Data Sovereignty, Cybersecurity Law, Personal Information Protection Law, SaaS Platform

I. INTRODUCTION

21Vianet was launched to fulfill the demands of cloud service delivery and internet infrastructure in China, a market with complex regulatory and operational challenges. Its core mission is to provide reliable, high-performance cloud and data center services that meet China's legal and security compliance. The obligation for cloud service providers to keep data that was generated in China in the country required a local operator capable of providing cloud services on behalf of international providers like Microsoft. As China accelerated its digitization, demand was rising among large enterprises and government organizations for secure, legal and scalable cloud hosting services. 21Vianet was created to satisfy that demand with its carrier-neutral, enterprise-grade data centers and hybrid cloud infrastructure that could accommodate the Chinese market. 21Vianet collaborates with international cloud service providers to address legal limitations and local market complexities through its own infrastructure to support compliance, Privacy Protection Law, Cybersecurity Law etc. The company tackles major issues including legal and compliance hurdles, data sovereignty and residency issues, operational efficiencies, market access. As it enables legal deployment of cloud solutions, honors data localization needs, and minimizes the complexity of developing local infrastructure, 21Vianet is a critical partner for foreign businesses seeking to enter China [1].

The company has many data centers in China's primary Tier 1 cities of Beijing, Shanghai, Shenzhen, and Hangzhou. It offers colocation and cloud services, primarily for businesses that wanted ultra-low latency for their mission- and business-critical data. Although the data center infrastructure is geared for business customers in these two cities, it can also serve local and foreign companies that require workspace, manage servers and networking hardware, while also complying with Cybersecurity Law and Personal Information Protection Law related to data sovereignty in China. These facilities ensure that businesses operate without the worry of running afoul of the regulation. The sites are located strategically to minimize latency and with the best connectivity possible when partnering with Tier 1 carriers. The businesses that partner with 21Vianet also support businesses with Microsoft, which adds value to the cloud service, and if businesses have disaster recovery measures, they would find enterprise-grade data center facilities with high availability and security. Overall, 21Vianet is a legitimate partner for companies looking for compliant cloud and/or data center services in China, especially if handling sensitive data, and it is valuable to thus data services.

21Vianet is a leading provider of managed network services, internet data centers, and cloud computing undertaking business primarily in China. It collaborates with Microsoft to offer localized cloud services supporting Azure and Office 365 usage, thus meeting Chinese regulations on data sovereignty and data protection. 21Vianet operates as an independent service operator to oversee the local data centers and cloud infrastructure, continuing to build trust and reliability among millions of users and over 100,000 corporate clients in China. Working with Microsoft positively impacted the development of cloud computing in China, establishing a model of international cloud operations in the market and providing a reliable environment for the leading cloud products. Strengths of 21Vianet that support successful cloud product offerings include their experience on local operations, existing infrastructure with energy efficient data centers, and unobstructed access to Microsoft cloud services designed for the China market. Additionally, this partnership should foster further growth and innovation by empowering businesses and developers in their efforts to build upon their cloud usage efforts, and accelerate their usage of cloud services [3].

II. RELATED WORK

Microsoft Azure, operated by 21Vianet, seeks to combine Microsoft's cloud services with China's regulatory framework, which allows Azure and Office 365 to operate in compliance with data sovereignty and cyber security regulations in China. This relationship allows Microsoft to solve multiple issues including obtaining an Internet Content Provider license for Azure's use in China, navigating strict data residency requirements, and working around the Great Firewall that blocks access to global services. Operationally, Microsoft engineers do not have access to Chinese data centers directly and must work with 21Vianet in a supporting capacity for trouble shooting, and sometimes reduced capacity for troubleshooting, and are working within limited Azure functionality as well. Technical adaptations must also be completed to ensure Azure services are functional in the unique restrictive environment called "Mooncake," as regional service management has local commitments to overcome challenges in offering services. The relationship must also overcome challenges related to ecosystems that are solely designed around the technology ecosystem approved in China and the inability to offer and/or control an application through to third-party apps and the limitations of integration. Collectively, Microsoft and 21Vianet are able to offer a local Cloud solution that is compliant and has superior performance, which supports a growing number of businesses across multiple sectors in China on a wider range of platforms. Thus, both organizations are facilitating the country's digital transformation journey to offer robust and reliable services enabled by regional infrastructure. [4]

The risk matrix details important distinctions between Mooncake, which is 21Vianet's Azure service in China, and Azure Worldwide on issues surrounding data residency, export regulations, and third-party access. Mooncake requires data to be held within China to comply with local laws, such as the PIPL and Cybersecurity Law. This means that data movement outside of China is limited, but it is focusing on legal compliance instead. In contrast, Azure Worldwide allows organizations to move data outside of China based on international regulations, such as GDPR, but has higher risk exposure to non-compliance if local laws are violated due to proper data residency and data management processes not being maintained. While nations like China have strict export regulations and must deal with legalities surrounding them, other countries have more liberal export regulations. With third-party access in Mooncake, it is very tightly controlled based on local laws, with Microsoft's support in this area being limited. On the other hand, Azure Worldwide is driven more by its ecosystem and its vendor support surrounding compliance, which is a valuable benefit while also introducing its own set of compliance risks. Stakeholders should weigh operational capabilities, support access, and compliance risk when choosing between Mooncake and Azure Worldwide, balancing them all against their organizational risk tolerance and local regulatory framework [5].

The implementation of Microsoft's Mooncake for hybrid and cross-border workloads in a cloud context in China creates operational complexity that is difficult to manage because of limitations and restrictions. In the first place, network latency and connection issues because of the Great Firewall could interfere with performance when data is synchronized between China and other locations in the world. Second, data residency rules require the data created with Mooncake to stay in China, which complicates the design of hybrid clouds and movement of data. Third, broadcasts will need to be designed for hybrid applications because Mooncake does not have access to some Azure services and APIs available in the rest of the world. Support is § complicated since any issues around Mooncake deployment that requires support must go through 21Vianet, which slows response and resolution times for issues involving both Mooncake and public Azure. Fourth, endpoints and API configurations will have to be managed by humans to avoid authentication failures. Finally, there could be restrictions on third party integration, limiting the usage of the cross-boarder applications, intertests ing modifications as needed for hybrid deployment [6].

In the context of Microsoft, we are referring to Azure, operated by 21Vianet in China, in which a number of Azure services have changed, limitations, or similar operational affects. Active Directory on Azure has modified authentication options due to cross-border data constraint and limited interaction capabilities with global AAD instances. Azure Storage has geo-replication restriction issues for data outside of China and requires that storage must continue to reside in China. Cosmos DB limitations on geo-replication capabilities, with a similar requirement that the data remains within China. There are networking issues related to Azure Networking and Virtual Machines to consider related to the connectivity and routing options affected by the constraints of the Great Firewall, particularly related to VPN connections and hybrid networking. Azure Managed Instances and SQL Databases can possibly present functionality and performance differences from other regions to service compliance with the regulations of China. Azure App Services may also: not have certain runtime version restrictions, limited capability to integrate with some third-party services and applications.

Azure Kubernetes Service has discernible limitations and localized tools for its monitoring function. Azure Developer Tools and DevOps may require different tool integrations for local compliance, with network restrictions affecting pipeline connections. Azure's Cognitive and AI Services are less accessible for specific models and APIs, with both inferring and model training being occupied by local data regulations. Security and compliance tools are modified to operate according to Chinese regulations, implying limited transfer of global threat intelligence. The aforementioned Azure Marketplace indicates limited access to third-party applications, specifically from Western developers, based on compliance and network conditions. Lastly, many SDKs and APIs for Azure Service Management may deviate from the global version, and often require endpoint configuration to set up manually [7].

The alliance of Microsoft and 21Vianet has achieved the successful entry of two important products for Microsoft into the Chinese market, as described in the introduction, by leveraging 21Vianet's operational history with local laws and regulations and Microsoft's technology capacity. The first project, Azure started in 2014, was the first public global cloud service that was made available to Chinese citizens. Since its launch, the project has expanded to over 100,000 companies, including companies such as Haier and Lenovo. The second project, Office 365, has become one of the top SaaS products in China and has streamlined operations of companies like Tencent and Huawei. 21 Vianet has a dedicated cloud management organization that has achieved over 98% customer satisfaction with 21Vianet's services and has obtained multiple certifications on security and compliance. The collaboration also acted swiftly to protect regulatory approvals to ensure compliance with the changing markets and regulatory framework. This collaboration represents a successful way of delivering public cloud services across an international border and into the strict regulatory framework of one of the largest digital economies in the world [8].

The collaboration of Microsoft with 21Vianet represents a successful model for providing Microsoft cloud services in China in compliance with laws, local regulation, and practices in China. This collaboration uses a localized model, utilizing 21Vianet's existing data centers and other offerings that are compliant under Chinese cybersecurity laws, while also balancing factors of data residency and sovereignty with the need for global scalable cloud innovation and services. Research has documented significant user growth and service adoption strategies including a partner ecosystem and scalable hybrid architecture. Technical modifications, including changes to Azure APIs and the configuration of network connectivity, are enabling Microsoft cloud services to be used legally within China. This partnership prioritizes compliance with legal requirements for data protections and cybersecurity regulations supported by procedures that build trust in their services and solutions. Other components of Microsoft 365 can be sourced through customized products developed for the Chinese market through localized content that also provides added flexibility in terms of product licensing. Overall, the studies reaffirm the significance of technology adaptations alongside the legal localization, as strict compliance is a cornerstone to operationalizing Microsoft's cloud services within China, while also demonstrating how a global cloud offering can maneuver the questioning of geopolitics [9].

The tenant designs of Microsoft 365 in China and their various configurations internationally also demonstrate stark contrasts pertaining to network performance, access to features, and data sovereignty. The global tenant is subject to international regulations such as GDPR, while the China tenant, hosted and actually owned by 21Vianet, must comply with local regulations by maintaining all data processing within China and implementing severe isolation from external data. Availability of features also differs; for example, the global tenant includes a breadth of services such as Microsoft Teams Live Events and Windows Autopilot, while the China tenant has processing limitations that restrict service availability to limited features. The user experience is also influenced by the network performance of each tenant; in this case, local users connecting to a tenant outside China dealt with latency and resiliency issues due to the Great Firewall, while the native tenant allowed for superior local performance at the sacrifice of integration with any international services. Depending on the IT strategy for tenant architecture, any tenants in China may consist of

isolating users on an China tenant; utilizing a multinational tenant anywhere in the world; or a hybrid architecture with the opportunity for limited cross-tenant collaboration utilizing Microsoft Entra B2B. Each of these options create an experience that emphasizes compliance vs. user experience. Cross-tenant integrations can be somewhat difficult to work with, particularly with Power Platform, Teams and Dataverse workflows, adding significant operational complexity and cost relative to single-tenant systems. Generally speaking, stakeholders will have to assess the structural and operational differences to find a tenant architecture that is compliant with legal requirements in China and the world over, but which also provides satisfactory levels of compliance, and operational and user experience needs across all the various national jurisdictions [10].

The differences in terms of Microsoft services at 21Vianet in China and Microsoft services globally are due to multiple operational, technical, and regulatory factors. 21Vianet operates Microsoft 365 in China under a license to comply with local regulations and data residency laws; as a result, Microsoft has no or limited access to the data centers and no direct control over the data, limits Microsoft’s access to support and troubleshooting the services. Advanced services, such as Azure Information Protection Premium and Microsoft Intune, are not available or do not fully operate in the 21Vianet-operated services, as expected in the regulatory environment in China. Service and product operators recognize the restrictions, but are making efforts to include new services and features in response to the regulatory environment, with the ultimate goal of convergence into the global offering. Service and product vendor operators also indicated that providing a seamless customer experience is more difficult when compared to their global services, especially with respect to ecosystem integrations and international collaboration; but viewed 21Vianet as an important partner to allow Microsoft to have a cloud presence in China. Operationally, 21Vianet provides an infrastructure that can deliver reliable cloud service delivery for customers in China, but this also makes it more difficult to provide hybrid or cross-border deployments and obtain ongoing updates and support from Microsoft [11].

When comparing Mooncake (21Vianet) services to Microsoft's global Azure and Microsoft 365 cloud, the difference in outage events and Service Level Agreement (SLA) enforcement arise from operational and legal circumstances. Microsoft Azure and Microsoft 365 services usually have high availability SLAs, meaning they are designed with strong geographic redundancy and failover. Conversely, Mooncake has localized outages more often due to Great Firewall restrictions and local infrastructure limitations. While Mooncake's SLA regarding uptime may be similar to Microsoft, there is no operational or regulatory context that guarantees the same level of assurance as Microsoft’s SLA commitments. For example, Microsoft articulates specific compensation service credits for SLA incidents, while Mooncake service users usually wait longer to resolve an issue when they should not have to, and they do not have as much information about the status of the issue as they would normally have due to 21Vianet involvement.

Furthermore, Mooncake is subject to connectivity issues related to the Chinese internet which may disrupt service intermittently without the appropriate audience recognizing the issue. Both services exclude scheduled maintenance and force majeure from SLA obligations, but the SLAs for Mooncake may also ignore disruptions stemming from the government. While there is anecdotal evidence to suggest strong reliability with Microsoft Azure, Mooncake users have reported network problems and delays in service. Overall, Microsoft Azure and Microsoft 365 provide better SLA enforcement and incident resolution time, and Mooncake offers a compliant cloud solution with trade-offs, including longer resolution time and higher risk of outages. Organizations seeking high availability in China should take these factors into account and consider hybrid options with Mooncake along with Azure services outside of China [13].

Organizations doing business in China face the tough decision of whether to use Microsoft 365 with 21Vianet, which has trade-offs around limited support and very limited functionality, or the global Microsoft 365 tenancy, which has more functionality but also multi-factor authentication, latency, as well as regulatory impediments. In this analysis we support multinational corporations make precise strategic decisions on cloud architecture, and tenant management in China, as in Table 1:

Aspect	Without 21Vianet (Global Microsoft 365 Tenant)	With 21Vianet (Microsoft 365 Operated by 21Vianet in China)
Data Residency & Compliance	Data stored globally, governed by GDPR and other international laws.	Data stored exclusively within China to comply with Chinese regulations (Cybersecurity Law, PIPL).
Tenant Isolation	Single global tenant, unified identity and management across regions.	Separate China-specific tenant isolated from global tenant; no shared infrastructure.
Service Feature	Full Microsoft 365 feature set: Teams	Reduced feature set: Limited Teams

Availability	Live Events, Intune, Windows Autopilot, Microsoft Defender, Power Automate integrations.	functionality, no Microsoft Intune, no Windows Autopilot, limited security tools and Power Automate connectors.
Network Performance	Users in China accessing global tenant suffer latency, Great Firewall impact.	Local access optimized with faster, stable connectivity inside China, but integration with global services limited.
Cross-Tenant Collaboration	Native, seamless collaboration across global regions.	Cross-tenant collaboration via Microsoft Entra B2B; adds complexity and management overhead.
Support and Operations	Direct Microsoft global support with rapid response and troubleshooting.	Support coordinated via 21Vianet; slower issue resolution due to limited Microsoft engineer access.
Identity Management	Global Azure AD integration with full identity federation and conditional access.	Separate Chinese Azure AD environment; limited global integration, causing potential identity silos.
Regulatory Restrictions	Not compliant with China’s data localization requirements for China users.	Fully compliant with China’s legal and regulatory framework for cloud services.

Table 1: Key differences between Implementing Microsoft 365 with and without 21Vianet in China

III. SYSTEM OVERVIEW

The Azure China (Mooncake) program is predicated on an acceptable level of compliance in accordance with, primarily, China’s legal regime pertaining to that data with a focus on China's Cybersecurity Law and Personal Information Protection Law (PIPL) which requires that client data is stored in China. Therefore, for any cloud service operation in China, which is operated by 21Vianet, an Internet Content Provider (ICP) license is required, which is typically up to 30 days for processing. The program is operated in specific cloud regions including China North (Beijing) and China East (Shanghai) to demonstrate compliance through network endpoints and APIs that are isolated. Microsoft partners closely with 21Vianet's local teams on support and incident management, as an engineer from Microsoft cannot access the data centers in China. This partnership also includes a transfer of knowledge and provide training to ensure the continuation and efficiency of operations.

The technical design for Mooncake contains technical concepts such as network isolation presented by the Great Firewall and the rationale to restrict foreign technology which may lead to API version differences and services that organized with limited access to some Azure Azure services. However, to mitigate these limitations, the architecture also must leverage hybrid integrations and establish configurations for localized service specific domains. Specific planning and application sophistication are necessary in integrating Mooncake hosted services and globally hosted systems that are all specifically optimized for localization - to support compliance but to also ensure full integration performance as intended. Overall, the program is an example of hybrid compliance driven cloud instantiation that balances the compliance needs for China with Microsoft's global cloud principles, all positioning the technical staff specialist to enable knowledge transfer and sustain sustainability of operational excellence, illustrated in relevant and notable Figure 1 below:

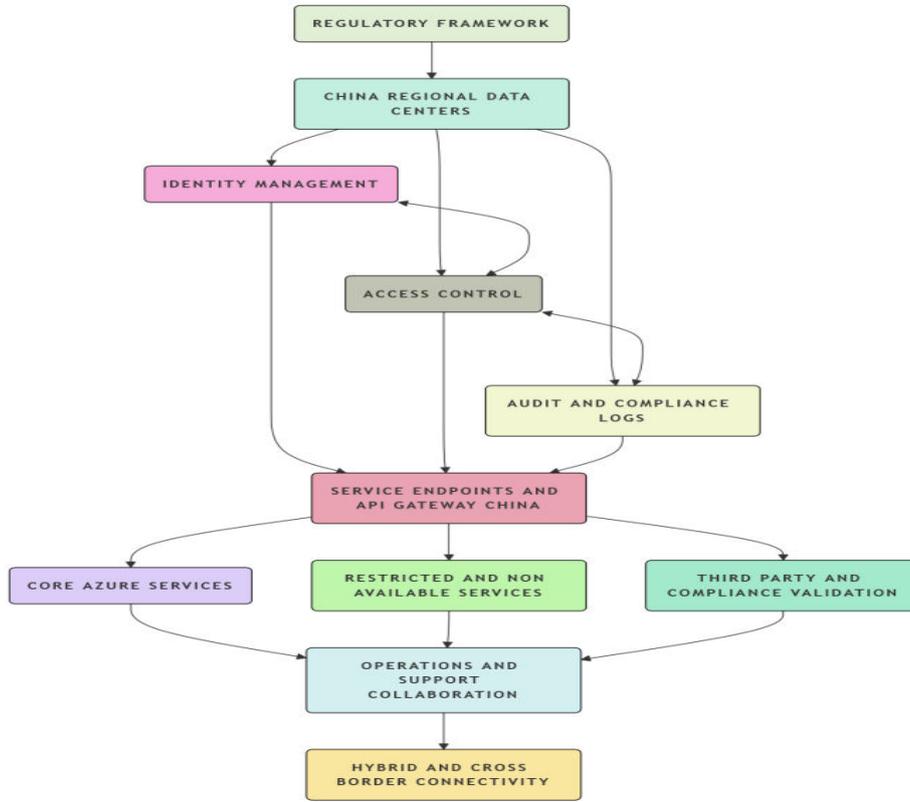


Figure 1: Compliance-First Azure China Architecture

1. Regional Data Centers:

The data centers have been established in located in Beijing, Shanghai, Zhangjiakou and Nantong, thus remaining compliant with Chinese data resident regulation via network separation and geo-fencing.

2. Regulatory Architecture:

ICP licenses are continuously maintained and validated for each service, and by having them maintained in real-time as an ongoing validation mechanism, compliance is assured. A provided and maintained audit trail and log for compliance reporting is also in place.

3. Network Infrastructure:

A local private backbone network connects the data centers enabling low latency, and high bandwidth for connections. Dedicated egress points for cross-border traffic have been provided, as well as managed VPN and ExpressRoute links to Hong Kong. Traffic advice has been implemented to mitigate the restrictions of the Great Firewall prohibiting unauthorized access.

4. Identity and Access Management:

New dedicated instances of Azure Active Directory (AD) have being created and maintained independently for tenants in China so that identity stores remain segregated from the global Azure AD infrastructure. This was adopted to remain compliant with local regulations to enforce access conditionality and multi-factor authentication.

5. Data and Service Segmentation:

Segregated service endpoints are created to enforce API versions and features compliance. Data is safely encrypted at rest by utilizing independent data stores specific to individual services. Moreover, the APIs, SDKs, and manual endpoint configurations are tailored to support the China-specific operational requirements.

6. Support and Operations:

Local operation centers are manned with 21Vianet engineers who are trained by Microsoft. Shared workflows for problem management and monitoring are enabled through these centers so that the collaboration among the Microsoft

and 21Vianet teams is ensured. Escalation interfaces have also been built to handle escalation paths that are compliance-gated.

7. Integration Layer and Ecosystem:

Third-party apps listed as operationally compliant in China are supported. Gateway and proxy services enable chosen external interfaces. Enterprise-level integrations are restricted to compliant services. Microsoft Entra B2B provides cross-tenant collaboration to handle hybrid global-China workflows.

The regulatory environment that governs the architecture is derived from Chinese cybersecurity law and ICP licenses. Chinese data centers are connected in a secure internal backbone such that the data is local. Identity and access management is tightly restricted by a custom Azure AD instance with tailored conditional access policies. Service endpoints, versions, and configurations are handled through custom API gateways designed for China. The platform separates fully functional Azure services that are locally available from limited or unavailable ones, which are based on alternative architecture. Operations and support are mirrored by a local 21Vianet-operated center that is tightly integrated with Microsoft's global teams for escalation and sharing of information. Hybrid connectivity also provides for regulated access to external resources internationally while adhering to China's network laws, enabling cross-tenant collaboration.

Compliance-first Azure China (21Vianet) cloud design prioritizes compliance with local regulations and operational readiness through multiple means and tools. It deals with design for regulatory compliance, such as separation of data and Chinese computing resources regulated by the Cybersecurity Law and PIPL. Operational management is maintained through ICP license management and through the identity management system that ensures data segregation between international and Chinese Azure tenants. Knowledge transfer is conducted through training and mentorship to the local engineers, as well as the deployment of monitoring and incident response protocols for continuity. Adjustments made to networking and security for compliance with the internet conditions in China include tailored routing and processes as required for the Great Firewall. Services and features are customized for China regionally, subject to availability and compliance, specifically for access and security policies. The architecture also employs a variety of tools such as custom APIs using the Azure Resource Manager for managing resources, Azure Portal China, operational dashboards for real-time operational monitoring, and targeted authentication endpoints for Azure AD in China. Hybrid cloud connectivity tools and also training and documentation enable ongoing partner enablement and compliance initiatives [14].

The deployment strategy for Azure China (21Vianet) includes several important elements for compliance with local law as well as operational improvements. These strategies ensure compliance with the Cybersecurity Law of the People's Republic of China and the Personal Information Protection Law (PIPL), which mandate that all data must be stored and processed in China, as well as a requirement for an Internet Content Provider (ICP) license. The strategy also includes knowledge transfer to onshore partners through seminars and training to develop self-sufficiency in technical positions. Partnering together is essential for Microsoft and 21Vianet to ensure cooperative operations, including working together on incident handling and support models to service customers. The network infrastructure is optimized to meet the unique topology of China with private backbones and secure links to ensure latency-sensitive access. Service endpoints are configured to access APIs optimized for the China stand-up market, with localized versions of Azure services for the China market. The availability of the service is also limited to regulated subsets of Microsoft 365 and Azure with local features to meet local regulatory needs. Finally, cross-tenant collaboration tools enable hybrid cloud deployments through support of international cooperation while complying with regulatory restrictions.

Planning cross-border networking in China with Azure entails overcoming operational complexities like latency, compliance, and secure communication across locations in China and Azure services outside of China. Network performance is an important consideration, where latency is considerably slower across Azure China and other global regions, leading to the suggestion to place workloads for Chinese customers within Azure China and for customers outside China in the closest global region. Connectivity can be realized through two standalone ExpressRoute circuits for safe traffic management, a China Express Simplified Model for IaaS offerings, or a VPN Site-to-Site Model for IaaS and PaaS services, but the latter will add latency and compliance. Compliance with China's cybersecurity regulations is important, and this would require ICP licenses and utilization of Secure Hub and Azure Virtual WAN for centralized security and monitoring. Also, Azure AD Connect and Microsoft Entra B2B support user ID management and cross-tenant communication. Operations support includes 21Vianet-Microsoft coordination to handle network problems and routing optimization for cross-region connectivity are depicted in below Figure 2:

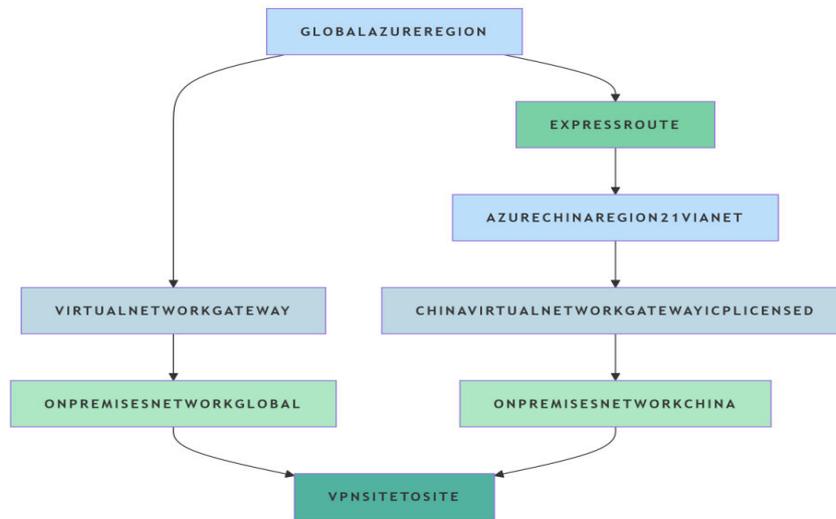


Figure 2: Designing Cross-border networking with Azure China

Microsoft Azure China (21Vianet) aspires to provide a 99.99 percent uptime SLA, utilizing regional failover and data center redundancy contained within both China North and China East regions according to Azure standards of internationally-available services. The data center has multiple cloud certifications that signify its operational integrity and has been assessed for hybrid cloud capabilities. However, cross-border latency is impacted by both the Great Firewall and geographic distance, with throughput latency higher than three times that of intra-global Azure transfers. To mitigate this, 21Vianet relies on region-specific network backbones to improve workload performance and latency for local users. User satisfaction scores exceed 98 percent for service delivery and responsiveness, which are confirmed by compliance standards. The platform's capacities have also seen significant growth, including a threefold growth announced in 2018. This provided increased availability of resources for applications and scalability for the client glass. 21Vianet contains levels of cloud certifications across multiple services by continuing to withstand strict standards in security and availability that are of the utmost importance to enterprises in China. Major clients including Tencent, Xiaomi, Lenovo, and Huawei use Azure China as a trusted platform for critical applications covering a range of services including virtual machines, Kubernetes, SQL databases, AI services, and SaaS products, all of which are tailored for the Chinese market.

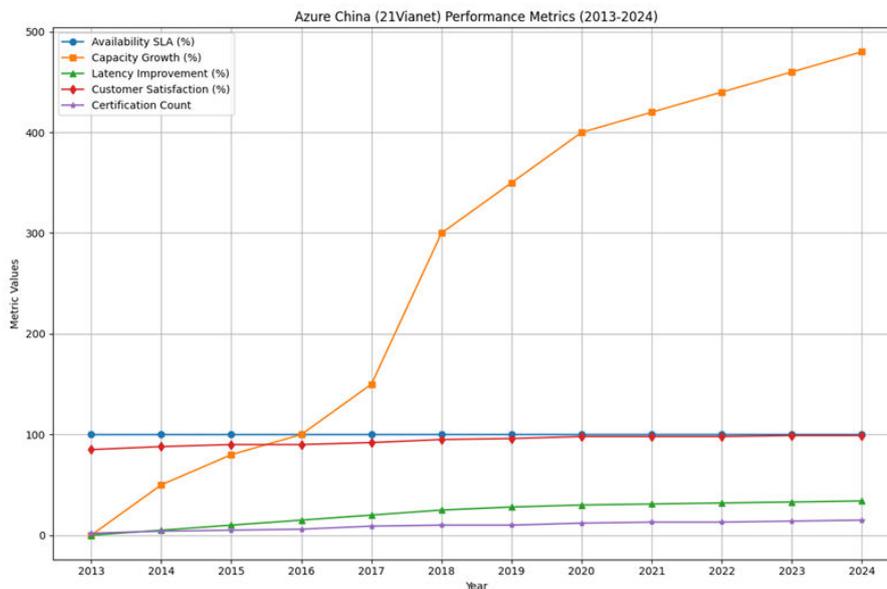


Figure 3: Azure China (21Vianet) Performance Metrics (2013-2024)

IV. CONCLUSION

Microsoft Azure, through 21Vianet, is a cloud platform that is built for China's regulatory and data sovereignty requirements while also maintaining the worldwide innovation and scale of Microsoft Azure. The partnership brings together 21Vianet's local expertise and Microsoft's leadership in cloud technology in order to bring a hybrid cloud and SaaS environment to enterprises in China while complying with national regulations, such as the Cybersecurity Law and PIPL. Azure China's planned development will broaden its infrastructure capacity by a significant measure, which various aspects will contribute to overall performance, latency, and service availability. New Azure regions will improve user proximity and disaster recovery. There are ongoing initiatives to close the features gap between Azure China and the global version, while providing users with similar service experiences that include analytics, AI, and hybrid cloud capabilities. Additionally, we are engineering improvements to identity federation, security, and cross-border networking to minimize disruptions compliance with local laws for international organizations to use with confidence. Continued investment in the partner ecosystem, and local people as well as compliance will accelerate innovation in cloud digital transformation, smart cities, sustainable technologies, and AI; positioning Azure China at the center of China's cloud innovation ecosystem.

REFERENCES

1. "21Vianet and Microsoft Adhere to New Cyber Security Law in the Chinese Market", May, 12 2017, <https://en.21vbluecloud.com/21vianet-and-microsoft-adhere-to-new-cyber-security-law.html>.
2. "21Vianet opens Shanghai data center", Yvonne Feng, October 12, 2018, <https://www.datacenterdynamics.com/en/news/21vianet-opens-shanghai-data-center/>.
3. "BitTitan and 21Vianet Blue Cloud partner to address Office 365 growth", Elly Yates-Roberts, 22 May 2019, <https://www.technologyrecord.com/article/bittitan-and-21vianet-blue-cloud-partner-to-address-office-365-growth>.
4. "21Vianet to Operate Azure Cloud in China into 2018", Jason Verge, April 2, 2015, <https://www.datacenterknowledge.com/cloud/21vianet-to-operate-azure-cloud-in-china-into-2018>.
5. "Data Residency Challenges and Opportunities for Standardization", Claude Baudoin, 2017, <file:///C:/Users/HIMA%20JYOTHI/Downloads/mars-17-03-22.pdf>.
6. "2022 ENVIRONMENTAL SOCIAL AND GOVERNANCE REPORT", 2022, <https://www.sands.com/content/uploads/2023/06/SANDS-ESG-Report-2022-1.pdf>.
7. "Microsoft and 21Vianet reinforce long-term cooperation on cloud services in China", Mar 14, 2018, <https://azure.microsoft.com/en-us/blog/microsoft-and-21vianet-reinforce-long-term-cooperation-on-cloud-services-in-china/>.
8. "21Vianet and Microsoft Reinforce Long-term Cooperation on Cloud Services in China", Mar, 14 2018, <https://en.21vbluecloud.com/21vianet-and-microsoft-reinforce-long-term-cooperation-on-cloud-services-in-china.html>.
9. "Red Cloud Rising: Cloud Computing in China (Revised)", Leigh Ann Ragland, Joseph McReynolds, Matthew Southerland, James Mulvenon, September 5, 2013, https://www.uscc.gov/sites/default/files/Research/DGI_Red%20Cloud%20Rising_2014.pdf.
10. "O365 - EU and China", Taen keren, Jan 08, 2019, <https://techcommunity.microsoft.com/discussions/microsoft-365/o365---eu-and-china/310241>.
11. "A Ponzi Scheme of Acquisitions - 21 Vianet Group Exposed", Trinity Research Group, Sep 10, 2014, <https://www.scribd.com/document/239281816/A-Ponzi-Scheme-of-Acquisitions-21-Vianet-Group-Exposed>.
12. "SRE fundamentals: SLIs, SLAs and SLOs", Jay Judkowitz, Mark Carter, July 20, 2018, <https://cloud.google.com/blog/products/devops-sre/sre-fundamentals-slis-slas-and-slos>.
13. "Comparative Analysis of Present Day Clouds using Service Level Agreements", Preeti Gulia, Sumedha Sood, May 2013, <https://research.ijcaonline.org/volume71/number3/pxc3888603.pdf>.
14. "Methods and Tool", Charlotte Håkansson, Margareta Nelke, 2015, <https://doi.org/10.1016/B978-0-08-100206-3.00012-5>.



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