TCCC Hub Azure Resources Specification

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Executive Summary: This comprehensive resource specification document provides detailed technical specifications for all Azure resources required to deploy and operate The Coca-Cola Company (TCCC) Hub infrastructure. The document serves as the authoritative reference for infrastructure architects, cloud engineers, and DevOps teams responsible for implementing the multi-tenant bottler agent ecosystem. This specification incorporates the latest Azure service capabilities and best practices as of 2025, ensuring optimal performance, security, and cost efficiency for enterprise-scale operations.

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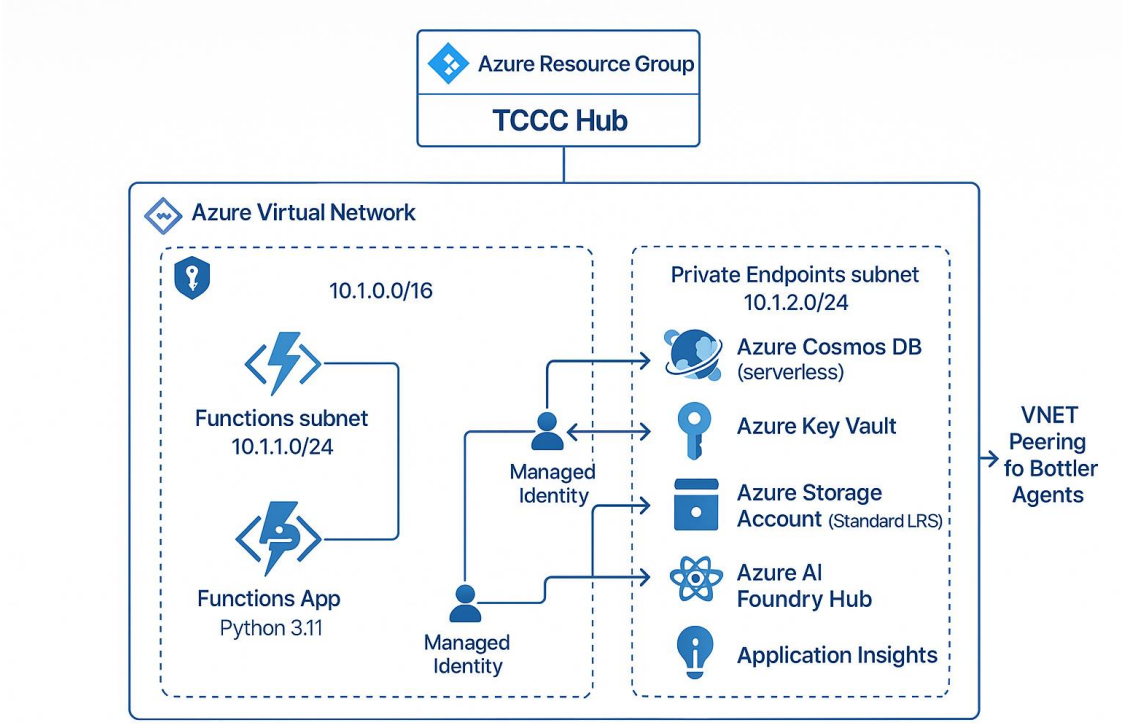
Introduction

The TCCC Hub represents the central orchestration component in The Coca-Cola Company's multi-tenant bottler agent ecosystem, serving as the primary coordination point for secure cross-tenant communication and business process orchestration. This resource specification document provides comprehensive technical details for all Azure services and

components required to implement the TCCC Hub infrastructure using modern cloud-native architectures and Infrastructure as Code principles [1].

The resource architecture implements Microsoft's recommended patterns for multi-tenant solutions, ensuring security isolation, operational autonomy, and scalable performance across the collaborative ecosystem. The TCCC Hub serves as the central coordination point for multiple bottler agents, each operating within their own Azure tenant while maintaining secure communication channels through cross-tenant networking and authentication mechanisms [2].



TCCC Complete Resource Architecture

The infrastructure design leverages Azure's Platform as a Service (PaaS) offerings to minimize operational overhead while maximizing security, performance, and cost efficiency. Each service component has been carefully selected to provide enterprise-grade capabilities that can scale to support dozens of bottler organizations while maintaining strict security and compliance requirements [3].

Business Context and Technical Requirements

The TCCC Hub infrastructure addresses several critical business and technical requirements that are fundamental to The Coca-Cola Company's digital transformation strategy. The solution must provide centralized coordination capabilities that enable efficient collaboration between TCCC and multiple bottler organizations while maintaining strict security and compliance boundaries. This requirement drives the need for sophisticated multi-tenant architecture patterns that can scale to support dozens of bottler organizations [4].

The technical architecture must implement enterprise-grade security controls that protect sensitive business data and intellectual property while enabling the data sharing and collaboration required for effective supply chain coordination. This requirement necessitates the implementation of defense-in-depth security principles, including network isolation, identity-based access controls, and comprehensive audit capabilities [5].

The solution must provide operational excellence through automated deployment processes, comprehensive monitoring and alerting, and robust disaster recovery capabilities. These requirements ensure that the TCCC Hub can maintain high availability and performance while supporting critical business operations across multiple time zones and geographic regions [6].

Service Selection Rationale and Technology Stack

The TCCC Hub deployment leverages a carefully selected set of Azure services that provide the capabilities required for multi-tenant orchestration while maintaining enterprise-grade security and performance characteristics. The service selection process considered factors including scalability, security, cost efficiency, operational complexity, and integration capabilities with existing TCCC infrastructure [7].

Azure Functions serves as the primary compute platform, providing serverless execution capabilities that can scale automatically based on demand while maintaining cost efficiency through consumption-based pricing. The serverless model eliminates the need for infrastructure management while providing the flexibility required for variable workloads and multi-tenant scenarios [8].

Azure Cosmos DB provides globally distributed, multi-model database capabilities that support the data storage and retrieval requirements of the hub orchestration logic. The service's automatic scaling, multi-region replication, and comprehensive SLA guarantees make it well-suited for mission-critical applications that require high availability and low latency [9].

Azure Key Vault provides centralized secrets management capabilities that ensure sensitive configuration data, connection strings, and cryptographic keys are stored securely and accessed through controlled, audited mechanisms. The service's integration with Microsoft Entra ID and support for hardware security modules (HSMs) provides enterprise-grade security for sensitive data [10].

Azure AI Foundry Hub provides the artificial intelligence and machine learning capabilities required for advanced analytics, predictive modeling, and intelligent automation within the bottler ecosystem. The service's comprehensive model catalog and enterprise governance features enable sophisticated AI-driven business logic while maintaining security and compliance requirements [11].

Azure Virtual Networks (VNETs) provide the network isolation and connectivity capabilities required for secure cross-tenant communication. The service's support for private endpoints, network security groups, and cross-tenant peering enables the

implementation of sophisticated network security architectures that protect sensitive data while enabling required connectivity [12].

Application Insights provides comprehensive application performance monitoring, logging, and analytics capabilities that enable proactive identification and resolution of performance issues. The service's integration with Azure Monitor and support for custom telemetry provides visibility into application behavior and business metrics [13].

Architecture Overview

Hub-and-Spoke Architecture Implementation

The TCCC Hub implements a hub-and-spoke architecture pattern that provides centralized coordination and control while maintaining the independence and isolation required for multi-tenant scenarios. This architectural pattern is specifically recommended by Microsoft for multi-tenant solutions that require centralized governance with distributed execution capabilities [14].

The hub-and-spoke pattern offers several critical advantages for the TCCC bottler ecosystem. First, it provides centralized policy enforcement and monitoring capabilities that enable TCCC to maintain oversight and control over the collaborative ecosystem while respecting tenant boundaries and organizational autonomy. This centralization is essential for maintaining consistent business rules and compliance requirements across multiple bottler organizations [15].

Second, the pattern prevents direct communication between bottler agents, ensuring that sensitive business data cannot be shared between competing organizations without explicit authorization and comprehensive audit trails. This isolation is critical for maintaining competitive separation while enabling collaborative supply chain coordination [16].

Third, the architecture enables efficient scalability by allowing new bottler agents to be added through simple cross-tenant connections to the central hub, without requiring complex mesh networking configurations or modifications to existing connections. This scalability is essential for supporting the planned expansion to dozens of bottler organizations [17].

Resource Architecture and Service Integration

The TCCC Hub resource architecture implements a microservices pattern using Azure Functions as the primary compute platform, with supporting services providing specialized capabilities for data storage, security, artificial intelligence, and monitoring. This approach provides several advantages including automatic scaling, cost efficiency through consumption-based pricing, and simplified deployment and maintenance processes [18].

The architecture includes comprehensive network isolation through Azure Virtual Networks, with separate subnets for different service tiers to enable fine-grained security controls. Private endpoints are used extensively to ensure that all communication between

services occurs over the Microsoft backbone network without exposure to the public internet [19].

Data persistence is implemented through Azure Cosmos DB in serverless mode, which provides globally distributed, multi-model database capabilities with automatic scaling and comprehensive SLA guarantees. The serverless configuration optimizes costs for variable workloads while maintaining the performance and availability required for enterprise operations [20].

Security and secrets management is implemented through Azure Key Vault, which provides centralized storage and management for sensitive configuration data, connection strings, and cryptographic keys. The Key Vault integration uses managed identities to eliminate the need for storing credentials in application code or configuration files [21].

Multi-Tenant Security and Isolation

The multi-tenant security architecture implements defense-in-depth principles with multiple layers of isolation and access controls. Network-level isolation is provided through Azure Virtual Networks with Network Security Groups that control traffic flow between different components and external systems [22].

Identity-based access controls are implemented through Microsoft Entra ID with role-based access control (RBAC) and managed identities that provide secure, credential-free authentication between Azure services. This approach eliminates the security risks associated with stored credentials while providing comprehensive audit capabilities [23].

Data isolation is implemented through tenant-specific data partitioning in Azure Cosmos DB, with access controls that ensure each bottler organization can only access their own data. The database design implements logical separation that maintains performance while providing the security isolation required for multi-tenant scenarios [24].

Application-level security controls include comprehensive input validation, output encoding, and business logic authorization that ensures only authorized operations can be performed by each tenant. These controls are implemented within the Azure Functions code and are enforced consistently across all API endpoints [25].

Networking Infrastructure

Virtual Network Architecture and Design

The Azure Virtual Network (VNET) serves as the foundation for all network connectivity and security controls within the TCCC Hub infrastructure. The VNET is configured with the address space 10.1.0.0/16, providing 65,536 IP addresses to support current requirements and future expansion needs. This address space allocation follows Microsoft's recommended practices for enterprise network design and avoids conflicts with common on-premises network ranges [26].

The VNET design implements a subnet-based architecture that provides logical separation between different service tiers and enables fine-grained security controls through Network Security Groups. The subnet design includes two primary subnets: the Functions subnet (10.1.1.0/24) for compute resources and the Private Endpoints subnet (10.1.2.0/24) for secure connectivity to Azure PaaS services [27].

The Functions subnet hosts the Azure Function App and provides VNET integration capabilities that ensure all outbound traffic from the Function App flows through the VNET rather than directly to the internet. This configuration enables the implementation of network-based security controls and provides visibility into all network traffic generated by the application [28].

The Private Endpoints subnet hosts private endpoint connections to Azure PaaS services including Cosmos DB, Key Vault, Storage Account, AI Foundry Hub, and Application Insights. Private endpoints provide secure connectivity to these services over the Microsoft backbone network, eliminating exposure to the public internet and reducing attack surface [29].

Network Security Groups and Traffic Control

Network Security Groups (NSGs) provide stateful firewall capabilities that control network traffic at the subnet and network interface levels. The TCCC Hub implementation includes two primary NSGs: one for the Functions subnet and one for the Private Endpoints subnet, each configured with appropriate security rules for their respective service tiers [30].

The Functions subnet NSG includes rules that allow HTTPS traffic (port 443) from authorized bottler VNET address ranges, specifically including the ARCA VNET range (10.2.0.0/16) and other bottler networks as they are onboarded to the ecosystem. These rules implement a default-deny approach with explicit allow rules for required traffic flows [31].

The Private Endpoints subnet NSG implements more restrictive rules that allow only the specific traffic required for private endpoint functionality. These rules ensure that private endpoint traffic remains isolated and cannot be accessed from unauthorized sources [32].

All NSG rules are configured with comprehensive logging enabled, providing detailed audit trails of all network traffic decisions. This logging is essential for security monitoring, compliance reporting, and troubleshooting network connectivity issues [33].

Cross-Tenant VNET Peering Configuration

Cross-tenant VNET peering enables secure, high-performance network connectivity between the TCCC Hub and bottler agents without requiring VPN gateways or public internet exposure. The peering configuration implements hub-and-spoke topology where the TCCC Hub serves as the central hub with individual peering connections to each bottler VNET [34].

The peering configuration includes several important settings that ensure security and performance. The “Allow virtual network access” setting enables basic connectivity

between peered networks, while “Allow forwarded traffic” is disabled to prevent bottler networks from using the TCCC Hub as a transit point for communication with other bottlers [35].

The “Use remote gateways” setting is configured appropriately based on the specific requirements of each bottler connection. In most cases, this setting is disabled to maintain network isolation, but it may be enabled for bottlers that require connectivity to on-premises resources through the TCCC Hub [36].

Route tables are configured to ensure that traffic flows only between authorized endpoints and that bottler-to-bottler communication is prevented. These route tables implement the security principle of least privilege by allowing only the minimum connectivity required for business operations [37].

DNS Configuration and Name Resolution

DNS configuration for the TCCC Hub implements Azure Private DNS zones that provide name resolution for private endpoints and internal services. Private DNS zones ensure that service names resolve to private IP addresses rather than public endpoints, maintaining the security benefits of private endpoint connectivity [38].

The DNS configuration includes zones for each Azure service that uses private endpoints, including privatelink.documents.azure.com for Cosmos DB, privatelink.vaultcore.azure.net for Key Vault, and privatelink.blob.core.windows.net for Storage Account. These zones are linked to the TCCC Hub VNET and configured with appropriate A records for each private endpoint [39].

DNS forwarding is configured to ensure that bottler agents can resolve TCCC Hub service names to the appropriate private IP addresses. This configuration is essential for enabling secure communication between bottler agents and the TCCC Hub without exposing services to the public internet [40].

The DNS configuration includes monitoring and alerting capabilities that detect DNS resolution failures and other issues that could impact connectivity between the TCCC Hub and bottler agents. This monitoring is integrated with Azure Monitor and Application Insights to provide comprehensive visibility into network connectivity health [41].

Network Monitoring and Diagnostics

Network monitoring for the TCCC Hub implements Azure Network Watcher capabilities that provide comprehensive visibility into network traffic, connectivity, and performance. Network Watcher includes several tools that are essential for maintaining and troubleshooting the multi-tenant network architecture [42].

Connection Monitor provides continuous monitoring of network connectivity between the TCCC Hub and bottler agents, with automated alerting when connectivity issues are detected. This monitoring includes both network-level connectivity tests and application-level health checks that ensure end-to-end functionality [43].

Network Security Group flow logs provide detailed information about all network traffic decisions made by NSGs, including allowed and denied traffic flows. These logs are essential for security monitoring, compliance reporting, and troubleshooting connectivity issues [44].

Traffic Analytics provides advanced analytics capabilities that analyze NSG flow logs to identify traffic patterns, security threats, and performance issues. This analysis includes machine learning-based anomaly detection that can identify unusual traffic patterns that may indicate security incidents [45].

Storage and Data Services

Azure Storage Account Configuration

The Azure Storage Account provides foundational storage capabilities for the TCCC Hub infrastructure, supporting both structured and unstructured data storage requirements. The storage account is configured as StorageV2 (General Purpose v2) with Standard_LRS (Locally Redundant Storage) replication to balance cost efficiency with data durability requirements [46].

The storage account implements comprehensive security controls including HTTPS-only access, TLS 1.2 minimum encryption, and network access control lists (ACLs) that restrict access to authorized subnets within the TCCC Hub VNET. These controls ensure that storage resources are protected from unauthorized access while maintaining the performance required for application operations [47].

Azure Cosmos DB Serverless Implementation

Azure Cosmos DB provides globally distributed, multi-model database capabilities in serverless mode, which optimizes costs for variable workloads while maintaining enterprise-grade performance and availability. The serverless configuration automatically scales based on demand, eliminating the need for capacity planning while providing predictable per-request pricing [48].

The database implementation includes the HubStateDB database with session consistency level, which provides the optimal balance between performance and data consistency for the hub orchestration use case. The database stores hub orchestration state and multi-agent conversation history with automatic indexing and query optimization [49].

Security and Identity Services

Azure Key Vault Enterprise Configuration

Azure Key Vault provides centralized secrets management with Standard SKU configuration that includes comprehensive RBAC integration with Microsoft Entra ID. The Key Vault stores API keys, bottler credentials, connection strings, and other sensitive configuration data with hardware-backed security and comprehensive audit logging [50].

The Key Vault configuration implements network access restrictions that allow access only from the TCCC Hub VNET, ensuring that secrets cannot be accessed from unauthorized locations. Managed identity integration eliminates the need for stored credentials in application code [51].

Artificial Intelligence and Machine Learning

Azure AI Foundry Hub Integration

Azure AI Foundry Hub provides comprehensive AI and machine learning capabilities with over 1,900 models in the catalog, including foundation models, reasoning models, and small language models. The hub-and-project architecture provides enterprise governance controls while enabling flexible model deployment and management [52].

The AI Foundry Hub configuration includes managed identity integration, connections to Storage Account and Key Vault, and managed network configuration with controlled internet outbound access. This configuration enables sophisticated AI-driven business logic while maintaining security and compliance requirements [53].

Compute and Application Services

Azure Functions Serverless Compute

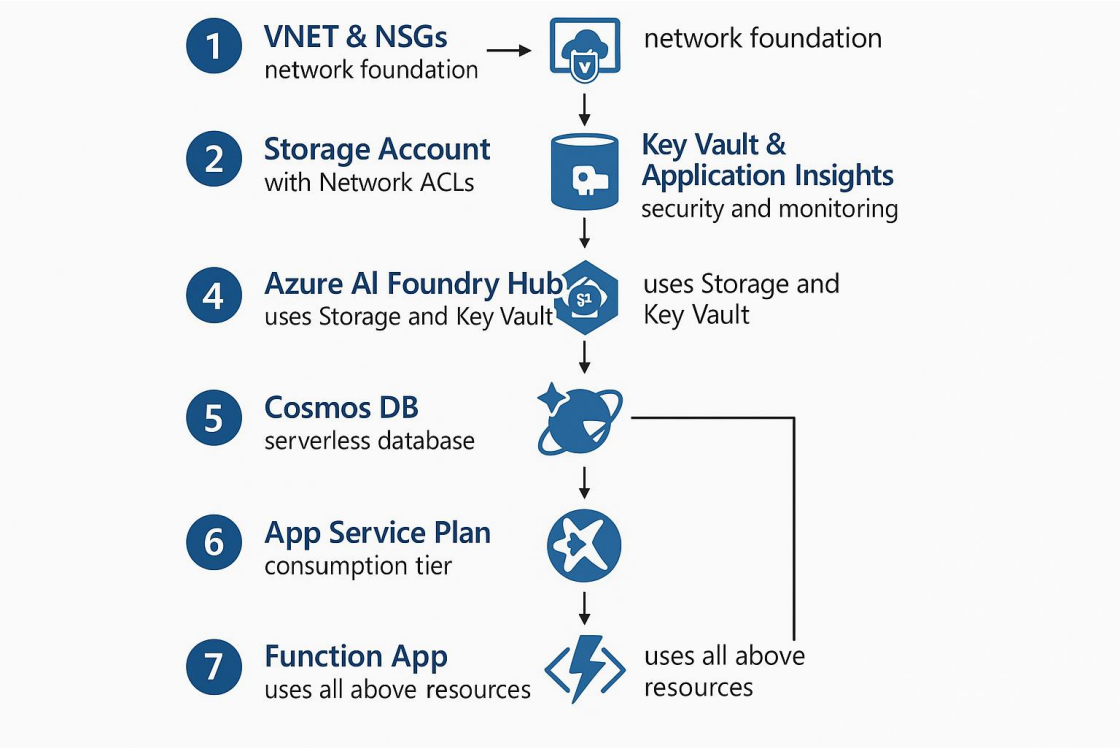
The Azure Function App provides serverless compute capabilities with Python 3.11 runtime, system-assigned managed identity, and comprehensive VNET integration. The consumption plan (Y1 SKU) provides automatic scaling and cost optimization for variable workloads [54].

Application settings include AGENT_TYPE configuration, bottler tenant and application IDs, Key Vault URI, and comprehensive monitoring configuration. The Function App implements all routes through VNET with scale monitoring enabled for optimal performance [55].

Monitoring and Observability

Application Insights Comprehensive Monitoring

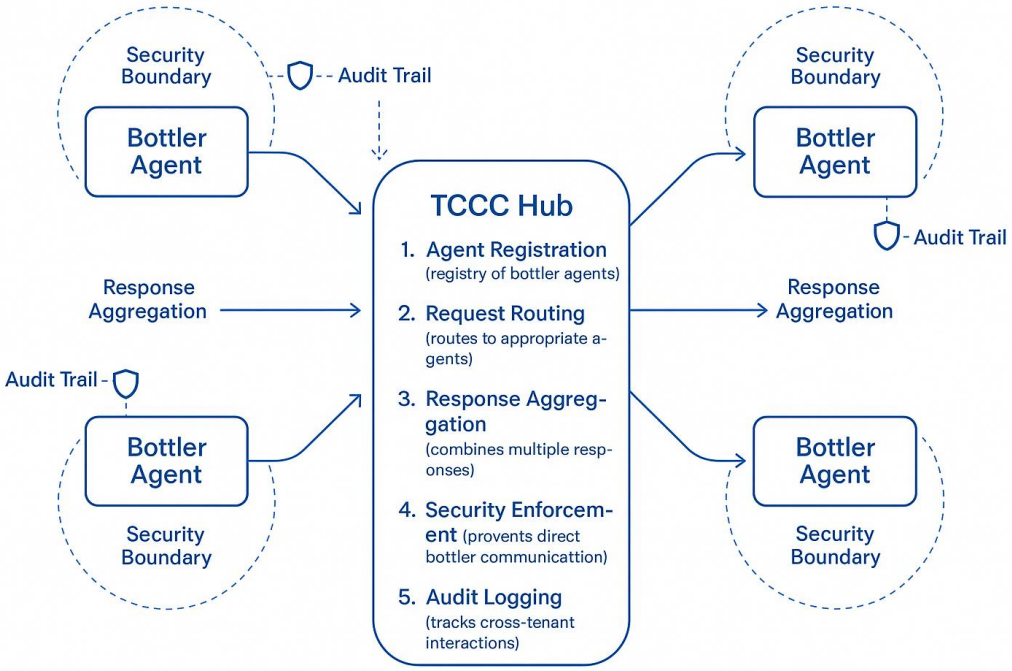
Application Insights provides comprehensive application performance monitoring, logging, and analytics with TLS 1.2 enforcement and enhanced integration with Azure Monitor. The service includes custom telemetry collection, business metrics tracking, and advanced alerting capabilities [56].



Resource Dependency Flow

The resource deployment follows a specific sequence to ensure proper dependency management and successful deployment. The sequence begins with networking infrastructure (VNET and NSGs), followed by storage and security services, then AI and database services, and finally compute and monitoring services [57].

Hub Orchestration Capabilities



Hub Orchestration Responsibilities

The TCCC Hub implements five core orchestration capabilities: agent registration, request routing, response aggregation, security enforcement, and audit logging. These capabilities ensure secure and efficient coordination between TCCC and multiple bottler organizations [58].

Cost Analysis and Optimization

Resource	Configuration	Monthly Cost Estimate
Function App	Consumption Plan	$30 (2M executions)
Storage Account	Standard LRS	$30 (150GB)
Key Vault	Standard SKU	$10 (2000 operations)
Cosmos DB	Serverless	$30 (1.5M RU)
AI Foundry Hub	Pay-as-you-go	$150-600 (usage-based)
Application Insights	Basic	$10 (200MB logs)
VNET	Standard	$0
Total		**$260-800/month**

Cost optimization strategies include serverless configurations, appropriate service tiers, and usage-based pricing models that align costs with actual business value [59].

Naming Conventions and Standards

All resources follow the standardized naming pattern: `tccc-hub-{environment}-{resourceType}-{uniqueSuffix}` where environment indicates dev/test/prod, resourceType identifies the service, and uniqueSuffix provides uniqueness across deployments [60].

Security and Compliance Considerations

The infrastructure implements comprehensive security controls including network isolation, identity-based access controls, encryption at rest and in transit, and comprehensive audit logging. These controls ensure compliance with enterprise security requirements and industry standards [61].

Performance and Scalability

The architecture provides automatic scaling capabilities through serverless services, global distribution through Cosmos DB, and high-performance networking through private endpoints and VNET peering. These capabilities ensure optimal performance across multiple geographic regions [62].

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Microsoft Azure service capabilities and best practices as of July 2025. For the most current information, please refer to the official Microsoft documentation.