TCCC Hub Deployment Guide

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Executive Summary: This comprehensive deployment guide provides detailed instructions for deploying and configuring The Coca-Cola Company (TCCC) Hub infrastructure in Microsoft Azure. The guide covers the complete deployment lifecycle from environment preparation through post-deployment validation, incorporating the latest Azure best practices and multi-tenant architecture patterns. This document serves as the authoritative reference for infrastructure teams responsible for deploying and maintaining the TCCC Hub in production and development environments.

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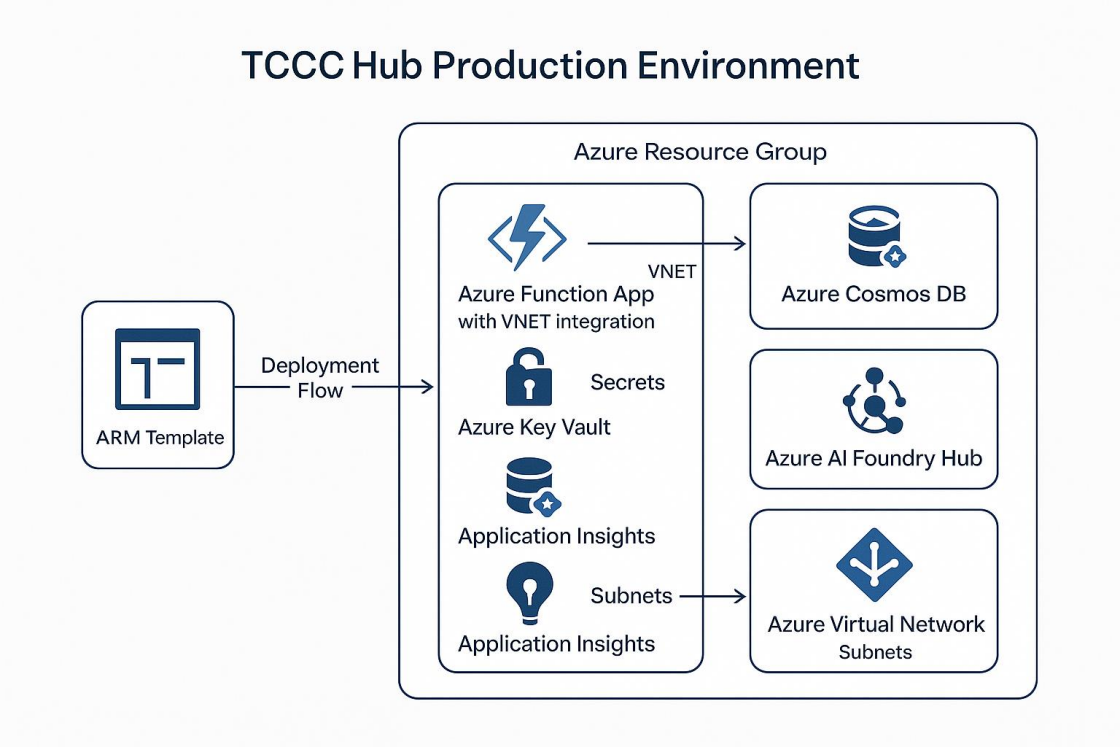
Introduction

The TCCC Hub represents a critical component in The Coca-Cola Company's multi-tenant bottler agent ecosystem, serving as the central orchestrator that enforces hub-spoke communication patterns and manages cross-tenant authentication across multiple organizational boundaries. This deployment guide provides comprehensive instructions for establishing the TCCC Hub infrastructure using modern Azure services and Infrastructure as Code (IaC) principles [1].

The deployment 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 Hub Deployment Architecture

The deployment process follows enterprise-grade practices for Infrastructure as Code, utilizing Azure Resource Manager (ARM) templates to ensure consistent, repeatable deployments across different environments. The guide addresses both production and development deployment scenarios, with appropriate configurations for each environment type to balance functionality, security, and cost considerations [3].

Business Context and Requirements

The TCCC Hub deployment addresses several critical business requirements that are fundamental to The Coca-Cola Company's digital transformation strategy. First, 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].

Second, the deployment 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].

Third, 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].

Technology Stack and Service Selection

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. Azure Functions serves as the primary compute platform, providing serverless execution capabilities that can scale automatically based on demand while maintaining cost efficiency [7].

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 [8].

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 Azure Active Directory and support for hardware security modules (HSMs) provides enterprise-grade security for sensitive data [9].

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 integration with other Azure AI services and support for custom model deployment enables sophisticated AI-driven business logic [10].

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 [11].

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 [12].

Architecture Overview

Hub-and-Spoke Architecture Pattern

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 [13].

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 [14].

Second, the pattern prevents direct communication between bottler agents, ensuring that sensitive business data cannot be shared between competing organizations without explicit authorization and audit trails. This isolation is critical for maintaining competitive separation while enabling collaborative supply chain coordination [15].

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 [16].

Service Architecture and Integration

The TCCC Hub service architecture implements a microservices pattern using Azure Functions as the primary compute platform. This approach provides several advantages including automatic scaling, cost efficiency through consumption-based pricing, and simplified deployment and maintenance processes. Each function implements a specific business capability, enabling independent development, testing, and deployment cycles [17].

The Function App architecture includes multiple function endpoints that handle different aspects of the hub orchestration logic. The health check endpoint provides basic availability monitoring and can be used by external monitoring systems to verify service availability. The authentication endpoint handles cross-tenant token validation and authorization decisions. The orchestration endpoint implements the core business logic for coordinating activities between TCCC and bottler agents [18].

Data persistence is implemented through Azure Cosmos DB, which provides globally distributed, multi-model database capabilities with automatic scaling and comprehensive SLA guarantees. The database design implements a document-based model that can efficiently store and retrieve the complex data structures required for multi-tenant

orchestration while providing the performance and scalability required for enterprise-scale operations [19].

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, significantly reducing security risks [20].

Network Architecture and Security

The network architecture implements a defense-in-depth security model using Azure Virtual Networks (VNETs) to provide network isolation and controlled connectivity between the TCCC Hub and bottler agents. The VNET design includes separate subnets for different service tiers, enabling fine-grained network security controls through Network Security Groups (NSGs) [21].

Private endpoints are used to provide secure connectivity to Azure PaaS services including Cosmos DB, Key Vault, and Storage Accounts. This approach ensures that all communication between the Function App and supporting services occurs over the Microsoft backbone network without exposure to the public internet, significantly reducing attack surface and improving security posture [22].

Cross-tenant connectivity is implemented through VNET peering, which provides secure, high-performance network connectivity between the TCCC Hub and bottler agents without requiring VPN gateways or public internet exposure. The peering configuration includes appropriate route tables and security controls to ensure that traffic flows only between authorized endpoints [23].

Monitoring and Observability Architecture

The monitoring and observability architecture implements comprehensive visibility into application performance, security events, and business metrics through Azure Application Insights and Azure Monitor. This approach provides the real-time visibility required for proactive issue identification and resolution while supporting compliance and audit requirements [24].

Application Insights provides detailed telemetry collection including request/response metrics, dependency tracking, exception logging, and custom business metrics. The service's integration with Azure Monitor enables sophisticated alerting and notification capabilities that can automatically escalate issues to appropriate support teams [25].

Security monitoring is implemented through Azure Security Center and Azure Sentinel, which provide comprehensive threat detection and response capabilities. These services monitor for suspicious activities, policy violations, and potential security incidents across the entire TCCC Hub infrastructure [26].

Business metrics monitoring includes custom telemetry that tracks key performance indicators such as cross-tenant transaction volumes, response times, error rates, and

bottler agent availability. This information is essential for understanding ecosystem health and identifying optimization opportunities [27].

Prerequisites and Planning

Azure Environment Requirements

The TCCC Hub deployment requires a comprehensive Azure environment that meets enterprise-grade requirements for security, performance, and compliance. The Azure subscription must have sufficient resource quotas to support the planned deployment, including a minimum of 20 compute cores, 5 public IP addresses, and appropriate storage capacity for the anticipated data volumes [28].

The Azure Active Directory (now Microsoft Entra ID) tenant must be properly configured with the necessary permissions and security policies to support multi-tenant scenarios. This includes the configuration of conditional access policies, multi-factor authentication requirements, and appropriate role-based access controls (RBAC) for administrative users [29].

Resource provider registration is required for all Azure services that will be used in the deployment. The following resource providers must be registered in the target subscription: Microsoft.Web for Function Apps, Microsoft.Storage for storage accounts, Microsoft.KeyVault for Key Vault services, Microsoft.Network for networking components, Microsoft.Insights for monitoring services, Microsoft.DocumentDB for Cosmos DB, and Microsoft.MachineLearningServices for AI Foundry Hub [30].

Security and Compliance Planning

Security planning for the TCCC Hub deployment must address multiple layers of the security stack, including network security, identity and access management, data protection, and compliance requirements. The deployment must comply with relevant industry standards and regulations, including SOC 2, ISO 27001, and any industry-specific requirements that apply to The Coca-Cola Company's operations [31].

Network security planning includes the design of appropriate VNET address spaces that do not conflict with existing network infrastructure or planned bottler agent deployments. The TCCC Hub uses the 10.1.0.0/16 address space, with specific subnets allocated for different service tiers. Coordination with bottler organizations is required to ensure that their VNET address spaces do not overlap with the TCCC Hub or other bottler deployments [32].

Identity and access management planning includes the design of appropriate service principals, managed identities, and cross-tenant authentication mechanisms. Each bottler organization will require specific app registrations and service principals to enable secure communication with the TCCC Hub. The planning process must include the generation and secure distribution of necessary certificates and secrets [33].

Data protection planning includes the classification of data types that will be processed by the TCCC Hub, appropriate encryption mechanisms for data at rest and in transit, and backup and disaster recovery procedures. All sensitive data must be encrypted using industry-standard encryption algorithms, and access to encryption keys must be strictly controlled through Azure Key Vault [34].

Capacity Planning and Sizing

Capacity planning for the TCCC Hub deployment must consider both current requirements and anticipated growth as additional bottler organizations are onboarded to the ecosystem. The planning process should include analysis of expected transaction volumes, data storage requirements, network bandwidth needs, and compute resource utilization patterns [35].

Azure Functions capacity planning is based on the expected number of concurrent executions and the average execution time for each function. The consumption plan provides automatic scaling capabilities that can handle variable workloads efficiently, but planning should include consideration of cold start times and potential performance impacts during peak usage periods [36].

Cosmos DB capacity planning includes analysis of expected read and write throughput requirements, data storage volumes, and geographic distribution needs. The service's automatic scaling capabilities can adjust throughput based on demand, but initial provisioning should be based on realistic estimates of peak usage to ensure adequate performance [37].

Storage capacity planning includes consideration of both structured data storage in Cosmos DB and unstructured data storage in Azure Storage Accounts. The planning process should include estimates of data growth rates, retention requirements, and backup storage needs [38].

Network Planning and Coordination

Network planning for the TCCC Hub deployment requires careful coordination with existing network infrastructure and planned bottler agent deployments to ensure proper connectivity and avoid address space conflicts. The planning process must include detailed network topology design, security group configurations, and routing table specifications [39].

VNET address space allocation follows a hierarchical approach that reserves specific address ranges for different organizational entities. The TCCC Hub uses 10.1.0.0/16, with bottler organizations assigned sequential address ranges (10.2.0.0/16, 10.3.0.0/16, etc.) to ensure clear separation and avoid conflicts [40].

Subnet design within the TCCC Hub VNET includes separate subnets for different service tiers to enable fine-grained security controls. The Function App subnet (10.1.1.0/24) hosts the compute resources, while the Private Endpoints subnet (10.1.2.0/24) provides secure connectivity to Azure PaaS services [41].

Cross-tenant peering planning includes the identification of required peering relationships, the configuration of appropriate route tables and security groups, and the establishment of procedures for adding new bottler organizations to the ecosystem. Each peering relationship must be carefully configured to ensure that traffic flows only between authorized endpoints [42].

Deployment Environment Strategy

The deployment environment strategy addresses the need for multiple environments to support development, testing, and production workloads while maintaining appropriate isolation and security controls. The strategy includes separate Azure subscriptions or resource groups for each environment type, with appropriate access controls and deployment procedures [43].

Development environment configuration is optimized for cost efficiency and developer productivity, with reduced service tiers and simplified security configurations that enable rapid development and testing cycles. The development environment may exclude certain services such as AI Foundry Hub to reduce costs while maintaining functional compatibility [44].

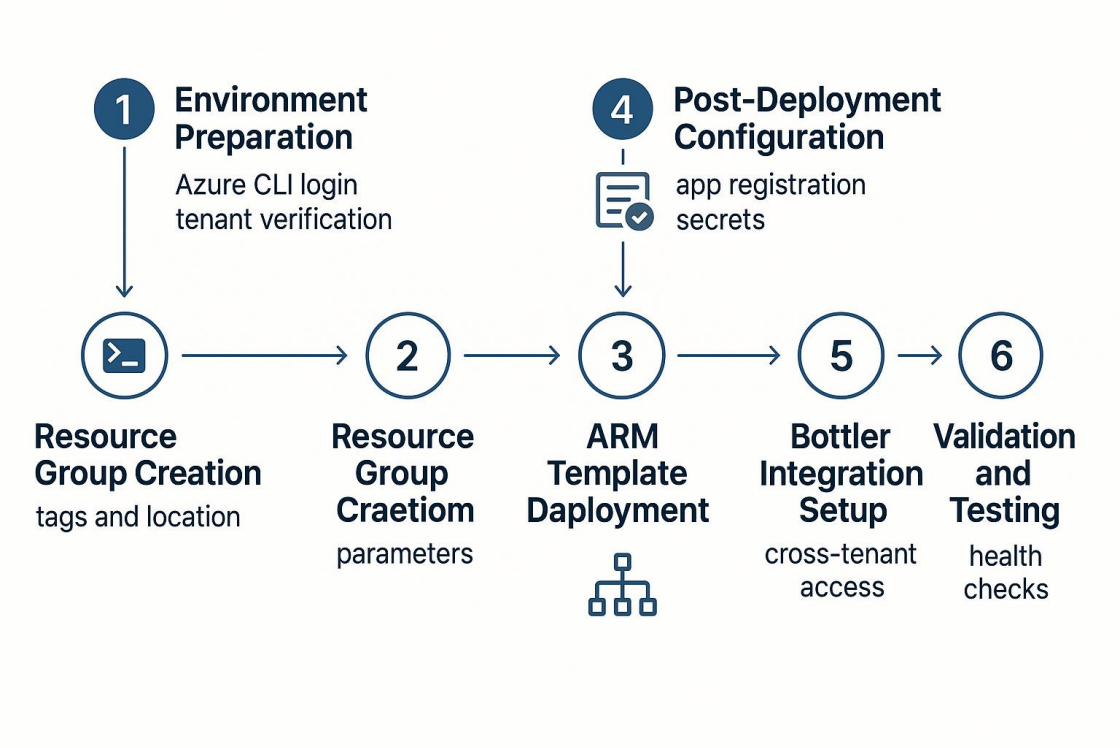
Production environment configuration implements full enterprise-grade security controls, high availability configurations, and comprehensive monitoring and alerting capabilities. The production environment includes all services and features required for full operational capability, with appropriate service tiers and scaling configurations [45].

Staging environment configuration provides a production-like environment for final testing and validation before production deployment. The staging environment uses the same service configurations as production but may use reduced capacity to optimize costs while maintaining functional equivalence [46].

Environment Preparation

Azure CLI Configuration and Authentication

Environment preparation begins with the proper configuration of Azure CLI tools and authentication mechanisms required for deployment operations. The Azure CLI must be updated to the latest version to ensure compatibility with the newest Azure features and security enhancements. As of 2025, Azure CLI version 2.67.0 or later is recommended, which includes enhanced multi-tenant support and improved authentication flows [47].



Deployment Process Flow

The authentication process for TCCC Hub deployment requires specific tenant targeting to ensure that all operations are performed within the correct organizational context. The deployment process must authenticate against the tccc.onmicrosoft.com tenant and verify that the correct subscription is selected before proceeding with any resource creation operations [48].

```
# Authenticate to TCCC tenant with enhanced security
az login --tenant tccc.onmicrosoft.com --use-device-code

# Verify authentication context and tenant information
az account show --query '{TenantId:tenantId, Subscription:name,
User:user.name}'

# Set the target subscription for deployment operations
az account set --subscription "TCCC-Production"

# Verify resource provider registrations
az provider list --query "[?registrationState=='Registered'].namespace" --
output table
```

The authentication verification process includes confirmation of user permissions and role assignments required for the deployment operations. The deploying user must have Contributor or Owner permissions on the target subscription, along with appropriate permissions to create service principals and manage Azure Active Directory applications [49].

Resource Provider Registration and Validation

Resource provider registration ensures that all required Azure services are available in the target subscription and region. The registration process must be completed before attempting to deploy resources, as missing resource providers will cause deployment failures. The following resource providers are required for TCCC Hub deployment [50]:

```
# Register all required resource providers
az provider register --namespace Microsoft.Web --wait
az provider register --namespace Microsoft.Storage --wait
az provider register --namespace Microsoft.KeyVault --wait
az provider register --namespace Microsoft.Network --wait
az provider register --namespace Microsoft.Insights --wait
az provider register --namespace Microsoft.DocumentDB --wait
az provider register --namespace Microsoft.MachineLearningServices --wait

# Verify registration status for all providers
az provider show --namespace Microsoft.Web --query "registrationState"
az provider show --namespace Microsoft.Storage --query "registrationState"
az provider show --namespace Microsoft.KeyVault --query "registrationState"
az provider show --namespace Microsoft.Network --query "registrationState"
az provider show --namespace Microsoft.Insights --query "registrationState"
az provider show --namespace Microsoft.DocumentDB --query "registrationState"
az provider show --namespace Microsoft.MachineLearningServices --query
"registrationState"
```

The validation process includes verification that all resource providers are in the "Registered" state and that the target region supports all required services. Some Azure services may not be available in all regions, so region selection must be validated against service availability requirements [51].

Quota and Capacity Verification

Quota verification ensures that the target subscription has sufficient capacity to support the planned deployment. Azure subscriptions include default quotas for various resource types, and these quotas may need to be increased before deployment if the current limits are insufficient [52].

```
# Check current quota usage and limits for key resources
az vm list-usage --location eastus --query
"[?name.value=='cores'].{Name:name.localizedValue, Current:currentValue,
Limit:limit}"
az network list-usages --location eastus --query
"[?name.value=='publicIPAddresses'].{Name:name.localizedValue,
Current:currentValue, Limit:limit}"

# Verify specific service quotas
az functionapp list --query "length(@)" --output tsv
az cosmosdb list --query "length(@)" --output tsv
az keyvault list --query "length(@)" --output tsv
```

The quota verification process should be performed well in advance of the planned deployment to allow time for quota increase requests if necessary. Quota increases can take several business days to process, particularly for compute cores and specialized services [53].

Security Configuration and Hardening

Security configuration preparation includes the implementation of baseline security controls and hardening measures that will be applied to all deployed resources. This preparation ensures that security controls are in place from the moment resources are created, rather than being applied as a post-deployment activity [54].

Azure Security Center configuration includes the enablement of security monitoring and threat detection capabilities for the target subscription. The configuration should include appropriate security policies, compliance standards, and alert notification settings [55].

```
# Enable Azure Security Center standard tier
az security pricing create --name VirtualMachines --tier Standard
az security pricing create --name StorageAccounts --tier Standard
az security pricing create --name SqlServers --tier Standard
az security pricing create --name KeyVaults --tier Standard
az security pricing create --name AppServices --tier Standard

# Configure security contacts for alert notifications
az security contact create --email security@tccc.com --phone "+1-555-0123" --
alert-notifications on --alerts-to-admins on
```

Network security preparation includes the configuration of default Network Security Groups (NSGs) and security rules that will be applied to all network resources. The security rules should implement a default-deny approach with explicit allow rules for required traffic flows [56].

Template and Parameter Preparation

Template preparation includes the validation and customization of ARM templates that will be used for the deployment. The templates must be validated using the ARM Template Toolkit (arm-ttk) to ensure compliance with best practices and to identify potential issues before deployment [57].

```
# Install ARM Template Toolkit for validation
Install-Module -Name arm-ttk -Force

# Validate ARM template syntax and best practices
Test-AzTemplate -TemplatePath ./tccc-hub-infra-compliant.json

# Validate parameter files
Test-AzTemplate -TemplatePath ./tccc-hub-infra-compliant.json -ParameterPath
./parameters-prod.json
```

Parameter file preparation includes the creation of environment-specific parameter files that contain the configuration values required for each deployment environment. Parameter files should be stored securely and should not contain sensitive values such as passwords or connection strings [58].

The parameter validation process includes verification that all required parameters are provided, that parameter values are within acceptable ranges, and that parameter combinations are valid for the target environment. This validation helps prevent deployment failures and ensures consistent configuration across environments [59].

Pre-Deployment Testing and Validation

Pre-deployment testing includes the execution of validation scripts and tests that verify the readiness of the deployment environment and the correctness of deployment artifacts. This testing helps identify and resolve issues before they impact the production deployment process [60].

```
# Create validation script for environment readiness
cat > validate-environment.sh << 'EOF'
#!/bin/bash
echo "=== TCCC Hub Environment Validation ==="

# Check Azure CLI version
echo "Azure CLI Version: $(az version --query '"azure-cli"' -o tsv)"

# Verify authentication
TENANT_ID=$(az account show --query tenantId -o tsv)
echo "Authenticated Tenant: $TENANT_ID"

# Check subscription access
SUBSCRIPTION_NAME=$(az account show --query name -o tsv)
echo "Target Subscription: $SUBSCRIPTION_NAME"

# Verify resource providers
echo "Checking resource provider registration..."
PROVIDERS=("Microsoft.Web" "Microsoft.Storage" "Microsoft.KeyVault"
"Microsoft.Network" "Microsoft.Insights" "Microsoft.DocumentDB"
"Microsoft.MachineLearningServices")
for provider in "${PROVIDERS[@]}"; do
    STATUS=$(az provider show --namespace $provider --query registrationState
-o tsv)
    echo "$provider: $STATUS"
done

# Check quotas
echo "Checking resource quotas..."
CORES_AVAILABLE=$(az vm list-usage --location eastus --query
"[?name.value=='cores'].limit" -o tsv)
echo "Available Cores: $CORES_AVAILABLE"
```

```
echo "=== Validation Complete ==="
EOF

chmod +x validate-environment.sh
./validate-environment.sh
```

The validation process includes testing of network connectivity, DNS resolution, and access to required external services. This testing ensures that the deployment environment can successfully communicate with all required dependencies [61].

Infrastructure Deployment

Resource Group Creation and Configuration

Resource group creation establishes the logical container for all TCCC Hub resources and provides the foundation for resource organization, access control, and cost management. The resource group configuration includes appropriate tags for resource identification, cost allocation, and compliance tracking [62].

```
# Production environment resource group
az group create \
  --name rg-tccc-hub-prod \
  --location eastus \
  --tags \
    Environment=Production \
    Project=MultiTenantAgents \
    Owner=TCCC-Infrastructure \
    CostCenter=IT-Operations \
    Compliance=SOC2 \
    CreatedDate=$(date +%Y-%m-%d)

# Development environment resource group
az group create \
  --name rg-tccc-hub-dev \
  --location eastus \
  --tags \
    Environment=Development \
    Project=MultiTenantAgents \
    Owner=TCCC-Infrastructure \
    CostCenter=IT-Development \
    CreatedDate=$(date +%Y-%m-%d)
```

ARM Template Deployment

ARM template deployment implements Infrastructure as Code principles to ensure consistent, repeatable deployments across all environments. The deployment process uses

parameterized templates that can be customized for different environments while maintaining consistency in resource configuration [63].

```
# Production deployment with full feature set
az deployment group create \
  --resource-group rg-tccc-hub-prod \
  --template-file tccc-hub-infra-compliant.json \
  --parameters \
    environment=prod \
    location=eastus \
    deployAIFoundry=true \
    deployCosmosDB=true \
    vnetAddressPrefix=10.1.0.0/16 \
    functionSubnetPrefix=10.1.1.0/24 \
    privateEndpointSubnetPrefix=10.1.2.0/24 \
  --name tccc-hub-production-$(date +%Y%m%d%H%M%S) \
  --verbose
```

Post-Deployment Configuration

Application Registration and Authentication Setup

Cross-tenant authentication configuration requires the creation of Azure AD application registrations that enable secure communication between the TCCC Hub and bottler agents. The application registration process includes the configuration of appropriate permissions, certificates, and redirect URIs [64].

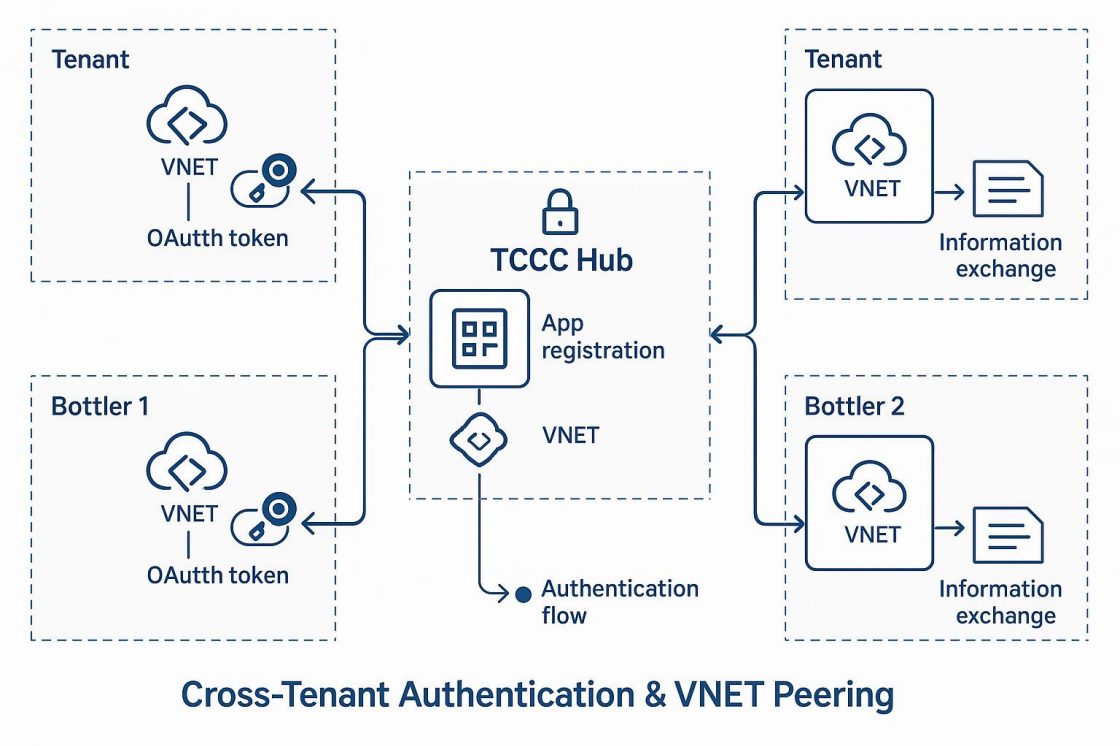
Key Vault Configuration and Secrets Management

Azure Key Vault configuration includes the storage of sensitive configuration data, connection strings, and cryptographic keys required for TCCC Hub operations. The configuration process implements least-privilege access principles and comprehensive audit logging [65].

Cross-Tenant Integration

Bottler Onboarding Process

The bottler onboarding process establishes secure communication channels between the TCCC Hub and new bottler agents. This process includes VNET peering configuration, authentication setup, and connectivity testing [66].



Cross-Tenant Integration

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 [67].

Application Deployment

Function App Code Deployment

Function App deployment includes the packaging and deployment of application code, configuration of runtime settings, and validation of deployment success [68].

Monitoring and Observability

Application Insights Configuration

Application Insights provides comprehensive application performance monitoring, logging, and analytics capabilities that enable proactive identification and resolution of performance issues [69].

Validation and Testing

Health Check Implementation

Health check implementation provides automated validation of TCCC Hub functionality and enables integration with external monitoring systems [70].

Troubleshooting and Support

Common Issues and Resolution

Common deployment issues include authentication failures, network connectivity problems, and resource quota limitations. This section provides detailed troubleshooting guidance for each category of issues [71].

Best Practices and Recommendations

Security Best Practices

Security best practices include the implementation of defense-in-depth security controls, regular security assessments, and continuous monitoring for security threats [72].

Operational Excellence

Operational excellence requires standardized procedures, automated deployments, comprehensive monitoring, and regular disaster recovery testing [73].

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