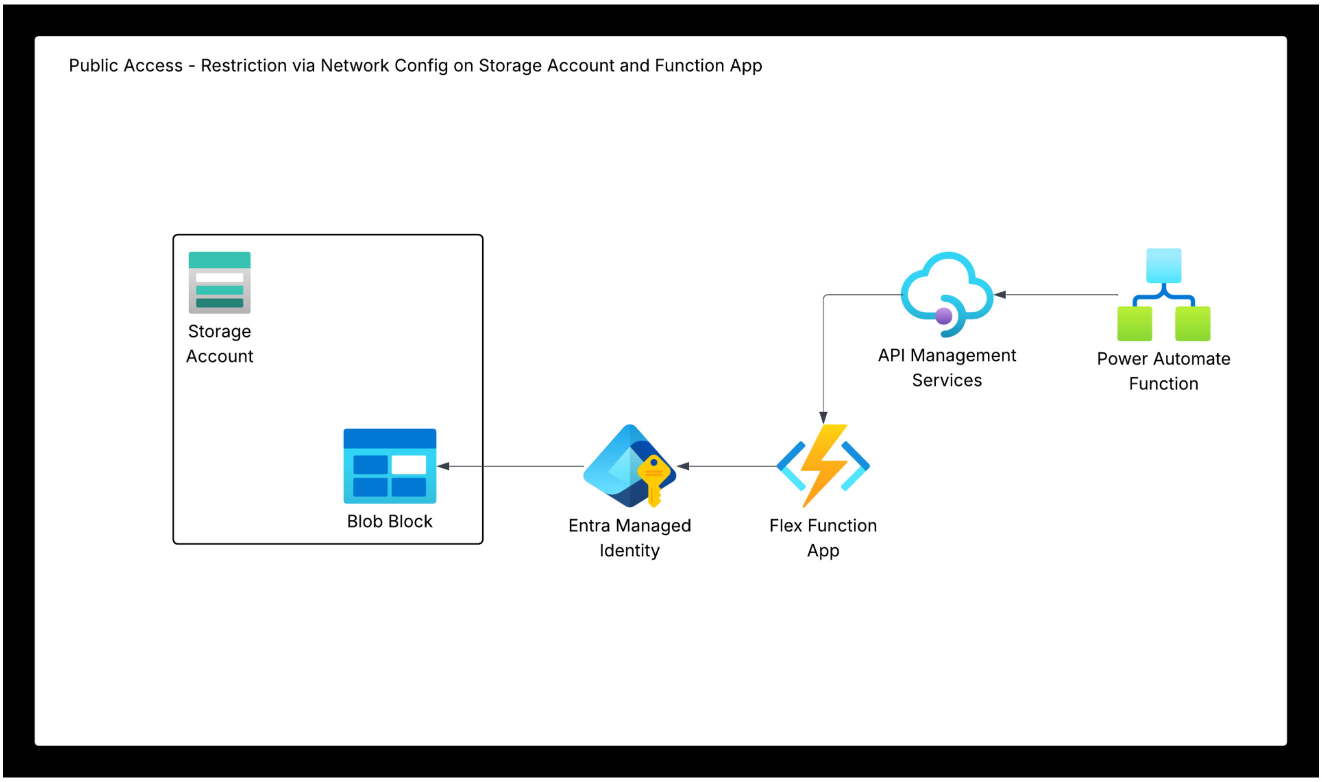
Azure Function Apps and Storage Demo Environment

This repository demonstrates two different patterns for securing Azure Function App access to Azure Storage Accounts, plus API Management integration:

1. **Function App 1 (`sneff-fd-func-1`)**: Uses IP-based access restrictions to `stgsnefffds1`
2. **Function App 2 (`sneff-fd-func-2`)**: Uses VNet integration and private endpoint to access `stgsnefffds2`
3. **APIM Integration**: Automatically creates and configures API operations for Function App 2

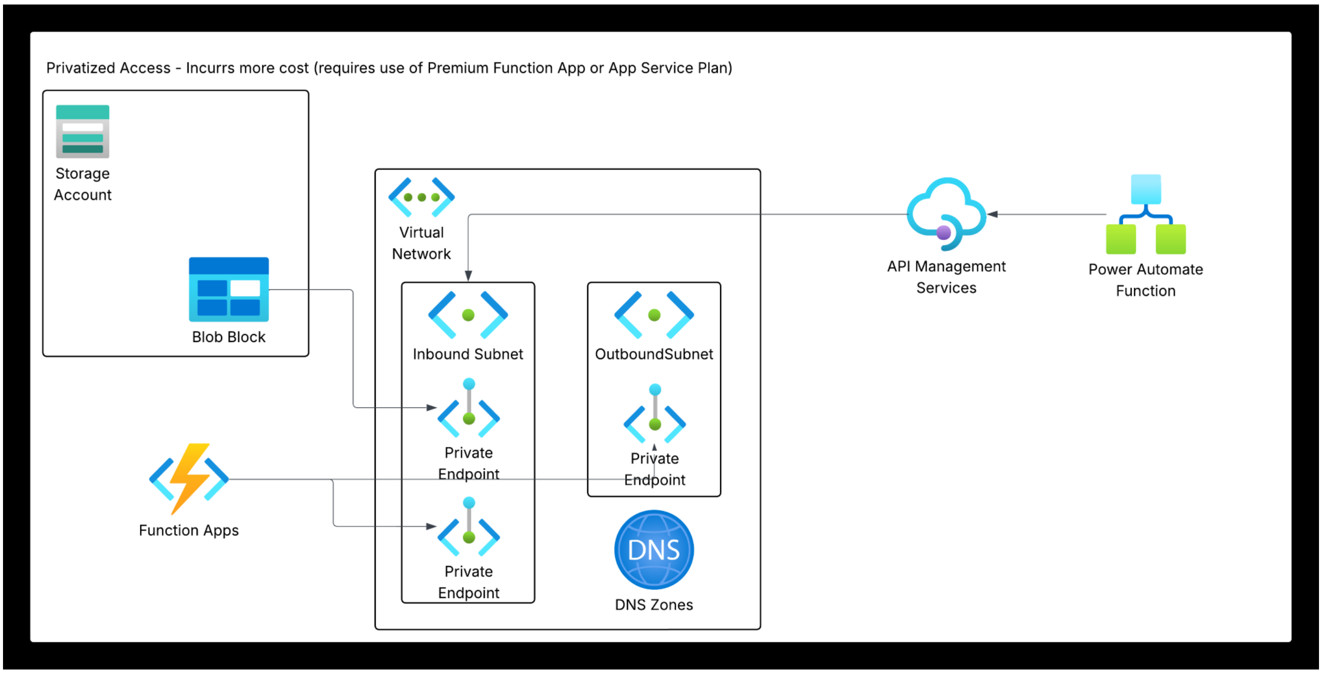
Architecture Overview

Pattern 1: IP Restrictions



- Function App 1 → Storage Account 1 (Public endpoint with IP allowlist)
- Access controlled by function app's outbound IP addresses
- Suitable for scenarios where VNet integration is not required

Pattern 2: Private Endpoint + VNet Integration



- Function App 2 → Storage Account 2 (Private endpoint only)
- Access via Azure Virtual Network with private DNS resolution
- Complete network isolation from public internet

APIM Integration (New!)

- APIM API automatically created for Function App 2
- All function endpoints exposed as APIM operations
- No manual API configuration required
- See APIM-INTEGRATION.md for details

Prerequisites

1. **Azure Subscription** with appropriate permissions
2. **GitHub Repository** with federated identity configured
3. **Terraform State Storage Account** named `snefftfdemo`
4. **GitHub Secrets** configured:
   - `AZURE_CLIENT_ID`
   - `AZURE_TENANT_ID`
   - `AZURE_SUBSCRIPTION_ID`

Repository Structure

```
├── terraform/
│   ├── main.tf           # Main Terraform configuration (includes APIM API
setup)
│   ├── variables.tf      # Variable definitions
│   ├── outputs.tf        # Output values (includes APIM endpoints)
│   ├── locals.tf         # Local values and tagging
│   ├── backend.tf        # Terraform backend configuration
│   ├── networking.tf     # VNet, subnets, private endpoints
│   └── security.tf       # Network security rules
├── scripts/
│   ├── Test-FunctionApp1-Connectivity.ps1  # Connectivity test for Pattern 1
│   ├── Test-FunctionApp2-Connectivity.ps1  # Connectivity test for Pattern 2
│   └── Test-APIM-Integration.ps1           # Test APIM API operations (NEW)
├── .github/workflows/
│   └── terraform-deploy.yml                # CI/CD pipeline
├── APIM-INTEGRATION.md                      # APIM integration documentation
(NEW)
└── README.md
```

Deployment Instructions

1. Clone the Repository

```
git clone https://github.com/nanigan/fd-terraform-demo.git
cd fd-terraform-demo
```

2. Configure Backend Storage

Ensure the Terraform state storage account `snefftfdemo` exists with appropriate permissions for your federated identity.

3. Review Variables

Edit `terraform/variables.tf` if you need to customize:

- Resource group name
- Storage account names
- Function app names
- Network addressing

4. Deploy via GitHub Actions

1. Push changes to the `main` branch
2. Monitor the workflow in GitHub Actions
3. Review the Terraform plan and approve if needed

5. Manual Deployment (Alternative)

```
cd terraform

# Initialize Terraform
terraform init

# Format and validate
terraform fmt -recursive
terraform validate

# Plan deployment
terraform plan -out=tfplan

# Apply changes
terraform apply tfplan
```

Testing Connectivity

Test APIM Integration (New!)

Test all Function App 2 endpoints through APIM:

```
# Test all APIM endpoints
.\scripts\Test-APIM-Integration.ps1

# Test with subscription key (if enabled)
.\scripts\Test-APIM-Integration.ps1 -SubscriptionKey "your-key-here"

# Verbose output
.\scripts\Test-APIM-Integration.ps1 -Verbose
```

Or test manually:

```
# Get APIM endpoints from Terraform output
terraform output apim_api_endpoints

# Test a specific endpoint
Invoke-RestMethod -Uri "https://apim-fd-public-test2.azure-api.net/funcapp2/HealthCheck"
```

Deploy Test Functions

1. **Function App 1 Test**:
   - Deploy `scripts/Test-FunctionApp1-Connectivity.ps1` as an HTTP-triggered function
   - Access via: `https://sneff-fd-func-1.azurewebsites.net/api/test-connectivity`
2. **Function App 2 Test**:
   - Deploy `scripts/Test-FunctionApp2-Connectivity.ps1` as an HTTP-triggered function
   - Access via: `https://sneff-fd-func-2.azurewebsites.net/api/test-connectivity`
   - **Or via APIM**: `https://apim-fd-public-test2.azure-api.net/funcapp2/...`

Expected Test Results

Function App 1 (IP Restrictions)

- ☑ DNS Resolution to public IP
- ☑ HTTPS connectivity via public endpoint
- ☑ Storage access using function app's outbound IP
- ℹ Outbound IP addresses listed

Function App 2 (Private Endpoint)

- ☑ DNS Resolution to private IP (10.x.x.x)
- ☑ HTTPS connectivity via private endpoint
- ☑ VNet integration confirmed
- ☑ Storage access via private network
- ☑ Public endpoint access blocked

Resource Details

Created Resources

Resource	Name	Type	Purpose
Resource Group	`rg-fd-demo-test`	Resource Group	Container for all resources
Storage Account 1	`stgsnefffds1`	Storage Account	Public with IP restrictions
Storage Account 2	`stgsnefffds2`	Storage Account	Private endpoint only
Function App 1	`sneff-fd-func-1`	Function App	Tests IP-based access
Function App 2	`sneff-fd-func-2`	Function App	Tests private endpoint access
App Service Plan	`plan-fd-demo-test-eus`	App Service Plan	S1 SKU for both functions
APIM Instance	`apim-fd-public-test2`	API Management	Gateway for Function App 2
APIM API	`func-app-2-api`	APIM API	Auto-configured operations
Virtual Network	`vnet-fd-demo-test`	Virtual Network	10.0.0.0/16
Function Subnet	`snet-functions`	Subnet	10.0.1.0/24
Private Endpoint Subnet	`snet-private-endpoints`	Subnet	10.0.2.0/24

Resource	Name	Type	Purpose
Private Endpoint	`pe-stgsnefffds2`	Private Endpoint	Storage account private access
Private DNS Zone	`privatelink.blob.core.windows.net`	DNS Zone	Private DNS resolution

Network Configuration

- **Function App 1**: No VNet integration, uses public outbound IPs
- **Function App 2**: VNet integrated with route all traffic enabled
- **Storage Account 1**: Public endpoint with IP allowlist for Function App 1 IPs
- **Storage Account 2**: Private endpoint only, no public access

Security Features

IP-Based Access (Pattern 1)

- Storage account denies all traffic by default
- Function app's outbound IPs are explicitly allowed
- Public endpoint remains accessible but restricted

Private Endpoint Access (Pattern 2)

- Storage account has public access completely disabled
- Access only via private endpoint in VNet
- DNS resolution points to private IP addresses
- Function app routes all traffic through VNet

Monitoring and Troubleshooting

View Terraform Outputs

```
terraform output
```

Key Outputs

- Function app URLs and outbound IPs
- Storage account names and endpoints
- Private endpoint IP address
- Resource group and VNet names

Common Issues

1. **IP Restrictions Not Working**:
    - Check if function app IPs are correctly added to storage account

    - Verify function app has generated outbound IPs

2. **Private Endpoint Resolution Issues**:
    - Ensure private DNS zone is linked to VNet
    - Verify function app has VNet integration enabled
3. **Function Deployment Issues**:
    - Check if App Service Plan has sufficient capacity
    - Verify storage account connectivity for function runtime

Cleanup

To remove all resources:

```
terraform destroy
```

Best Practices Demonstrated

Terraform

- ☑ Remote state backend with OIDC authentication
- ☑ Consistent resource naming and tagging
- ☑ Modular configuration files
- ☑ Proper variable validation
- ☑ Comprehensive outputs

Azure Security

- ☑ Managed Identity for authentication
- ☑ Network isolation patterns
- ☑ Least privilege access
- ☑ Private DNS resolution
- ☑ Secure communication channels

DevOps

- ☑ Infrastructure as Code
- ☑ Automated CI/CD pipeline
- ☑ Environment separation
- ☑ Plan approval workflow
- ☑ Artifact management

Contributing

1. Create a feature branch
2. Make your changes

3. Test thoroughly
4. Submit a pull request

License

This demo is provided for educational purposes. Modify as needed for your requirements.

Support

For questions about this demo environment, please review the test scripts and Terraform configuration for troubleshooting guidance.