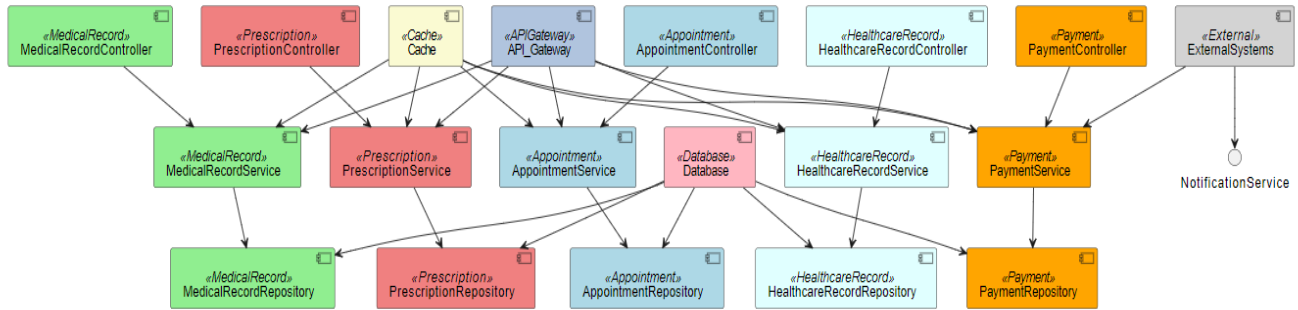
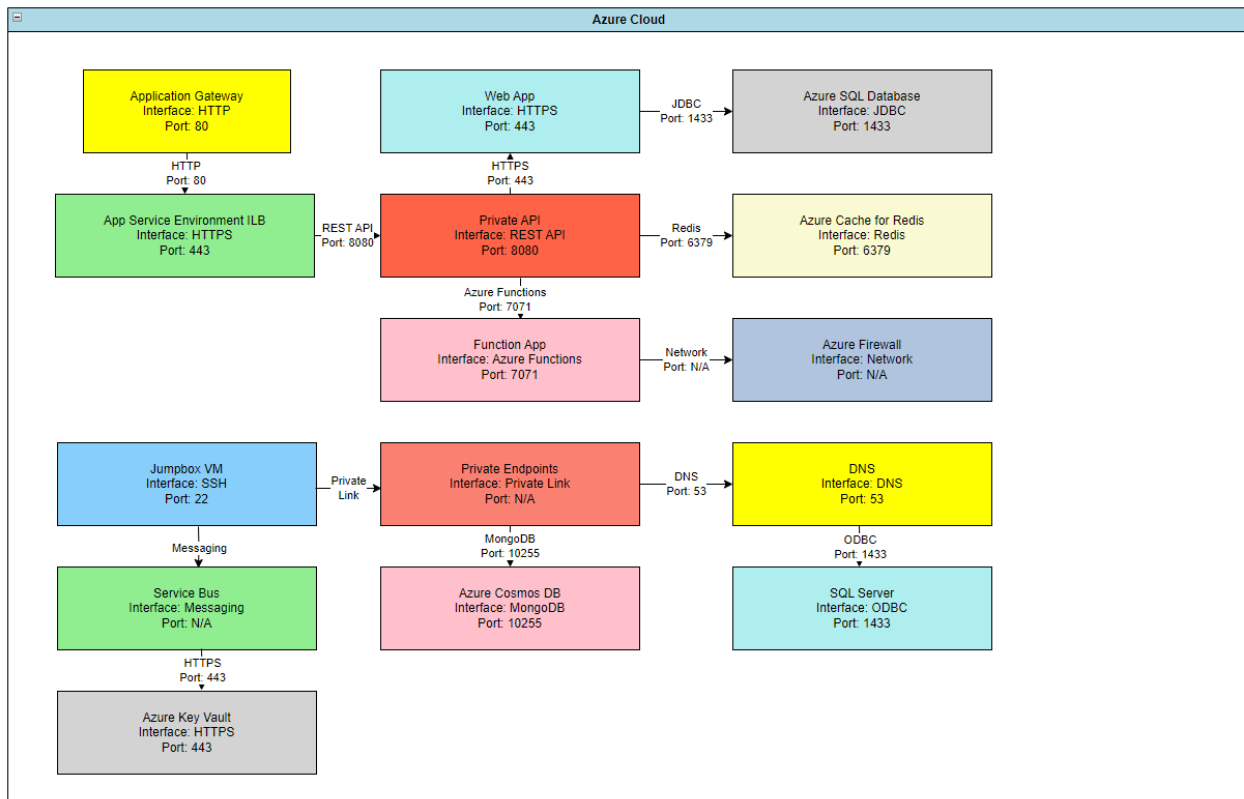


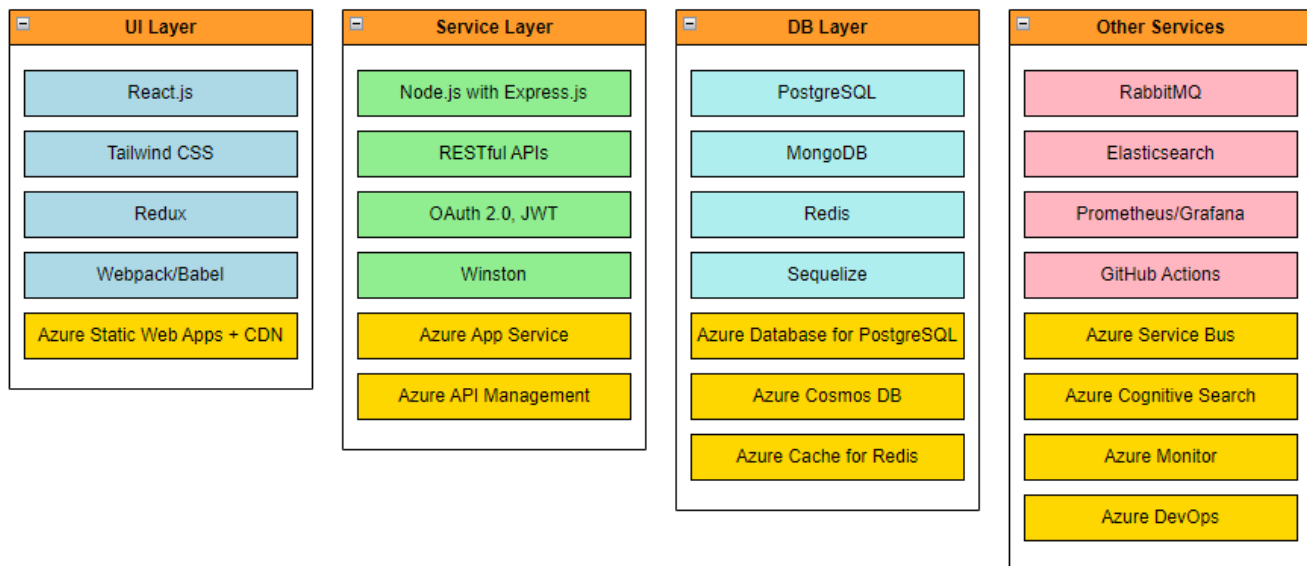
Component Diagram



Deployment Diagram



Tech Stack and Cloud Service Provider



Rational for Choosing Specific Deployment Patterns and Component Structure

UI Layer:

- React.js provides an efficient and flexible way to build user interfaces.
- Tailwind CSS allows for rapid and customizable styling.
- Redux manages the application state effectively.
- Webpack/Babel ensures code is compatible across different environments.
- Azure Static Web Apps and CDN offer fast, globally distributed content delivery.

Service Layer:

- Node.js with Express.js is perfect for building lightweight and efficient APIs.
- RESTful APIs are a standard for designing networked applications, making the service interactions straightforward and reliable.
- OAuth 2.0 and JWT ensure secure authentication and authorization, protecting data.
- Winston helps with logging, which is crucial for tracking and troubleshooting issues in the application.
- Azure App Service provides a managed environment for deploying applications easily.
- Azure API Management helps secure, publish, and monitor our APIs effectively.

DB Layer:

- PostgreSQL is a robust relational database, ideal for handling complex queries and transactions.
- MongoDB provides flexibility for NoSQL data storage.
- Redis offers high-speed, in-memory caching to improve application performance.
- Sequelize simplifies database management and interactions.
- Azure Database for PostgreSQL provides a managed, scalable, and secure relational database service.

- Azure Cosmos DB offers a globally distributed, multi-model database service.
- Azure Cache for Redis enhances performance with a managed caching solution.

Other Services:

- RabbitMQ provides reliable messaging between services.
- Elasticsearch enhances search capabilities with its powerful search and analytics engine.
- Prometheus/Grafana are essential for monitoring application performance and health.
- GitHub Actions streamline CI/CD processes.
- Azure Service Bus manages messaging between applications.
- Azure Cognitive Search improves data retrieval and search functionalities.
- Azure Monitor ensures application health.
- Azure DevOps supports the CI/CD pipeline.

Scaling

100 Concurrent Users or 100 TPS: My current setup doesn't require any modification. The existing architecture can handle 100 users efficiently with built-in auto-scaling.

1,000 Concurrent Users or 1,000 TPS:

- **Service Layer:** Will need to increase instance count in Azure App Service or move to Azure Kubernetes Service (AKS).
- **DB Layer:** Will need to scale up Azure Database for PostgreSQL, add read replicas, and optimize Azure Cosmos DB, and enhance caching with Azure Cache for Redis.

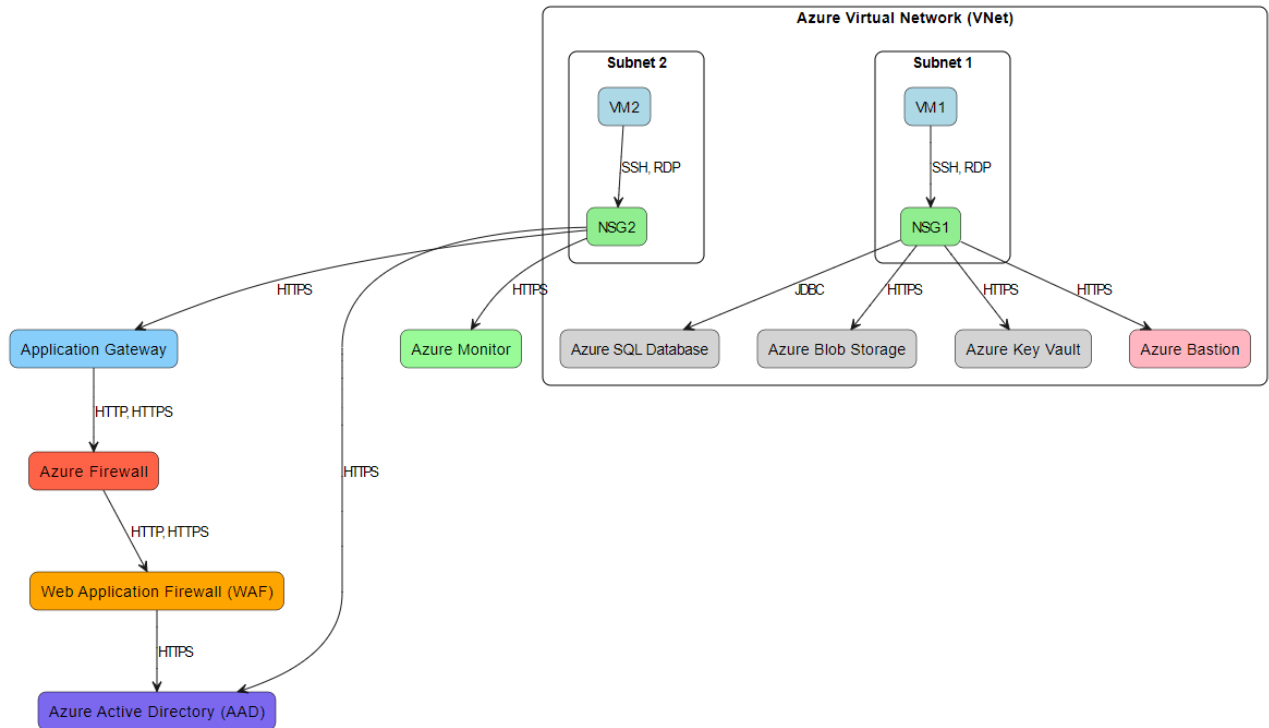
10,000 Concurrent Users or 3,000 TPS:

- **Service Layer:** Will need to transition fully to AKS.
- **DB Layer:** Will need to implement sharding in PostgreSQL and partition data in Cosmos DB and increase Redis instances.
- **Other Services:** Will need to use Azure Event Grid with Azure Service Bus for better event handling.

100,000 Concurrent Users

- **UI Layer:** Will need to use multiple CDN providers alongside Azure CDN.
- **Service Layer:** Will need to use AKS with auto-scaling and service mesh for traffic management.
- **DB Layer:** Will need to use advanced sharding and multi-region deployments for PostgreSQL and Cosmos DB as well as implement multi-tier caching with Redis and Azure Blob Storage.
- **Other Services:** Will need to implement distributed tracing and advanced monitoring with Azure Monitor and Log Analytics.

Security Architecture



IAC Template using Terraform

```
provider "azurerm" {  
  version = "=3.0.0"  
  features {}  
}  
  
resource "azurerm_resource_group" "integris_rg" {  
  name     = "rg-integris-healthcare"  
  location = "Oklahoma City"  
}  
  
resource "azurerm_virtual_network" "integris_vnet" {  
  name            = "vnet-integris-healthcare"  
  address_space   = ["10.0.0.0/16"]  
  location        = azurerm_resource_group.integris_rg.location  
  resource_group_name = azurerm_resource_group.integris_rg.name  
}  
  
resource "azurerm_subnet" "app_subnet" {  
  name            = "subnet-app-integris"  
  resource_group_name = azurerm_resource_group.integris_rg.name
```

Richard C. Ropac
SWENG 873, Section 001/002 2024
Lesson 6

```
virtual_network_name = azurerm_virtual_network.integris_vnet.name
address_prefixes    = ["10.0.1.0/24"]
}
```

```
resource "azurerm_subnet" "db_subnet" {
  name            = "subnet-db-integris"
  resource_group_name = azurerm_resource_group.integris_rg.name
  virtual_network_name = azurerm_virtual_network.integris_vnet.name
  address_prefixes    = ["10.0.2.0/24"]
}
```

```
resource "azurerm_network_security_group" "app_nsg" {
  name            = "nsg-app-integris"
  location        = azurerm_resource_group.integris_rg.location
  resource_group_name = azurerm_resource_group.integris_rg.name
```

```
  security_rule {
    name            = "SSH"
    priority        = 1001
    direction       = "Inbound"
    access          = "Allow"
    protocol         = "Tcp"
    source_port_range = "*"
    destination_port_range = "22"
    source_address_prefix = "*"
    destination_address_prefix = "*"
  }
}
```

```
resource "azurerm_network_security_group" "db_nsg" {
  name            = "nsg-db-integris"
  location        = azurerm_resource_group.integris_rg.location
  resource_group_name = azurerm_resource_group.integris_rg.name
```

```
  security_rule {
    name            = "HTTPS"
    priority        = 1001
    direction       = "Inbound"
    access          = "Allow"
    protocol         = "Tcp"
    source_port_range = "*"
    destination_port_range = "443"
    source_address_prefix = "*"
    destination_address_prefix = "*"
  }
}
```

```
resource "azurerm_network_interface" "app_nic" {
  name            = "nic-app-integris"
```

Lesson 6

```
location      = azurerm_resource_group.integris_rg.location
resource_group_name = azurerm_resource_group.integris_rg.name
```

```
ip_configuration {
  name          = "internal"
  subnet_id     = azurerm_subnet.app_subnet.id
  private_ip_address_allocation = "Dynamic"
}
}
```

```
resource "azurerm_network_interface" "db_nic" {
  name          = "nic-db-integris"
  location      = azurerm_resource_group.integris_rg.location
  resource_group_name = azurerm_resource_group.integris_rg.name
```

```
ip_configuration {
  name          = "internal"
  subnet_id     = azurerm_subnet.db_subnet.id
  private_ip_address_allocation = "Dynamic"
}
}
```

```
resource "azurerm_linux_virtual_machine" "app_vm" {
  name          = "vm-app-integris"
  location      = azurerm_resource_group.integris_rg.location
  resource_group_name = azurerm_resource_group.integris_rg.name
  network_interface_ids = [azurerm_network_interface.app_nic.id]
  size          = "Standard_DS1_v2"
```

```
os_disk {
  name          = "appOsDisk"
  caching       = "ReadWrite"
  storage_account_type = "Premium_LRS"
}
```

```
os_profile {
  computer_name = "app-server"
  admin_username = "adminuser"
  admin_password = "Password1234!"
}
```

```
os_profile_linux_config {
  disable_password_authentication = false
}
```

```
source_image_reference {
  publisher = "Canonical"
  offer     = "UbuntuServer"
  sku       = "18.04-LTS"
```

```
    version = "latest"
  }
}

resource "azurerm_linux_virtual_machine" "db_vm" {
  name                = "vm-db-integris"
  location            = azurerm_resource_group.integris_rg.location
  resource_group_name = azurerm_resource_group.integris_rg.name
  network_interface_ids = [azurerm_network_interface.db_nic.id]
  size                = "Standard_DS1_v2"

  os_disk {
    name          = "dbOsDisk"
    caching       = "ReadWrite"
    storage_account_type = "Premium_LRS"
  }

  os_profile {
    computer_name = "db-server"
    admin_username = "adminuser"
    admin_password = "Password1234!"
  }

  os_profile_linux_config {
    disable_password_authentication = false
  }

  source_image_reference {
    publisher = "Canonical"
    offer     = "UbuntuServer"
    sku       = "18.04-LTS"
    version   = "latest"
  }
}

resource "azurerm_sql_server" "sql" {
  name                = "sql-integris"
  resource_group_name = azurerm_resource_group.integris_rg.name
  location            = azurerm_resource_group.integris_rg.location
  version             = "12.0"
  administrator_login = "sqladmin"
  administrator_login_password = "Password1234!"
}

resource "azurerm_sql_database" "sqlldb" {
  name                = "sqlldb-integris"
  resource_group_name = azurerm_resource_group.integris_rg.name
  location            = azurerm_resource_group.integris_rg.location
  server_name         = azurerm_sql_server.sql.name
}
```

Lesson 6

```
edition          = "Standard"
requested_service_objective_name = "S1"
}
```

```
resource "azurerm_storage_account" "storage" {
  name                = "storageaccountintegris"
  resource_group_name = azurerm_resource_group.integris_rg.name
  location            = azurerm_resource_group.integris_rg.location
  account_tier        = "Standard"
  account_replication_type = "LRS"
}
```

```
resource "azurerm_storage_container" "storage_container" {
  name                = "integris-container"
  storage_account_name = azurerm_storage_account.storage.name
  container_access_type = "private"
}
```

```
resource "azurerm_key_vault" "keyvault" {
  name                = "keyvaultintegris"
  location            = azurerm_resource_group.integris_rg.location
  resource_group_name = azurerm_resource_group.integris_rg.name
  tenant_id          = data.azurerm_client_config.current.tenant_id
  sku_name            = "standard"

  soft_delete_retention_days = 7
  purge_protection_enabled   = true
}
```

```
resource "azurerm_bastion_host" "bastion" {
  name                = "bastionhostintegris"
  resource_group_name = azurerm_resource_group.integris_rg.name
  location            = azurerm_resource_group.integris_rg.location
  dns_name            = "bastionhostintegris"
  ip_configuration {
    name                = "configuration"
    subnet_id          = azurerm_subnet.app_subnet.id
    public_ip_address_id = azurerm_public_ip.bastion.id
  }
}
```

```
resource "azurerm_public_ip" "bastion" {
  name                = "bastionpublicip"
  location            = azurerm_resource_group.integris_rg.location
  resource_group_name = azurerm_resource_group.integris_rg.name
  allocation_method   = "Static"
  sku                 = "Standard"
}
```


Lesson 6

```
resource "azurerm_application_gateway" "appgw" {
  name          = "appgatewayintegris"
  resource_group_name = azurerm_resource_group.integris_rg.name
  location      = azurerm_resource_group.integris_rg.location
  sku {
    name     = "Standard_v2"
    tier      = "Standard_v2"
    capacity = 2
  }

  gateway_ip_configuration {
    name     = "configuration"
    subnet_id = azurerm_subnet.db_subnet.id
  }

  frontend_port {
    name = "frontendport"
    port = 80
  }

  frontend_ip_configuration {
    name          = "frontend"
    public_ip_address_id = azurerm_public_ip.appgw.id
  }

  backend_address_pool {
    name = "backendpool"
  }

  http_settings {
    name          = "http_settings"
    cookie_based_affinity = "Disabled"
    port          = 80
    protocol      = "Http"
    request_timeout = 20
  }

  listener {
    name          = "listener"
    frontend_ip_configuration_name = "frontend"
    frontend_port_name          = "frontendport"
    protocol                    = "Http"
  }

  routing_rule {
    name          = "routingrule"
    rule_type     = "Basic"
    http_listener_name = "listener"
    backend_address_pool_name = "backendpool"
  }
}
```

Richard C. Ropac
SWENG 873, Section 001/002 2024
Lesson 6

```
    backend_http_settings_name = "http_settings"
  }
}

resource "azurerm_public_ip" "appgw" {
  name          = "appgwpublicip"
  location      = azurerm_resource_group.integris_rg.location
  resource_group_name = azurerm_resource_group.integris_rg.name
  allocation_method = "Static"
  sku           = "Standard"
}

resource "azurerm_firewall" "firewall" {
  name          = "firewallintegris"
  location      = azurerm_resource_group.integris_rg.location
  resource_group_name = azurerm_resource_group.integris_rg.name
  sku           = "AZFW_VNet"
  threat_intel_mode = "Alert"

  ip_configuration {
    name          = "configuration"
    subnet_id     = azurerm_subnet.db_subnet.id
    public_ip_address_id = azurerm_public_ip.firewall.id
  }
}

resource "azurerm_public_ip" "firewall" {
  name          = "firewallpublicip"
  location      = azurerm_resource_group.integris_rg.location
  resource_group_name = azurerm_resource_group.integris_rg.name
  allocation_method = "Static"
  sku           = "Standard"
}

resource "azurerm_monitor_diagnostic_setting" "monitor" {
  name          = "monitor"
  target_resource_id = azurerm_firewall.firewall.id
  log_analytics_workspace_id = azurerm_log_analytics_workspace.law.id

  log {
    category = "FirewallPolicy"
    enabled = true
    retention_policy {
      enabled = true
      days    = 30
    }
  }
}
}
```

Richard C. Ropac
SWENG 873, Section 001/002 2024
Lesson 6

```
resource "azurerm_log_analytics_workspace" "law" {  
  name          = "loganalyticsintegris"  
  location      = azurerm_resource_group.integris_rg.location  
  resource_group_name = azurerm_resource_group.integris_rg.name  
  sku           = "PerGB2018"  
}
```